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THE CHEMISTRY OF BINUCLEAR RHODIUM COMPLEXES WITH SMALL MOLECULES

by

© STEPHEN KENNETH DWIGHT

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Chemistry of Binuclear Rhodium Complexes with Small Molecules submitted by Stephen Kenneth Dwight in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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Date July 18, 1980

To my wife, Maureen.

ABSTRACT

An X-ray structural determination of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$ ($DPM = Ph_2PCH_2PPh_2$), has indicated that in this "A-frame" complex both the enclosed bridging site and exposed terminal sites are open to attack by small molecules. Whereas, in *trans*-$[RhCl(CO)(DPM)]_2$, a structural determination has shown that the bridging site is effectively blocked by the equatorial ligands, in particular the chloro ligands are skewed into this site, leaving only the possibility of terminal attack.

Halide exchange reactions were carried out on *trans*-$[RhCl(CO)(DPM)]_2$ in an effort to prepare the bromo and iodo derivatives. Instead the complexes $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$, which was structurally characterized, and $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2][I]$ were isolated as the final products. Iodide exchange on *trans*-$[RhCl(CO)(DAM)]_2$ ($DAM = Ph_2AsCH_2AsPh_2$) yields a mixture of *trans*-$[RhI(CO)(DAM)]_2$ and $[Rh_2I(CO)(\mu\text{-}CO)(DAM)_2][I]$.

The chemistry of these binuclear rhodium species with CO, CS_2 and SO_2 was investigated. The "A-frame" species $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BPh_4]$ undergoes a facile and reversible reaction with SO_2 yielding $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][BPh_4]$. Spectroscopic studies indicate that attack by SO_2 occurs directly at the bridging site. Treatment of this SO_2 adduct with excess SO_2 in the presence of chloride

ion or $[Rh_2Cl_2(CO)_2]^-$, which functions as a chloride transfer agent, results in the isolation of a second product $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ whose structure has been determined. Reaction of either *trans*-$[RhCl(CO)(DPM)]_2$ or $[Rh_2Cl_2(\mu\text{-}CO)\text{-}(DPM)_2]$ with SO_2 results finally in the isolation of $[Rh_2\text{-}Cl_2(\mu\text{-}SO_2)(DPM)_2]$ and reaction schemes are presented for both these reactions based on spectroscopic evidence. Treatment of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ with CO yields the tricarbonyl species $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][Cl]$. Similarly the reaction of $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ with excess CO also yields this tricarbonyl species. However on slow stepwise addition of CO, *trans*-$[RhCl(CO)(DPM)]_2$ is isolated. Reaction of a mixture of *trans*-$[RhI(CO)(DAM)]_2$ and $[Rh_2I(CO)\text{-}(\mu\text{-}CO)(DAM)_2][I]$ with CO or SO_2 yield the products $[Rh_2\text{-}(CO)_2(\mu\text{-}L)(\mu\text{-}I)(DAM)_2][I]$ ($L = CO, SO_2$).

Although CS_2 does not react with $[Rh_2(CO)_2(\mu\text{-}Cl)\text{-}(DPM)_2][BPh_4]$, its reaction with either trans-$[RhCl(CO)\text{-}(DPM)]_2$ or $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ yields as the final product $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$. A structural determination of this species has shown that two molecules of CS_2 have condensed yielding a C_2S_4 fragment which bridges the two rhodium centres such that a five membered Rh-C-S-C-S metallocycle and a four membered Rh-C-S-Rh metallocycle results. Reaction schemes for these reactions are presented based on spectroscopic data and analogies to SO_2 and acetylene chemistry.

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LIST OF ABBREVIATIONS

Me = methyl

Et = ethyl

n-Pr = n-propyl

i-Pr = iso-propyl

n-Bu = n-butyl

t-Bu = tert-butyl

COD = 1,5 cyclooctadiene

THF = tetrahydrofuran

HFB = hexafluoro-2-butyne

DMA = dimethylacetylenedicarboxylate

DPM = bis(diphenylphosphino)methane

DAM = bis(diphenylarsino)methane

CHAPTER I.

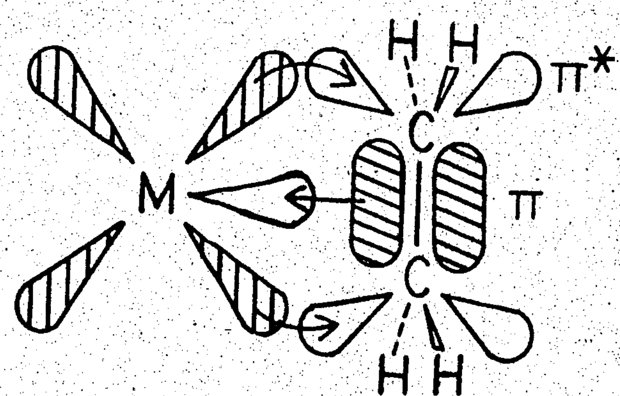
INTRODUCTION

Homogeneous catalysis by transition metal complexes is currently, and has been for two decades, an area of considerable interest.[1-4] Several important successes have been achieved in this area translating homogeneously catalyzed reactions into viable commercial processes. Included among these are the Wacker process for olefin oxidation based on a palladium catalyst,[5,6] the hydroformylation process using a rhodium (I) phosphine complex[7] and the carbonylation of methanol to acetic acid employing a rhodium carbonyl iodide species.[8,9]

Many approaches have been used in catalytic studies, however it remains of fundamental importance to obtain an understanding of the chemical processes which occur at the metal centre during the catalytic reaction. Such information is required if one hopes intelligently to modify the catalyst's properties to achieve the results desired. With this objective in mind it becomes convenient to break the catalytic reaction down into three steps:[10] 1) substrate coordination and activation; 2) substrate transformation into product or product precursor; and 3) product elimination. If catalyst regeneration has not occurred a fourth step, that of catalyst regeneration, must also be added.

In catalytic reactions direct information about any of the above steps is, by the very nature of the catalytic process, limited. However, one approach which has proven useful, involves model system studies utilizing complexes which are similar to a given catalyst but which are not themselves catalysts.[10-12] By this approach useful analogies can be made between the model system and the related catalyst. It is obvious, therefore, that small molecule coordination in transition metal complexes and the activation of the small molecule by the metal centre are of interest in that these topics pertain to the first step in the above breakdown of catalytic reactions. It is on this theme, i.e. the coordination and activation of small molecules in transition metal complexes, that this thesis will concentrate.

In studies of small molecule coordination and activation, the initial step involves the coordination of the small molecule to a coordinately unsaturated metal centre. Here it is important to have a knowledge of how the small molecule coordinates in order to understand the resulting chemistry. Concurrent with coordination is activation of the small molecule, making it more reactive than it was prior to coordination. Activation results from a net change in the electron density distribution within the coordinated molecule. In molecular orbital terms this corresponds to electron donation from the substrate bonding orbitals to the metal centre followed by back donation from the metal centre into orbitals which are antibonding in terms of the substrate bonds. The well known Dewar, Chatt, Duncanson[13,14] model for ethylene coordination to metals, which is diagrammed below, is a familiar example of this.



The bonding here is considered to consist of two interdependent components: 1) donation of π-electron density from the olefin to a σ-type acceptor orbital on the metal atom; and 2) back donation of electron density from filled metal dxz or other dπ-pπ hybrid orbitals into antibonding π^* orbitals of the olefin. Both components are synergically related, that is an increase in one component tends to promote an increase in the other and further both tend to decrease the bond order of the olefinic linkage. The structural results of this ethylene activation are well documented,[15,16] showing a lengthening of the C-C bond and a bending back of the hydrogen atoms away from the metal centre. Clearly, a thorough understanding of this first important step in catalytic processes, that of substrate coordination and activation, is extremely important for a better understanding of these reactions.

In this thesis the small molecules whose transition metal chemistry will be pursued are carbon monoxide, carbon disulfide and sulfur dioxide. Each of these molecules has important relevance to catalysis. The catalyzed activation of carbon monoxide, for example, is of importance since the conversion of coal[17] to substitute natural gas, hydrocarbons and organic chemicals is based on the metal catalyzed reduction of carbon monoxide via methanation reactions and the Fischer-Tropsch synthesis.[18-21] Carbon disulfide activation, on the other hand, may serve as a useful model for the activation of the less reactive carbon dioxide molecule, which is an abundant potential feedstock for hydrocarbon production.[10] And with the increased utilization of coal, the deleterious effects of sulfur dioxide on the environment encourage efforts aimed at its removal. The use of transition metal catalysts for SO_2 removal from flue gases has proven useful in this regard.[22-26]

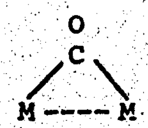
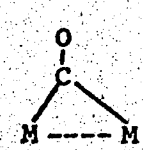
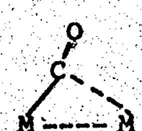
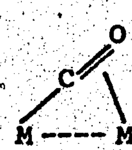
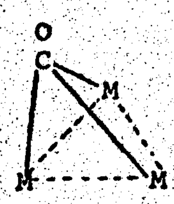
Furthermore, the three small molecules of interest are particularly germane to studies of small molecule coordination and activation since they each display a rich variety of coordination modes in metal complexes. Their study promises to yield valuable information relating these coordination modes to properties of the metal complexes, and therefore promises to increase our understanding of factors affecting small molecule coordination and activation.

Insertion reactions of these small molecules other than into metal-metal bonds, although potentially important models for catalytic processes such as the Fischer-Tropsch synthesis,[20,21] the catalytic carbonylation of methanol to acetic acid,[8] and hydroformylation reactions,[27,28] will not be discussed here.

The carbonyl group, which has been extensively studied,[10,29] is found to be a tremendously versatile ligand displaying a wide variety of coordination modes. These modes, together with examples of each are presented in Figure 1. The first and most common bonding mode is that of the terminal carbonyl ligand. In this geometry the carbonyl group is associated with only one metal centre, is bound through the carbon atom and has an essentially linear M-C-O linkage.

The second class is that of the doubly bridging carbonyl group in which the carbonyl ligand is associated simultaneously with two metal centres. In this case classification is somewhat more complex than in the terminal class, since now the carbonyl ligand can display a significant range in coordination geometries. For the sake of convenience however, these ligands can be grouped into three classes; symmetrical, asymmetrical and semibridging. One method of distinguishing these three, somewhat arbitrary classes is based on metal-carbonyl bond distances. For the

Figure 1. Coordination Modes of the Carbonyl Ligand

Mode		Example	Reference
terminal	M-C-O	*trans*-$[IrCl(CO)_2(PPh_3)_2]$	30
		trans-$[RhCl(CO)(DAM)]_2$	31
symmetrical-μ_2		$[Pd_2Cl_2(\mu\text{-}CO)(DAM)_2]$	32
		$[Fe_2(CO)_6(\mu\text{-}CO)(DPM)]$	33
asymmetrical-μ_2		$[Rh(CO)(\mu\text{-}CO)(PPh_3)_2]_2$	34
		$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]^+$	35
semibridging-μ_2		$[Fe_2(CO)_5(\mu\text{-}CO)(PhCCPh)]$	36
linear-μ_2		$[Mn_2(CO)_4(\mu\text{-}CO)(DPM)_2]$	37
triply-bridging		$[Co_6(CO)_{14}]^{4-}$	38

symmetrical species the metal-carbonyl distances differ by less than 3σ where, $\sigma = \sqrt{\sigma_a^2+\sigma_b^2}$ and σ_a and σ_b are the standard deviations in the two metal-carbonyl bond lengths. The species within the semibridging group, on the other hand, are arbitrarily defined as having metal-carbonyl distances, which differ by greater than 0.3 Å, and the third class, containing the asymmetrical species, between the two above extremes. In addition, a further distinction between these differing doubly bridging carbonyl geometries can be made based on the carbonyl C-O vector. In the symmetrical bridging mode the C-O vector is perpendicular to the M-M axis whereas in the asymmetrical and semibridging groups the C-O vector tends away from normality. Therefore, the closer the carbonyl geometry approaches the semibridging limit, the closer the M-C-O linkage is to being colinear with respect to the more strongly bound metal.

Another bridging carbonyl geometry, that of the linear-μ_2-bridging carbonyl mode, might be considered as a further extreme of the semibridging mode. In this carbonyl bonding mode the carbonyl ligand is σ-bound to one metal centre, resulting in an approximately linear M-C-O linkage and is simultaneously π-bound to a second metal centre. Unlike all previous carbonyl bonding modes, however, which function as two electron donors, this linear-μ_2-bridging ligand acts as a four electron donor.

The carbonyl ligand can also function as a triply bridging ligand having the carbonyl group simultaneously associated with three metal centres. As with the doubly bridging carbonyl ligands, the triply bridging carbonyl group can be either symmetrical or asymmetrical.

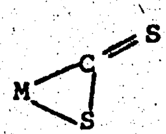
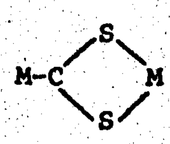
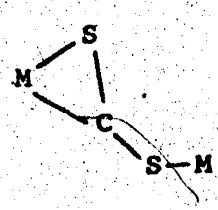
Until recently it was a well established dogma of transition metal carbonyl chemistry that bridging carbonyl groups were always accompanied by a metal-metal bond.[39,40] However, the recent structural characterizations of $[Pd_2Cl_2(\mu\text{-}CO)(DAM)_2]$,[32] $[Pt_2Cl_2(\mu\text{-}CO)(DAM)_2]$[41] and $[Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-}DMA)(DPM)_2]$[42] have shown that this is not the case. In each of the three complexes the metal-metal separation (ranging from 3.162(4)Å to 3.354(1)Å) is too long for a direct metal-metal interaction and the metal-carbonyl-metal angles are *ca.* 120°, contrasting with conventional bridging carbonyl ligands where angles between 62° and 90° are common.[29] The drawings in Figure 1, therefore, show dotted lines between the metal atoms to avoid implications regarding the presence or absence of a metal-metal bond.

The differentiation between the above carbonyl bonding modes can in general be conveniently carried out using infrared spectroscopy, since the carbonyl stretching frequencies for terminal carbonyl ligands are usually higher than those of doubly bridging carbonyl groups which are in turn higher than those for the triply bridging mode. However, differentiation between the types of doubly bridging modes presents a problem, since no obvious trend in their carbonyl stretching frequencies is observed. Thus, in

$[Pt_2Cl_2(\mu\text{-}CO)(DAM)_2]$,[41] which contains a symmetrical carbonyl ligand, the carbonyl frequency (1638 cm^{-1}) is significantly different than that observed in the analogous palladium complex, $[Pd_2Cl_2(\mu\text{-}CO)(DAM)_2]$ (1704 cm^{-1}) but compares well with that of $[Mn_2(CO)_4(\mu\text{-}CO)(DPM)_2]$ (1645 cm^{-1}),[37] which contains a linear-μ_2-bridging carbonyl group. It is relevant to discussions of carbonyl activation that the carbonyl stretching frequencies indicate an increase in activation (i.e. a decrease in C-O bond order) as the number of metal atoms associated with the ligand increases.

The carbon disulfide molecule also displays a variety of coordination modes, both in mononuclear and polynuclear species. Yet this small molecule has received relatively little attention with only a few species having been structurally characterized.[43,44] The three modes of carbon disulfide coordination which were structurally characterized at the time this research was undertaken are summarized in Figure 2. In the C,S-η^2 coordination geometry the carbon disulfide molecule is associated with only one metal centre, coordinating in a side-on manner via one of the sulfur atoms and the carbon atom. This is perhaps the commonest mode of CS_2 coordination. In addition, two bridging geometries have been observed for the carbon disulfide ligand, shown in Figure 2 as modes A and B. Mode A has the carbon atom bound to one metal centre and the two sulfur atoms coordinated to the second metal centre;

Figure 2. Structurally Characterized Coordination Modes of Carbon Disulfide

Mode		Example	Reference
C,S-η^2		$[Pt(PPh_3)_2(CS_2)]$	45
bridging A		$[Pt_2Cl(CS_2)(PPh_3)_4]^+$	46
bridging B		$(PhMe_2P)_2(CO)_2Fe(CS_2)Mn(CO)_2Cp$	47

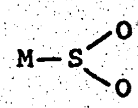
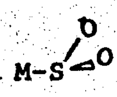
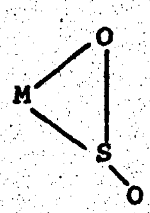
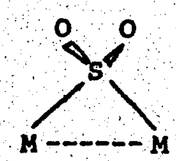
whereas mode B, has the CS_2 ligand coordinated in an $C,S-\eta^2$ fashion to one metal centre and via the second sulfur atom to the other metal centre.

Two other CS_2 bonding modes have been proposed although these have not been structurally characterized. Coordination of CS_2 through the sulfur atom (M-S=C=S) has been suggested,[48] however these species tend to be poorly characterized. Condensation of the carbon disulfide molecules yielding a C_2S_5 fragment has also been proposed in $[RhCl(PPh_3)_2(C_2S_5)]$[49] but characterization is again incomplete. In addition to these proposed coordination modes two others are possible based on analogies with CO_2 chemistry. These involve either a C_2S_4 fragment, resulting from the condensation of two CS_2 molecules, analogous to the C_2O_4 fragment observed in $[IrCl(C_2O_4)(PPh_3)_2]$,[50] or an η^1 carbon-bound species analogous to that proposed for CO_2 coordination in $[Ni(CO_2)(P(n\text{-}Bu)_3)_3]$.[51]

Correlations between the coordination mode of carbon disulfide and the infrared stretching frequencies have not been reported to date due to the limited structural data available. But again a significant drop in CS_2 stretching frequencies is observed on coordination implying activation of this molecule.

The sulfur dioxide ligand also displays a variety of coordination geometries in transition metal complexes.[52,53] Those geometries which have been structurally characterized are shown in Figure 3. When associated with a single metal

Figure 3. Coordination Modes of Sulfur Dioxide with Transition Metals

Mode		Example	Reference
coplanar-η^1		$[Ni(SO_2)(PPh_3)_3]$	54
		$[CpRh(C_2H_4)(SO_2)]$	55
pyramidal-η^1		$[IrCl(CO)(SO_2)(PPh_3)_2]$	56
		$[RhCl(SO_2)(PPh_3)_2]_2$	57
O,S-η^2		$[Rh(NO)(\eta^2\text{-}SO_2)(PPh_3)_2]$	58
		$[RuCl(NO)(\eta^2\text{-}SO_2)(PPh_3)_2]$	59
bridging-μ_2		$[Ir_2(CO)_4H_2(SO_2)(PPh_3)_2]$	60
		$[Ir_2(CO)_2I_4(SO_2)(PPh_3)_2]$	61
η^1-O	M-O-S-O	$[SbF_5OSO]$ [a]	62

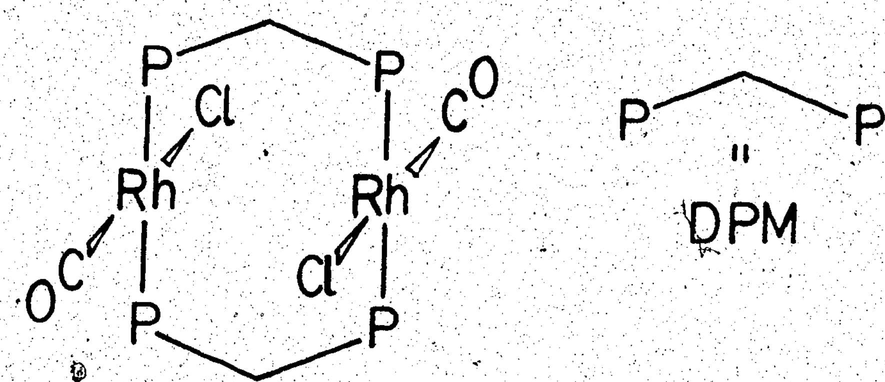
[a] Although Sb is not a transition metal, this represents a potential coordination mode in transition metal complexes.

centre sulfur dioxide can exhibit the following coordination modes: the coplanar geometry, in which the $M-SO_2$ framework is approximately planar; the pyramidal geometry, with the SO_2 plane inclined to the M-S vector; $O,S-\eta^2$ coordination with the sulfur atom and one of the oxygen atoms coordinated to the metal in a side-on manner; and terminal η^1-O coordination, in which the sulfur dioxide ligand is bound through one of the oxygen atoms. The coplanar and pyramidal coordination modes are often compared to the linear and bent geometries observed with the more extensively studied nitrosyl ligand.[63]

Sulfur dioxide has also been observed to bridge two metal centres in a symmetrical fashion. As now appears to be the case with the carbonyl ligand, a metal-metal bond is not a prerequisite to having a bridging SO_2 group. Therefore, in $[(Cp)_2Fe_2(CO)_4(\mu-SO_2)]$[64] the SO_2 ligand is bridging and unsupported, whereas in $[Ir_2(CO)_4H_2(PPh_3)_2(\mu-SO_2)]$[60] the bridging SO_2 ligand is accompanied by a metal-metal bond. Sulfur dioxide coordination to a terminal halogen in a pyramidal fashion is also known, as for example in $[Pt(Me)(I-SO_2)(PPh_3)_2]$.[65]

Spectroscopic identification of the sulfur dioxide coordination mode is not without difficulty. Although the various coordination geometries have associated ranges of ν(SO), large regions of overlap exist, especially between the bridging and pyramidal modes where the regions are essentially superimposed.[53] Thus unambiguous identification of the coordination geometry using infrared techniques, is in some cases difficult.

The chemistry of the above small molecules will be limited, in this thesis, to that involving binuclear diphosphine and diarsine bridged complexes of rhodium, similar to that shown below for *trans*-$[RhCl(CO)(DPM)]_2$:[66]



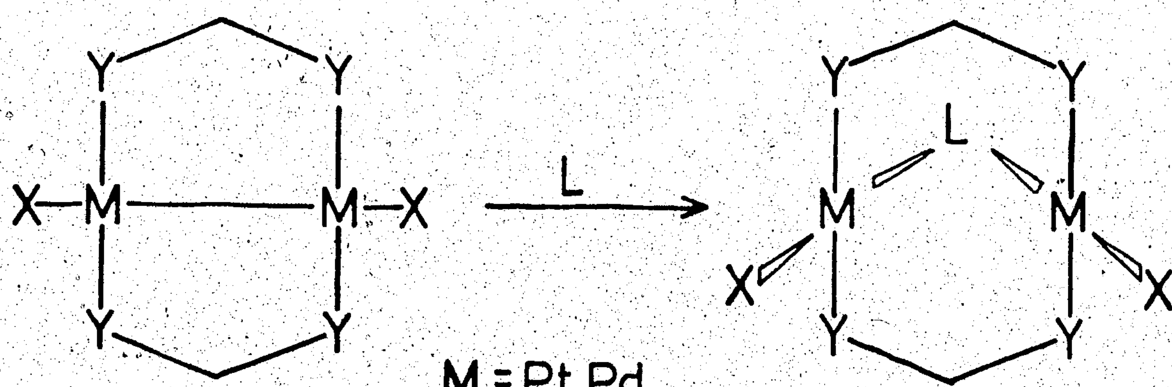
These binuclear complexes are closely related to group VIII mononuclear, four coordinate phosphine complexes such as Vallarino's compound, $[RhCl(CO)(PPh_3)_2]$[67] and Vaska's compound, $[IrCl(CO)(PPh_3)_2]$.[68] These mononuclear compounds have received a great deal of attention in the last twenty years and have been found to display a wide variety of small molecule addition and oxidative addition reactions.[69,70] The analogous binuclear complexes, of the type shown above, have on the other hand received much less attention and very little small molecule chemistry has been reported for them. In these binuclear complexes the metal atoms are held in close proximity by the bridging DPM or DAM ligands and, although chemistry similar to the related mononuclear complexes might be expected, one might also anticipate differences in their chemistries owing to the effects of metal proximity, in the binuclear case. In these species, the metal centres can react independently of each other reacting essentially as two monomeric units, or one metal centre can perturb the other thereby altering its chemistry significantly relative to the related mononuclear complex. Balch and Tulyathan[71] have carried out studies in this regard, relating the chemistry at the metal centres to the distance between them, utilizing diphosphines and other bidentate ligands of varying bite size to bridge two square planar Rh(I) centres. In one example, involving complexes of the type $[RhCl(CO)(L-L)]_2$, where L-L = $Ph_2P(CH_2)_nPPh_2$ (n=3,4), SO_2 attack was observed at only one rhodium site. It was therefore concluded that the normal reactivity of the rhodium site is diminished in these dimeric complexes and it was suggested that this lack of reactivity resulted from the inability of the unreactive rhodium site to readjust its coordination geometry to the arrangement necessary to bind a second substrate molecule.

The close proximity of the metals in binuclear species also suggests that they may serve as useful models for multi-centered metal catalysis.[11]

Although binuclear transition metal species have been reported for several bidentate diphosphine and diarsine ligands including R_2PPR_2 (R = Me,Et,Ph),[72] $Me_2AsAsMe_2$,[73] Me_2XYXMe_2 (X = P,As; Y = O,S),[73,74] $Me_2P(CH_2)_2PMe_2$,[75] $Ph_2P(CH_2)_2AsPh_2$,[76] $(t\text{-}Bu)_2P(CH_2)_nP(t\text{-}Bu)_2$ (n = 10,12),[77] $Ph_2P\overline{CC(PPh_2)(CF_2)_n}$ (n = 2,3,4)[78,79] and $Me_2As\overline{CC(AsMe_2)(CF_2)_n}$ (n = 2,3),[78,79] no reports on the chemistry of binuclear species containing these ligands with the small molecules of interest have appeared.

With the ligand of specific interest, bis(diphenylphosphino)methane (DPM) and bis(diphenylarsino)methane (DAM), several binuclear transition metal complexes are known, including: $[Mn_2(CO)_8(DPM)]$,[80] $[Mn_2(CO)_6(DPM)_2]$,[80] $[Mn_2(CO)_4(\mu\text{-}CO)(DPM)_2]$,[37,80] $[Mn_2(CO)_5(para\text{-}CH_3C_6H_4NC)(DPM)_2]$,[81] $[Mn(CO)_4(\mu\text{-}para\text{-}CH_3C_6H_4NC)(DPM)_2]$,[81] $[Fe_2(CO)_6(\mu\text{-}CO)(DPM)_2]$[33] and $[IrCl(CO)(DPM)]_2$.[82] Again the reactivity of these complexes towards small molecules has not been reported.

Some small molecule chemistry has been reported for binuclear DPM and DAM species of Pt, Pd and Rh. The Pt(I)[83] and Pd(I)[32,84] species of the type $[MX(L\text{-}L)]_2$ (M = Pd,Pt; X = Cl,Br; L-L = DPM,DAM), for example, undergo facile reactions with several small molecules including CO,[32,41,84] SO_2,[85] PhN_2^+,[86] CNR (R = CH_3, C_6H_{11}, C_6H_5, para-CH_3-C_6H_4),[84] acetylenes,[87] olefins,[87] N_2CH_2 (which yields a methylene species)[88] and S_8 (which yields a sulfido species)[85b] as shown below, by inserting into the metal-metal bond.



The carbonyl adduct, $[Pd_2Cl_2(\mu\text{-}CO)(DAM)_2]$,[32] represented the first structural characterization of a carbonyl ligand bridging two nonbonded metal centres. In addition, the insertions of CO and SO_2 in these systems were shown to be reversible. Kubiak and Eisenberg[89] have aptly dubbed these species "A-frame" complexes owing to the configuration of the equatorial ligands which roughly describes a letter A having the ligand L at the apex.

In addition, DPM-bridged Pd species are reported to undergo two other reactions. The first involves insertion of $SnCl_2$ into the Pd-Cl bonds of $[PdCl(DPM)]_2$ yielding $[Pd_2Cl(SnCl_3)(DPM)_2]$ and $[Pd(SnCl_3)(DPM)]_2$.[90] The second involves halide displacement from $[Pd_2Cl_2(\mu\text{-}CNR)\text{-}(DPM)_2]$ in the presence of excess isocyanide to reversibly yield the dicationic species $[Pd_2(CNR)_2(\mu\text{-}CNR)(DPM)_2]^{2+}$.[84]

Some small molecule chemistry of DPM-bridged rhodium complexes has also been reported. The reaction of the rhodium dicarbonyl "A-frame" species, $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]$-$[BPh_4]$ with CO produces the tricarbonyl complex $[Rh_2(CO)_2$-$(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][BPh_4]$.[35,91] However in contrast to the Pd and Pt species (vide supra) where insertion into a metal-metal bond occurs, carbon monoxide addition here occurs with the formation of a Rh-Rh bond. This tricarbonyl species verifies that small molecules can coordinate in the open bridging site of these "A-frame" complexes as was originally suggested by Eisenberg and Kubiak.[89] The analogous sulfido bridged "A-frame" species, $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$ has been treated with MeI, EtI, or LiI followed by CO addition resulting in a species postulated as $[RhI(CO)(\mu\text{-}CO)(DPM)]_2$.[89] However, based on the spectral data presented, this species is probably more correctly assigned as an iodo-bridged tricarbonyl complex, analogous to the cationic chloro-bridged species noted above. In addition, the reaction of the sulfido-bridged complex with HCl yields the species *trans*-$[RhCl(CO)(DPM)]_2$.[89] Both $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$[89] and *trans*-$[RhCl(CO)(DPM)]_2$[71] have been reported to react with SO_2, however the formulations for the products are unknown. Finally *trans*-$[RhCl(CO)(DPM)]_2$ has been observed to react with iodine yielding the novel Rh(II) species $[RhClI(CO)$-$(DPM)]_2$.[71]

Owing to the lack of small molecule chemistry with binuclear Rh species and because of the potential relevance of such studies to catalytically interesting systems, as mentioned previously, an investigation into the chemistry of trans-$[RhCl(CO)(DPM)]_2$ and $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ with CO, CS_2 and SO_2 was undertaken.

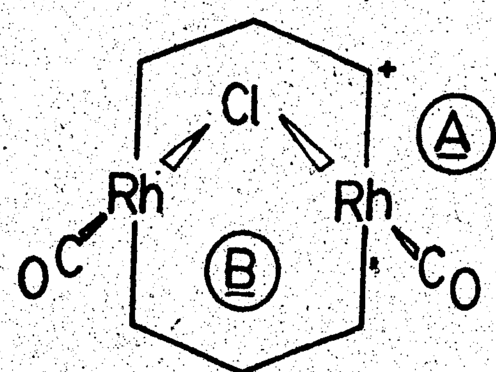
Since it is difficult on the basis of analytical and spectral data to unambiguously assign the mode of small molecule coordination, the technique of X-ray diffraction was used extensively throughout this study. The reader is referred to several standard texts for detailed discussions of the theoretical and experimental considerations of X-ray diffraction.[92-95]

CHAPTER II.

The Structure of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$: A Binuclear "A-frame" Complex

INTRODUCTION

The cationic complex, $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ (1), was assumed to be an "A-frame" type species, as shown below, based on spectral data, on the structural characterization of its carbonyl adduct,[35,91] $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]^+$ (2) and on analogies with the sulfido-bridged species,[89] $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$ (3).



1

Complex 1 reacts reversibly with CO[35,91] and SO_2[96] (see Chapter IV) and undergoes facile reactions with several other small molecules, including NO[97] and tetracyanoethylene.[98] The reactions of 1 with CO and SO_2 contrast the two possible modes of attack on this species by small molecules.

Whereas CO attacks the open terminal coordination site A, remote from the bridging site B and results in one of the originally coordinated carbonyl ligands swinging into the bridging site,[91] SO_2 seems to attack directly at the bridging site yielding $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2]^+$.[96]

The structural determination of the closely related, sulfido bridged "A-frame" complex 3,[89] indicated that the bridging site was blocked, at least in the solid state, by four of the DPM phenyl groups. In particular, two rings were found to severely obstruct this site. Although the details of the chemistry of 3 with small molecules are not known to us, other "A-frame" species, having their bridging sites obstructed in the same way, show chemistry consistent with terminal ligand attack as opposed to attack at the bridging site (see Chapter IV). Since 1 seems to allow attack at both the bridging and terminal sites, it was of interest to obtain precise structural information on this "A-frame" species with hopes of establishing possible structure-reactivity correlations.

EXPERIMENTAL

All solvents used throughout this study were dried and degassed prior to use and all reactions were performed under Schlenk conditions using an atmosphere of dinitrogen or the reactant gas. $RhCl_3 \cdot 3H_2O$ was purchased from Research Organic/Inorganic Chemical Corporation and DPM and

DAM were purchased from Strem Chemicals. All other chemicals were reagent grade and used as received. Infrared spectra were recorded on either a Perkin Elmer Model 467 spectrometer or a Nicolet 7199 F.T. interferometer using Nujol mulls on KBr plates. NMR spectra were recorded on a Bruker HFX-90 NMR spectrometer. Conductivity measurements were obtained on a Yellow Springs Instruments Model 31 Conductivity bridge using approximately 1.0 mM solutions in acetone.

Preparation of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BPh_4]$

Treatment of a solution of 0.100 g (0.202 mmol) of $[RhCl(COD)]_2$[99] in 20 mL of CH_2Cl_2 with 0.103 g (0.269 mmol) of DPM dissolved in 5 mL of toluene under a carbon monoxide atmosphere yielded $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][RhCl_2(CO)_2]$. Addition of 0.458 g (1.34 mmol) of $NaBPh_4$, followed by 40 mL of Et_2O resulted in the precipitation of the cationic tricarbonyl species as the BPh_4^- salt in 90% yield. ~~Slow~~ concentration of this solution of $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]$-$[BPh_4]$ under a dinitrogen flow yielded the dicarbonyl species, $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BPh_4]$, as a yellow-orange microcrystalline solid.

The serendipitous crystallization of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$

To a solution of 0.100 g (0.072 mmol) of $[Rh_2(CO)_2$-$(\mu\text{-}Cl)(DPM)_2][BPh_4]$ in 8 mL of acetone was added 0.020 g (0.080 mmol) of $[PhN_2][PF_6]$. Slow diffusion of Et_2O into the reaction mixture yielded yellow-orange prismatic crystals. Although too few of the yellow-orange crystals were obtained for elemental analysis or a ^{31}P NMR spectrum, an infrared spectrum of the complex ($\nu(CO)$ 1995(s), 1978(vs) cm^{-1}; $\nu(BF)$ 1060 (m,br) cm^{-1}) indicated that they were $[Rh_2(CO)_2(\mu-Cl)(DPM)_2][BF_4]$.

Preparation of $[Rh_2(CO)_2(\mu-Cl)(DPM)_2][BF_4]$

To a solution of 0.100 g (0.075 mmol) of $[Rh_2(CO)_2-(\mu-Cl)(DPM)_2][RhCl_2(CO)_2]$ in 10 mL of CH_2Cl_2 was added 0.017 g (0.150 mmol) of $NaBF_4$. Slow concentration of this solution under a dinitrogen stream yielded yellow-orange crystals of $[Rh_2(CO)_2(\mu-Cl)(DPM)_2][BF_4]$. The infrared spectrum of this compound was identical to that of the crystals initially obtained, one of which was used in the structure determination (vide infra).

^{31}P and ^{19}F NMR Results

A solution was prepared in d^6-acetone containing 0.050 g (0.036 mmol) of $[Rh_2(CO)_2(\mu-Cl)(DPM)_2][BPh_4]$ and 0.010 g (0.040 mmol) of $[PhN_2][PF_6]$. The ^{19}F and $^{31}P\{^1H\}$ NMR were recorded immediately after preparation and again after approximately two weeks. The initial spectra showed that the only fluorine containing species was the PF_6^- anion (^{19}F NMR $\delta = 71.7$ ppm,[100] doublet, $|J_{P-F}| = 707$ Hz; $^{31}P\{^1H\}$ NMR $\delta = -144.0$ ppm,[101] septet, $J_{P-F} = 708$ Hz). The spectra of the aged sample showed the presence of the PF_6^- anion as well as resonances in the ^{19}F NMR at $\delta = 130.8$ ppm (heptet, $|J_{F-H}|$ = 6.3 Hz, possibly Me_2SiF_2); δ = 150.0 ppm (singlet) and δ = 150.1 ppm (br singlet, BF_4^-). In both $^{31}P\{^1H\}$ NMR spectra (new and two week old samples) the resonance due to the cation $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ was observed. No other rhodium-DPM species was detected.

Data Collection

A crystal of the title compound was mounted and sealed in a glass capillary. Preliminary film data showed $\bar{1}$ Laué symmetry and no systematic absences, consistent with the space groups P1 and P$\bar{1}$. The centrosymmetric space group P$\bar{1}$ was chosen and later verified by; (1) the successful refinement of the structure with acceptable positional parameters, thermal parameters and agreement indices, and (2) the location of all hydrogen atoms in electron density difference maps. Accurate cell parameters were obtained by a least-squares analysis of the setting angles of 12 carefully centered reflections chosen from diverse regions of reciprocal space ($50° < 2\theta < 70°$, CuKα radiation) and obtained by using a narrow X-ray source (see Table I for pertinent crystal data). A cell reduction[102] failed to show the presence of higher symmetry. The reduced cell is reported.

Intensity data were collected on a Picker four-circle automated diffractometer equipped with a scintillation counter and pulse-height analyzer, tuned to accept 90% of the CuKα peak. Background counts were measured at both ends of the scan range with crystal and counter stationary.

Table 1. Summary of Crystal Data and Intensity Collection for $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$

Compound	$[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$
Formula	$C_{52}H_{44}B_1Cl_1F_4O_2P_4Rh_2$
Formula Weight	1152.89 amu
Reduced Cell Parameters	
a	13.044(1)Å
b	14.962(1)Å
c	12.800(1)Å
α	96.20(1)°
β	92.56(1)°
γ	86.42(1)°
V	2476.8 $Å^3$
Z	2
Density	1.545 $g\cdot cm^{-3}$ (calc'd.) 1.547(5) $g\cdot cm^{-3}$ (expt'l. by flotation)
Space Group	$C_i^1 - P\bar{1}$
Crystal Dimensions	0.345 x 0.303 x 0.147 mm
Crystal Volume	0.0129 mm^3
Crystal Faces (and distances from an arbitrary origin within the crystal (mm))	1 1 0 (0.145) 1 $\bar{1}$ 0 (0.145) $\bar{1}$ 1 0 (0.155) $\bar{1}$ $\bar{1}$ 0 (0.195) 0 0 1 (0.075) 0 0 $\bar{1}$ (0.071) 0 $\bar{1}$ 0 (0.222) 0 1 $\bar{1}$ (0.122) 0 $\bar{1}$ 1 (0.162) $\bar{1}$ 0 1 (0.122) $\bar{1}$ 0 0 (0.208)
Temperature	20°C
Radiation	CuKα (λ=1.540562 Å) filtered with 0.5 mil thick nickel foil
μ	77.256 cm^{-1}
Range in Absorption Correction Factors	0.156 - 0.403

Table 1, continued

Takeoff Angle	2.90°
Scan Speed	2° in 2θ/min
Scan Range	0.80° below $K_{\alpha 1}$ to 0.80° above $K_{\alpha 2}$
Background Counting Time	10s (3°<2θ<75°); 20s (75°<2θ≤104°); 40s (104°<2θ≤120°)
2θ limits	3°≤2θ≤120°
2θ units for centred reflections	50°≤2θ≤70°
Final number of variables	298
Unique Data Collected	7416
Unique Data Used ($F_o^2 \geq 3\sigma(F_o^2)$)	5729
Error in observation of unit weight	1.792
R	0.046
R_w	0.064

Assuming approximate linearity of background, the intensity of the peak (I) is given by:

$$I = PK - (B_1+B_2)\ t_P/t_B \qquad (2)$$

where PK = peak count, t_P = peak scan time, t_B = the sum of the two background collection times and B_1 and B_2 are the background counts. Standard deviations in the intensity were computed from the relationship:

$$\sigma(I) = (PK+t^2B_T+p^2I^2)^{\frac{1}{2}} \qquad (3)$$

where $B_T = B_1+B_2$, $t = t_P/t_B$ and p is an ignorance factor used to account for machine uncertainty and to prevent unreasonably high weighting being applied to reflections of high intensity (a value of 0.05 was used for p).[103] The intensities of three standard reflections were measured automatically every 100 reflections and four additional standards were measured three times a day in order to check crystal stability and centering. All standards remained constant to within 1.5% of the mean throughout the data collection.

The intensities of 7416 unique reflections ($3° \leq 2\theta \leq 120°$) were measured using CuKα radiation. Of these, 5729 were considered significantly above background ($F^2/\sigma(F^2) \geq 3.0$, see Table 1) and were used in subsequent calculations. These observed data were reduced to structure factor amplitudes and standard deviations in the structure factors, σ(F), by correction for Lorentz, polarization and absorption effects.[92-95] Similar procedures of data collection and reduction were followed on all subsequent structures.

Structure Solution and Refinement

A Patterson map[104,105] was computed between the limits $0 \leq u \leq 1.0$, $0 \leq v \leq 1.0$ and $0 \leq w \leq 0.5$. The Rh-Rh vectors are derived for two independent rhodium atoms in the space group $P\bar{1}$ in Table 2. The origin peak corresponds to the sum of the vectors between every atom and itself, in the unit cell. Therefore the magnitude of the origin vector is roughly proportional to: $\sum_i Z_i^2$, summed over the contents of the unit cell, $= (4\text{x}45^2 + 2\text{x}17^2 + 8\text{x}15^2 + 8\text{x}9^2 + 4\text{x}8^2 + 104\text{x}6^2 + 2\text{x}5^2 + 88\text{x}1^2) = 15264$. In the Fourier program used to calculate the vector map, the origin peak is normalized to 1000. Therefore assuming comparable thermal parameters for all atoms one expects the Rh(1)-Rh(2) vectors which are doubly weighted (see Table 2) to have an approximate, normalized value of 265 (ie. $\frac{2\text{x}45^2}{15264} \text{ x } 1000$), and the Rh(1)-Rh(1) and Rh(2)-Rh(2) vectors, which are singly weighted to have an intensity of 133 above background. Viewing the Patterson map, the nine most intense peaks of which, are summarized in Table 3, it is obvious that three vectors, instead of the anticipated two, are observed with weights comparable to those expected for the Rh(1)-Rh(2) vectors. One of these three, the second peak listed, is actually a result of Rh-P_o vector build-up. Generally the DPM ligands are mutually trans

Table 2. Derivation of the Rh-Rh Vectors for the Space Group $P\bar{1}$

	x_1,y_1,z_1 [a]	$\bar{x}_1,\bar{y}_1,\bar{z}_1$	x_2,y_2,z_2	$\bar{x}_2,\bar{y}_2,\bar{z}_2$
x_1,y_1,z_1	0,0,0	$2\bar{x}_1,2\bar{y}_1,2\bar{z}_1$	$-(x_1-x_2)$ $-(y_1-y_2)$ $-(z_1-z_2)$	$-(x_1+x_2)$ $-(y_1+y_2)$ $-(z_1+z_2)$
$\bar{x}_1,\bar{y}_1,\bar{z}_1$	$2x_1,2y_1,2z_1$	0,0,0	x_1+x_2 y_1+y_2 z_1+z_2	x_1-x_2 y_1-y_2 z_1-z_2
x_2,y_2,z_2	x_1-x_2 y_1-y_2 z_1-z_2	$-(x_1+x_2)$ $-(y_1+y_2)$ $-(z_1+z_2)$	0,0,0	$2\bar{x}_2,2\bar{y}_2,2\bar{z}_2$
$\bar{x}_2,\bar{y}_2,\bar{z}_2$	x_1+x_2 y_1+y_2 z_1+z_2	$-(x_1-x_2)$ $-(y_1-y_2)$ $-(z_1-z_2)$	$2x_2,2y_2,2z_2$	0,0,0

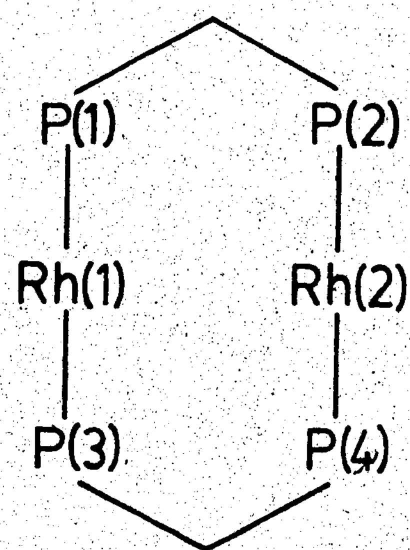
Vector	Weight
0,0,0	4
x_1+x_2,y_1+y_2,z_1+z_2	2
$-(x_1+x_2),-(y_1+y_2),-(z_1+z_2)$	2
x_1-x_2,y_1-y_2,z_1-z_2	2
$-(x_1-x_2),-(y_1-y_2),-(z_1-z_2)$	2
$2x_1,2y_1,2z_1$	1
$2\bar{x}_1,2\bar{y}_1,2\bar{z}_1$	1
$2x_2,2y_2,2z_2$	1
$2\bar{x}_2,2\bar{y}_2,2\bar{z}_2$	1

[a] (x_1,y_1,z_1) and (x_2,y_2,z_2) are the coordinates of Rh(1) and Rh(2) respectively.

Table 3: Assignment of the Most Intense Patterson Map Vectors

No.	u	v	w	Relative Weight	Assignment
1	0.640	0.420	0.192	357	$(x_1+x_2, y_1+y_2, z_1+z_2)$
2	0.960	0.030	0.192	339	Rh-P vector build-up
3	0.160	0.120	0.064	290	$(x_1-x_2, y_1-y_2, z_1-z_2)$
4	0.120	0.150	0.224	190	Rh-P vector build-up
5	0.680	0.390	0.032	187	Rh-P vector build-up
6	0.800	0.540	0.256	180	$(2x_1, 2y_1, 2z_1)$
7	0.600	0.420	0.384	175	Rh-P vector build-up
8	0.000	0.180	0.000	152	Rh(1)-Cl and Rh(1)-O
9	0.480	0.270	0.160	148	$(2x_2, 2y_2, 2z_2)$

and the Rh-P framework is approximately planar as shown below:



The Rh(1)-P(1), Rh(2)-P(2), P(3)-Rh(1) and P(4)-Rh(2) vectors are therefore almost coincident, yielding a Rh-P vector build-up of approximate weight 353 ($\frac{2x4x15x45}{15264}$ x 1000). Similarly other vector build-ups may also occur. This complication in solving the Patterson maps continued throughout this study, however it is readily overcome by using image seeking techniques and comparing vector lengths. Typically Rh-P vectors are *ca.* 2.35 Å whereas the Rh(1)-Rh(2) vectors are in the range 2.7 - 3.4 Å. Applying these methods it became obvious that the first peak was associated with the Rh(1)-Rh(2) vector, (x_1+x_2, y_1+y_2, z_1+z_2) and the third peak with the Rh(1)-Rh(2) vector (x_1-x_2, y_1-y_2, z_1-z_2) with the latter having a distance from the origin of *ca.* 2.87 Å (the approximate metal-metal separation in the dimer). The second peak which is approximately 2.52 Å from the (1.0,0.0,0.0) origin is due to Rh-P vector build-up. The positions of the rhodium atoms are then calculated as Rh(1) (0.40,0.27,0.13) and Rh(2) (0.23,0.14,0.07). The sixth peak then corresponds to the $(2x_1, 2y_1, 2z_1)$ vector and the ninth peak to the $(2x_2, 2y_2, 2z_2)$ vector, with the intervening peaks resulting from vector build-up as indicated in Table 3.

A full-matrix, least-squares refinement based on the two rhodium atom positions converged in two cycles to $R = 0.46$ and $R_w = 0.56$. These R factors as calculated in the least-squares program are defined as:

$$R = \Sigma||F_o| - |F_c||/\Sigma|F_o| \quad (4)$$

and

$$R_w = \{\Sigma w(|F_o| - |F_c|)^2/\Sigma w|F_o|^2\}^{\frac{1}{2}} \quad (5)$$

where $|F_o|$ and $|F_c|$ are the observed and calculated structure amplitudes, respectively, and w, the weighting factor, is defined as $w = 1/\sigma^2(F)$. The function minimized during the least square refinement was $\Sigma w(|F_o| - |F_c|)^2$. Structure factors were calculated using the atomic scattering factors taken from Cromer and Waber's[106] tabulation for all atoms except hydrogen for which the values of Stewart *et al.*[107] were used. Anomalous dispersion corrections,[108] both real and imaginary[109] were applied to F_c.

An electron density difference map, phased on the two rhodium atom positions, yielded the location of the phosphorus and chlorine atoms. A subsequent least-squares refinement and an electron density difference map calculated using the rhodium, phosphorus and chlorine atom positions, revealed the location of all other non-hydrogen atoms within the cation. The carbon atoms of the phenyl rings were refined in all least-squares calculations as rigid groups having D_{6h} symmetry and C-C distances of 1.392 Å.

Although the infrared spectrum indicated that the present complex had crystallized as the BF_4^- salt, our initial unwillingness to accept the apparent transformation of PF_6^- and BPh_4^- into BF_4^- together with the pseudo octahedral coordination about the central atom in the electron density difference map, led us to attempt refinement of the electron density about the 1(c) and 1(f) inversion centres as PF_6^- anions. However, these refinement attempts proved unsuccessful, even considering disorder of the groups. The thermal parameters for both phosphorus atoms exceeded 30 $Å^2$ and chemically unreasonable P-F distances resulted. A closer inspection of the electron density difference map revealed that there were eight peaks about both sets of inversion centres and not just the six originally located. The placement of these eight peaks corresponded to superimposed, inversion related, tetrahedral BF_4^- groups. Furthermore, the central peaks were more consistent with boron than phosphorus, having intensities in the electron density difference map (4.7 and 3.3 e/Å^3) comparable to the half-weighted fluorine peaks (3.7-1.8 e/Å^3). Refinement of this model as inversion disordered BF_4^- groups proceeded well, resulting in reasonable bond lengths, thermal parameters and well defined tetrahedral geometries about the central boron atom.

The data were corrected for the effects of absorption by Gaussian integration. All non-group atoms excluding hydrogen were refined with anisotropic thermal parameters, where the form of the thermal ellipsoid used was $\exp[-(\beta_{11}h^2+\beta_{22}k^2+\beta_{33}\ell^2+2\beta_{12}hk+2\beta_{13}h\ell+2\beta_{23}k\ell)]$.

An electron density difference map at this stage revealed the location of all hydrogen atoms in the structure. These atoms were included as fixed contributions in calculating the structure factors and were not refined. Their idealized positions were calculated from the geometries of their attached carbon atoms by using C-H distances of 0.95 Å. Hydrogen atoms were assigned isotropic thermal parameters of 1 Å^2 greater than those of their attached carbon atom or 1 Å^2 greater than the equivalent isotropic B when the carbon atom was refined anisotropically. Throughout this study hydrogen atoms were always handled in a similar manner.

The final model with 298 parameters varied converged to $R = 0.046$ and $R_w = 0.064$. In the final electron density difference map all of the highest 20 peaks were in the vicinity of the phenyl rings (0.66-0.41 e/Å^3), with smaller residuals in the areas of the BF_4^- anions. A typical carbon atom on an earlier difference map had an electron density of about 5.0 e/Å^3.

The programs used in the solution and refinement of structure and presentation of data are listed briefly in Appendix I.

Results

The final positional and thermal parameters for the nongroup and group atoms are given in Tables 4 and 5, respectively. The idealized positional and thermal parameters for the hydrogen atoms are given in Table 6. Least-squares plane calculations are recorded in Table 7 and selected bond lengths and angles are shown in Tables 8 and 9, respectively. A listing of the observed and calculated structure amplitudes is available.[110]

The unit cell of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$ is shown in Figure 4. The crystallographic *b* axis is horizontal to the right, the *c* axis runs from top to bottom and the *a* axis goes into the page. With the exception of the methylene hydrogen atoms, which are drawn artificially small for clarity of the drawing, 20% thermal ellipsoids are used on this and all subsequent drawings unless noted otherwise. Only one set of the inversion disordered F atoms for each BF_4^- group is included. Figure 5 presents a perspective view of the $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ cation, including the numbering scheme. The numbering of the phenyl carbon atoms starts at the carbon bound to the phosphorus atom and increases sequentially around the ring. The inner coordination sphere of the $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ cation is shown in Figure 6 along with some relevant bond lengths. In this figure 50% thermal ellipsoids are used. The two independent tetrafluoroborate anions are shown in Figure 7; again only one of each of the disorder sets of F atoms is included.

TABLE 4. Positional and Thermal Parameters For The Nongroup Atoms of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$.

Atom	x[a]	y	z	U11[b]	U22	U33	U12	U13	U23
Rh(1)	0.40834(4)	0.26969(3)	0.12814(3)	4.39(3)	3.55(3)	2.97(2)	-0.60(2)	0.40(2)	0.16(2)
Rh(2)	0.22996(3)	0.13772(3)	0.07315(3)	3.50(3)	4.48(3)	2.83(2)	-0.32(2)	0.20(2)	0.02(2)
Cl	0.4043(1)	0.1092(1)	0.1290(1)	4.06(8)	3.84(8)	4.00(7)	0.05(6)	-0.07(6)	0.38(6)
P(1)	0.3539(1)	0.2916(1)	0.2999(1)	4.30(9)	3.56(8)	2.98(7)	-0.28(7)	0.24(6)	0.20(6)
P(2)	0.1866(1)	0.1546(1)	0.2482(1)	3.84(8)	3.97(9)	3.02(7)	-0.31(7)	0.19(6)	0.37(6)
P(3)	0.4513(1)	0.2486(1)	-0.0471(1)	3.76(8)	4.04(9)	3.41(8)	-0.14(7)	0.54(6)	0.41(7)
P(4)	0.2816(1)	0.1132(1)	-0.0994(1)	3.56(8)	4.34(9)	3.03(7)	-0.08(7)	0.31(6)	-0.02(6)
O(1)	0.4525(5)	0.4614(4)	0.1349(5)	12.0(5)	4.9(3)	7.0(4)	-2.7(3)	1.0(4)	0.4(3)
O(2)	0.0117(4)	0.1436(5)	0.0009(5)	3.8(3)	16.0(7)	6.7(4)	-0.9(3)	-0.5(3)	0.4(4)
C(1)	0.4330(6)	0.3875(5)	0.1318(5)	6.8(5)	4.8(4)	3.5(3)	-1.4(4)	1.0(3)	-0.2(3)
C(2)	0.0969(6)	0.1438(6)	0.0295(5)	4.6(4)	9.5(6)	3.1(3)	-0.5(4)	1.1(3)	0.1(4)
C(3)	0.2926(5)	0.1943(4)	0.3379(4)	4.3(3)	3.3(3)	2.7(3)	-0.6(3)	0.2(3)	0.3(2)
C(4)	0.4151(5)	0.1398(4)	-0.1155(5)	3.9(3)	4.4(4)	3.1(3)	-0.5(3)	0.4(3)	0.1(3)
B(1)	1/2	0	1/2	8(1)	6(1)	24(4)	1(1)	-5(2)	5(2)
B(2)	0	1/2	0	5.5(8)	8(1)	4.4(6)	-3.8(7)	1.8(6)	-1.4(6)
F(1)	0.4693(8)	0.0401(7)	0.400(1)	7.8(7)	7.0(7)	16(1)	1.2(6)	0.5(8)	3.8(7)
F(2)	0.416(1)	-0.0482(9)	0.518(1)	11(1)	9.2(9)	15(1)	-0.1(8)	-1.5(9)	4.1(8)
F(3)	0.585(1)	-0.057(2)	0.471(2)	7.4(9)	20(2)	25(2)	1(1)	-2(1)	10(2)
F(4)	0.504(3)	0.071(2)	0.590(2)	26(3)	34(4)	26(4)	-11(3)	-8(3)	21(3)
F(5)	-0.021(3)	0.516(2)	0.101(1)	17(2)	21(2)	7(1)	4(2)	2(1)	1(1)
F(6)	-0.101(1)	0.543(2)	-0.036(1)	10(1)	28(2)	10(1)	4(1)	-0.3(9)	2(1)
F(7)	-0.015(3)	0.420(2)	-0.032(3)	24(3)	30(3)	22(3)	-13(3)	11(2)	-11(3)
F(8)	0.062(2)	0.536(4)	-0.036(4)	14(2)	40(5)	23(3)	-11(3)	5(3)	8(4)

[a] Estimated standard deviations in the least signicant figure(s) are given in parentheses in this and all subsequent tables.

[b] The form of the thermal ellipsoid is: $\exp[-2\pi^2(a^{*2}U_{11}h^2+b^{*2}U_{22}k^2+c^{*2}U_{33}l^2+2a^*b^*U_{12}hk+2a^*c^*U_{13}hl+2b^*c^*U_{23}kl)]$. The quantities given in the table are the thermal coefficients x 10^2.

TABLE 5. Derived Parameters For the Rigid Group Atoms of [Rh2(CO)2(mu-Cl)(DPM)2][BF4].

Atom	x	y	z	B(A^2)	Atom	x	y	z	B(A^2)
C(11)	0.4583(4)	0.3097(3)	0.3990(3)	3.2(1)	C(51)	0.3953(4)	0.3319(3)	-0.1297(5)	3.1(1)
C(12)	0.5109(4)	0.3878(3)	0.3988(4)	5.1(2)	C(52)	0.3195(4)	0.3956(3)	-0.0927(3)	3.7(1)
C(13)	0.5950(4)	0.4031(3)	0.4678(4)	6.1(2)	C(53)	0.2792(3)	0.4599(3)	-0.1566(4)	4.7(2)
C(14)	0.6266(4)	0.3403(3)	0.5370(3)	5.2(2)	C(54)	0.3146(4)	0.4603(3)	-0.2575(5)	4.8(2)
C(15)	0.5740(4)	0.2622(3)	0.5373(4)	4.7(2)	C(55)	0.3904(4)	0.3966(3)	-0.2945(3)	4.9(2)
C(16)	0.4899(4)	0.2469(3)	0.4683(4)	4.0(1)	C(56)	0.4308(3)	0.3324(3)	-0.2306(4)	4.1(1)
C(21)	0.2626(4)	0.3859(3)	0.3369(5)	3.1(1)	C(61)	0.5878(3)	0.2488(4)	-0.0706(3)	3.4(1)
C(22)	0.2289(4)	0.3976(3)	0.4394(5)	4.0(1)	C(62)	0.6338(4)	0.3306(3)	-0.0484(4)	5.0(2)
C(23)	0.1575(5)	0.4677(3)	0.4696(3)	4.9(2)	C(63)	0.7376(4)	0.3360(3)	-0.0662(4)	5.8(2)
C(24)	0.1199(4)	0.5260(3)	0.3974(5)	5.3(2)	C(64)	0.7955(3)	0.2596(4)	-0.1063(3)	6.3(2)
C(25)	0.1537(4)	0.5143(3)	0.2949(5)	5.4(2)	C(65)	0.7495(4)	0.1778(3)	-0.1285(4)	7.5(2)
C(26)	0.2251(5)	0.4443(3)	0.2647(3)	4.4(1)	C(66)	0.6457(4)	0.1725(3)	-0.1106(4)	5.5(2)
C(31)	0.1580(4)	0.0486(3)	0.2949(4)	3.1(1)	C(71)	0.2819(4)	-0.0054(3)	-0.1488(5)	3.6(1)
C(32)	0.0703(4)	0.0085(3)	0.2508(4)	4.7(2)	C(72)	0.3512(4)	-0.0443(3)	-0.2225(3)	4.9(2)
C(33)	0.0407(3)	-0.0706(3)	0.2858(3)	5.5(2)	C(73)	0.3497(4)	-0.1357(4)	-0.2571(3)	6.4(2)
C(34)	0.0986(4)	-0.1097(3)	0.3647(4)	6.7(2)	C(74)	0.2789(4)	-0.1882(3)	-0.2180(5)	6.5(2)
C(35)	0.1862(4)	-0.0696(3)	0.4087(4)	6.5(2)	C(75)	0.2096(4)	-0.1493(3)	-0.1443(3)	6.9(2)
C(36)	0.2159(3)	0.0095(3)	0.3738(3)	4.6(2)	C(76)	0.2110(4)	-0.0579(4)	-0.1097(3)	5.3(2)
C(41)	0.0735(5)	0.2272(3)	0.2846(3)	3.2(1)	C(81)	0.2112(4)	0.1735(3)	-0.1989(3)	3.2(1)
C(42)	0.0435(6)	0.2979(3)	0.2256(3)	4.2(1)	C(82)	0.2215(4)	0.1442(3)	-0.3051(5)	4.5(1)
C(43)	-0.0436(4)	0.3531(3)	0.2515(5)	5.2(2)	C(83)	0.1700(5)	0.1919(3)	-0.3811(3)	5.5(2)
C(44)	-0.1006(5)	0.3375(3)	0.3364(3)	5.4(2)	C(84)	0.1082(4)	0.2687(3)	-0.3509(3)	5.5(2)
C(45)	-0.0705(6)	0.2668(3)	0.3954(3)	5.0(2)	C(85)	0.0979(4)	0.2979(3)	-0.2447(5)	5.2(2)
C(46)	0.0165(4)	0.2116(3)	0.3695(5)	4.0(1)	C(86)	0.1494(5)	0.2503(3)	-0.1687(3)	4.1(1)

Rigid Group Parameters

	Xc [a]	Yc	Zc	Delta [b]	Epsilon	Eta
Ring1	0.5425(2)	0.3250(2)	0.4680(3)	0.449(3)	2.401(3)	6.049(3)
Ring2	0.1913(2)	0.4560(2)	0.3671(3)	2.443(3)	1.338(4)	1.187(4)
Ring3	0.1283(3)	-0.0306(2)	0.3298(3)	3.671(3)	2.445(4)	4.772(3)
Ring4	-0.0135(2)	0.2823(2)	0.3105(2)	-0.699(3)	0.826(4)	5.497(4)
Ring5	0.3550(2)	0.3961(2)	-0.1936(2)	2.424(3)	1.212(4)	2.062(3)
Ring6	0.6916(3)	0.2542(3)	-0.0884(3)	3.350(4)	0.241(3)	3.025(3)
Ring7	0.2804(3)	-0.0968(2)	-0.1834(3)	3.311(3)	0.726(4)	4.582(3)
Ring8	0.1597(2)	0.2211(2)	-0.2749(3)	-0.653(3)	1.719(4)	3.792(3)

[a] Xc, Yc and Zc are the fractional coordinates of the centroid of the rigid group.

[b] The rigid group orientation angles Delta, Epsilon and Eta(radians) are the angles by which the rigid body is rotated with respect to a set of axes X, Y and Z. The origin is the centre of the ring; X is parallel to a*, Z is parallel to c and Y is parallel to the line defined by the intersection of the plane containing a* and b* with the plane containing b and c.

TABLE 6. Idealized Positional and Thermal Parameters For the Hydrogen Atoms of [Rh2(CO)2(mu-Cl)(DPM)2][BF4].

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
H(1C3)	0.2662	0.2099	0.4060	3.70	H(45)	-0.1094	0.2562	0.4534	6.03
H(2C3)	0.3434	0.1462	0.3411	3.70	H(46)	0.0370	0.1634	0.4098	5.02
H(1C4)	0.4592	0.0936	-0.0895	4.04	H(52)	0.2953	0.3953	-0.0238	4.72
H(2C4)	0.4253	0.1405	-0.1884	4.04	H(53)	0.2274	0.5034	-0.1313	5.71
H(12)	0.4893	0.4308	0.3517	6.07	H(54)	0.2871	0.5042	-0.3011	5.83
H(13)	0.6308	0.4565	0.4678	7.09	H(55)	0.4145	0.3970	-0.3634	5.88
H(14)	0.6840	0.3508	0.5842	6.22	H(56)	0.4824	0.2889	-0.2559	5.08
H(15)	0.5955	0.2193	0.5846	5.75	H(62)	0.5944	0.3827	-0.0213	6.05
H(16)	0.4540	0.1936	0.4685	4.97	H(63)	0.7691	0.3917	-0.0512	6.79
H(22)	0.2545	0.3578	0.4887	4.97	H(64)	0.8664	0.2632	-0.1184	7.32
H(23)	0.1345	0.4757	0.5395	5.86	H(65)	0.7890	0.1257	-0.1558	8.52
H(24)	0.0712	0.5738	0.4180	6.34	H(66)	0.6144	0.1166	-0.1258	6.53
H(25)	0.1281	0.5541	0.2456	6.44	H(72)	0.3994	-0.0084	-0.2493	5.92
H(26)	0.2482	0.4362	0.1947	5.42	H(73)	0.3970	-0.1621	-0.3075	7.40
H(32)	0.0308	0.0352	0.1970	5.72	H(74)	0.2779	-0.2505	-0.2417	7.47
H(33)	-0.0193	-0.0978	0.2558	6.52	H(75)	0.1613	-0.1851	-0.1176	7.87
H(34)	0.0781	-0.1635	0.3887	7.65	H(76)	0.1638	-0.0314	-0.0594	6.34
H(35)	0.2255	-0.0962	0.4628	7.53	H(82)	0.2636	0.0918	-0.3257	5.54
H(36)	0.2756	0.0368	0.4040	5.62	H(83)	0.1769	0.1720	-0.4536	6.50
H(42)	0.0824	0.3085	0.1676	5.19	H(84)	0.0729	0.3013	-0.4027	6.52
H(43)	-0.0640	0.4013	0.2112	6.24	H(85)	0.0556	0.3504	-0.2240	6.16
H(44)	-0.1600	0.3751	0.3541	6.39	H(86)	0.1424	0.2702	-0.0962	5.09

Table 7. Least-Squares Plane Calculations

Plane no.	Equation[a]
1	$-0.9474X+0.0789Y-0.3102Z+5.4077 = 0.0$
2	$-0.2057X-0.9781Y-0.0322Z+2.5719 = 0.0$
3	$-0.5694X+0.7959Y-0.2055Z+0.3962 = 0.0$
4	$-0.5653X+0.7961Y-0.2159Z+0.3913 = 0.0$
5	$0.2996Z-0.0306Y-0.9536Z+0.0220 = 0.0$

Deviations from the Planes (Å)

Atom	Plane no. 1	2	3	4	5
Rh(1)	-0.0093(5)		-0.0058(5)	-0.0043(5)	-0.0002(4)
Rh(2)		-0.0077(5)	0.0057(5)	0.0042(5)	-0.0001(4)
Cl	-0.0092(14)	0.0042(14)			0.0012(14)
P(1)	0.0668(16)		.0696(15)		
P(2)		0.0384(16)	- .0691(15)		
P(3)	0.0684(15)			0.0519(16)	
P(4)		0.0393(16)		-0.0517(16)	
O(1)	-0.522(7)[b]				0.056(6)[b]
O(2)		0.417(8)[b]			0.031(6)[b]
C(1)	-0.293(7)				0.031(6)
C(2)		0.214(8)			0.014(6)
C(3)			-0.708(6)[b]		
C(4)				-0.678(6)[b]	

Dihedral Angle Between Planes

Plane A	Plane B	Angle (deg)
1	2	82.66
3	5	89.95
4	5	89.31

[a] X, Y, and Z are the orthogonal coordinates (Å) with X along the a axis, Y in the (a-b) plane and Z along c^*-axis.

[b] Not included in least squares plane calculation.

Table 8: Selected Distances (Å) in $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$

Bond Distances

Bond	Distance	Average	Bond	Distance	Average
Rh(1)-Cl	2.406(2)		P(1)-C(11)	1.832(4)	1.822(5)
Rh(2)-Cl	2.380(2)		P(1)-C(21)	1.825(3)	
Rh(1)-C(1)	1.807(7)		P(2)-C(31)	1.821(4)	
Rh(2)-C(2)	1.799(7)		P(2)-C(41)	1.823(3)	
Rh(1)-P(1)	2.324(2)	2.321(2)[a]	P(3)-C(51)	1.819(3)	
Rh(1)-P(3)	2.320(2)		P(3)-C(61)	1.819(4)	
Rh(2)-P(2)	2.319(2)		P(4)-C(71)	1.818(4)	
Rh(2)-P(4)	2.322(2)		P(4)-C(81)	1.822(4)	
C(1)-O(1)	1.184(8)		B(1)-F(1)	1.49(1)	1.38(10)
C(2)-O(2)	1.202(9)		B(1)-F(2)	1.39(1)	
P(1)-C(3)	1.825(6)	1.836(8)	B(1)-F(3)	1.39(2)	
P(2)-C(3)	1.843(6)		B(1)-F(4)	1.47(4)	
P(3)-C(4)	1.841(6)		B(2)-F(5)	1.33(2)	
P(4)-C(4)	1.836(6)		B(2)-F(6)	1.51(1)	
			B(2)-F(7)	1.25(3)	
			B(2)-F(8)	1.24(3)	

Nonbonded Distances

Rh(1)-Rh(2)	3.1520(8)	Cl-H1C4	2.90
P(1)-P(2)	3.088(2)	C(1)-H(52)	2.63
P(3)-P(4)	3.097(2)	C(2)-H(86)	2.72
O(1)-H(26)	2.86	F(1)-H(16)	2.37
O(1)-H(12)	2.87	F(1)-H(2)	2.37
O(1)-H(62)	2.89	F(3)-H(16)	2.35
O(2)-H(75)	2.76	F(3)-H(36)	2.38
C(1)-H(26)	2.61	H(36)-H(2)	2.15
Cl-H2C3	2.85	H(66)-H(3)	2.15

[a] For averaged quantities, the estimated standard deviation is the larger of an individual standard deviation or the standard deviation of a single observation as calculated from the mean.

Table 9: Selected Angles (Deg) in $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$

Bond Angles

Cl-Rh(1)-C(1)	170.9(2)	C(11)-P(1)-C(21)	102.2(2)
Cl-Rh(1)-P(1)	90.44(5)	C(31)-P(2)-C(41)	102.4(2)
Cl-Rh(1)-P(3)	89.68(5)	C(51)-P(3)-C(61)	102.6(2)
C(1)-Rh(1)-P(1)	91.0(2)	C(71)-P(4)-C(81)	105.8(2)
C(1)-Rh(1)-P(3)	89.5(2)	P(1)-C(3)-P(2)	114.7(3)
P(1)-Rh(1)-P(3)	176.20(6)	P(3)-C(4)-P(4)	114.7(3)
Cl-Rh(2)-C(2)	172.6(3)	P(1)-C(11)-C(12)	117.0(3)
Cl-Rh(2)-P(2)	88.59(5)	P(1)-C(11)-C(16)	122.8(3)
Cl-Rh(2)-P(4)	88.28(5)	P(1)-C(21)-C(22)	118.5(2)
C(2)-Rh(2)-P(2)	91.7(2)	P(1)-C(21)-C(26)	121.5(2)
C(2)-Rh(2)-P(4)	91.1(2)	P(2)-C(31)-C(32)	116.5(3)
P(2)-Rh(2)-P(4)	176.12(6)	P(2)-C(31)-C(36)	123.4(3)
Rh(1)-Cl-Rh(2)	82.38(5)	P(2)-C(41)-C(42)	119.4(2)
Rh(1)-C(1)-O(1)	177.4(7)	P(2)-C(41)-C(46)	120.6(2)
Rh(2)-C(2)-O(2)	177.0(8)	P(3)-C(51)-C(52)	121.0(2)
Rh(1)-P(1)-C(3)	112.6(2)	P(3)-C(51)-C(56)	119.0(2)
Rh(2)-P(2)-C(3)	112.8(2)	P(3)-C(61)-C(62)	116.9(3)
Rh(1)-P(3)-C(4)	113.6(2)	P(3)-C(61)-C(66)	123.0(3)
Rh(2)-P(4)-C(4)	113.8(2)	P(4)-C(71)-C(72)	121.9(3)
Rh(1)-P(1)-C(11)	113.9(2)	P(4)-C(71)-C(76)	118.1(3)
Rh(1)-P(1)-C(21)	118.7(1)	P(4)-C(81)-C(82)	120.1(3)
Rh(2)-P(2)-C(31)	112.6(2)	P(4)-C(86)-C(86)	119.9(3)
Rh(2)-P(2)-C(41)	117.8(1)	F(1)-B(1)-F(2)	103.5(7)
Rh(1)-P(3)-C(51)	115.9(1)	F(1)-B(1)-F(3)	102.8(9)
Rh(1)-P(3)-C(61)	115.5(2)	F(1)-B(1)-F(4)	111 (1)
Rh(2)-P(4)-C(71)	111.5(2)	F(2)-B(1)-F(3)	111.6(9)
Rh(2)-P(4)-C(81)	118.8(2)	F(2)-B(1)-F(4)	105 (1)
C(3)-P(1)-C(11)	103.9(2)	F(3)-B(1)-F(4)	122 (1)
C(3)-P(1)-C(21)	103.8(2)	F(5)-B(2)-F(6)	93 (2)
C(3)-P(2)-C(31)	103.5(2)	F(5)-B(2)-F(7)	110 (1)
C(3)-P(2)-C(41)	106.2(2)	F(5)-B(2)-F(8)	122 (2)
C(4)-P(3)-C(51)	104.5(2)	F(6)-B(2)-F(7)	99 (2)
C(4)-P(3)-C(61)	103.0(2)	F(6)-B(2)-F(8)	106 (2)
C(4)-P(4)-C(71)	102.5(3)	F(7)-B(2)-F(8)	120 (2)
C(4)-P(4)-C(81)	102.8(2)		

Torsion Angles

P(1)-Rh(1)-Rh(2)-P(2)	3.70(5)	C(2)-Rh(2)-P(4)-C(71)	85.3(3)
P(1)-Rh(1)-Rh(2)-P(4)	179.84(6)	C(2)-Rh(2)-P(4)-C(81)	-38.1(3)
P(2)-Rh(2)-Rh(1)-P(3)	-178.90(6)	C(11)-P(1)-P(2)-C(31)	8.5(3)
P(3)-Rh(1)-Rh(2)-P(4)	-2.76(6)	C(11)-P(1)-P(3)-C(61)	-1.4(2)
C(1)-Rh(1)-P(1)-C(11)	72.9(3)	C(21)-P(1)-P(2)-C(41)	3.0(2)
C(1)-Rh(1)-P(1)-C(21)	-47.6(3)	C(21)-P(1)-P(3)-C(51)	-1.8(2)
C(1)-Rh(1)-P(3)-C(51)	45.9(3)	C(31)-P(2)-P(4)-C(71)	1.2(2)
C(1)-Rh(1)-P(3)-C(61)	-74.2(3)	C(41)-P(2)-P(4)-C(81)	-3.4(3)
C(2)-Rh(2)-P(2)-C(31)	-84.0(3)	C(51)-P(3)-P(4)-C(81)	-5.6(2)
C(2)-Rh(2)-P(2)-C(41)	34.9(3)	C(61)-P(3)-P(4)-C(71)	-11.3(4)

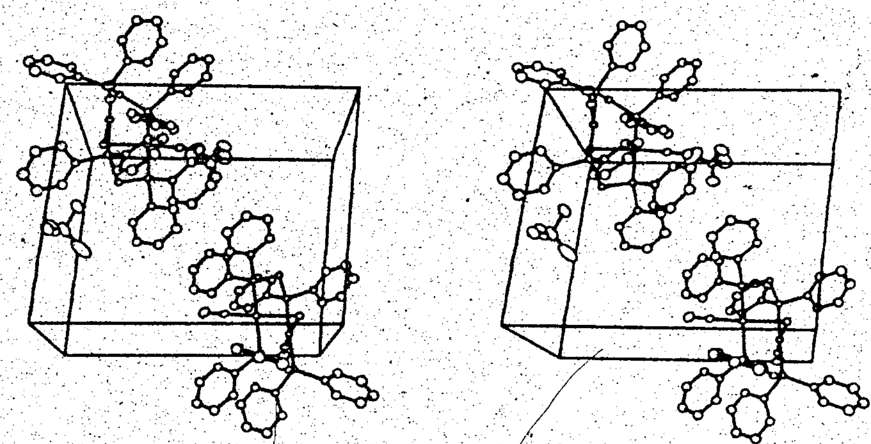


Figure 4. Cell Packing Diagram of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]$-$[BF_4]$.

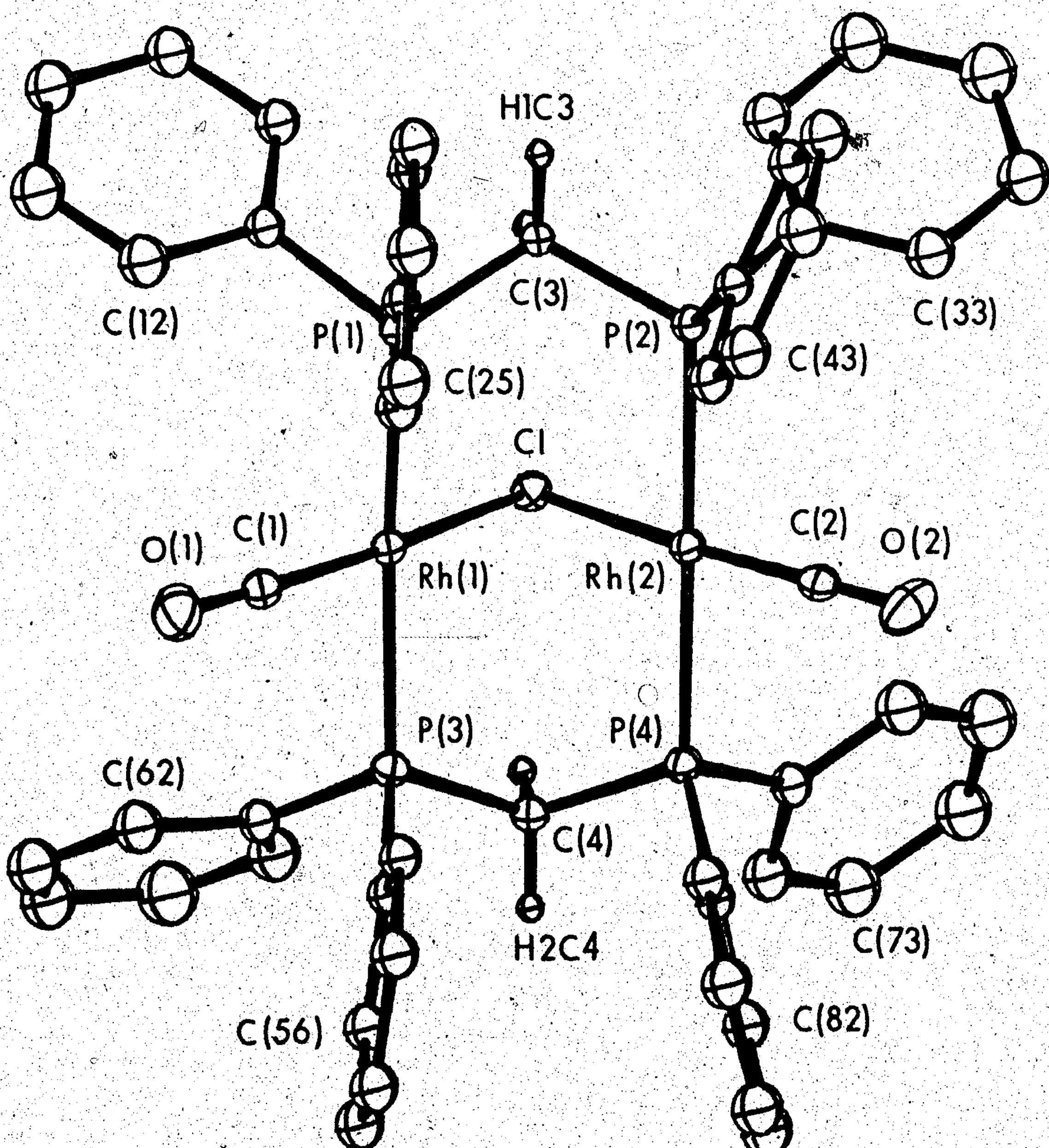


Figure 5. A Perspective View of the $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ Cation.

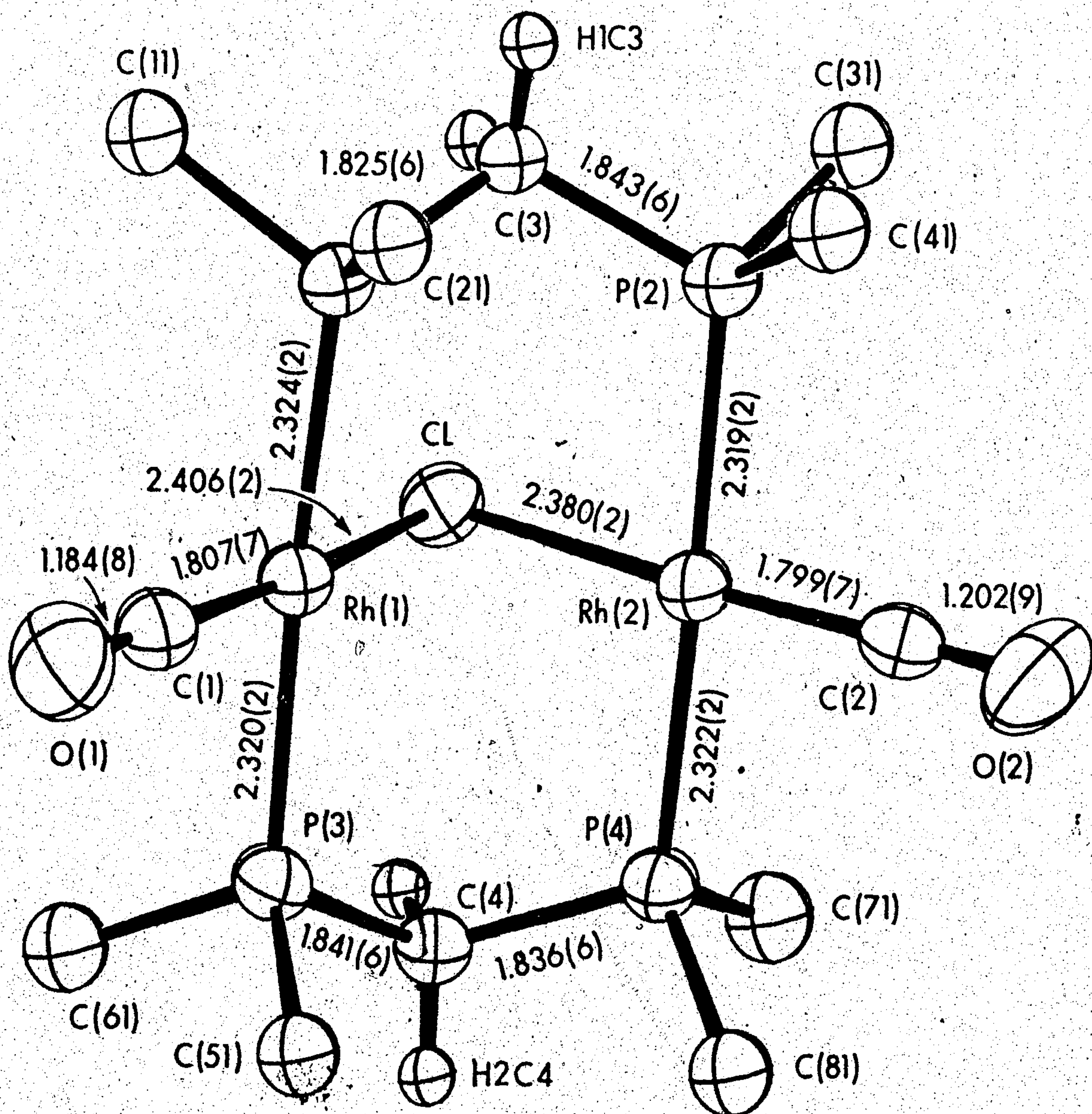


Figure 6. The Inner Coordination Sphere of $[Rh_2(CO)_2$-$(\mu$-$Cl)(DPM)_2]^+$ Cation.

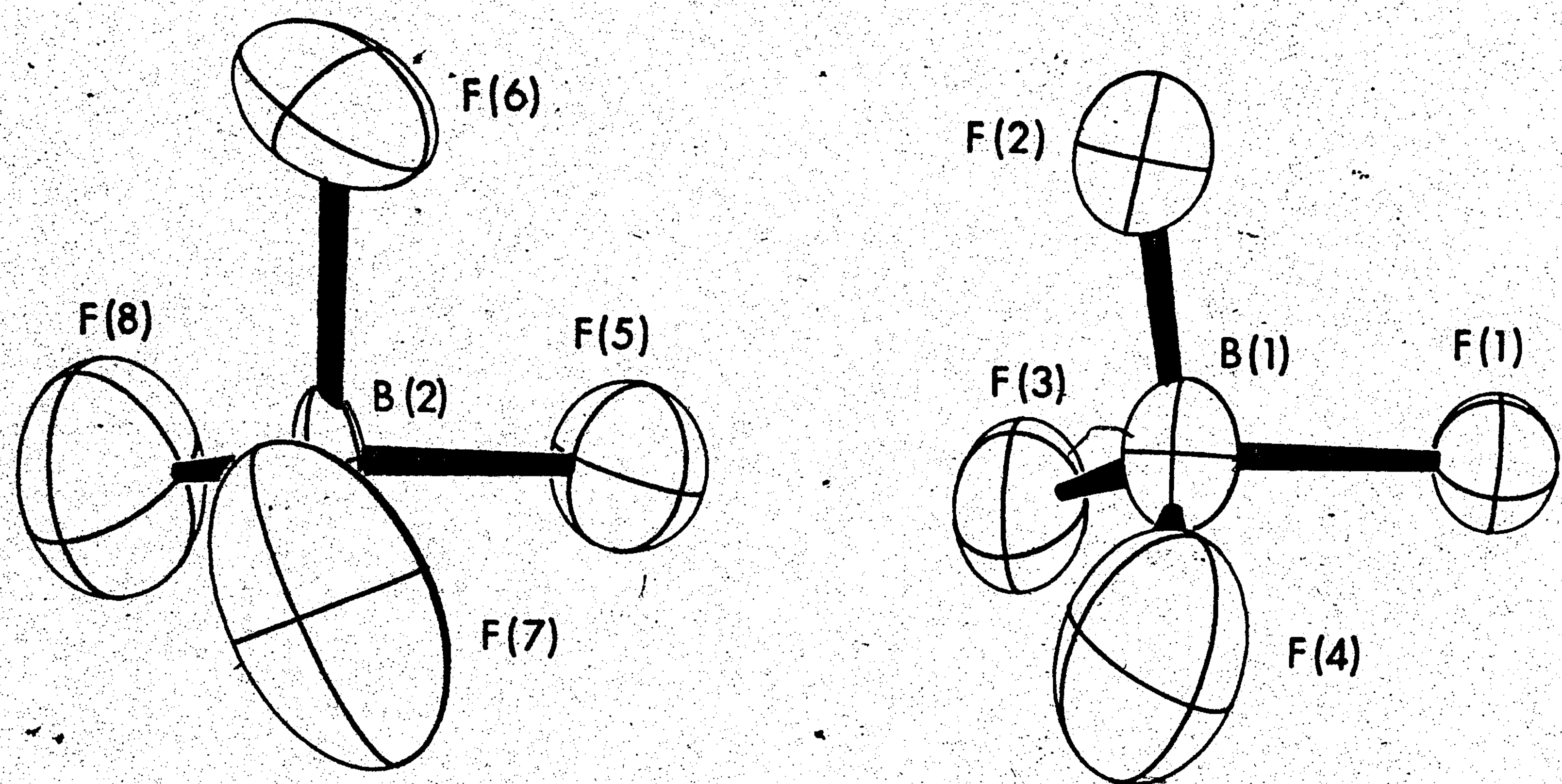


Figure 7. The Two Independent Tetrafluoroborate Anions.

DESCRIPTION OF STRUCTURE

The two independent BF_4^- anions, although inversion disordered and undergoing a large amount of thermal vibration, show reasonable tetrahedral geometries (see Figure 4). The range in the B-F distances (1.24(3)-1.51(1)Å) and the F-B-F angles (93(2)-122(2)°) are not unreasonable considering the observed disorder and thermal motion, suggesting that the refined model is acceptable. These values are in reasonable agreement with other structural determinations involving BF_4^- salts.[111] The only significant nonbonded contacts involving the BF_4^- anion are between the fluorine atoms and the phenyl hydrogen atoms (see Table 8). These distances (2.35-2.38 Å) are somewhat shorter than the sum of their van der Waal's radii (2.57)[112] and may explain the orientations of the phenyl rings and the relatively open bridging site, between the two rhodium centres (vide infra).

The $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ cation displays the expected "A-frame" geometry in which the rhodium atoms are bridged by two DPM ligands which are mutually trans. The chloro ligand bridges the two metal centres in the equatorial plane perpendicular to the Rh-P vectors, and the carbonyl ligands, also lying in this plane, are bonded to each Rh atom trans to the bridging Cl atom. Both Rh atoms display slightly distorted square-planar geometries, whose least-square planes are inclined to each other by 82.66°.

The distortions from square planar geometry seem to result from close nonbonded contacts between the carbonyl ligands and the hydrogen atoms of the endo phenyl groups which enclose the bridging site. Indeed the larger distortion, about Rh(1), is accompanied by the shortest nonbonded contacts, involving C(1) and O(1) (see Table 8).

The relatively long Rh···Rh separation of 3.1520(8)Å is consistent with no formal Rh-Rh bond. This distance is significantly longer than the Rh-Rh distance of 2.8415(7)Å observed in the carbonyl adduct $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]$-$[BPh_4]$ (2),[35] where all evidence suggests the presence of a formal Rh-Rh single bond. The absence of a formal Rh-Rh bond in the present complex is substantiated by the following structural parameters: i) the Rh-Rh separation is significantly greater than the intraligand P···P separations of 3.088(2) and 3.097(2)Å, (when the metals are mutually bonded the converse is true);[35b] ii) the Rh(1)-Cl-Rh(2) angle of 82.38(5)° compares well with values typically observed when no formal metal-metal bond is present (range 80-95°)[113-116] and contrasts to the value of 66.51(4)° observed in the Rh-Rh bonded carbonyl adduct 2. In addition, the absence of a formal metal-metal bond is required to explain the observed diamagnetism and to give each rhodium atom a 16-electron configuration.

The Rh-Cl distances of 2.406(2) and 2.380(2)Å are in the range typically observed in other chloro-bridged dimer systems (*ca.* 2.30-2.45 Å)[113-116] and are significantly shorter than those observed in the carbonyl adduct 2 (2.575(2) and 2.607(2)Å).[35] The observed asymmetry in these parameters involving the chloro ligand presumably results as a consequence of nonbonded contacts, since there is no *a priori* reason to expect a chemical difference in the two rhodium centres. In support of this argument, the shortest nonbonded contacts involving the chloro ligands are H2C3-Cl and H1C4-Cl (2.80-2.90 Å, respectively). These interactions act in such a way as to force the bridging chloro ligand out of the symmetrical position towards Rh(2). This chloride asymmetry is reflected in the parameters of the carbonyl groups which are trans to the Cl atom. Although not statistically significant, the trend in the carbonyl parameters is consistent with the chloro ligand acting as a weaker π-donor to Rh(1) than to Rh(2) with the concomitant result that C(1)O(1) has a weaker π-accepting ability compared to C(2)O(2) (Rh(1)-C(1) = 1.807(7)Å, C(1)-O(1) = 1.184(8)Å, Rh(2)-C(2) = 1.799(7)Å, C(2)-O(2) = 1.202(9)Å). No other short contacts are observed that would readily explain the observed asymmetry in the chloro ligand. The slight bend in both carbonyl ligands (Rh-C-O(av) = 177.2(8)°) is not unusual and is probably also steric in origin.

Within the Rh-DPM framework the parameters are not unusual. The Rh-P distances (average 2.321(2)Å) compare well with other Rh-DPM[35,88-90,96] systems and are typical for Rh(I)-phosphine distances when trans to another phosphine ligand (e.g., 2.322(4) and 2.338(4)Å in red and orange Wilkinson's catalyst).[117] The P-C distances (both methylene and phenyl) are quite ordinary and the P-C-P angles (average 114.7(3)°) are close to the expected tetrahedral value as is typical when the DPM ligand bridges two metals.

The methylene groups of the DPM ligands are folded in a cis configuration, with both groups inclined towards the bridging chloro ligand. Therefore, C(3) is 0.708(6)Å out of the Rh(1)-P(1)-P(2)-Rh(2) plane and C(4) is 0.678(6)Å out of the Rh(1)-P(3)-P(4)-Rh(2) plane. This cis methylene orientation is quite typical of most analogous DPM and DAM bridged species.[32,35,41,81,85,89] In general the methylene groups bend towards the more sterically encumbered site; so for example when two bridging equatorial ligands are present, the folding is towards the more bulky of these bridging ligands. By folding in this manner the non-bonded contacts between the more bulky phenyl groups and the equatorial ligands are minimized. Further, in the present structure the cis methylene configuration results in a phenyl ring orientation which allows relatively free access to the bridging site, between the Rh atoms and opposite the chloro ligand. The trans configuration of the methylene groups has been observed[31,32,83b,118] when there is no steric preference for one side of the Rh-phosphine framework over the other.

Viewed along the Rh-Rh axis the Rh-P vectors on adjacent rhodium atoms are close to eclipsed as is evidenced by the small P-Rh(1)-Rh(2)-P torsion angles (0.16(6) to 3.70(5)°, see Table 9). This presents an interesting contrast to that observed in the analogous sulfido bridged species, $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$[89] (3), which appears to be severely twisted about the Rh-Rh axis. Model building has shown that this twist about the Rh-Rh axis in "A-frame" complexes results in two of the endo phenyl rings moving into the bridging site, thereby effectively blocking this site, as was observed in the sulfido bridged species. The orientation of the phenyl rings in the present species, however is such that the bridging site is more accessible than in the sulfido complex. It is difficult, however, in the present case to draw analogies between the solution chemistries and the solid state structures since the observed differences in phosphine twists between 1 and 3 may be a result of crystal packing. Indeed in the present complex the BF_4^- anion at the 1(c) inversion centre sits directly above the bridging site (see Figure 4) and displays non-bonded contacts with the hydrogen atoms of the surrounding phenyl rings which are shorter than van der Waal's distances[112] (vide supra). It is expected that the BF_4^- anion, in this position, exerts considerable influence on the orientations of these phenyl groups and hence on the crowding of the bridging site. Certainly there is no obvious chemical reason to explain the twist difference in the two otherwise similar compounds.

DISCUSSION

The crystallization of **1** as the BF_4^- salt was somewhat of a surprise, considering that the anions initially present were PF_6^- and BPh_4^-. There are two obvious sources of this BF_4^- anion. The first is through fluorination of BPh_4^- anion by HF, which is known to be present in acetone solutions of PF_6^-, and the second is through leaching of boron from the borosilicate glass by HF. On the basis of ^{31}P and ^{19}F NMR studies, it seems that the latter is more likely. When complex **1** and $[N_2Ph][PF_6]$ are reacted in acetone and the mixture left for several weeks the NMR spectra indicated that the PF_6^- concentration is greatly diminished, and shows the presence of fluorosilanes, BF_4^- and other unidentified species. Furthermore, the NMR tubes and glassware used in the crystallizations were found to be etched, suggesting that significant leaching of the glass had occurred. In any case the well formed crystals were a pleasant surprise since all known previous attempts to obtain suitable single crystals of complex **1** with other anions had failed.[119]

Although the present structure seems significantly different than that of the sulfido bridged analogue **3** with respect to crowding of the bridging site, it is believed that this is a consequence more of solid-state effects than of chemical differences. Any differences in the chemistries of these two species that might occur are more likely a consequence of the difference in bridging ligands (S^{2-} and Cl^{-}) and the overall charge of the species. In this regard it will be of obvious interest to compare the chemistries of these species.

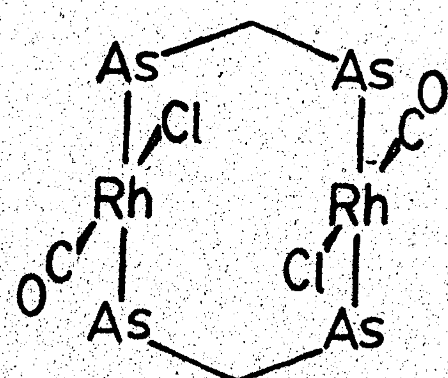
The present structure verifies that the bridging site in DPM-bridged species is accessible to small molecules and therefore it is not unexpected that some small molecules, such as SO_2, are capable of attack at this site, as the experimental evidence suggests (Chapter IV). It is however, not obvious, based on this structure determination, why some small molecules attack at the bridging site and others attack at the terminal site,

CHAPTER III.

The Structure of *trans*-$[RhCl(CO)(DPM)]_2$-

INTRODUCTION

The reactions of *trans*-$[RhCl(CO)(DPM)]_2$ (1) with small molecules were investigated as part of our studies into the chemistry of DPM-bridged binuclear rhodium complexes.[35,96] Although the structure of compound 1 had not been determined, it was believed, on the basis of X-ray powder diffraction studies,[66] to be the same as the DAM-bridged analogue, *trans*-$[RhCl(CO)(DAM)]_2$ (2),[31] whose structure is known and whose framework is sketched below:



2

Unlike the "A-frame" species (see Chapter II),[120] only the terminal sites above the square planar metal atoms in 1 and 2 are open to attack since the sites between the metals are blocked by the chloro and carbonyl ligands.

In spite of the proposed structural analogies in compounds 1 and 2,[66] however, significant differences in their chemistries led us to question the extent of their similarities. It had been noted, for example, that "ketonic" carbonyl complexes of Pt and Pd were more stable with DAM than with DPM,[32,41,84] whereas our work tended to indicate that the opposite was true with rhodium. In species containing unsupported bridging ligands, such as the "ketonic" carbonyl ligand, we anticipated that the metal-metal separation might be an important factor in determining the stability of the unsupported ligand complex. Since the obvious difference in the DPM and DAM ligands lies in their ligand bites, due to the greater size of As compared to P, and since the DAM ligand would therefore tend to prefer larger metal-metal separations than DPM, it was deemed important to obtain structural information on the DPM complex 1 in order to compare the metal-metal separations and the subsequent effects on ligand orientations in the two compounds 1 and 2.

Furthermore, we prepared an isomer of 1,[96] which appears to be the cis-dichlorodicarbonyl species (see Chapter IV). This isomer has a greatly differing solubility and chemistry with CO compared to the trans isomer 1 so structural comparisons of the two species seemed in order. Therefore, when reaction of 1 (of which suitable, single crystals had never been obtained by us) with CS_2 resulted in the serendipitous crystallization of well formed rhombs of complex 1, it was decided to undertake its structural determination.

EXPERIMENTAL

Crystallization of *trans*-[RhCl(CO)(DPM)]$_2$

To a suspension of 0.100 g (0.091 mmol) of *trans*-[RhCl(CO)(DPM)]$_2$[66] in 15 mL of CH_2Cl_2 was added 15 mL of CS_2. After one hour diethyl ether was added to the clear red solution to induce crystallization. The red solid obtained was then redissolved in 15 mL of CH_2Cl_2 from which well formed yellow crystals were obtained by diethyl ether diffusion. Chemical and spectral analysis showed that the crystals were the starting material, complex 1.

Data Collection

A clear yellow plate of *trans*-[RhCl(CO)(DPM)]$_2$ was mounted on a glass fiber. Preliminary film data showed $\bar{1}$ Laué symmetry and no systematic absences, consistent with the space groups P1 or P$\bar{1}$. The centrosymmetric space group was chosen and later verified by the successful refinement of the structure with acceptable positional parameters, thermal parameters and agreement indices and the location of all hydrogen atoms in the electron density difference maps. A cell reduction[102] failed to show the presence of higher symmetry. The reduced cell is reported and is presented together with the pertinent crystal data and details of data collection are in Table 10. Otherwise data collection proceeded as described in Chapter II.

Table 10. Summary of Crystal Data and Intensity Collection for *trans*-[RhCl(CO)(DPM)]$_2$

Compound	*trans*-[RhCl(CO)(DPM)]$_2$
Formula	$C_{52}H_{44}Cl_2O_2P_4Rh_2$
Formula Weight	1101.54 amu
Reduced Cell Parameters	
a	11.0542(11)Å
b	12.5640(10)Å
c	10.3191(9)Å
γ	99.899(6)°
β	115.708(7)°
α	65.082(7)°
V	1171.0 Å^3
Z	1
Density	1.562 g·cm^{-3} (calc'd.) 1.565(5) g·cm^{-3} (expt'l. by flotation)
Space Group	C_i^1 - $P\bar{1}$
Crystal Dimensions	0.346 x 0.555 x 0.077 mm
Crystal Volume	0.0094 mm^3
Crystal Faces (and distances from an arbitrary origin within the crystal (mm))	1 1 0 (0.114) $\bar{1}$ $\bar{1}$ 0 (0.114) 0 1 0 (0.035) 0 $\bar{1}$ 0 (0.035) 0 0 1 (0.250) 0 0 $\bar{1}$ (0.250) 0 $\bar{1}$ $\bar{1}$ (0.192)
Temperature	20°C
Radiation	CuKα (λ=1.540562 Å) filtered with 0.5 mil thick nickel foil
μ	85.439 cm^{-1}
Range in Absorption Correction Factors	0.140 - 0.567
Receiving Aperture	4x4 mm, 30 cm from the crystal

Table 10, continued

Takeoff Angle	4.1°
Scan Speed	2° in 2θ/min
Scan Range	1.00 below $K_{\alpha 1}$ to 1.00 above $K_{\alpha 2}$
Background Counting Time	10s ($3° < 2\theta < 60°$) 20s ($60° < 2\theta \leq 120°$)
2θ limits	$3.0° \leq 2\theta \leq 120.0°$
2θ limits for centered reflections	$60° \leq 2\theta \leq 70°$
Final number of variables	113
Unique Data Collected	3505
Unique Data Used ($F_o^2 \geq 3\sigma(F_o^2)$)	3368
Error in observation of unit weight	1.866
R	0.037
R_w	0.069

Solution of Structure

The independent Rh atom position was obtained from a sharpened Patterson map. Subsequent least-squares calculations and electron density difference maps led to the location of all other atoms. Anomalous dispersion terms[108] for Rh, P and Cl were included in F_c. The carbon atoms of the phenyl rings were refined as rigid groups. Hydrogen atoms were included as fixed contributions and not refined. All nongroup atoms were refined individually with anisotropic thermal parameters (for a more detailed discussion of structure solution and rigid group treatment see Chapter II).

The final model with 115 parameters varied converged to $R = 0.037$ and $R_w = 0.069$.[121] In the final electron density difference map all of the highest 20 peaks were in the vicinities of the phenyl rings (0.91-0.54 e/Å^3). A typical carbon atom on an earlier electron density difference map had an electron density of 7.7 e/Å^3.

Results

The final positional and thermal parameters for the nongroup and group atoms are given in Tables 11 and 12, respectively. The idealized positional and thermal parameters for the hydrogen atoms are given in Table 13. Least squares plane calculations are presented in Table 14 and selected bond distances and angles are given in Tables 15 and 16, respectively. A listing of observed and calculated structure amplitudes is available.[110] The unit cell of *trans*-$[RhCl(CO)(DPM)]_2$ is shown in Figure 8. Four adjacent molecules are drawn in order to show some of the packing interactions. The crystallographic *b* axis runs from bottom to top of the page, the *c* axis is horizontal to the right and the *a* axis runs into the page. Figure 9 presents a perspective view of the compound, including the numbering scheme (phenyl hydrogens have the same number as their attached carbon atom). The inner coordination sphere of *trans*-$[RhCl(CO)(DPM)]_2$ is shown in Figure 10, along with some relevant bond lengths, 50% thermal ellipsoids are drawn.

TABLE 11. Positional and Thermal Parameters For the Nongroup Atoms of Trans-[RhCl(CO)(DPM)]2.

Atom	x[a]	y	z	U11[b]	U22	U33	U12	U13	U23
Rh	0.02710(2)	-0.04223(2)	0.15345(2)	2.36(2)	2.13(2)	2.83(2)	-0.68(1)	1.26(1)	0.09(1)
Cl	0.18334(9)	0.06132(8)	0.2207(1)	3.63(5)	3.77(5)	4.22(5)	-1.76(4)	1.70(4)	-0.16(4)
P(1)	-0.22241(9)	0.20635(7)	-0.13917(9)	2.63(5)	2.20(4)	3.00(5)	-0.64(3)	1.32(4)	0.24(3)
P(2)	-0.17744(9)	0.12221(7)	0.15280(9)	2.48(4)	2.34(4)	2.80(5)	-0.69(3)	1.32(4)	-0.01(3)
O(1)	-0.1297(4)	-0.1852(3)	0.1355(4)	7.1(2)	4.4(2)	10.3(3)	-2.9(2)	5.8(2)	-0.9(2)
C(1)	-0.0725(4)	-0.1309(3)	0.1376(5)	3.4(2)	3.4(2)	5.6(3)	-1.0(2)	2.4(2)	-1.2(2)
C(2)	-0.3019(3)	0.1785(3)	-0.0309(4)	2.6(2)	2.7(2)	2.9(2)	-0.7(1)	1.5(1)	-0.2(1)

[a] Estimated standard deviations in the least signicant figure(s) are given in parentheses in this and all subsequent tables.

[b] The form of the thermal ellipsoid is: $\exp[-2\pi^2(a^{*2}U_{11}h^2+b^{*2}U_{22}k^2+c^{*2}U_{33}l^2+2a^*b^*U_{12}hk+2a^*c^*U_{13}hl+2b^*c^*U_{23}kl)]$. The quantities given in the table are the thermal coefficients x 10^2.

TABLE 12. Derived Parameters For the Rigid Group Atoms of Trans-[RhCl(CO)(DPM)]2.

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
C(11)	-0.2018(3)	0.3442(2)	-0.0656(3)	2.48(6)	C(31)	-0.1562(3)	0.2475(2)	0.2675(3)	2.43(6)
C(12)	-0.3189(2)	0.4518(2)	-0.1109(2)	3.66(8)	C(32)	-0.0330(3)	0.2239(2)	0.3966(2)	3.61(8)
C(13)	-0.3039(2)	0.5548(2)	-0.0460(2)	4.71(9)	C(33)	-0.0182(4)	0.3131(3)	0.4952(2)	4.8(1)
C(14)	-0.1718(3)	0.5503(2)	0.0641(3)	4.8(1)	C(34)	-0.1265(3)	0.4259(2)	0.4648(3)	4.64(9)
C(15)	-0.0549(2)	0.4428(2)	0.1094(2)	4.34(9)	C(35)	-0.2496(3)	0.4495(2)	0.3357(2)	4.57(9)
C(16)	-0.0698(2)	0.3397(2)	0.0445(2)	3.09(7)	C(36)	-0.2645(4)	0.3603(3)	0.2371(2)	3.33(7)
C(21)	-0.3759(6)	0.2513(2)	-0.3145(2)	2.51(6)	C(41)	-0.2962(4)	0.0928(3)	0.2113(6)	2.25(6)
C(22)	-0.5019(5)	0.2311(3)	-0.3546(5)	3.10(7)	C(42)	-0.4395(5)	0.1074(2)	0.1225(4)	2.86(6)
C(23)	-0.6134(4)	0.2652(3)	-0.4909(3)	3.92(8)	C(43)	-0.5214(2)	0.0819(2)	0.1747(2)	3.29(7)
C(24)	-0.5989(6)	0.2194(2)	-0.5870(2)	4.30(9)	C(44)	-0.4600(4)	0.0420(3)	0.3157(6)	3.29(7)
C(25)	-0.4728(5)	0.3[illegible]6(3)	-0.5469(5)	4.55(9)	C(45)	-0.3166(5)	0.0274(2)	0.4045(4)	3.83(8)
C(26)	-0.3614(4)	0.3055(3)	-0.4107(3)	3.67(8)	C(46)	-0.2347(2)	0.0529(2)	0.3524(2)	3.40(7)

Rigid Group Parameters

	Xc [a]	Yc	Zc	Delta [b]	Epsilon	Eta
Ring1	-0.1869(2)	0.4473(2)	-0.0007(2)	-0.231(2)	2.822(2)	4.892(1)
Ring2	-0.4874(2)	0.2854(2)	-0.4508(2)	0.916(2)	2.384(3)	3.127(3)
Ring3	-0.1413(2)	0.3367(2)	0.3662(2)	2.683(2)	2.597(2)	1.198(2)
Ring4	-0.3781(2)	0.0674(1)	0.2635(2)	4.237(2)	2.366(3)	4.823(3)

[a] Xc,Yc and Zc are the fractional coordinates of the centroid of the rigid group.

[b] The rigid group orientation angles Delta,Epsilon and Eta(radians) are the angles by which the rigid body is rotated with respect to a set of axes X,Y and Z. The origin is the centre of the ring; X is parallel to a* , Z is parallel to c and Y is parallel to the line defined by the intersection of the plane containing a* and b* with the plane containing b and c.

TABLE 13. Idealized Postional and Thermal Parameters For the Hydrogen Atoms of Trans-[RhCl(CO)(DPM)]2.

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
H(1)	-0.3433	0.1229	-0.0808	3.22	H(26)	-0.2751	0.3186	-0.3835	4.70
H(2)	-0.3770	0.2501	-0.0251	3.22	H(32)	0.0412	0.1466	0.4177	4.62
H(12)	-0.4090	0.4550	-0.1858	4.50	H(33)	0.0663	0.2969	0.5833	5.89
H(13)	-0.3839	0.6284	-0.0766	5.52	H(34)	-0.1158	0.4867	0.5319	5.64
H(14)	-0.1618	0.6209	0.1085	5.81	H(35)	-0.3232	0.5262	0.3150	5.49
H(15)	0.0353	0.4400	0.1845	5.39	H(36)	-0.3484	0.3759	0.1493	4.38
H(16)	0.0102	0.2666	0.0753	4.18	H(42)	-0.4814	0.1353	0.0266	3.85
H(22)	-0.5127	0.1947	-0.2891	3.99	C(43)	-0.6192	0.0921	0.1140	4.33
H(23)	-0.7000	0.2520	-0.5185	4.85	H(44)	-0.5159	0.0245	0.3511	4.40
H(24)	-0.6749	0.3426	-0.6803	5.19	H(45)	-0.2748	0.0001	0.5008	4.74
H(25)	-0.4625	0.3759	-0.6128	5.46	H(46)	-0.1370	0.0433	0.4134	4.31

Table 14. Least-Squares Plane Calculations

Plane no.	Equation
1	$-0.7174X-0.5092Y-0.4755Z+0.0 = 0.0^a$
2	$0.1832X+0.1661Y-0.9689Z+1.5689 = 0.0$

Deviations from the Planes (Å)

Plane no.	Atom: Rh	P(1)	P(2)	P(2)'	Cl	C(1)	O	C(2)
1	-0.0047(2)	-0.040 (1)	0.040(1)					
2	-0.0021(2)	0.0637(9)		0.0608(9)	-0.0492(9)	-0.302(4)	-0.553(4)	0.720(4)[b]

Angle between Rh-Rh vector and plane 2 = 75.9°

[a] X, Y, and Z are orthogonal coordinates (Å) with X along the a axis Y in the a-b plane and Z along the C*-axis.

[b] Not included in least squares plane calculation.

Table 15. Selected Distances (Å) in *trans*-[RhCl(CO)(DPM)]$_2$

Bonded

Rh-Cl	2.3875(9)	P(1)-C(11)	1.833(2)
Rh-P(1)	2.3141(9)	P(1)-C(21)	1.831(2)
Rh-P(2)'[a]	2.3315(9)	P(2)-C(31)	1.834(2)
Rh-C(1)	1.814 (4)	P(2)-C(41)	1.842(2)
P(1)-C(2)	1.840 (3)	C(1)-O	1.102(5)
P(2)-C(2)	1.835 (3)		

Nonbonded

Rh-Rh'	3.2386(5)	O-H(14)[c]	2.56
Rh-Cl'	3.569 (1)	C(1)-H(16)'	2.69
P(1)-P(2)	3.130 (1)	C(2)-H(42)	2.57
Cl-H(16)	2.69	C(2)-H(22)	2.64
Cl-H(45)[b]	2.73		

[a]Primed atoms related to unprimed atoms by a center of inversion in this and all subsequent tables.

[b]Atom located at $\bar{x}$, $\bar{y}$, 1-z.

[c]Atom located at x, y-1, z.

Table 16. Selected Angles (deg) in *trans*-$[RhCl(CO)(DPM)]_2$

Bond Angles

Cl-Rh-P(1)	86.20(3)	C(2)-P(1)-C(11)	102.7(1)
Cl-Rh-P(2)'	95.33(3)	C(2)-P(1)-C(21)	103.2(1)
Cl-Rh-C(1)	169.1 (1)	C(2)-P(2)-C(31)	107.8(1)
C(1)-Rh-P(1)	91.6 (1)	C(2)-P(2)-C(41)	101.8(1)
C(1)-Rh-P(2)'	87.5 (1)	C(11)-P(1)-C(21)	103.1(1)
P(1)-Rh-P(2)'	176.50(2)	C(31)-P(2)-C(41)	99.5(1)
Rh-C(1)-O	176.3 (4)	P(1)-C(11)-C(12)	121.0(1)
P(1)-C(2)-P(2)	116.8 (2)	P(1)-C(11)-C(16)	118.9(1)
Rh-P(1)-C(2)	112.2 (1)	P(1)-C(21)-C(22)	122.8(1)
Rh-P(2)'-C(2)'	110.9 (1)	P(1)-C(21)-C(26)	117.1(1)
Rh-P(1)-C(11)	121.22(8)	P(2)-C(31)-C(32)	117.3(1)
Rh-P(1)-C(21)	112.39(9)	P(2)-C(31)-C(36)	122.4(1)
Rh-P(2)'-C(31)'	120.35(8)	P(2)-C(41)-C(42)	123.6(1)
Rh-P(2)'-C(41)'	114.53(9)	P(2)-C(41)-C(46)	116.4(1)

Torsion Angles

P(1)-Rh-Rh'-P(2)	2.19(3)	C(1)-Rh-P(1)-C(2)	140.6(2)
Cl-Rh-P(1)-C(2)	- 50.1 (1)	C(1)-Rh-P(1)-C(11)	18.9(2)
Cl-Rh-P(1)-C(11)	-171.7 (1)	C(1)-Rh-P(1)-C(21)	-103.5(2)
Cl-Rh-P(1)-C(21)	65.74([illegible])	C(1)-Rh-P(2)'-C(2)'	- 90.8(2)
Cl-Rh-P(2)'-C(2)'	99.7 (1)	C(1)-Rh-P(2)'-C(31)	142.2(2)
Cl-Rh-P(2)'-C(31)'	- 27.2 (1)	C(1)-Rh-P(2)'-C(41)'	23.7(2)
Cl-Rh-P(2)'-C(41)'	-145.73(9)		

Vector-Plane Normal Angles

Rh-Rh',	Rh-Cl-P(1)	12.98(2)
Rh-Rh',	Rh-C(1)-P(2)'	23.6 (1)

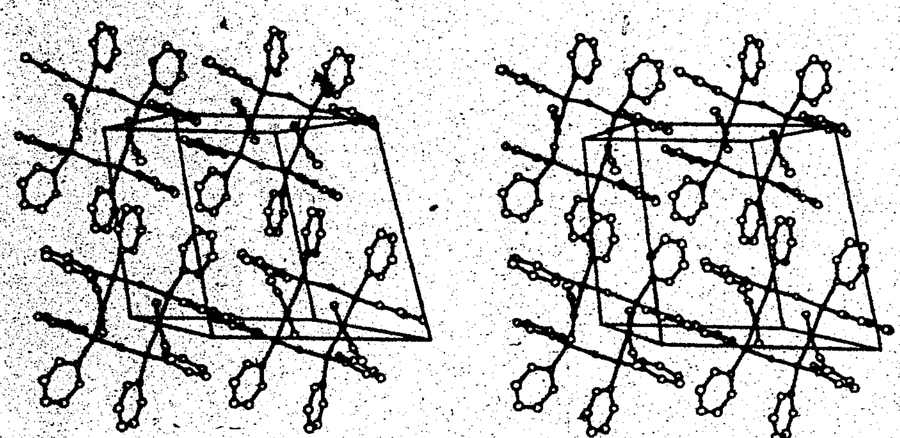


Figure 8. Cell Packing Diagram of *trans*-[RhCl(CO)(DPM)]$_2$.

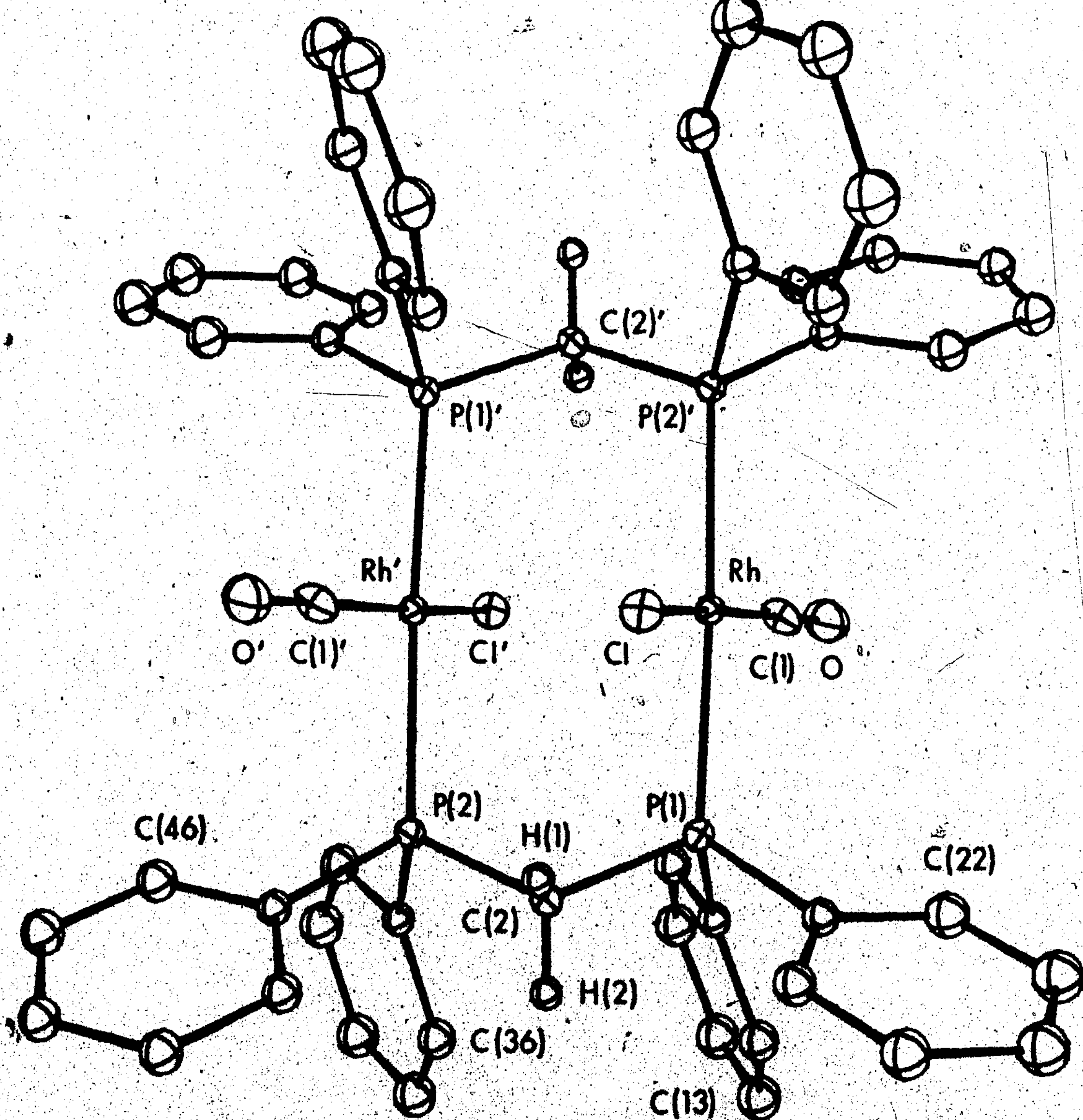


Figure 9. A Perspective View of *trans*-$[RhCl(CO)(DPM)]_2$.

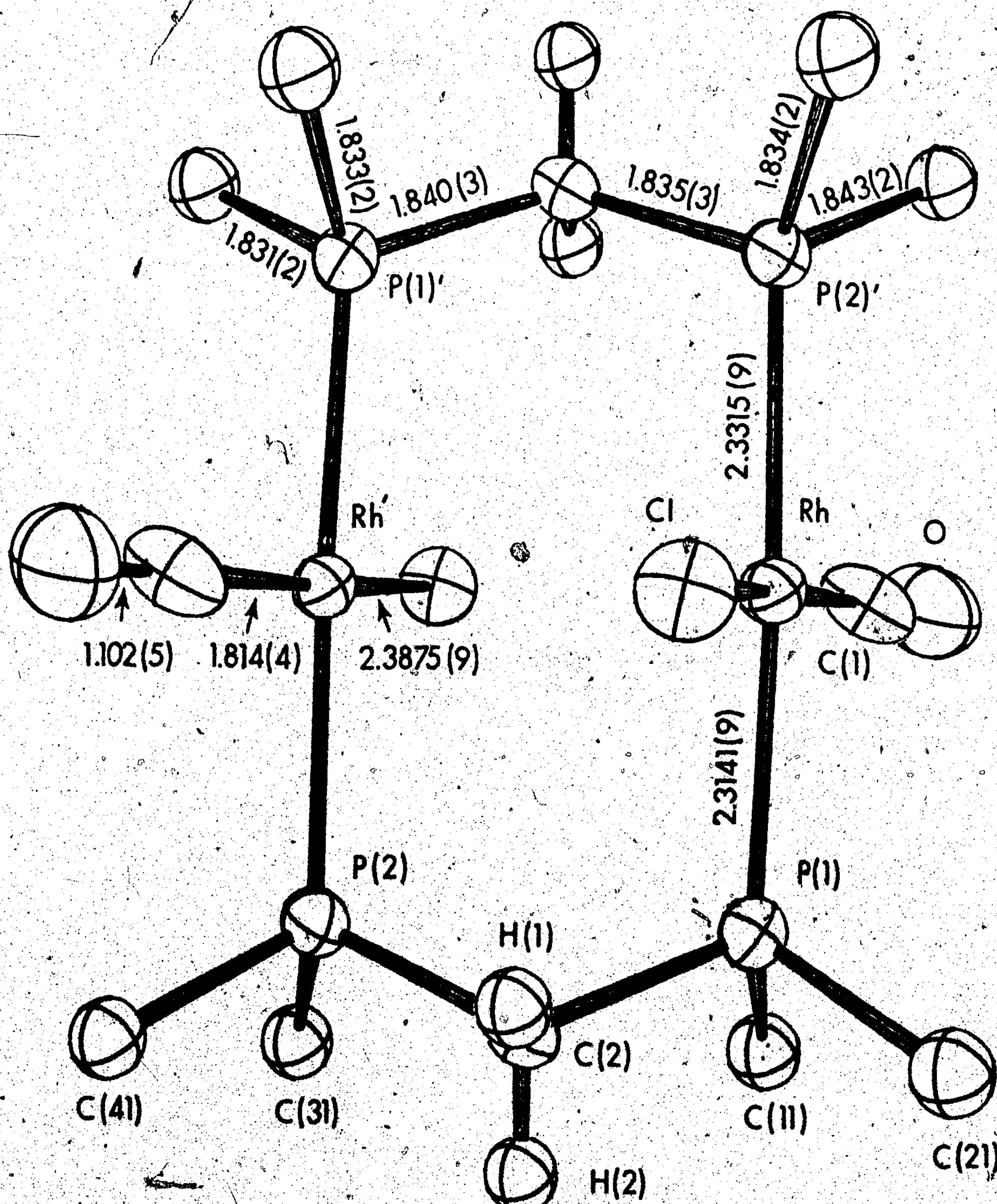


Figure 10. The Inner Coordination Sphere of *trans*-[RhC[illegible]
(DPM)]$_2$.

DESCRIPTION OF STRUCTURE

The structure of *trans*-[RhCl(CO)(DPM)]$_2$ (1) consists of a discrete dimeric unit located on the inversion centre at the origin; thus the molecule possesses crystallographically imposed $\bar{1}$ symmetry. The coordination about each Rh atom is effectively square planar with trans geometry about each metal, much like Vallarino's compound[66] and its analogues.[122] Slight tetrahedral distortions of the square plane are evident as was observed in the red and orange forms of Wilkinson's compound.[117,123] Therefore the two phosphorus atoms are folded towards each other in the direction of the Rh-Rh vector whereas the Cl and CO ligands are folded in the opposite direction (Table 14). The dimeric unit is composed of two of these parallel square planes in an eclipsed conformation and bridged by the diphosphine ligands. These planes are arranged such that the chloro ligands on adjacent rhodium atoms are mutually trans, as are the carbonyl ligands. Significantly, the square planes are not perpendicular to the Rh-Rh vector but are inclined to it by *ca.* 75.9° (Table 14) with the chloro ligands folded in towards the bridging sites between the metal centers. This same twist of the Rh square planes is also observed in *trans*-[RhCl(CO)(DAM)]$_2$, although it was not noted in the original report on this compound.[31] The skewing of these planes seems to result from an attempt to minimize the non-bonded contacts between the equatorial chloro and carbonyl ligands and the phenyl rings. So in the observed conformation the Rh-Cl and Rh-CO vectors are staggered with respect to the P-C vectors (Table 16).

Within the Rh-DPM framework the parameters are essentially as observed in other similar DPM-bridged complexes.[35,37,84,85,89] The two independent Rh-P distances (2.3141(9) and 2.3315(9)Å) are significantly different, however no chemical significance is attached to this difference. More likely the difference is a consequence of packing considerations (vide infra). Unlike most other DPM-bridged species which have a cis methylene arrangement, the methylene groups in the present compound are folded in a trans configuration with the methylene carbon atoms displaced by 0.720(4)Å from the best intraligand Rh-P-P-Rh planes. The folding of the methylene carbon atoms out of these planes occurs such that the phenyl groups avoid the equatorial ligands.

The parameters involving the chloro- and carbonyl ligands are not unusual, being typical for Rh(I) phosphino complexes.[31,35,89,120,122]

The relatively long Rh···Rh separation of 3.2386(5)Å is consistent with no formal metal-metal bond, and is in fact significantly longer than the non-bonded Rh···Rh separations of 3.1520(8)Å and 3.155(4)Å observed in $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$[120] (Chapter II) and $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$,[89] respectively. In these two "A-frame" species the metal centres are held closer than in the present structure owing to the constraints of the bridging chloro and sulfido ligands, respectively, in the former two species. As in previous determinations in which no metal-metal bond was present the intraligand P···P separation (3.130(1)Å) is significantly less than the Rh···Rh separation. However the Rh···Rh separation is still considerably less than that observed in the DAM analogue (3.396(1)-Å),[31] reflecting the differences in bite size of the two ligands. A further indication that the Rh-Rh interaction, in the present compound, is repulsive is seen in a comparison of the P-C-P (116.8(2)°) and As-C-As (113.5(4)°) angles in the DPM and DAM[31] complexes, respectively. The larger P-C-P angle reflects the strain on the DPM ligand as the metal centres are tending apart.

A comparison of the metrical parameters of the DPM and DAM ligands in the present complex and in *trans*-[RhCl(CO)-(DAM)]$_2$,[31] respectively, shows the expected trend resulting from the larger covalent radius of As compared to P. Therefore the average P-$C_{methylene}$ (1.838(4)Å),[124] P-C_{phenyl} (1.835(5)Å) and Rh-P (2.32(1)Å) distances are all significantly less than the corresponding As-$C_{methylene}$ (1.97(2)Å), As-C_{phenyl} (1.936(9)Å) and Rh-As (2.407(4)Å) distances.

DISCUSSION

The primary reason for undertaking the structural determination of trans-[RhCl(CO)(DPM)]$_2$ was to permit comparisons between it and the analogous DAM complex[31] in order to gain an understanding of the differences in their solubilities and chemistries. Based on the packing of the complex, shown in Figure 5, it is not difficult to understand the insolubility of the DPM complex. All the phenyl rings in the lattice have one of essentially two orientations allowing extremely efficient packing of the molecules and efficient stacking of the parallel phenyl rings. However, since the DPM complex turns out to be essentially isostructural with the DAM analogue we find the solubility differences somewhat surprising. It is therefore assumed that the subtle differences resulting from the larger Rh(DAM) framework (vide supra) result in less efficient packing than in the DPM complex. The effect of the larger molecular framework is obvious in the cell parameters which result in unit cell volume of the DAM complex being *ca.* 4% larger than that of the DPM complex.

As had been expected, the Rh···Rh separation in the DPM complex is significantly shorter than that in the DAM complex. This arises because of the smaller bite of the DPM ligand which holds the metals closer together. It is anticipated that these different ligand bites will have significant effects on the stability of species containing bridging ligands, especially unsupported ligands such as "ketonic" carbonyls. Certainly studies to date do indicate a difference in stability between DPM and DAM "ketonic" carbonyl species. The present structure and that of complex 2 conclusively establish the significantly different effects that the DPM and DAM ligands have in establishing metal-metal separations, in analogous structures. However, it must be noted that the present structure and that of **2** as determined by Mague[31] reflect only the preferred metal-metal separations of the two ligands under similar conditions. These ligands have extremely flexible bites which are rather easily changed. Therefore, a redetermination of the structure of *trans*-[RhCl(CO)(DAM)]$_2$,[125] as the CH_2Cl_2 solvate, indicates a Rh-Rh separation of only 3.236(2)Å. This is of course comparable to that in the present DPM compound and much less than that observed in the identical unsolvated complex. The difference (0.160(2)Å) is due presumably to packing considerations. At the other extreme, the largest metal-metal separation of 3.492(1)Å, has been observed in [Pd_2Cl_2(μ-HFB)(DPM)$_2$],[87] indicating just how far the metals can be forced apart. Notwithstanding, the minimum and maximum metal-metal separations allowed should occur in DPM and DAM, respectively, as is the case for the two essentially isostructural compounds **1** and **2**.

CHAPTER IV.

The Chemistry of Binuclear Rhodium Complexes with Sulfur Dioxide and the Structure of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$

INTRODUCTION

The cationic "A-frame" species $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ (1) has been shown to undergo facile and often reversible reactions with small molecules.[35a,91,96a] An X-ray structural determination of 1 as the BF_4^- salt has indicated that both the enclosed bridging site, between the metal centres, and the terminal exposed sites, remote from the bridging site, are open to attack by small molecules[120] (Chapter II). The accessibility of these sites has been confirmed by experiments which have shown that CO attacks at the terminal site,[91] yielding $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)\text{-}(DPM)_2]^+$ (2) (see Figure 11), whereas preliminary studies indicated that attack by SO_2 seems to occur directly at the bridging site.[96a] Therefore a detailed study of the chemistry of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ with SO_2 was undertaken to gain a better understanding of the modes of SO_2 attack and coordination.

It was also observed that on prolonged treatment of the initially formed adduct $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2]^+$ (3) with SO_2, a disproportionation reaction seemed to occur yielding a neutral carbonyl free species containing SO_2, which was formulated as $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ (4), and at

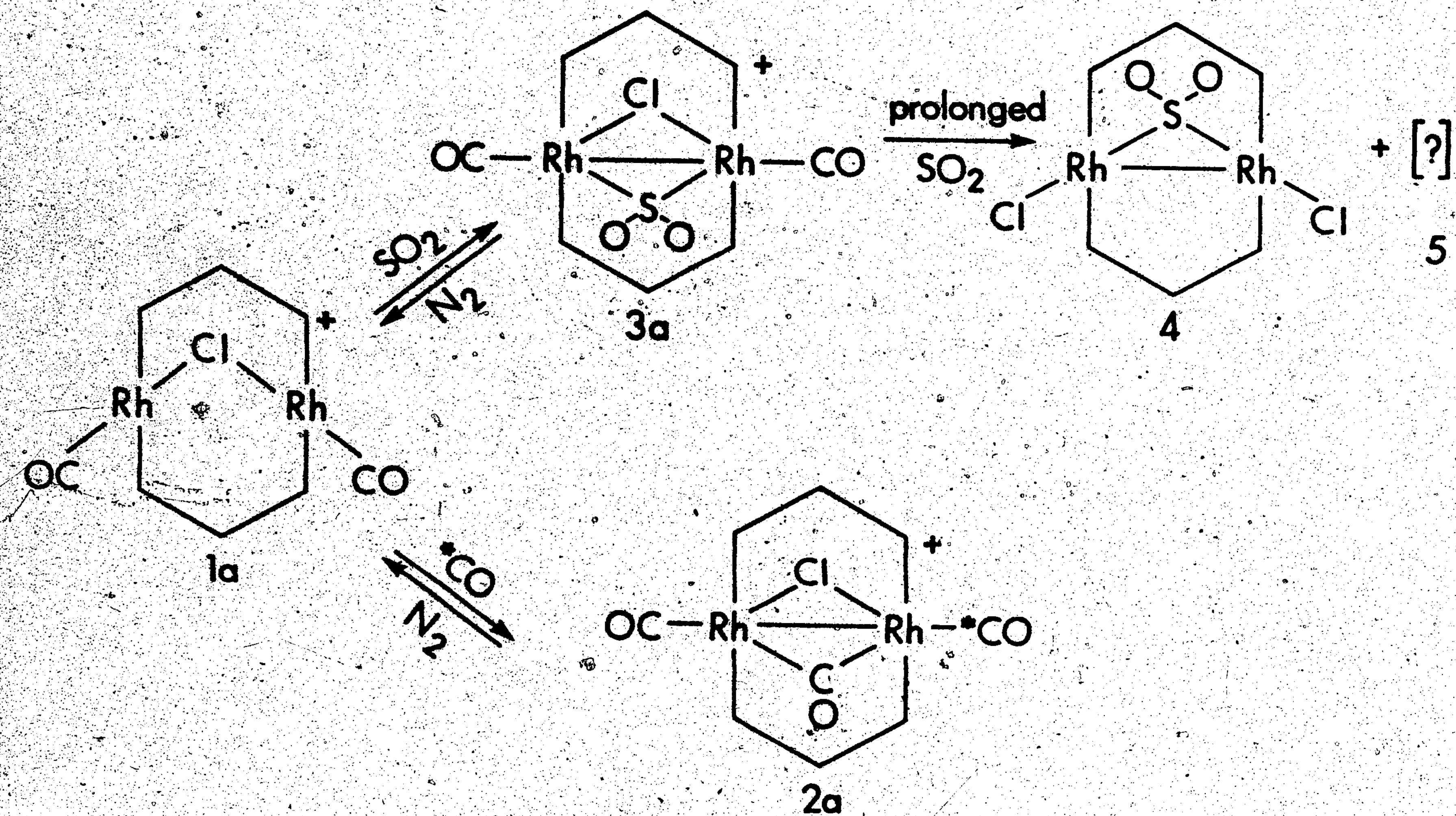


Figure 11. Reaction Scheme of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BPh_4]$ with CO and SO_2.

least one other unidentified species (5).[96a] The structural characterization of this new SO_2 complex was undertaken to establish unambiguously its identity and a detailed investigation of the chemistry yielding the species was undertaken to establish the nature of this "disproportionation" reaction.

In addition the chemistry of another binuclear complex, *trans*-[RhCl(CO)(DPM)]$_2$, with SO_2 was investigated to offer comparisons with the chemistry of the "A-frame" species (1). In the dichlorodicarbonyl species only terminal attack is possible, since the positions between the metal centres are blocked by the equatorial ligands[126] (Chapter III). Therefore, interesting comparisons in the chemistries of this species with that of the "A-frame" complex (1) were anticipated.

EXPERIMENTAL

Preparation of [Rh_2Cl_2(μ-SO_2)(DPM)$_2$], Method A

A solution of 0.100 g (0.072 mmol) of [$Rh_2(CO)_2$(μ-Cl)-(DPM)$_2$][BPh_4] in 10 mL of THF was treated with SO_2 for 10 min and then crystallization was induced by addition of diethyl ether saturated with SO_2. The resulting red orange crystals, analyzed as [$Rh_2(CO)_2$(μ-Cl)(μ-SO_2)(DPM)$_2$][BPh_4] (3a) and were obtained in 90-95% yield. This solid was redissolved in THF and slow concentration under a stream of SO_2 yielded the final product, [Rh_2Cl_2(μ-SO_2)(DPM)$_2$], 4, as well formed red-orange crystals. The remaining solution was yellow. The yield of this second SO_2 complex varied between 0 and 50%, depending on the batch of $Rh_2(CO)_2(\mu\text{-}Cl)\text{-}(DPM)_2][BPh_4]$ used (vide infra). Elemental analyses for all complexes are shown in Table 17 and the spectroscopic data and conductivity measurements are given in Table 18.

Method B

A suspension of 0.200 g (0.182 mmol) of *trans*-$[RhCl(CO)(DPM)]_2$[66] in 20 mL of CH_2Cl_2 was treated with SO_2 for approximately 2 h. Slow concentration, under a stream of SO_2, yielded the desired crystalline product in 95% yield.

Method C

To a solution of 0.100 g (0.202 mmol) of $[RhCl(COD)]_2$[99] in 20 mL of CH_2Cl_2 was added 0.156 g (0.405 mmol) of DPM dissolved in 5 mL of benzene. Immediate treatment with SO_2 and concentration of the solution by evaporation under SO_2 yielded the crystalline product $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ in 90% yield.

Preparation of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][Cl]$, $[Rh_2(CO)_2(\mu\text{-}CO)\text{-}(\mu\text{-}Cl)(DPM)_2][Cl]$ and *cis*-$[RhCl(CO)(DPM)]_2$

Treatment of a solution of 0.100 g (0.085 mmol) of $[Rh_2Cl_2(SO_2)(DPM)_2]$ in 10 mL of CH_2Cl_2 with CO and concentration under a CO stream yielded quantitatively the product $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][Cl]$ (2b) as an orange microcrystalline solid. Pumping on this solid under vacuum resulted in the total conversion of 2b to $[Rh_2(CO)_2(\mu\text{-}Cl)\text{-}$

Table 17. Analytical Data on Complexes

No.	Complex	Found	Calculated
2b.	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][Cl]$	C, 56.39; H, 4.25; Cl, 6.43	C, 56.36; H, 3.93, Cl, 6.28
3a.	$[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][BPh_4]$	C, 62.85; H, 4.44	C, 62.98; H, 4.45
3b.	$[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][Cl]$	C, 53.01, H, 4.09	C, 53.58; H, 3.80
4.	$[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$	C, 54.6; H, 3.80	C, 54.12; H, 4.00
6.	cis-$[Rh_2Cl_2(CO)_2(DPM)_2]$	C, 57.37; H, 4.55; Cl, 6.46	C, 56.70; H, 4.03; Cl, 6.44

Table 18. Spectral and Conductivity Data on the Complexes

No.	Complex	Infrared Absorption Maxima[a]	Assignment	$^{31}P\{^1H\}$nmr Chemical Shifts[b]	Conductivity[c] ($ohm^{-1}cm^2mole^{-1}$)
1a.	$[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BPh_4]$[d]	1997(s), 1978(vs)	ν_{CO}	16.1 (113.3 Hz)	99.0
1b.	$[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][Cl]$	1994(s), 1972(vs)	ν_{CO}	--	--
2a.	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][BPh_4]$[d]	1992(s), 1977(vs), 1863(s)	ν_{CO}	29.6 (94.2 Hz)	94.0
2b.	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][Cl]$	2004(s), 1960(vs), 1868(s)	ν_{CO}	29.8 (94.0 Hz)	115.0 (acetone) 49.6 (CH_2Cl_2)
3a.	$[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][BPh_4]$	2015(s), 1985(ssh)	ν_{CO}	24.6 (91.3 Hz)	90.0
		1229(m), 1070(m)	ν_{SO_2}		
3b.	$[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][Cl]$	2010(s), 1985(ssh)	ν_{CO}	24.5 (91.6 Hz)	65.0
		1230(m), 1071(m)	ν_{SO_2}		
4.	$[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$	1191(m), 1063(m)	ν_{SO_2}	19.6 (115.0 Hz)	0
6.	*cis*-$[Rh_2Cl_2(CO)_2(DPM)_2]$	1971(s)	ν_{CO}	19.6 (113.5 Hz)	0
7.	*trans*-$[Rh_2Cl_2(CO)_2(DPM)_2]$[e]	1968(s)	ν_{CO}		0

[a] Infrared spectra were run as Nujol Mulls on KBr Plates; vs, very strong; s, strong; m, medium; w, weak; sh, shoulder.

[b] $^{31}P\{^1H\}$ nmr chemical shifts are relative to H_3PO_4 (down field positive), coupling constants ($|^1J_{Rh-P} + {}^xJ_{Rh-P}|$) are given in parentheses.

[c] Solvent is acetone unless noted otherwise.

[d] References 35 and 91.

[e] Reference 66.

$(DPM)_2$][Cl] (1b). Bubbling dinitrogen through the solution of 2b followed by slow concentration under dinitrogen yielded "*cis*-[RhCl(CO)(DPM)]$_2$" 6 as a yellow crystalline solid.

Spectroscopic Studies on the Stepwise Reactions with SO_2

A solution was prepared by dissolving 0.100 g (0.072 mmol) of 1a in 3 mL of CD_2Cl_2 in a 10 mm NMR tube. This was cooled in a 2-propanol/dry ice bath and approximately 0.5 mL of gaseous SO_2 was admitted. The $^{31}P\{^1H\}$ NMR spectrum was recorded immediately at 223 K. This procedure was repeated measuring the NMR spectrum after each addition of SO_2 until nearly all of 1a had been converted to 3a. Throughout the experiment only resonances assignable to 1a or 3a were detected.

Infrared spectra were recorded in an analogous manner, by recording the infrared spectrum after each stepwise addition of 0.5 ml of SO_2 (at atmospheric pressure) to a CH_2Cl_2 solution of 1a (0.500 g (0.361 mmol) in 30 mL). Only bands assignable to complexes 1a, 3a and free SO_2 were detected. The stepwise addition of SO_2 to *trans*-[RhCl(CO)(DPM)]$_2$ was similarly monitored by infrared spectroscopy; however, in this case infrared bands at 1740(m), 1995(sh) and 2020(s) cm^{-1} were observed at intermediate times in the experiment. After all of the *trans*-dichlorodicarbonyl complex had reacted, only bands attributable to 3b and free SO_2 were observed (Table 18). The NMR and infrared studies on both complexes indicated that several additions of SO_2 were required before any evidence of a reaction was detected.

A $^{31}P\{^1H\}$ NMR spectrum of a sample of **3a** that had "disproportionated" showed bands assignable to **3a** and **4** as well as bands at $\delta = 8.05$ ppm (singlet),[101] $\delta = 5.90$ ppm (doublet, 70 Hz) and $\delta = -13.4$ ppm (doublet, 120 Hz). The sum of the integrated intensities of the last three peaks was approximately equal to that of **4**.

X-ray Data Collection

Red crystals of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ suitable for single-crystal X-ray diffraction studies, were supplied by Dr. A.R. Sanger of the Alberta Research Council. Preliminary film data showed that the crystals belonged to the monoclinic system with extinctions ($h0\ell$, ℓ odd; $0k0$, k odd) characteristic of the centrosymmetric space group $P2_1/c$. See Table 19 for pertinent crystal data and intensity collection information and Chapter II for a more complete discussion of data collection.

Structure Solution and Refinement

The structure was solved by using a sharpened Patterson map to locate the two independent Rh atoms. Subsequent refinements and electron density difference maps led to the location of all remaining atoms. Anomalous dispersion terms[108] for Rh, P, Cl and S were included in F_c. The phenyl rings were refined as rigid groups and the hydrogen atoms were included as fixed contributions and not refined.

Table 19. Summary of Crystal Data and Intensity Collection for $[Rh_2Cl_2(\mu-SO_2)(DPM)_2]$

Compound	$[Rh_2Cl_2(\mu-SO_2)(DPM)_2]$
Formula	$C_{50}H_{44}Cl_2O_2P_4Rh_2S$
Formula Weight	1109.58 amu
Cell Parameters	
a	18.228(1)Å
b	13.526(1)Å
c	19.632(2)Å
β	104.72(1)°
V	4681.6 $Å^3$
Z	4
Density	1.574 $g \cdot cm^{-3}$ (calc'd.) 1.59(2) $g \cdot cm^{-3}$ (expt'l. by flotation)
Space Group	C_{2h}^5 - $P2_1/c$
Crystal Dimensions	0.31 x 0.21 x 0.06 mm
Crystal Volume	0.0025 mm^3
Crystal Faces (and distances from an arbitrary origin within the crystal (mm))	1 0 0 (0.0213) $\bar{1}$ 0 0 (0.0194) 0 0 1 (0.1470) 0 0 $\bar{1}$ (0.1460) 1 1 0 (0.0913) $\bar{1}$ 1 0 (0.0810) 1 $\bar{1}$ 0 (0.0790) $\bar{1}$ $\bar{1}$ 0 (0.0940)
Temperature	20°C
Radiation	CuKα (λ=1.540562 Å) filtered with 0.5 mil thick nickel foil
μ	89.55 cm^{-1}
Range in Absorption Correction Factors	0.229 - 0.700
Receiving Aperture	3x3 mm, 30 cm from the crystal
Takeoff Angle	2.6°

Table 19, continued

Scan Speed	$2°$ in 2θ/min $(3°<2\theta<100°)$ $1°$ in 2θ/min $(100°<2\theta<123°)$
Scan Range	$0.75°$ below $K_{\alpha 1}$ to $0.75°$ above $K_{\alpha 2}$
Background Counting Time	10s $(3°<2\theta<76°)$ 20s $(76°<2\theta<100°)$ 40s $(100°<2\theta\leq 123°)$
2θ limits	$3°\leq 2\theta\leq 123°$
2θ units for centred reflections	$50°\leq 2\theta\leq 70°$
Final number of variables	216
Unique Data Collected	7690
Unique Data Used $(F_o^2 \geq 3\sigma(F_o^2))$	5207
Error in observation of unit weight	2.199
R	0.058
R_w	0.067

All nongroup atoms were refined individually with anisotropic thermal parameters. An isotropic secondary extinction parameter was included and refined since several intense low angle reflections systematically showed F_{obs} significantly less than F_{cal}.[92] (For a more detailed discussion of the techniques used in solution of the structure see Chapter II.)

The final model with 216 parameters varied converged to $R = 0.058$ and $R_w = 0.067$.[121] In the final electron density difference map all of the 20 highest residuals were in the vicinities of the phenyl groups (0.99-0.55 e/Å^3). A typical carbon atom on an earlier synthesis had an electron density of about 3.9 e/Å^3.

On the basis of the high thermal parameters of some of these group atoms and the residuals about the phenyl groups, it seems that an anisotropic refinement of the phenyl carbon atoms would have been more suitable. However this was not attempted due to the very high cost and the feeling that no significant change would result in the parameters of interest.

Results

The positional and thermal parameters for the individual anisotropic atoms, rigid group atoms and idealized hydrogen atoms are given in Tables 20, 21 and 22, respectively. Least-squares plane calculations are shown in Table 23 and selected bond lengths and angles are given in Tables 24 and 25, respectively. A listing of the observed and calculated structure amplitudes is available.[110]

A stereoview of the unit cell is shown in Figure 12. The crystallographic *a* axis is horizontal to the right, the *c* axis runs from top to bottom and the *b* axis goes into the page. Figure 13 presents a perspective view of the compound including the numbering scheme (phenyl hydrogen atoms have the same number as their attached carbon atom). The inner coordination sphere is shown in Figure 14 along with some relevant bond lengths, 50% thermal ellipsoids are drawn.

TABLE 20. Positional and Thermal Parameters For The Nongroup Atoms of [Rh2Cl2(mu-SO2)(DPM)2].

Atom	x [a]	y	z	U11 [b]	U22	U33	U12	U13	U23
Rh(1)	0.27944(3)	0.33834(5)	0.51141(3)	3.61(4)	3.37(4)	3.52(4)	-0.11(3)	1.37(3)	0.04(3)
Rh(2)	0.21069(3)	0.16337(5)	0.45320(3)	3.41(4)	3.65(4)	2.77(4)	0.05(3)	0.86(3)	-0.10(3)
P(1)	0.1677(1)	0.4272(2)	0.5018(1)	4.1(1)	3.8(1)	3.7(1)	0.2(1)	1.6(1)	0.2(1)
P(2)	0.0937(1)	0.2442(2)	0.4266(1)	3.3(1)	4.2(1)	3.2(1)	-0.1(1)	1.07(9)	0.0(1)
P(3)	0.3957(1)	0.2738(2)	0.5056(1)	3.7(1)	4.0(1)	4.8(1)	-0.1(1)	1.6(1)	0.1(1)
P(4)	0.3232(1)	0.0771(2)	0.4579(1)	4.2(1)	4.1(1)	3.9(1)	0.9(1)	0.6(1)	-0.4(1)
Cl(1)	0.3413(1)	0.4912(2)	0.5333(2)	5.2(1)	4.0(1)	8.2(2)	-0.7(1)	1.3(1)	-0.3(1)
Cl(2)	0.1495(1)	0.0353(2)	0.3805(1)	4.8(1)	4.8(1)	4.3(1)	-1.0(1)	1.2(1)	-1.1(1)
S	0.2441(1)	0.2110(2)	0.5622(1)	4.1(1)	3.8(1)	2.8(1)	-0.11(9)	1.10(9)	0.09(9)
O(1)	0.3057(4)	0.1574(5)	0.6091(3)	5.2(4)	5.3(4)	3.2(3)	0.7(3)	0.4(3)	0.9(3)
O(2)	0.1805(3)	0.2256(5)	0.5932(3)	4.9(4)	5.6(4)	3.4(3)	0.3(3)	2.4(3)	0.7(3)
C(1)	0.0830(5)	0.3497(6)	0.4814(5)	3.5(4)	4.2(5)	3.9(5)	0.4(4)	1.3(4)	0.4(4)
C(2)	0.4077(5)	0.1385(6)	0.5106(5)	4.1(5)	4.5(5)	4.4(6)	0.3(4)	1.0(4)	0.2(4)

[a] Estimated standard deviations in the least signicant figure(s) are given in parentheses in this and all subsequent tables.

[b] The form of the thermal ellipsoid is: $\exp[-2\pi^2(a^{*2}U11h^2+b^{*2}U22k^2+c^{*2}U33l^2+2a^*b^*U12hk+2a^*c^*U13hl+2b^*c^*U23kl)]$. The quantities given in the table are the thermal coefficients $\times 10^2$.

TABLE 21. Derived Parameters For the Rigid Group Atoms of [Rh2Cl2(mu-SO2)(DPM)2].

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
C(11)	0.1471(6)	0.5213(5)	0.4326(5)	3.4(2)	C(51)	0.4781(9)	0.3152(7)	0.5723(4)	3.7(2)
C(12)	0.1927(5)	0.5318(5)	0.3860(4)	4.7(2)	C(52)	0.531(1)	0.3813(7)	0.5592(7)	7.0(3)
C(13)	0.1763(7)	0.6044(6)	0.3341(4)	6.1(3)	C(53)	0.5924(6)	0.4107(5)	0.6138(8)	8.1(4)
C(14)	0.1142(6)	0.6666(5)	0.3288(5)	6.3(3)	C(54)	0.6001(9)	0.3740(7)	0.6815(4)	7.3(3)
C(15)	0.0686(5)	0.6561(5)	0.3755(4)	7.9(4)	C(55)	0.547(1)	0.3079(7)	0.6946(7)	12.3(6)
C(16)	0.0850(7)	0.5835(6)	0.4274(4)	6.6(3)	C(56)	0.4857(6)	0.2785(5)	0.6400(8)	9.7(5)
C(21)	0.1620(5)	0.4948(5)	0.5809(3)	3.7(2)	C(61)	0.408(2)	0.3061(6)	0.419(1)	4.3(2)
C(22)	0.1879(5)	0.5919(5)	0.5907(3)	5.9(3)	C(62)	0.478(1)	0.3022(5)	0.4032(9)	8.3(4)
C(23)	0.1933(4)	0.6390(4)	0.6548(4)	6.3(3)	C(63)	0.483(2)	0.3235(6)	0.335(1)	10.2(5)
C(24)	0.1726(5)	0.5892(5)	0.7091(3)	6.1(3)	C(64)	0.419(2)	0.3488(6)	0.283(1)	7.8(4)
C(25)	0.1467(5)	0.4921(5)	0.6994(3)	5.6(3)	C(65)	0.348(1)	0.3527(5)	0.2994(9)	6.3(3)
C(26)	0.1413(4)	0.4450(4)	0.6353(4)	4.5(2)	C(66)	0.343(2)	0.3314(6)	0.367(1)	4.5(2)
C(31)	0.0089(4)	0.1740(4)	0.429(1)	3.1(2)	C(71)	0.349(1)	0.0554(7)	0.3747(5)	4.6(2)
C(32)	-0.0037(9)	0.1526(6)	0.4941(6)	5.9(3)	C(72)	0.4136(9)	0.0005(6)	0.3759(8)	11.5(6)
C(33)	-0.069(1)	0.1015(6)	0.4982(6)	7.6(4)	C(73)	0.4372(5)	-0.0123(6)	0.3144(9)	14.8(7)
C(34)	-0.1211(4)	0.0718(4)	0.437(1)	5.8(3)	C(74)	0.396(1)	0.0298(7)	0.2516(5)	8.7(4)
C(35)	-0.1086(9)	0.0932(6)	0.3715(6)	6.0(3)	C(75)	0.3309(9)	0.0846(6)	0.2504(8)	6.0(3)
C(36)	-0.044(1)	0.1443(6)	0.3673(6)	5.4(3)	C(76)	0.3073(5)	0.0974(6)	0.3119(9)	4.6(2)
C(41)	0.0776(6)	0.2969(5)	0.3383(5)	3.1(2)	C(81)	0.3265(5)	-0.0469(5)	0.4969(5)	4.0(2)
C(42)	0.0170(5)	0.3601(5)	0.3109(4)	5.0(2)	C(82)	0.3470(5)	-0.0588(5)	0.5698(5)	5.6(3)
C(43)	0.0079(4)	0.4008(4)	0.2441(6)	6.0(3)	C(83)	0.3457(5)	-0.1523(7)	0.5990(3)	6.7(3)
C(44)	0.0594(6)	0.3784(5)	0.2048(5)	5.2(2)	C(84)	0.3238(5)	-0.2340(5)	0.5553(5)	6.5(3)
C(45)	0.1200(5)	0.3152(5)	0.2322(4)	5.2(2)	C(85)	0.3033(5)	-0.2220(5)	0.4825(5)	9.0(4)
C(46)	0.1291(4)	0.2745(4)	0.2990(6)	4.1(2)	C(86)	0.3046(5)	-0.1285(7)	0.4533(3)	8.6(4)

Rigid Group Parameters

	Xc [a]	Yc	Zc	Delta [b]	Epsilon	Eta
Ring1	0.1306(3)	0.5939(4)	0.3807(3)	-0.703(4)	0.864(7)	4.322(6)
Ring2	0.1673(2)	0.5420(4)	0.6450(3)	0.339(5)	1.464(5)	5.775(5)
Ring3	-0.0561(3)	0.1229(3)	0.4328(3)	1.049(4)	1.79(1)	1.48(1)
Ring4	0.0685(3)	0.3376(3)	0.2715(3)	2.242(4)	1.124(7)	2.452(7)
Ring5	0.5391(3)	0.3446(4)	0.6269(3)	0.872(6)	2.146(8)	5.824(9)
Ring6	0.4133(3)	0.3274(3)	0.3513(3)	-1.303(5)	0.62(2)	4.04(2)
Ring7	0.3722(3)	0.0426(4)	0.3132(4)	-0.980(6)	1.45(1)	2.92(1)
Ring8	0.3252(3)	-0.1404(4)	0.5261(3)	0.144(5)	1.853(5)	1.165(5)

[a] Xc,Yc and Zc are the fractional coordinates of the centroid of the rigid group.

[b] The rigid group orientation angles Delta,Epsilon and Eta(radians) are the angles by which the rigid body is rotated with respect to a set of axes X,Y and Z. The origin is the centre of the ring; X is parallel to a* , Z is parallel to c and Y is parallel to the line defined by the intersection of the plane containing a* and b* with the plane containing b and c.

TABLE 22. Idealized Positional and Thermal Parameters For the Hydrogen Atoms of [Rh2Cl2(mu-SO2)(DPM)2].

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
H(1C1)	0.0409	0.3882	0.4571	3.99	H(45)	0.1552	0.2998	0.2054	6.20
H(2C1)	-0.0739	0.3262	0.5241	3.99	H(46)	0.1705	0.2313	0.3177	5.09
H(1C2)	0.4163	0.1179	0.5583	4.43	H(52)	0.5261	0.4064	0.5129	7.98
H(2C2)	0.4502	0.1205	0.4937	4.43	H(53)	0.6288	0.4559	0.6048	9.09
H(12)	0.2351	0.4894	0.3896	5.72	H(54)	0.6416	0.3941	0.7187	8.29
H(13)	0.2075	0.6116	0.3023	7.13	H(55)	0.5519	0.2829	0.7407	13.27
H(14)	0.1030	0.7461	0.2934	7.33	H(56)	0.4493	0.2334	0.6489	10.73
H(15)	0.0262	0.6985	0.3718	8.93	H(62)	0.5221	0.2846	0.4387	9.35
H(16)	0.0538	0.5763	0.4591	7.59	H(63)	0.5311	0.3206	0.3245	11.11
H(22)	0.2020	0.6259	0.5536	6.84	H(64)	0.4222	0.3633	0.2371	8.82
H(23)	0.2110	0.7052	0.6615	7.20	H(65)	0.3043	0.3701	0.2640	7.29
H(24)	0.1763	0.6212	0.7529	7.10	H(66)	0.2953	0.3341	0.3783	5.52
H(25)	0.1326	0.4579	0.7364	6.60	H(72)	0.4417	-0.0280	0.4190	12.62
H(26)	0.1236	0.3786	0.6286	5.55	H(73)	0.4815	-0.0497	0.3155	15.60
H(32)	0.0321	0.1729	0.5359	6.91	H(74)	0.4121	0.0209	0.2099	9.66
H(33)	-0.0773	0.0869	0.5428	8.60	H(75)	0.3028	0.1133	0.2076	7.05
H(34)	-0.1655	0.0370	0.4397	6.77	H(76)	0.2629	0.1350	0.3110	5.64
H(35)	-0.1442	0.0730	0.3296	6.98	H(82)	0.3620	-0.0030	0.5996	6.57
H(36)	-0.0349	0.1590	0.3226	6.43	H(83)	0.3597	-0.1604	0.6487	7.68
H(42)	-0.0181	0.3754	0.3377	6.03	H(84)	0.3229	-0.2977	0.5753	7.51
H(43)	-0.0334	0.4439	0.2254	6.96	H(85)	0.2883	-0.2775	0.4527	10.05
H(44)	0.0533	0.4061	0.1593	6.20	H(86)	0.2906	-0.1201	0.4037	9.60

Table 23. Least-Squares Plane Calculations

Plane No.	Equation [a]
1	0.2235 X + 0.3314 Y - 0.9166 Z + 6.7751 = 0.0
2	- 0.9043 X + 0.4149 Y - 0.1006 Z + 1.3775 = 0.0
3	- 0.3075 X - 0.8651 Y - 0.3962 Z + 7.2045 = 0.0

Deviation from Planes (Å)

Atom

Plane No.	Rh(1)	Rh(2)	P(1)	P(2)	P(3)	P(4)	C(1)	C(2)	S	O(1)	O(2)
1	-0.0407(6)	-0.0272(6)	0.081(2)	0.352(2)	0.250(2)	0.250(2)	-0.234(9)[b]	-0.400(9)[b]			
2	0.0	0.0							0.0		
3									0.0	0.0	0.0

Dihedral Angle Between Planes 2 and 3 = 92.35°

[a] X, Y, Z are the orthogonal coordinates (Å) with X along the a axis, Y in the a-b plane and Z along the c* axis.

[b] Not included in least squares plane calculations.

Table 24. Selected Distances (Å) in $Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2$

Bond Distances

Rh(1)-Rh(2)	2.7838(8)		P(1)-C(1)	1.824(9)	1.829(9)
Rh(1)-S	2.169(2)		P(2)-C(1)	1.827(9)	
Rh(2)-S	2.169(2)		P(3)-C(2)	1.843(9)	
Rh(1)-Cl(1)	2.342(2)		P(4)-C(2)	1.822(9)	
Rh(2)-Cl(2)	2.341(2)		P(1)-C(11)	1.830(6)	1.827(8)
Rh(1)-P(1)	2.330(2)	2.331(9)[a]	P(1)-C(21)	1.830(6)	
Rh(1)-P(3)	2.320(2)		P(2)-C(31)	1.824(5)	
Rh(2)-P(2)	2.334(2)		P(2)-C(41)	1.827(5)	
Rh(2)-P(4)	2.341(2)		P(3)-C(51)	1.812(7)	
S-O(1)	1.452(6)		P(3)-C(61)	1.820(7)	
S-O(2)	1.452(6)		P(4)-C(71)	1.832(7)	
			P(4)-C(81)	1.839(6)	

Nonbonded Distances

P(1)-P(2)	3.018(3)	O(1)-H1C2	2.52
P(3)-P(4)	3.012(3)	O(2)-H(45)[b]	2.39
Rh(1)-H(66)	2.70	O(2)-H2C1	2.48
Rh(2)-H(46)	2.73	O(2)-H(26)	2.49
C(52)-H(62)	2.67	H2C1-H(26)	2.15
C(62)-H(52)	2.54	H1C2-H(82)	2.17
O(1)-H(82)	2.43	H(46)-H(76)	2.16
		H(52)-H(62)	2.19

[a] For averaged quantities, the estimated standard deviation is the larger of an individual standard deviation or the standard deviation of a single observation as calculated from the mean.

[b] H(45) is associated with the molecule at the general equivalent position x, 1/2 - y, 1/2 + z.

Table 25. Selected Angles (deg) in $Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2$

Bond Angles

Rh(2)-Rh(1)-Cl(1)	166.28(8)	Rh(1)-P(3)-C(51)	116.6(3)
Rh(2)-Rh(1)-P(1)	96.43(6)	Rh(1)-P(3)-C(61)	106.6(3)
Rh(2)-Rh(1)-P(3)	88.94(6)	Rh(2)-P(4)-C(71)	117.6(3)
Rh(2)-Rh(1)-S	50.07(6)	Rh(2)-P(4)-C(81)	114.0(3)
Cl(1)-Rh(1)-S	143.33(9)	C(1)-P(1)-C(11)	103.5(4)
Cl(1)-Rh(1)-P(1)	85.98(9)	C(1)-P(1)-C(21)	104.3(4)
Cl(1)-Rh(1)-P(3)	86.45(9)	C(1)-P(2)-C(31)	100.1(4)
P(1)-Rh(1)-P(3)	168.46(9)	C(1)-P(2)-C(41)	103.8(3)
P(1)-Rh(1)-S	95.23(8)	C(2)-P(3)-C(51)	101.7(4)
P(3)-Rh(1)-S	96.04(8)	C(2)-P(3)-C(61)	103.4(4)
Rh(1)-Rh(2)-Cl(2)	167.17(6)	C(2)-P(4)-C(71)	102.2(4)
Rh(1)-Rh(2)-P(2)	89.10(6)	C(2)-P(4)-C(81)	102.2(4)
Rh(1)-Rh(2)-P(4)	96.25(6)	C(11)-P(1)-C(21)	103.7(3)
Rh(1)-Rh(2)-S	50.08(6)	C(31)-P(2)-C(41)	106.9(3)
Cl(2)-Rh(2)-S	142.44(8)	C(51)-P(3)-C(61)	108.9(4)
Cl(2)-Rh(2)-P(2)	86.75(7)	C(71)-P(4)-C(81)	103.7(4)
Cl(2)-Rh(2)-P(4)	86.11(8)	P(1)-C(11)-C(12)	120.9(4)
P(2)-Rh(2)-P(4)	169.59(9)	P(1)-C(11)-C(16)	119.0(4)
P(2)-Rh(2)-S	95.37(8)	P(1)-C(21)-C(22)	119.9(4)
P(4)-Rh(2)-S	94.91(8)	P(1)-C(21)-C(26)	119.6(4)
Rh(1)-S-Rh(2)	79.84(7)	P(2)-C(31)-C(32)	117.9(4)
O(1)-S-O(2)	111.9(4)	P(2)-C(31)-C(36)	122.1(4)
Rh(1)-S-O(1)	114.6(3)	P(2)-C(41)-C(42)	121.8(4)
Rh(1)-S-O(2)	116.5(3)	P(2)-C(41)-C(46)	118.2(4)
Rh(2)-S-O(1)	117.1(3)	P(3)-C(51)-C(52)	123.7(6)
Rh(2)-S-O(2)	113.6(3)	P(3)-C(51)-C(56)	116.3(6)
Rh(1)-P(1)-C(1)	113.3(3)	P(3)-C(61)-C(62)	122.6(5)
Rh(2)-P(2)-C(1)	117.5(3)	P(3)-C(61)-C(66)	117.3(5)
Rh(1)-P(3)-C(2)	117.9(3)	P(4)-C(71)-C(72)	118.5(6)
Rh(2)-P(4)-C(2)	113.6(3)	P(4)-C(71)-C(76)	121.4(6)
Rh(1)-P(1)-C(11)	115.5(2)	P(4)-C(81)-C(82)	120.4(5)
Rh(1)-P(1)-C(21)	115.2(2)	P(4)-C(81)-C(86)	119.6(5)
Rh(2)-P(2)-C(31)	118.9(2)	P(1)-C(1)-P(2)	111.6(4)
Rh(2)-P(2)-C(41)	108.2(2)	P(3)-C(2)-P(4)	110.5(5)

Torsion Angles

P(1)-Rh(1)-Rh(2)-P(2)	6.31(8)	C(21)-P(1)-P(2)-C(31)	18.3(5)
P(3)-Rh(1)-Rh(2)-P(4)	7.60(9)	C(51)-P(3)-P(4)-C(81)	20.5(6)
P(1)-Rh(1)-Rh(2)-P(4)	177.36(9)	C(61)-P(3)-P(4)-C(71)	17.1(4)
P(3)-Rh(1)-Rh(2)-P(2)	163.45(8)	C(11)-P(1)-Rh(1)-Cl(1)	60.1(3)
C(1)-P(1)-P(3)-C(2)	16.2(5)	C(21)-P(1)-Rh(2)-Cl(2)	60.9(3)
C(1)-P(2)-P(4)-C(2)	15.3(5)	C(31)-P(2)-Rh(2)-Cl(2)	44.8(3)
C(11)-P(1)-P(3)-C(61)	18.2(4)	C(41)-P(2)-Rh(2)-Cl(2)	77.3(3)
C(21)-P(1)-P(3)-C(51)	17.9(4)	C(51)-P(3)-Rh(1)-Cl(1)	43.2(3)
C(31)-P(2)-P(4)-C(81)	17.4(4)	C(61)-P(3)-Rh(1)-Cl(1)	78.5(3)
C(41)-P(2)-P(4)-C(71)	17.2(4)	C(71)-P(4)-Rh(2)-Cl(2)	60.0(3)
C(11)-P(1)-P(2)-C(41)	12.2(3)	C(81)-P(4)-Rh(2)-Cl(2)	61.6(3)

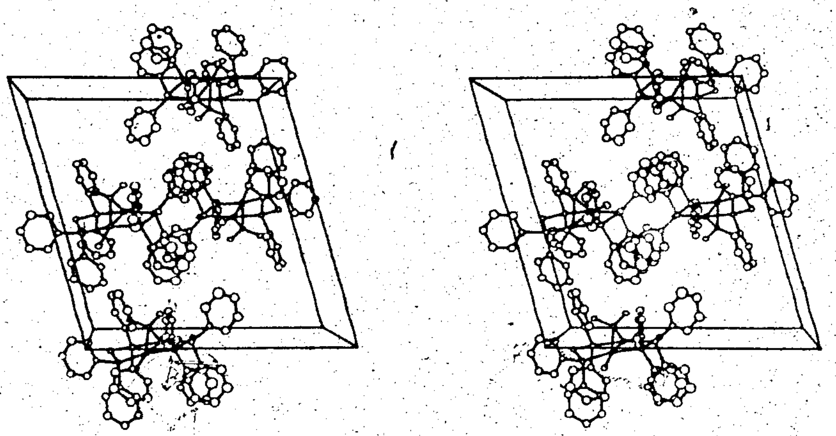


Figure 12. Cell Packing Diagram of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$.

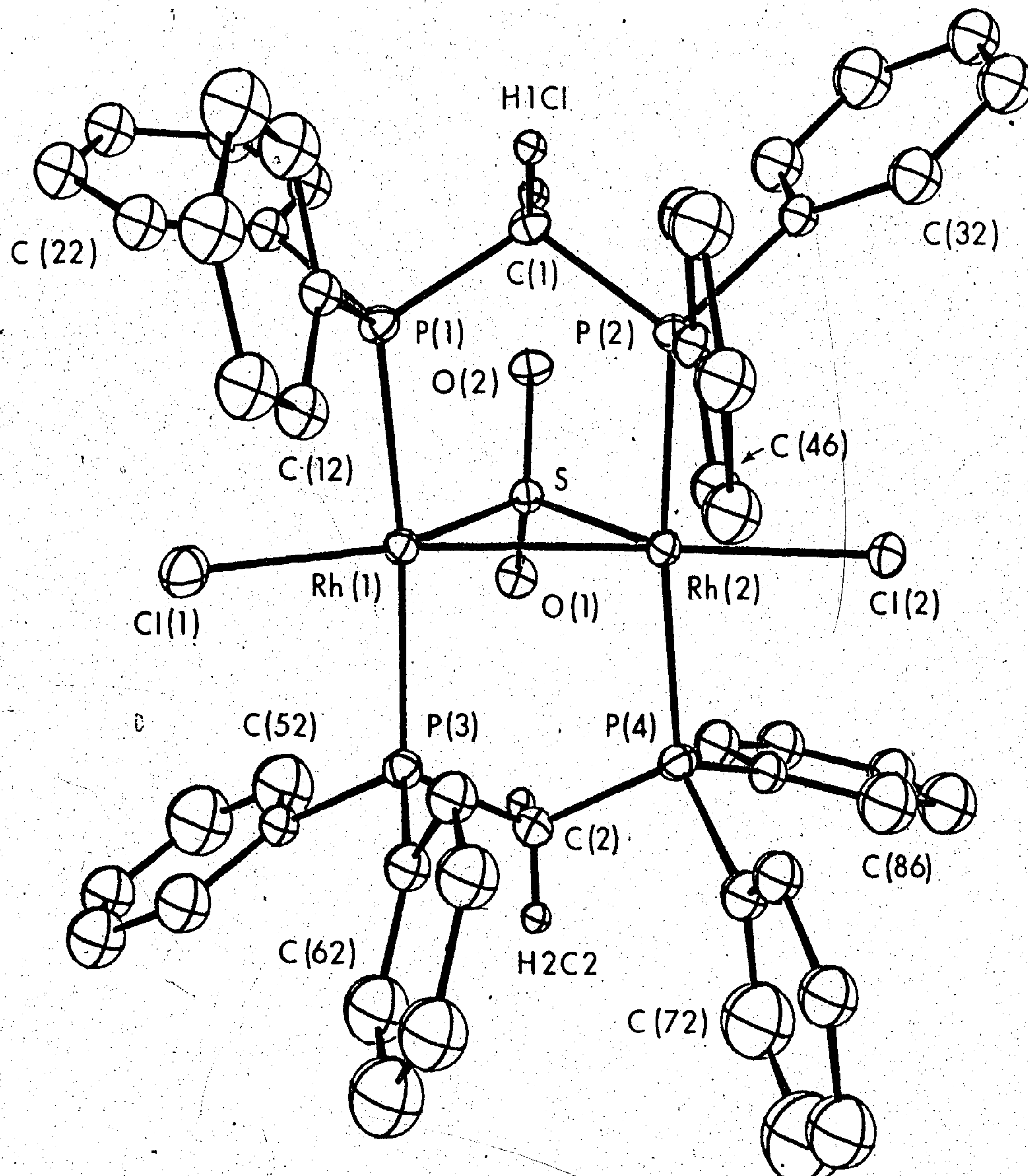


Figure 13. A Perspective View of $[Rh_2Cl_2(\mu-SO_2)(DPM)_2]$.

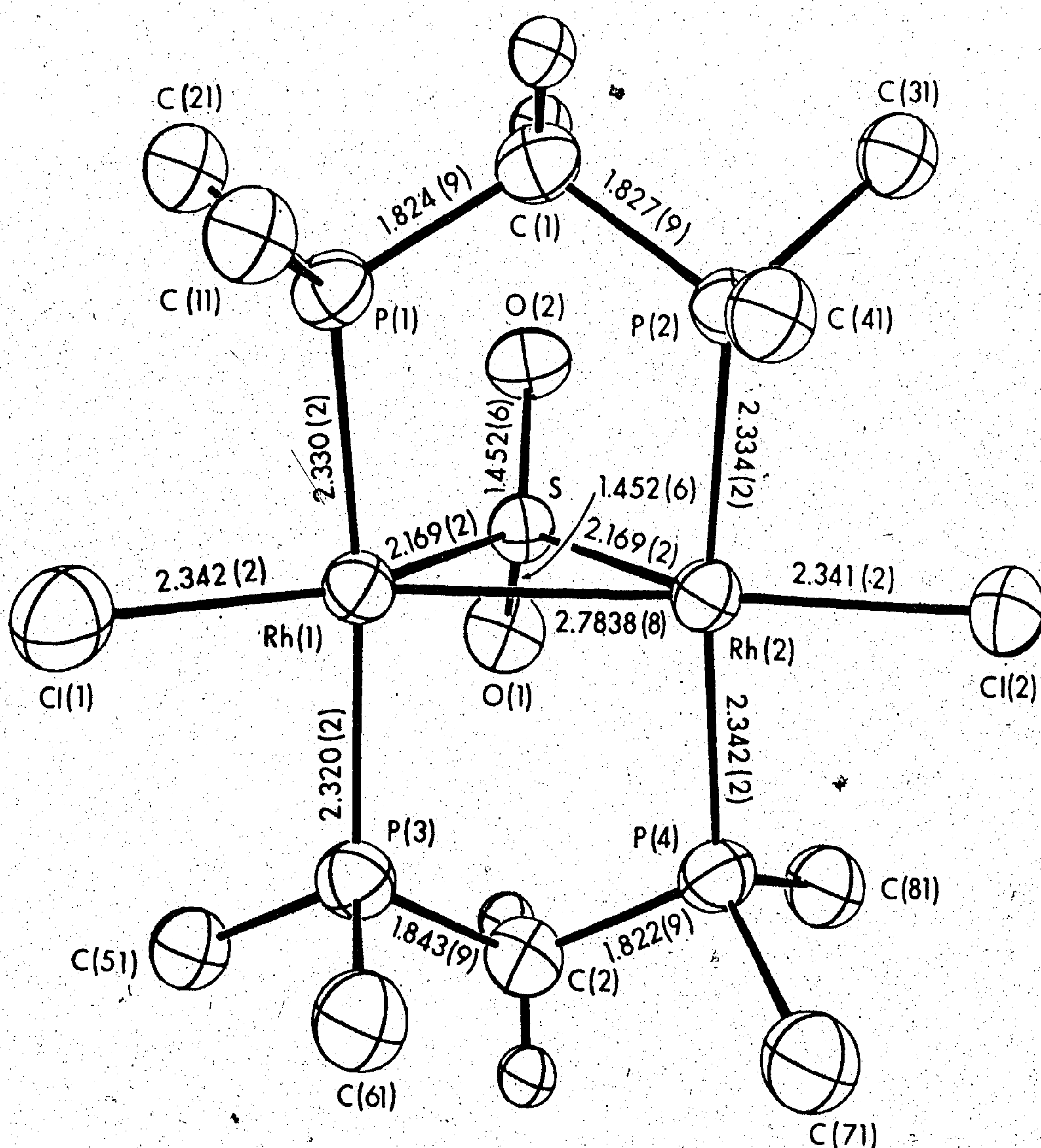


Figure 14. The Inner Coordination Sphere of $[Rh_2Cl_2-(\mu-SO_2)(DPM)_2]$.

DISCUSSION

Description of Structure

The complex, $[Rh_2Cl_2(\mu-SO_2)(DPM)_2]$, displays a distorted "A-frame" geometry, similar to that displayed by the palladium analogue $[Pd_2Cl_2(\mu-SO_2)(DPM)_2]$[85] (apart from the metal-metal bond in the present species). The "A" configuration is described by the chloro and sulfur dioxide ligands in the equatorial plane, with the apical position occupied by the bridging SO_2 ligand. Both rhodium centres are bridged by two DPM ligands, which are mutually trans and approximately perpendicular to the equatorial plane. The distortion from the idealized "A-frame" structure which would have the terminal Cl ligands trans to the bridging SO_2 ligand results both from close nonbonded contacts between the chloro ligands and the phenyl rings and from the presence of the Rh-Rh bond (see Figure 13 and Table 24). Therefore, unlike other "A-frame" complexes which have approximately square planar coordination at the metals, the present complex exhibits a highly distorted trigonal-bipyramidal metal environment with the average S-Rh-Rh, S-Rh-Cl and Cl-Rh-Rh angles (50.07(6), 142.9(5) and 166.7(5)°, respectively, see Table 25) deviating significantly from the idealized 120° value.

The Rh-Rh distance of 2.7838(9)Å is consistent with a normal Rh-Rh single bond, falling within the range previously reported for such distances (2.617(3)-2.8415(7)Å).[35,126-133]

The present value can be compared to that observed in the related Rh-Rh bonded tricarbonyl species $[Rh_2(CO)_2(\mu\text{-}CO)\text{-}(\mu\text{-}Cl)(DPM)_2]^+$ (2.8415(7)Å)[35] and can be contrasted to the distances of 3.1520(8) and 3.155(4)Å, respectively, for $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ [120] and $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$,[89] in which no Rh-Rh bond is present.

The geometry of the bridging SO_2 ligand is consistent with a Rh-Rh bonded system. Thus the acute Rh-S-Rh angle of 79.84(7)° indicates compression along the Rh-Rh axis and is comparable to other such values obtained when SO_2 bridges a metal-metal bond (72.6(1) - 75.6(2)°)[60,134-136] but is significantly smaller than the range in M-S-M angles observed (91.2(2) - 118.0(2)°)[64,85,137] when SO_2 bridges two metal atoms which are not bonded to each other. The bonding in this SO_2 ligand is symmetrical (Rh(1)-S = Rh(2) - S = 2.169(2)Å) and these Rh-S distances are significantly shorter than the metal-sulfur distances observed in other sulfur dioxide bridged complexes of the second and third row platinum metals ($[Pd_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$, Pd-S = 2.234(3) and 2.240(3)Å;[85] $[IrH(CO)_2(PPh_3)_2]SO_2$, Ir-S = 2.313 Å;[60] $[Pd_3(SO_2)_2(t\text{-}BuNC)_5]$, Pd-S (av.) = 2.261(9)Å;[138] and $[Pt_3(SO_2)_3(PPh_3)_3]$, Pt-S(av.) = 2.275(5)Å).[136] The S-O distances of 1.452(6) Å and the O-S-O angle of 111.9(4)° compare well with other determinations in which SO_2 acts as either a bridging or a terminal ligand[52,134-138] and can be compared to the analogous parameters in free SO_2

(1.431(1)Å and 119.0(5)°, respectively).[139] The differences between free and coordinated SO_2 can be attributed to back donation into SO_2 orbitals which are slightly bonding with respect to the O-O interaction and antibonding with respect to the S-O interactions.[52] However, more simply they reflect the change from sp^2 to sp^3 hybridization about the sulfur atom. The Rh-S-O angles are also close to the expected tetrahedral values.

The Rh-Cl distances of 2.342(2) and 2.341(2)Å are not unusual; however they are somewhat shorter than those typically observed (range 2.355(2) - 2.386(3)Å)[31,122,123,140] for rhodium (I) phosphine complexes.

Within the Rh-DPM framework most parameters are usual. The Rh-P distances (average 2.331(9)Å)[124] are within the range normally observed when phosphine ligands are mutually trans,[35,85,89,117,120] and the P-C distances (both methylene and phenyl) compare well with other determinations.[35,85,89,120] The methylene carbon atoms of the bridging DPM ligand are folded in a cis configuration towards the sulfur dioxide ligand (see Table 23 and Figure 13). This orientation of the methylene groups allows the phenyl groups to stagger themselves with respect to the terminal chloro ligands in the equatorial plane (see Cl-Rh-P phenyl torsion angles, Table 25) and also places four of the eight phenyl rings in the open positions around the bridging site. Viewed down the Rh-Rh axis the Rh-P vectors are slightly staggered with respect to one another as can be seen from the P-Rh-Rh-P torsion angles of 6.31(8)° and 7.60(9)°. This observed twist in the Rh-DPM framework thrusts rings 4 and 6 further into the enclosed bridging site, effectively blocking this site and resulting in short Rh-H nonbonded contacts (Rh(1) - H(66) = 2.70 Å and Rh(2) - H(46) = 2.73 Å). Although the enclosed site is effectively blocked by these phenyl rings, the exposed terminal sites are conspiciously vacant and open to attack by small molecules.

Transformation of $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2]^+$ to $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$

The reaction of the parent "A-frame" complex, as the BPh_4^- salt, 1a, with sulfur dioxide yields initially the sulfur dioxide adduct $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Cl)(DPM)_2][BPh_4]$ 3a (see Figure 11). The assignment of this structure is based on (1) the infrared spectrum which is similar to that of the carbonyl adduct 2a, which has been characterized by an X-ray structural determination;[35] (2) the SO_2 bands in the infrared spectrum at 1230 and 1070 cm^{-1} which are in the region observed for other SO_2 ligands bridging metal-metal bonded centres;[60,138] (3) the $^{31}P\{^1H\}$ NMR spectrum which displays only one phosphorus environment; (4) satisfactory elemental analysis; and (5) treatment of a solution of 3a with dinitrogen which leads to SO_2 loss and isolation of the parent species 1a.

Prolonged treatment of a solution of **3a** with SO_2 resulted in an apparent disproportionation reaction yielding $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ (**4**) as a brown microcrystalline solid and a yellow solution containing the other unidentified disproportionation product(s). Subsequent attempts to repeat the above reaction have shown that it is not a simple disproportionation reaction. When the reaction was repeated using the pure parent "A-frame", which had been recrystallized several times, it was found that the reaction stopped at the sulfur dioxide adduct **3a**. Whereas when **1a** was purified by only a single crystallization or if the reaction was carried out in situ without purification of **1a**, the transformation of compound **3a** to **4** proceeded to completion in about 4 h. This suggested the involvement of an impurity in the reaction yielding compound **4**.

Since $[RhHCl(DPM)_2][BPh_4]$ was known to be an impurity in some preparations of **1a**,[141] this species was added to solutions of **3a** to assess its effect on the above reaction. It was found however, that even when present in equimolar amounts this hydrido complex had no apparent effect on the reaction rate.

Another potential impurity is the $[RhCl_2(CO)_2]^-$ anion, which is generated as the counter ion in the initial preparation of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ (see Chapter II). An ion exchange was then performed to replace this anion with BPh_4^-. However, if exchange is incomplete, trace amounts of $[Rh(Cl)_2(CO)_2]^-$ may be present. To test the possible involvement of the $[RhCl_2(CO)_2]^-$ anion, we treated the complex $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][RhCl_2(CO)_2]$, **1c**, with SO_2. Regardless of solvent, the transformation of **3** to **4** proceeded to completion in every case within 3 h. When traces of **1c** were added to pure **1a**, this reaction again occurred much more readily than with only pure **1a**, suggesting the involvement of the $[RhCl_2(CO)_2]^-$ anion as a chloride transfer agent in the reaction. It has already been shown by Balch and co-workers[142] that the dimer $[RhCl(CO)_2]_2$ abstracts chloride anion from *trans*-$[RhCl(CO)(DAM)]_2$ to give $[Rh_2(CO)_2(\mu\text{-}Cl)(DAM)_2]^+$ and $[RhCl_2(CO)_2]^-$. It is not unreasonable to expect therefore that a similar process is occurring in the transformation of **3** to **4**. In fact a model of $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][RhCl_2(CO)_2]$, constructed from data made available to us by Professor Balch,[142,143] shows that the anion approaches the tricarbonyl cationic species (which we assume is structurally similar to complex **3a**), in such an orientation that chloride transfer from the anion to the cation is very feasible. We believe that the species resulting from Cl^- transfer by $[RhCl_2(CO)_2]^-$, i.e., $[RhCl(CO)_2]$ or the dimer $[RhCl(CO)_2]_2$, then abstracts a chloride ion from another cationic species **3a** to restart the process, resulting in a net chloride transfer reaction. The rhodium-DPM species produced is presumably a neutral dichlorodicarbonyl, sulfur dioxide bridged species, $[Rh_2Cl_2(CO)_2(\mu-SO_2)(DPM)_2]$, which then loses CO to yield complex 4.

It is not surprising that the relatively small species $[RhCl_2(CO)_2]^-$ is accomplishing the chloride transfer as opposed to any species containing the bulky DPM ligand. Of course when the chloride ion is added directly to a solution of 3a, evaporation of this solution under a SO_2 atmosphere results in quantative conversion of 3a to 4. Therefore the conversion of complex 3a into 4 occurs in the presence of any chloride ion source. It is also of interest at this stage to note the differences between SO_2 and CO in these systems. In the presence of a chloride ion source the SO_2 adduct 3a is unstable, yielding complex 4, whereas the analogous tricarbonyl species $[Rh_2(CO)_2(\mu-CO)-(\mu-Cl)(DPM)_2][X]$, $X = Cl^-$ (vide infra) or $[RhCl_2(CO)_2]^-$,[142] are stable and readily isolated. Two possible reasons are suggested for this difference. The bridging SO_2, we believe withdraws more electron density from the metals than the bridging CO ligands. This favours nucleophilic Cl^- attack on the SO_2 adduct. Another significant difference lies in the orientation of the methylene carbon atoms of the DPM ligands. Structural studies have shown that the methylene groups fold towards the more bulky bridging equatorial group. In the carbonyl adduct this is the Cl ligand, whereas in the SO_2 adduct the bulkier group is the SO_2 ligand. Thus, methylene orientation in the SO_2 adduct may lead to a more favourable orientation of the phenyl rings allowing easier access of the chloride donor to the metal center.

Efforts at characterizing the other so-called disproportionation products have met with little success. On the basis of $^{31}P\{^1H\}$ NMR spectra of the products in this reaction, we find, in addition to resonances due to 4, that at least three other unidentified resonances occur. The sum of their integrated intensities is approximately equal to that of complex 4. It seems therefore that the second product in the reaction, species 5, is unstable and is reacting further to yield the species observed in the NMR experiment. This is consistent with the fact that the relative intensities of the bands in the infrared spectra of the yellow product changed from sample to sample. However, it was noted that no carbonyl species was ever observed in the infrared spectra of the final yellow product.

Reaction of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ with CO

Reaction of 4 with CO, was initially believed to yield the tricarbonyl species *cis*-$[Rh_2Cl_2(CO)_2(\mu\text{-}CO)(DPM)_2]$.[96a] However further investigations have shown that this tricarbonyl species is actually $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]$-[Cl], 2b, (see Figure 15). It is a 1:1 electrolyte in acetone and dichloromethane solutions, its $^{31}P\{^1H\}$ NMR spectrum is identical to that of the BPh_4^- salt, whose structure has been determined,[35] and its infrared spectrum is

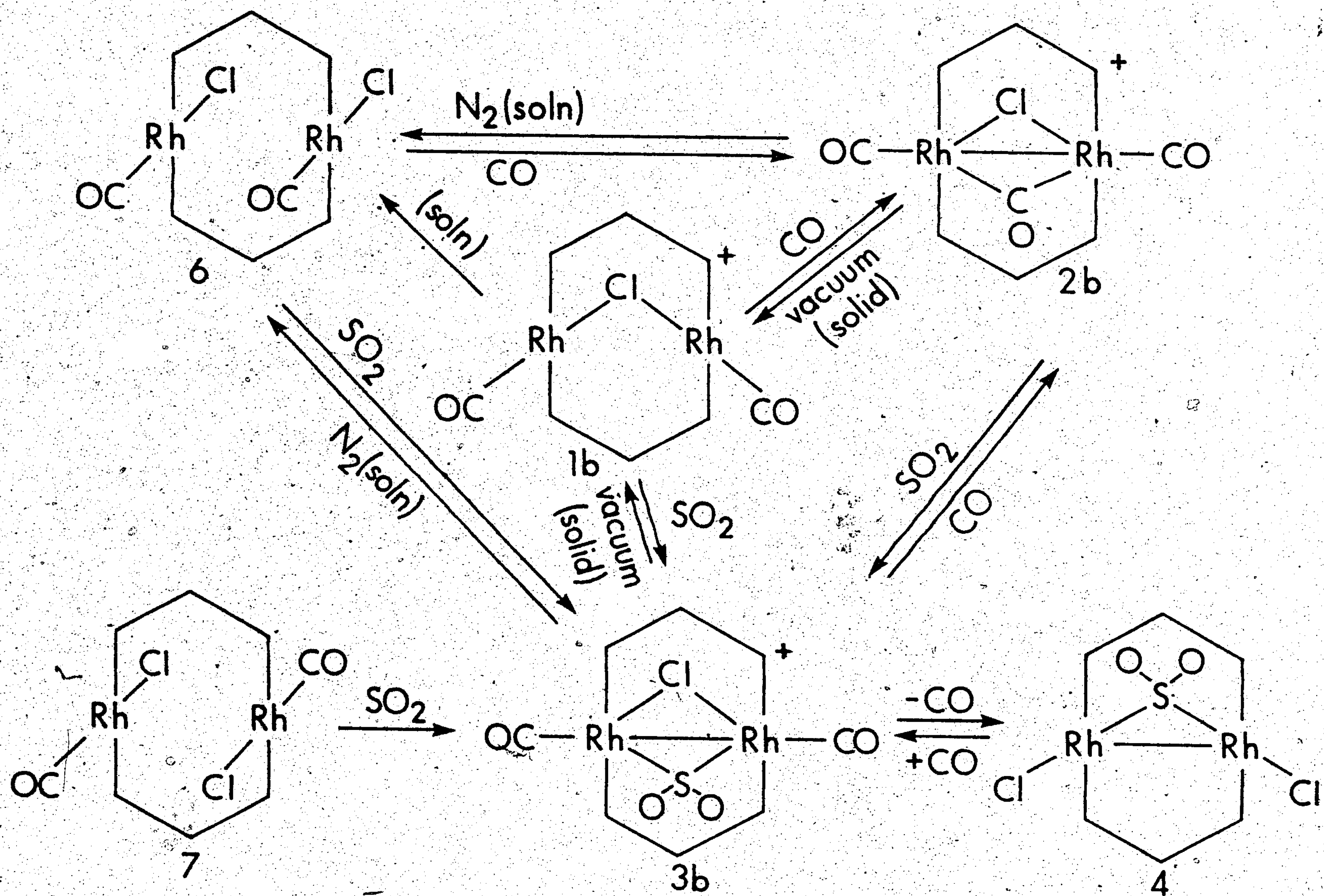


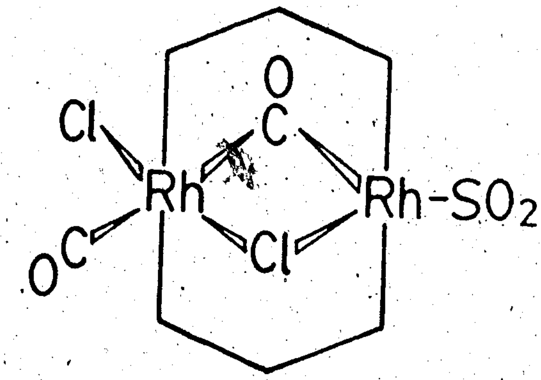
Figure 15. A Reaction Scheme for Binuclear Rh-DPM Complexes with CO and SO_2.

also similar to that of the BPh_4^- salt. Under vacuum, a solid sample of 2b loses the bridging carbonyl ligand as indicated by its infrared spectrum, which is essentially identical with that of 1a (see Table 18). This species can therefore be formulated as $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][Cl]$ (1b). A solution of 1b, however is a nonelectrolyte, and it is believed that recoordination of the chloride ion occurs such that the species present in solution is actually *cis*-$[RhCl(CO)(DPM)]_2$ (6, see Figure 15). Complex 6 can also be obtained directly by bubbling N_2 through a solution of 2b. The infrared spectra of 6 and 1b are markedly different and furthermore the $^{31}P\{^1H\}$ NMR spectrum of 6 is not similar to that of the BPh_4^- "A-frame" complex 1a. This together with the conductivity differences between 1a and 6 supports our assignment of this species as *cis*-$[RhCl(CO)(DPM)]_2$. In addition, the infrared spectrum and elemental analysis of 6 are essentially identical with those of the trans analogue 7. Our formulation of 6 as the cis species instead of the trans isomer is based on chemical differences. Complex 6 is soluble in CH_2Cl_2 and acetone whereas the trans analogue 7 is extremely insoluble. Furthermore, 6 reacts readily and reversibly with CO in CH_2Cl_2 to give 2b, whereas 7 does not react even after extended periods of time. However, unambiguous assignment of complex 6 as the cis species must await a structural determination. The *trans*-DAM analogue, *trans*-$[RhCl(CO)(DAM)]_2$, has been observed to crystallize in different forms,[31,125] therefore 6 may be another crystalline modification of 7.

Both the cis and trans species (6 and 7, respectively) react with SO_2 to yield the species $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}SO_2)(DPM)_2][Cl]$, 3b, which is assigned this structure on the basis of its conductivity (1:1 electrolyte) and its $^{31}P\{^1H\}$ NMR spectrum which shows only one phosphorus environment and which is identical with that of its BPh_4^- analogue 3a (vide supra). In addition, when solutions of 6 and 7 are treated for prolonged periods of time with SO_2, complex 4 is obtained (see Figure 15).

Reaction of *trans*-$[RhCl(CO)(DPM)]_2$ with SO_2

The reaction of the trans species (7) with SO_2 has been studied by monitoring, using infrared spectroscopy, the slow stepwise addition of SO_2. Initially species are observed which contain bridging carbonyl ligands (ν_{CO}=1740 cm^{-1}). Upon completion of the reaction none of these species is observed; instead only the symmetric SO_2-bridged species 3b remains. In addition a solution containing the initially formed product of the SO_2 reaction with 7 is nonconducting for several minutes (although on the basis of spectral and colour changes it is obvious that a reaction has occurred) after which it becomes a 1:1 electrolyte. The above data are consistent with terminal attack of SO_2 and formation of an intermediate species of the form:



This species is then believed to lose Cl^- and to rearrange to the final product 3b, having a bridging SO_2 ligand. The possibility that the carbonyl vibration at 1740 cm^{-1} is due to the monocarbonyl species $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ (see Chapter V), which was observed in the analogous reaction with CS_2 at intermediate times, is ruled out since this species is never detected in the ^{31}P NMR spectra of this reaction.

Site of SO_2 attack in $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$

In these "A-frame" species, there are two potential sites of attack, either directly at the enclosed site, bridging the metal centres, or at a terminal, exposed position remote from the bridging site. It has been shown that CO attacks 1a terminally, forcing one of the previously coordinated ligands into the bridging site.[35,91] Likewise CO appears to attack the SO_2 "A-frame" complex 4 terminally since no evidence is obtained for attack at the bridging site. In contrast, SO_2 appears to attack complex **1** directly at the bridging site, which has been shown by the structural determination of $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$ to be open[120] (see Chapter II). Spectroscopic evidence supports SO_2 attack at the bridging site. The infrared spectra obtained during the slow stepwise addition of SO_2 to **1a** displayed no bands assignable to bridging carbonyl species. On the basis of the analogous reaction of **1** with CO and of the reaction of the *trans*-dichlorodicarbonyl species **7** with SO_2 (vide supra), both of which occur by terminal attack, we would have anticipated observing species with bridging CO bands in the infrared spectra, if attack of SO_2 on **1** were also terminal. Furthermore even at -50°C when the reaction is monitored by $^{31}P\{^1H\}$ NMR techniques the only resonances observed are assignable to the symmetric species **1a** and **3a**. If attack were terminal, it is anticipated that resonances assignable to an asymmetrical species would be observed. We believe therefore that, on the basis of the above data, terminal attack of **1** with SO_2 can be ruled out, since no asymmetric species were detected. Furthermore we feel that it is unlikely that a facile rearrangement is operating since no simple rearrangement mechanism can be devised that would readily yield the symmetric bridged species **3a** from terminal attack. The reasons for the varying modes of CO and SO_2 in complex **1** is at the present time not obvious, although attack by the better π-acid (SO_2) would be favoured at the bridging site since in this site both electron rich metals can donate electron density to this ligand.

CHAPTER V.

Unusual Structural and Chemical Trends Within a Series of Binuclear Rhodium Carbonyl Halide Complexes

INTRODUCTION

The reaction of SO_2 with *trans*-$[RhCl(CO)(DPM)]_2$ (1) and *trans*-$[RhCl(CO)(DAM)]_2$ (2) is believed to proceed through an intermediate of the form $[Rh_2Cl(CO)(SO_2)(\mu\text{-}Cl)(\mu\text{-}CO)(L\text{-}L)_2]$ (L-L = DPM or DAM)[96] (Chapter IV). However, this intermediate is short lived in the case of DPM and is not observed in the case of DAM, making definitive characterization impossible. Since the stabilities of these intermediates appear to change on going from DPM to DAM as the bridging ligand, it was felt that by changing halides, it might have been possible to isolate this intermediate, as a result of the increased steric bulk of the bromo and iodo ligands slowing the rearrangement process. Therefore the preparation of the previously unreported *trans*- dibromo and *trans*-diiodo, DPM complexes and the *trans*-diiodo, DAM complex was attempted.

EXPERIMENTAL

Preparation of $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2][I]$, $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ and $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$

Typically 0.100 g of *trans*-$[RhCl(CO)(DPM)]_2$ [66] was suspended in 15 mL of CH_2Cl_2 and to this a five fold excess of the halide salt (NaBr,KI), in a minimum volume of methanol, was added. After *ca.* 12 h the solution was concentrated to about 15 mL then precipitated with diethyl ether and dried in vacuum, yielding $[Rh_2X(CO)(\mu\text{-}CO)(DPM)_2][X]$ (X = Br,I). However in solution the bromo species undergoes CO loss at room temperature over a period of 24 h, or on refluxing in CH_2Cl_2 for 2 h yielding $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$. The analogous chloro complex, $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ was obtained as a red-brown species in solution on refluxing a toluene suspension of *trans*-$[RhCl(CO)(DPM)]_2$ for 12 h. Recrystallization of all species was from methylene chloride and diethyl ether. Typical yields were from 70 to 90%. Elemental analyses: $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$: $C_{51}H_{44}Br_2O_1P_4Rh_2$; calc. C, 52.70; H, 3.81; Br, 13.7: Found C, 52.3; H, 3.70; Br, 13.0: $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2][I]$: $C_{52}H_{44}I_2O_2P_4Rh_2$: calc. C, 48.62; H, 3.45: Found C, 48.25; H, 3.51. See Table 26 for spectral data.

Reactions with SO_2 and CO

(a) Dicarbonyl Species

Typically 0.100 g of $[RhX(CO)(DPM)]_2$ or $[RhX(CO)(DAM)]_2$ (X = Cl,Br,I) in 15 mL of CH_2Cl_2 was treated with SO_2 or CO for 10 min, the volume was reduced under a stream of the reactant gas to about 7 mL and then the products were precipitated with diethyl ether saturated with the reactant

Table 26. Spectral Data for the Complexes

No.	Complex	Infrared Absorption Maxima (cm^{-1})[a]	$^{31}P\{^1H\}$nmr Chemical Shifts (ppm)[b]
3	$[Rh_2Br(\mu\text{-}CO)(CO)(DPM)_2][Br]$	1958(s), 1800(m)	25.0 (multiplet)
4a	$[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$	1745(s)	19.7 (115.9 Hz)
4b	$[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$	1745(s)	19.4 (114.7 Hz)
5	$[Rh_2I(\mu\text{-}CO)(CO)(DPM)_2][I]$	1955(s), 1810(m)	21.5 (multiplet)
6,7	$[Rh_2I_2(CO)_2(DAM)_2]$	1965(sh), 1940(s), 1820(m)	-
9a	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][Cl]$	2004(m), 1960(s), 1868 (m)	29.8 (94.0)
9b	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Br)(DPM)_2][Br]$	2005(m), 1968(s), 1865(m)	28.7 (93.8)
9c	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}I)(DPM)_2][I]$	1990(sh), 1970(s), 1860(m)	26.6 (92.7)
10a	$[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Cl)(DPM)_2][Cl]$	2010(s), 1980(sh) 1230(m), 1070(m)	24.5 (91.6)
10b	$[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Br)(DPM)_2][Br]$	2005(s), 1970(sh) 1230(m), 1085(m)	27.0 (90.6)
10c	$[Rh_2(\mu\text{-}SO_2)(\mu\text{-}I)(CO)_2(DPM)_2][I]$	2005(m), 1990(s) 1210(m), 1065(m)	26.0 (90.3)
11	$[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}I)(DAM)_2][I]$	2005(m), 1958(s), 1860(m)	-
12	$[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}I)(DAM)_2[I]$	1985(s), 1205(m), 1065(m)	-
13a	$[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$	1191(m), 1063(s)	19.6 (113.5)
13b	$[Rh_2Br_2(\mu\text{-}SO_2)(DPM)_2]$	1190(m), 1060(s)	21.1 (113.6)

[a] Infrared spectra were run as nujol mulls on KBr plates; s, strong; m, medium; w, weak; sh, shoulder.

[b] $^{31}P\{^1H\}$nmr chemical shifts are relative to H_3PO_4 (downfield positive), coupling constants ($|^1J_{Rh-P} + {}^xJ_{Rh-P}|$) are given in parentheses. The solvent used was CD_2Cl_2.

gas. Yields of the expected products, $[Rh_2(CO)_2(\mu\text{-}L)(\mu\text{-}X)\text{-}(DPM)_2][X]$ (L = CO, SO_2; X = Cl, Br, I) averaged *ca.* 75%. The reversibility of the CO and SO_2 reactions were studied by dissolving the products of these reactions in CH_2Cl_2 and bubbling N_2 through the solution for up to 48 h.

(b) Monocarbonyl Species

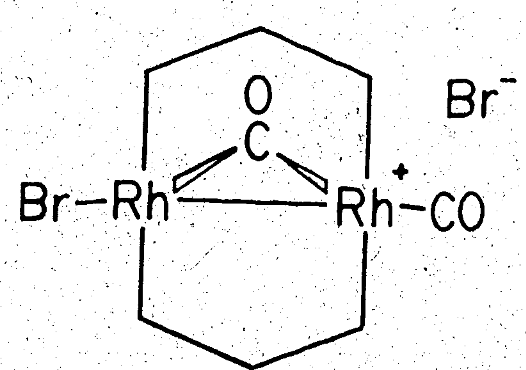
Typically 200 mg of sample was dissolved in 2 mL of CD_2Cl_2 and the reactant gas introduced a bubble at a time. The $^{31}P\{^1H\}$ NMR spectra were recorded, at −50°C. After each addition of gas until no significant changes were observed. The infrared spectra were recorded in an analogous manner using 200 mg of sample in 20 mL of CH_2Cl_2.

DISCUSSION

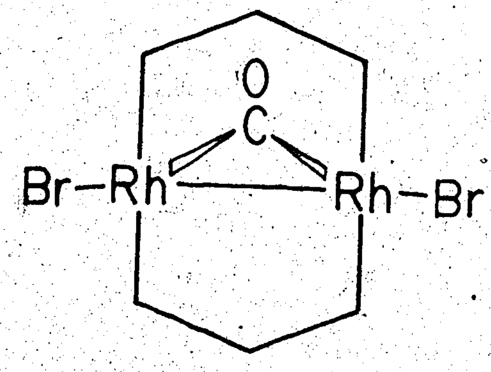
Halide Exchange Reactions

The products of the halide exchange reactions show interesting chemical and structural trends which seem to depend on the steric bulk of the halide ligands and also on the crowding at the two metal centres as governed by the bridging DPM and DAM groups.

The reaction of *trans*-$[RhCl(CO)(DPM)]_2$ (1), with NaBr yields initially $[Rh_2Br(CO)(\mu\text{-}CO)(DPM)_2][Br]$ (3), a species with bands in the infrared spectrum at 1958 and 1800 cm^{-1}, consistent with terminal and bridging carbonyl ligands. This species is a 1:1 electrolyte in acetone (70 ohm^{-1} cm^{-2} $mole^{-1}$) and its $^{31}P\{^1H\}$ NMR spectrum, which is similar to the iodo species, shown in Figure 16, (vide infra) indicates an asymmetric structure. This evidence coupled with elemental analysis leads to the formulation of 3 as shown below



3



4b

In solution complex 3 recoordinates Br^- and undergoes CO loss, over a period of several hours, to yield $[Rh_2Br_2(\mu\text{-}CO)\text{-}(DPM)_2]$ (4b), which has been characterized by an X-ray structure determination[144] (see Chapter VI). The $^{31}P\{^1H\}$ NMR spectrum of this species is shown in Figure 16 and is consistent with the symmetric structure observed in the solid state. All $^{31}P\{^1H\}$ NMR parameters (Table 26) are in excellent agreement with those of the analogous species $[Rh_2X_2(\mu\text{-}SO_2)(DPM)_2]$ (X = Cl, Br).[96] A solution of 4b is non conducting. The analogous chloro complex, $[Rh_2Cl_2\text{-}(\mu\text{-}CO)(DPM)_2]$ (4a) is obtained on refluxing a suspension of the *trans*-dichloro dicarbonyl species 1. This reaction has also been observed by Professor Balch and coworkers,[143] although it is not clear whether the species isolated by

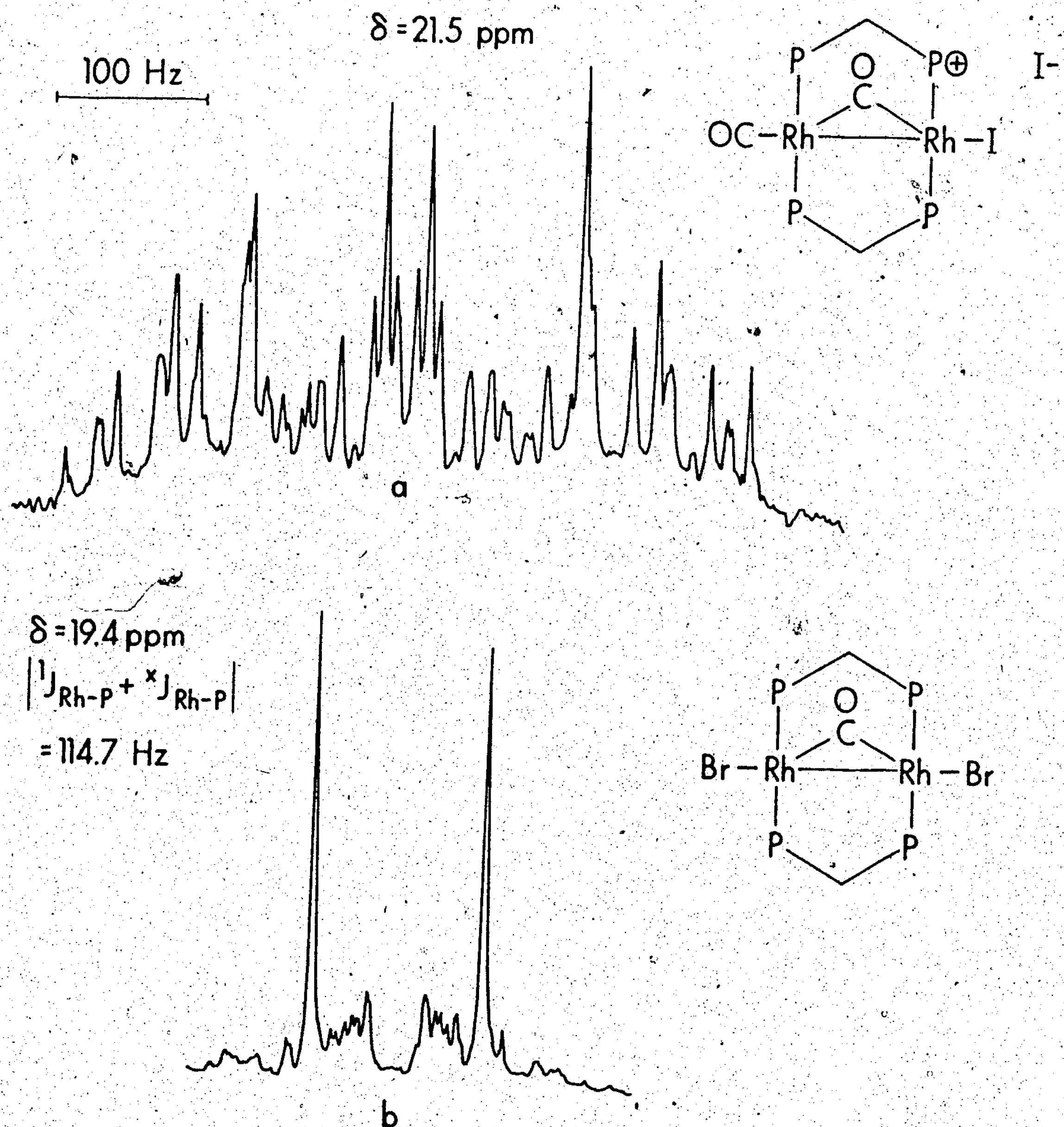


Figure 16. The $^{31}P\{^{1}H\}$ NMR Spectra at 223 K of a) $[Rh_2I(CO)$-$(\mu$-$CO)(DPM)_2][I]$ and b) $[Rh_2Br_2(\mu$-$CO)(DPM)_2]$.

these workers is identical to the one which we observe.

The reaction of **1** with KI yields $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2]$-[I] (**5**), analogous to complex **3**. The carbonyl bands in the infrared spectrum are observed at 1955 and 1810 cm^{-1} and the $^{31}P\{^1H\}$ NMR spectrum (Figure 16) is consistent with the asymmetric structure proposed. Complex **5** is a 1:1 electrolyte in solution. Unlike complex **3** however, complex **5** is stable under N_2 in solution and does not undergo CO loss.

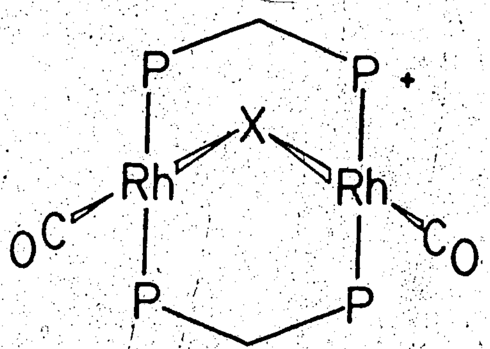
The bromo DAM species, *trans*-$[RhBr(CO)(DAM)]_2$, is known and is probably structurally similar to *trans*-dichlorodicarbonyl DAM species (**2**).[66] Iodide exchange on complex **2** yields a species which infrared studies and elemental analysis indicate is probably a mixture of the *trans*-diiododicarbonyl complex, *trans*-$[RhI(CO)(DAM)]_2$ **6** and an asymmetric species [Rh[illegible](CO)(μ-CO)(DAM)$_2$][I] (**7**), which is probably simi[illegible] DPM species **5**. The asymmetric species comprises [illegible] 75% of the product.

Th[illegible]uctural trends observed in the above series of DPM and [illegible]M halides is therefore consistent with steric bulk arguments indicating that the trans configuration of equatorial ligands, as observed in the dichloro species **1** and **2**, and in *trans*-$[RhBr(CO)(DAM)]_2$, is destabilized with bulkier halide ligands. The larger steric bulk of the bromo ligand, compared to the chloro ligand, does not favour simultaneous coordination of both bromo and both carbonyl ligands in the DPM complex and the asymmetric, ionic species is formed initially. When bromide recoordination does occur it is accompanied by CO loss to give the monocarbonyl species 4b. With the DPM ligand, the stable iodo species is the asymmetric complex 5, again because simultaneous coordination of all iodo and carbonyl ligands is not favoured due to steric crowding. Furthermore, the large size of I^- does not favour its recoordination and CO loss is not observed in this species. The effect of the large DAM ligand is seen in the dibromo DAM species which still exists as the trans complex $[RhBr(CO)(DAM)]_2$, unlike its DPM analogue. The DAM ligand presumably allows more room to accommodate the larger bromo ligand. Even with the bulkier iodo ligand some *trans*-$[RhI(CO)(DAM)]_2$ 6 is observed together with the asymmetric species 7.

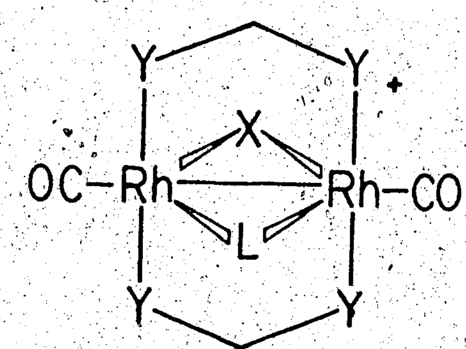
Reactions with CO

i) Dicarbonyl Species

It is interesting that no evidence is seen for the symmetric "A-frame" species 8 (X = Br, I), even though the reaction of 3 and 5 with CO and SO_2 yield species 9 and 10, respectively, which are analogous to the products obtained (9a and 10a) by the reaction of 8a (X = Cl) with these small molecules.[35,91,96] The $^{31}P\{^1H\}$ NMR spectra of the tricarbonyl species 9b and 9c (X = Br, I, respectively, L = CO) show one phosphine environment and are extremely similar to that of the chloro analogue, $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]^+$ 9a, whose structure has been determined.[35,142] These DPM



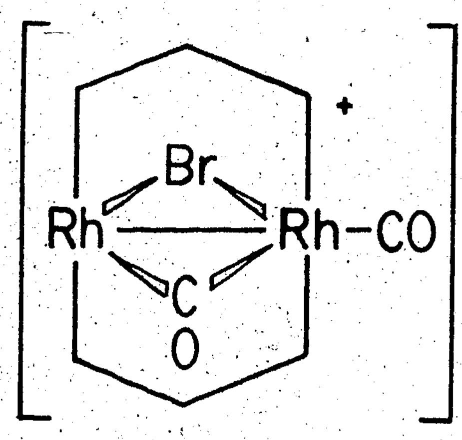
8



9 L = CO, Y = P
10 L = SO_2, Y = P
11 L = CO, Y = As, X = I
12 L = SO_2, Y = As, X = I

tricarbonyl complexes show an interesting trend in ^{31}P shifts and coupling constants (Cl,Br,I; $\delta = 29.6, 28.7, 26.6$ ppm; $|^{1}J_{Rh-P} + {}^{x}J_{Rh-P}| = 94.2, 93.8, 92.7$ Hz, respectively). Furthermore, the infrared data for compounds 9a, 9b and 9c are all closely comparable. The complexes, *trans*-$[RhX(CO)(DAM)]_2$ (X = Cl,Br), like their DPM chloro analogue, 1 show no reaction with CO under our conditions. Reaction of the mixture of iodo-DAM species 6 and 7 with CO however results in the isolation of a tricarbonyl species 11, which appears from its infrared spectrum, to be analogous to 9b and 9c.

An investigation of the ease of decarbonylation of complexes 9 shows a notable trend. The chloro complex 9a readily loses CO in solution under an N_2 stream or in the solid state under vacuum,[35,91] the bromo species 9b on the other hand does not lose CO in the solid state under vacuum even after 72 h but loses it slowly in solution to give complex 3 and subsequently complex 4b. The iodo species 9c does not lose CO in either the solid state or in solution. The DAM-iodo species 11 undergoes CO loss slowly in solution under an N_2 stream. On decarbonylation of the bromo tricarbonyl species 9b, the complex initially produced is the asymmetric species 3. This is consistent with the findings of Mague and coworkers[35,91] which indicate that in the chlorotricarbonyl complex 9a, it is initially a terminal carbonyl group which is lost with the bridging carbonyl ligand then moving to the terminal site. Assuming the same mechanism for the bromo analogue, the intermediate species after carbonyl loss would then be:



Because of the large size of the bromo ligand it is this ligand which moves to the less sterically encumbered terminal site yielding species 3, whereas in the chloro species migration of the carbonyl ligand is favoured, presumably for electronic reasons.

ii) Monocarbonyl Species

Reaction of $[Rh_2X_2(\mu\text{-}CO)(DPM)_2]$ (X = Cl, 4a; X = Br, 4b) with excess CO results in the formation of the tricarbonyl species 9a and 9b. When slow stepwise reaction of 4b with CO is monitored by $^{31}P\{^1H\}$ NMR spectroscopy, resonances are observed which are assignable to the asymmetric dicarbonyl species 3 and to the tricarbonyl complex 9b. Complex 3 is observed throughout the reaction but only in trace amounts. In contrast, the monocarbonyl species is found in significant quantities until completion of the reaction. It seems therefore that CO reacts preferentially with 3 compared to 4b.

If instead of reacting 4a with excess CO, the CO is added slowly, *trans*-$[RhCl(CO)(DPM)]_2$ (1) precipitates from solution (see Figure 17). The observation of two products (1 and 9a) from slow and rapid addition, respectively, of CO suggests the presence of an intermediate dicarbonyl species, $[Rh_2Cl(CO)(\mu\text{-}CO)(DPM)_2][Cl]$ 3a, analogous to the bromo species 3. We postulate that on slow CO addition attack of this intermediate by Cl^- occurs giving complex 1, whereas in the presence of excess CO (ie. during rapid CO addition), attack by CO predominates yielding instead the tricarbonyl species 9a. Based on our other work with related "A-frame" species[96b,144] and on a consideration of

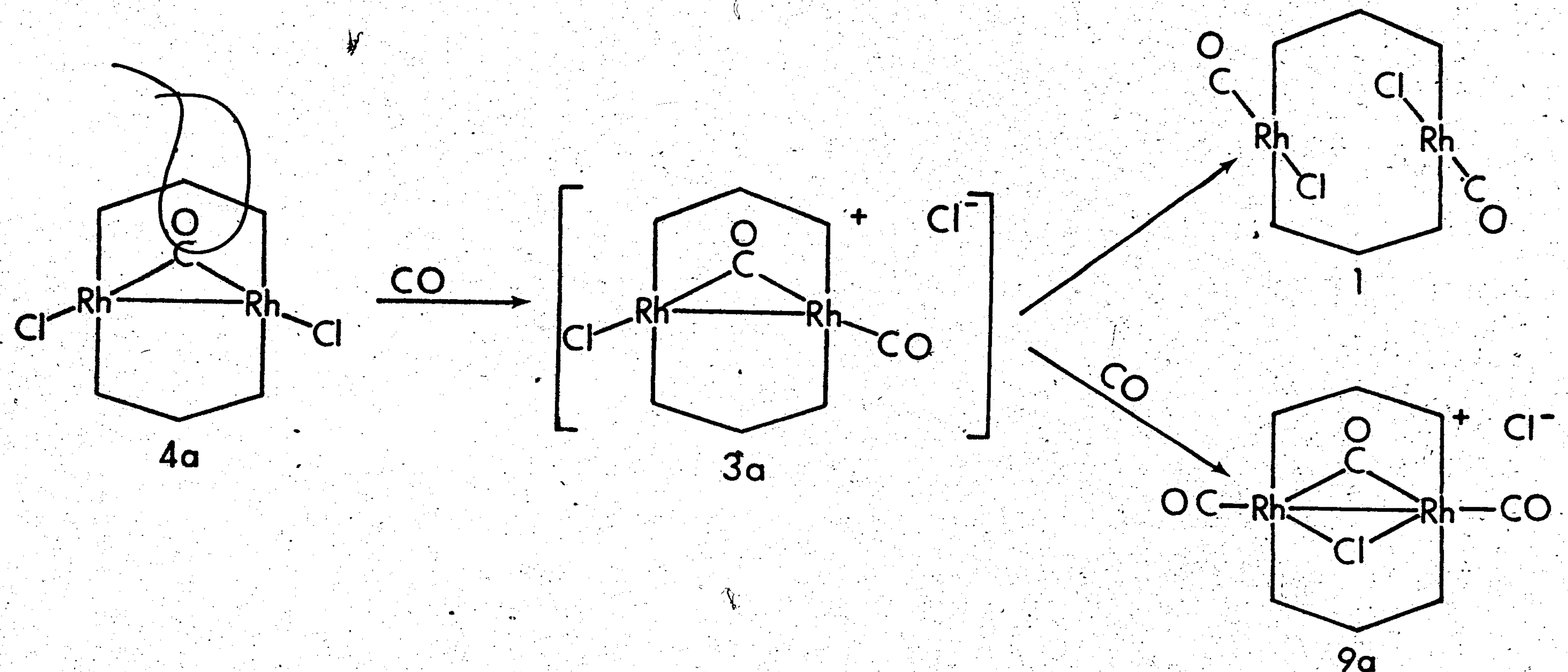
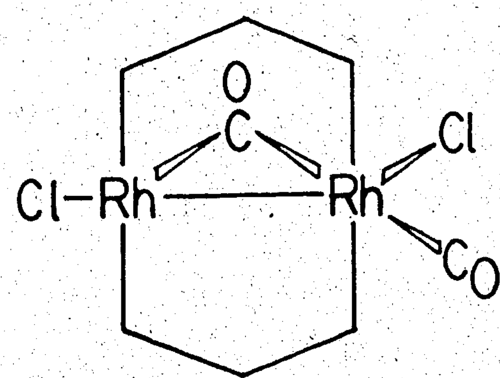


Figure 17. A Scheme for the Reaction of $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ with CO.

the electronic preference of each metal we would predict that Cl^- attack on species 3a (Figure 17) occurs at the metal site between the bridging and terminal CO ligands yielding a species as shown below, which could then rearrange to the *trans*-dichlorodicarbonyl species (1).



Support of this postulated intermediate comes from the structural determination[145] of an analogous species which has $(MeO)_2PN(Et)P(OMe)_2$ instead of the DPM ligands and adopts this asymmetric geometry. Similarly if CO attacks species 3a between the bridging carbonyl and chloro ligand, as we believe it does, complex 9a is obtained by a facile shift of the chloro ligand into the bridging position.

Reactions with SO_2

i) Dicarbonyl Species

The $^{31}P\{^1H\}$ NMR spectra of SO_2 adducts 10b and 10c are consistent with one phosphine environment in each case and are similar to that obtained for $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Cl)$-

$(DPM)_2]^+$ 10a[96] (see Chapter IV) (Cl,Br,I; $\delta = 24.6, 27.0, 26.0$; $|{}^1J_{Rh-P} + {}^xJ_{Rh-P}| = 91.6, 90.6, 90.3$ Hz, respectively). In addition the infrared spectra of 10b and 10c are comparable to that of 10a leading to the formulation of these species as shown previously. Preliminary studies with *trans*-$[RhX(CO)(DAM)]_2$ (X = Cl,Br), indicate that these complexes react in a manner similar to *trans*-$[RhCl(CO)(DPM)]_2$ yielding initially $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}X)(DAM)_2][X]$ and eventually undergoing CO loss yielding $[Rh_2X_2(\mu\text{-}SO_2)(DAM)_2]$. Similarly the iodo complexes 6 and 7 react with SO_2 to yield an SO_2 adduct $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}I)(DAM)_2][I]$ 12 analogous to the DPM complexes.

The bromo species, $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Br)(DPM)_2][Br]$ (10b), on prolonged SO_2 treatment, undergoes a decarbonylation reaction yielding $[Rh_2Br_2(\mu\text{-}SO_2)(DPM)_2]$ 13b, paralleling the chemistry of the chloro analogue.[96b] In contrast, the iodo species 10c does not undergo this reaction Studies on the conversion of $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}Cl)(DPM)_2]^-$ to $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ indicated that chloride ion coordination was required before CO loss was observed (Chapter IV), so we assume that although Br^- coordination occurs in 10b the increased steric bulk of the iodo ligand prevents coordination of a second I^- ion in 10c and therefore prevents CO loss.

Although SO_2 can be readily removed from species 10a it is not removed from complexes 10b and 10c. The bromo species 10b instead undergoes CO loss in solution under an N_2 flush to yield 13b, whereas 10c loses neither CO nor SO_2.

ii) Monocarbonyl Species

The reaction of $[Rh_2X_2(\mu\text{-}CO)(DPM)_2]$ (X = Cl, 4a; X = Br, 4b) with SO_2 yields as the final products $[Rh_2X_2\text{-}(\mu\text{-}SO_2)(DPM)_2]$ (13a and 13b) and $[Rh_2(CO)_2(\mu\text{-}SO_2)(\mu\text{-}X)\text{-}(DPM)_2][X]$ (10a and 10b) for the chloro and bromo complexes, respectively. When these reactions are monitored, during the slow stepwise addition of SO_2, utilizing $^{31}P\{^1H\}$ NMR spectroscopy, several unexpected products are observed. The spectra of the reaction of 4b with SO_2 show the presence of two asymmetric species (3 and 14b) and four symmetric species (4b, 9b, 10b and 13b) at different times during the experiment (see Figure 18). Of these species only 14b has not been previously characterized by us. This species we tentatively assign as a monocarbonylmonosulfur dioxide species, possibly having the structure shown. This asymmetric structure is consistent with the $^{31}P\{^1H\}$ NMR pattern observed and the infrared data which show an SO_2 species with a terminal carbonyl ligand as one of the first products. Of course, 14b is not an unreasonable initial product in the reaction. All other species can be explained by facile CO transfer from this species to others present in solution. Although Figure 18 is not meant to represent unambiguously the sequence of events, it does present some plausible steps in the production of the ob-

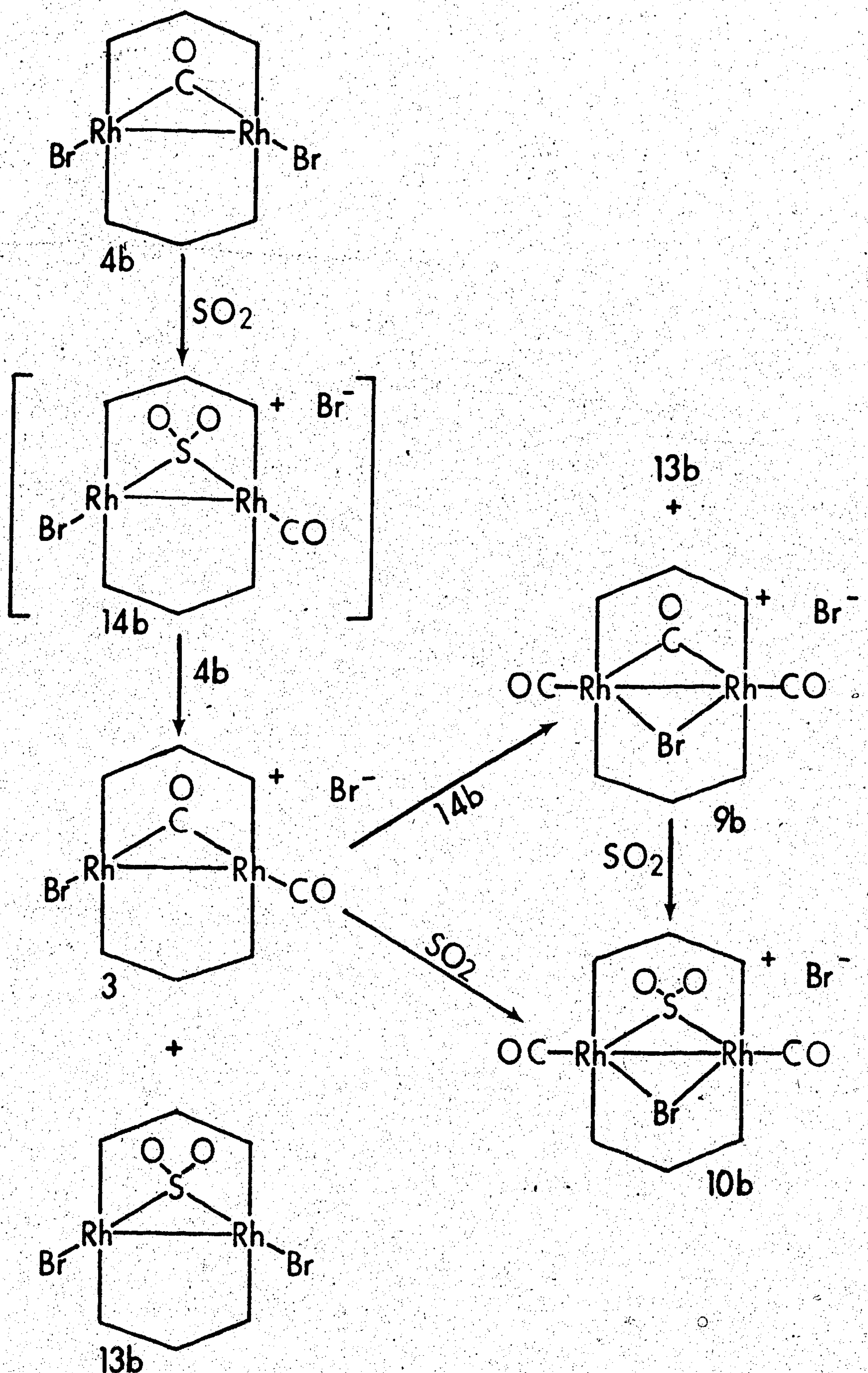


Figure 18. A Possible Reaction Sequence for the Reaction of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ with SO_2.

served species, and in particular offers some rationale for the production of di- and tricarbonyl products from a monocarbonyl reactant. For example, CO transfer from 14b to 4b would yield 3 and one of the final products, 13b. The other final product in the reaction, 10b, can be obtained by the reaction of 3 with SO_2. Complex 3 can also react with 14b yielding more of 13b and the tricarbonyl species 9b which can subsequently react with SO_2 giving 10b.

The analogous reaction of 4a with SO_2 seems to proceed by a simpler route. Again an asymmetric species 14a tentatively assigned as being analogous to the bromo species 14b, is observed in the NMR experiment. However only two other species 10a and 13a are observed, resulting from CO transfer from one molecule of 14a to another. There may be other intermediates in this reaction but none is observed.

Summary

We have seen in these halide complexes an interesting structural trend which is dependent on halide size and on the relative dimensions of the DPM and DAM ligands. The chemistries of these halide species with CO and SO_2 also show interesting trends which again can be attributed, at least in part, to steric interaction between the ligands. Also notable in this chemistry is the strong tendency toward symmetric species. Only in the two iodo species 5 and 7, where steric bulk of the iodo ligand inhibits the chemistry favoured by the other halide species, are the asymmetric species stable. Therefore the asymmetric complex $[Rh_2Br(CO)(\mu\text{-}CO)(DPM)_2][Br]$ either loses CO yielding the symmetric species $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ or gains CO to give another symmetric species $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Br)(DPM)_2][Br]$. This tendency toward symmetric species is commonly observed throughout our binuclear chemistry with the DPM and DAM ligands (Chapter IV) but is in contrast to analogous complexes with the related methoxydiphenylazane ligand, $(MeO)_2PN(Et)P(OMe)_2$, which show a tendency toward asymmetric species.[145]

CHAPTER VI.

The Structure of $[Rh_2Br_2(\mu\text{-CO})(DPM)_2]$: A Binuclear Rhodium Carbonyl Complex Having an Unusually Low Carbonyl Stretching Frequency

INTRODUCTION

The reaction of *trans*-$[RhCl(CO)(DPM)]_2$ with NaBr initially yields an asymmetric species $[Rh_2Br(CO)(\mu\text{-CO})(DPM)_2]$ [Br] which undergoes a rearrangement in solution to give a symmetric species having an unusually low value for $\nu(CO)$ of 1745 cm^{-1} (see Chapter V).[126] Based on spectral data, elemental analyses, and its chemistry with SO_2 this symmetric product can be equally well formulated as $[RhBr(\mu\text{-CO})(DPM)]_2$, containing two "ketonic" carbonyl ligands, or as $[Rh_2Br_2(\mu\text{-CO})(DPM)_2]$, having one carbonyl ligand and a formal Rh-Rh bond. The low value of the carbonyl vibration is consistent with a "ketonic" carbonyl formulation, being comparable to the value observed in $[Pd_2Cl_2(\mu\text{-CO})(DAM)_2]$[32] and $[Rh_2Cl_2(\mu\text{-CO})(\mu\text{-DMA})(DPM)_2]$[42] which contain "ketonic" carbonyl ligands and the $^{31}P\{^1H\}$ NMR is very similar to other symmetric dirhodium species which have no metal-metal bond.[120,146,147] Furthermore, its reaction with SO_2 yields the dicarbonyl species $[Rh_2(CO)_2(\mu\text{-SO}_2)(\mu\text{-Br})(DPM)_2]$[Br] as one of the final products. However, this data can also be interpreted in terms of a monocarbonyl formulation. The analogous SO_2-bridged compound[96]

$[Rh_2Cl_2(\mu-SO_2)(DPM)_2]$ (Chapter IV), has a low value for $\nu(SO)$ and has $^{31}P\{^1H\}$ NMR parameters very similar to those in the present carbonyl compound, although it has a formal Rh-Rh bond. In addition, the formation of a dicarbonyl product in the reaction with SO_2 can be explained by CO transfer from one molecule to another (see Chapter V) since a carbonyl-free species, $[Rh_2Br_2(\mu-SO_2)(DPM)_2]$ is also observed.

The structure determination was therefore undertaken in order to unambiguously establish the mode of carbonyl bonding.

EXPERIMENTAL

Crystallization of $[Rh_2Br_2(\mu-CO)(DPM)_2]$

A (50 mg) sample of $[Rh_2Br_2(\mu-CO)_x(DPM)_2]$ $(x = 1,2)$, prepared as described in Chapter V, was dissolved in 3 mL of CH_2Cl_2 from which well formed crystals were obtained by slow diethyl ether diffusion. The crystals were analyzed spectrally as either $[Rh_2Br_2(\mu-CO)(DPM)_2]$ or $[Rh_2Br_2(\mu-CO)_2-(DPM)_2]$.

Data Collection

A clear red plate of the title complex was mounted on a glass fibre. Preliminary film data showed that the crystal belonged to the monoclinic system with extinctions ($h0\ell$, $h+\ell$ odd; $0k0$, k odd) characteristic of the centrosymmetric space group $P2_1/n$, a non standard setting of $P2_1/c$.

Data collection was as previously described in Chapter II and pertinent crystal and intensity collection data are presented in [illegible] 27.

Structure [illegible] and Refinement

The positions of the Rh, Br and P atoms were obtained by direct methods using MULTAN.[148] The remaining atoms were located from subsequent least-squares refinements and electron density difference maps. Anomalous dispersion terms for Rh, Br and P[108] were included in F_c. All carbon atoms of the phenyl rings were refined as rigid groups having D_{6h} symmetry and C-C distance of 1.392 Å. The hydrogen atoms were included as fixed contributions and were not refined. All non group atoms were refined individually with anisotropic thermal parameters (see Chapter II for a more detailed discussion).

The final model with 205 parameters varied converged to $R = 0.045$ and $R_w = 0.055$.[121] In the final electron density difference map the highest 20 peaks were in the vicinities of either the phenyl groups or the Rh and Br atoms (0.45 - 0.25 e/Å^3). A typical carbon atom on earlier syntheses had an electron density of about 3.5 e/Å^3.

Results

The positional and thermal parameters for the individual anisotropic atoms, rigid group atoms and idealized hydrogen parameters are given in Tables 28, 29 and 30 respectively. Least-squares plane calculations are pre-

Table 27. Summary of Crystal Data and Intensity Collection for $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$

Compound	$[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$
Formula	$C_{51}H_{44}Br_2O_1P_4Rh_2$
Formula Weight	1162.4 amu
Cell Parameters	
a	20.429(2) Å
b	11.895(1) Å
c	18.865(2) Å
β	100.275(9)°
V	4510.7 Å^3
Z	4
Density	1.711 (calc'd.)
Space Group	C_{2h}^5-$P2_1/n$ (non-standard setting of $P2_1/c$)
Crystal Dimensions	0.240 x 0.088 x 0.301 mm
Crystal Volume	0.00442 mm^3
Crystal Faces (and distances from an arbitrary origin within the crystal (mm))	0 1 0 (0.044) 0 $\bar{1}$ 0 (0.044) 1 0 0 (0.138) $\bar{1}$ 0 0 (0.098) 0 0 $\bar{1}$ (0.156) $\bar{1}$ 0 2 (0.131) $\bar{2}$ 0 $\bar{1}$ (0.120) $\bar{2}$ $\bar{1}$ $\bar{1}$ (0.094) 1 1 0 (0.082) 1 $\bar{1}$ 0 (0.059) 1 0 1 (1.103)
Temperature	20°C
Radiation	CuKα (λ=1.540562 Å) filtered with 0.5 mil thick nickel foil)
μ	98.229 cm^{-1}
Range in Absorption Correction Factors	0.190 - 0.476
Receiving Aperture	6x6 mm, 30 cm from the crystal

Table 27, continued

Takeoff Angle	3.9°
Scan Speed	2° in 2θ/min
Scan Range	1.00° below $K\alpha_1$ to 1.00° above $K\alpha_2$
Background Counting Time	10s ($3° \leq 2\theta < 45°$) 20s ($45° \leq 2\theta < 96°$) 40s ($96° < 2\theta \leq 120°$)
2θ limits	$3° \leq 2\theta \leq 120°$
2θ units for centred reflections	($60° \leq 2\theta \leq 70°$)
Final number of variables	205
Unique Data Collected	7071
Unique Data Used ($F_o^2 \geq 3\theta(F_o^2)$)	4718
Error in observation of unit weight	1.392
R	0.045
R_w	0.055

sented in Table 31 and selected bond length and angles are shown in Tables 32 and 33, respectively. A listing of observed and calculated structure amplitudes is available.[110]

A stereoview of the unit cell of [Rh_2Br_2(μ-CO)(DPM)$_2$] is shown in Figure 19. The crystallographic *a* axis is horizontal to the right, the *c* axis runs from the bottom to the top and the *b* axis goes into the page. Figure 20 presents a perspective view of the compound including the numbering scheme, 50% thermal ellipsoids are drawn. The inner coordination sphere is shown in Figure 21 along with some relevant bond lengths, 50% thermal ellipsoids are drawn.

TABLE 28. Positional and Thermal Parameters For The Nongroup Atoms of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$.

Atom	x[a]	y	z	U11[b]	U22	U33	U12	U13	U23
Rh(1)	0.58004(3)	0.09336(5)	0.32748(3)	2.10(3)	2.26(3)	2.89(3)	0.06(2)	0.98(2)	-0.06(3)
Rh(2)	0.44867(3)	0.15824(5)	0.31124(3)	1.99(3)	2.13(3)	3.44(4)	-0.01(2)	0.61(2)	0.25(3)
Br(1)	0.69272(4)	0.03208(8)	0.31204(6)	3.03(4)	3.94(5)	5.79(6)	0.57(4)	1.96(4)	-0.37(5)
Br(2)	0.33105(5)	0.20589(9)	0.26417(8)	2.60(5)	3.90(5)	13.0(1)	0.10(4)	-0.32(5)	1.93(7)
P(1)	0.61619(9)	0.2724(2)	0.3085(1)	2.35(9)	2.56(9)	2.7(1)	-0.21(8)	1.02(8)	-0.01(8)
P(2)	0.47370(9)	0.3473(2)	0.3022(1)	2.36(9)	2.32(9)	3.2(1)	0.10(8)	0.67(8)	-0.06(9)
P(3)	0.55003(9)	-0.0946(2)	0.3208(1)	2.5(1)	2.31(9)	3.8(1)	0.14(8)	1.02(8)	0.15(9)
P(4)	0.40793(9)	-0.0248(2)	0.3104(1)	2.31(9)	2.37(9)	3.3(1)	-0.26(8)	0.57(8)	0.45(9)
O	0.5269(3)	0.1498(6)	0.4559(3)	4.0(3)	6.5(4)	2.7(4)	0.9(3)	1.3(3)	-0.9(3)
C(1)	0.5210(4)	0.1375(6)	0.3938(5)	2.5(4)	2.2(4)	4.6(6)	-0.5(3)	1.3(4)	-0.3(4)
C(2)	0.5613(4)	0.3818(6)	0.3346(4)	2.4(4)	2.7(4)	3.0(5)	-0.2(3)	0.5(3)	-0.6(3)
C(3)	0.4716(4)	-0.1243(6)	0.3513(4)	3.0(4)	2.5(4)	3.1(5)	0.4(3)	1.2(3)	0.3(3)

[a] Estimated standard deviations in the least significant figure(s) are given in parentheses in this and all subsequent tables.

[b] The form of the thermal ellipsoid is: $\exp[-2\pi^2(a^{*2}U_{11}h^2+b^{*2}U_{22}k^2+c^{*2}U_{33}l^2+2a^*b^*U_{12}hk+2a^*c^*U_{13}hl+2b^*c^*U_{23}kl)]$. The quantities given in the table are the thermal coefficients x 10^2.

TABLE 29. Derived Parameters For the Rigid Group Atoms of [Rh2Br2(mu-CO)(DPM)2].

Atom	x	y	z	B(A^2)	Atom	x	y	z	B(A^2)
C(11)	0.6232(3)	0.3053(5)	0.2153(2)	2.5(1)	C(51)	0.6042(3)	-0.2070(4)	0.3643(5)	3.1(2)
C(12)	0.6298(3)	0.4160(4)	0.1937(3)	3.8(2)	C(52)	0.5958(5)	-0.2493(5)	0.4308(3)	3.8(2)
C(13)	0.6387(3)	0.4391(4)	0.1238(3)	4.3(2)	C(53)	0.6360(5)	-0.3367(5)	0.4626(4)	5.2(2)
C(14)	0.6412(3)	0.3515(5)	0.0754(2)	4.6(2)	C(54)	0.6846(3)	-0.3817(4)	0.4278(5)	5.0(2)
C(15)	0.6347(3)	0.2407(4)	0.0970(3)	4.8(2)	C(55)	0.6931(5)	-0.3393(5)	0.3612(3)	5.4(3)
C(16)	0.6257(3)	0.2176(4)	0.1670(3)	3.5(2)	C(56)	0.6529(5)	-0.2520(5)	0.3295(4)	4.3(2)
C(21)	0.6969(3)	0.3113(5)	0.3614(3)	2.3(1)	C(61)	0.5346(3)	-0.1274(6)	0.2240(3)	3.0(2)
C(22)	0.7070(4)	0.2903(4)	0.4352(8)	3.1(2)	C(62)	0.5191(4)	-0.0366(4)	0.1774(4)	3.6(2)
C(23)	0.7674(6)	0.3183(5)	0.4783(6)	3.6(2)	C(63)	0.5057(4)	-0.0540(5)	0.1033(3)	5.1(2)
C(24)	0.8177(3)	0.3672(5)	0.4478(3)	3.4(2)	C(64)	0.5078(3)	-0.1622(6)	0.0757(3)	5.8(3)
C(25)	0.8076(4)	0.3882(4)	0.3740(8)	3.4(2)	C(65)	0.5233(4)	-0.2530(4)	0.1222(4)	6.1(3)
C(26)	0.7472(6)	0.3603(5)	0.3308(6)	2.9(2)	C(66)	0.5367(4)	-0.2356(5)	0.1963(3)	4.7(2)
C(31)	0.4569(3)	0.3856(5)	0.2071(3)	2.4(1)	C(71)	0.3700(3)	-0.0935(5)	0.2259(2)	2.4(1)
C(32)	0.4441(3)	0.4956(4)	0.1836(3)	3.5(2)	C(72)	0.3549(3)	-0.2076(5)	0.2272(3)	3.7(2)
C(33)	0.4321(3)	0.5198(4)	0.1103(3)	4.7(2)	C(73)	0.3229(3)	-0.2606(4)	0.1648(3)	4.0(2)
C(34)	0.4329(3)	0.4338(5)	0.0603(3)	5.0(2)	C(74)	0.3059(3)	-0.1997(5)	0.1011(2)	4.3(2)
C(35)	0.4458(3)	0.3238(4)	0.0838(3)	4.7(2)	C(75)	0.3211(3)	-0.0857(5)	0.0999(3)	5.0(2)
C(36)	0.4578(3)	0.2996(4)	0.1572(3)	3.7(2)	C(76)	0.3531(3)	-0.0326(4)	0.1623(3)	3.9(2)
C(41)	0.4304(3)	0.4574(4)	0.3449(3)	2.4(1)	C(81)	0.3454(4)	-0.0352(5)	0.3681(5)	2.1(1)
C(42)	0.3636(3)	0.4783(5)	0.3176(4)	3.9(2)	C(82)	0.3619(2)	0.0074(4)	0.4378(5)	3.3(2)
C(43)	0.3301(2)	0.5628(5)	0.3475(3)	4.5(2)	C(83)	0.3157(5)	0.0042(4)	0.4837(7)	4.2(2)
C(44)	0.3633(3)	0.6264(4)	0.4048(3)	4.1(2)	C(84)	0.2529(4)	-0.0415(5)	0.4601(5)	3.8(2)
C(45)	0.4301(3)	0.6054(5)	0.4321(4)	3.9(2)	C(85)	0.2363(2)	-0.0840(4)	0.3904(5)	3.8(2)
C(46)	0.4636(2)	0.5209(5)	0.4021(3)	3.3(2)	C(86)	0.2825(5)	-0.0809(4)	0.3445(7)	2.9(2)

Rigid Group Parameters

	Xc [a]	Yc	Zc	Delta [b]	Epsilon	Eta
Ring1	0.6322(2)	0.3284(4)	0.1454(2)	3.201(4)	1.450(4)	2.943(3)
Ring2	0.7573(2)	0.3393(3)	0.4046(2)	4.279(4)	2.126(9)	0.605(8)
Ring3	0.4449(2)	0.4097(4)	0.1337(2)	2.992(4)	1.717(4)	2.931(3)
Ring4	0.3968(2)	0.5419(3)	0.3748(2)	-0.720(4)	2.782(5)	4.429(5)
Ring5	0.6444(2)	-0.2943(4)	0.3960(2)	-0.728(4)	1.086(6)	1.553(5)
Ring6	0.5212(2)	-0.1448(4)	0.1498(3)	3.023(4)	1.786(4)	3.292(4)
Ring7	0.3380(2)	-0.1466(4)	0.1635(2)	0.224(4)	2.000(4)	2.658(3)
Ring8	0.2991(2)	-0.0383(3)	0.4141(2)	1.119(4)	0.895(8)	6.345(8)

[a] Xc,Yc and Zc are the fractional coordinates of the centroid of the rigid group.

[b] The rigid group orientation angles Delta,Epsilon and Eta(radians) are the angles by which the rigid body is rotated with respect to a set of axes X,Y and Z. The origin is the centre of the ring; X is parallel to a* , Z is parallel to c and Y is parallel to the line defined by the intersection of the plane containing a* and b* with the plane containing b and c.

TABLE 30. Idealized Positional and Thermal Parameters For the Hydrogen Atoms of [Rh2Br2(mu-CO)(DPM)2].

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
H(1C2)	0.5714	0.4512	0.3121	3.10	H(45)	0.4522	0.6483	0.4717	4.90
H(2C2)	0.5698	0.3905	0.3843	3.10	H(46)	0.5090	0.5068	0.4211	4.26
H(1C3)	0.4784	-0.1174	0.4025	3.29	H(52)	0.5629	-0.2178	0.4549	4.92
H(2C3)	0.4580	-0.1985	0.3383	3.29	H(53)	0.6304	-0.3650	0.5082	5.97
H(12)	0.6285	0.4758	0.2267	4.57	H(54)	0.7117	-0.4416	0.4493	6.04
H(13)	0.6430	0.5146	0.1088	5.25	H(55)	0.7255	-0.3709	0.3370	6.17
H(14)	0.6469	0.3672	0.0274	5.38	H(56)	0.6580	-0.2237	0.2837	5.37
H(15)	0.6363	0.1809	0.0639	5.78	H(62)	0.5184	0.0373	0.1964	4.62
H(16)	0.6217	0.1421	0.1818	4.26	H(63)	0.4946	0.0082	0.0716	6.06
H(22)	0.6726	0.2562	0.4558	3.97	H(64)	0.4971	-0.1739	0.0250	6.74
H(23)	0.7740	0.3039	0.5286	4.46	H(65)	0.5233	-0.3269	0.1030	6.67
H(24)	0.8586	0.3866	0.4773	4.33	H(66)	0.5471	-0.2977	0.2278	5.45
H(25)	0.8418	0.4216	0.3533	4.34	H(72)	0.3668	-0.2495	0.2702	4.54
H(26)	0.7404	0.3739	0.2804	4.08	H(73)	0.3130	-0.3383	0.1650	5.14
H(32)	0.4438	0.5541	0.2176	4.17	H(74)	0.2842	-0.2351	0.0583	5.10
H(33)	0.4241	0.5947	0.0941	5.60	H(75)	0.3093	-0.0431	0.0567	5.72
H(34)	0.4256	0.4501	0.0102	5.71	H(76)	0.3631	0.0457	0.1619	4.81
H(35)	0.4469	0.2648	0.0497	5.49	H(82)	0.4046	0.0396	0.4532	4.27
H(36)	0.4685	0.2242	0.1732	4.58	H(83)	0.3271	0.0341	0.5309	5.24
H(42)	0.3413	0.4357	0.2780	4.91	H(84)	0.2215	-0.0435	0.4916	4.86
H(43)	0.2845	0.5771	0.3286	5.48	H(85)	0.1934	-0.1156	0.3746	4.70
H(44)	0.3399	0.6834	0.4255	4.95	H(86)	0.2709	-0.1101	0.2969	3.95

Table 31. Least-Squares Plane Calculations

Plane no.	Equation[a]
1	0.0657X - 0.1380Y - 0.9883Z + 5.4452 = 0.0
2	0.1087X - 0.0040Y - 0.9941Z + 4.8736 = 0.0
3	0.2867X + 0.9530Y - 0.0975Z - 3.5520 = 0.0

deviation from planes, Å

Plane no.	Rh(1)	Rh(2)	Br(1)	Br(2)	P(1)	P(2)	P(3)	P(4)	C(1)	C(2)	C(3)	O
1	-0.0091(6)	0.0097(6)			0.098(2)	0.100(2)				-0.639(8)[b]		
2	-0.0053(6)	0.0056(6)					0.063(2)	-0.060(2)			-0.683(8)[b]	
3	-0.0044(5)	0.0066(5)	0.0037(9)	-0.012(1)					-0.034(7)			-0.032(7)

[a] X, Y, Z are *orthogonal* coordinates (Å) with X along the a axis, Y in the a-b plane and Z along the c^* axis.

[b] Not included in least squares plane calculations.

Table 32. Selected Distances (Å) in $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$

Rh(1)-Rh(2)	2.7566(8)		P(1)-C(2)	1.841(8)	1.832(8)
Rh(1)-Br(1)	2.481 (1)		P(2)-C(2)	1.832(7)	
Rh(2)-Br(2)	2.474 (1)		P(3)-C(3)	1.830(8)	
Rh(1)-C(1)	1.958 (8)		P(4)-C(3)	1.825(7)	
Rh(2)-C(1)	1.961 (8)		P(1)-C(11)	1.831(5)	1.833(7)
Rh(1)-P(1)	2.303 (2)	2.317(11)[a]	P(1)-C(21)	1.828(4)	
Rh(1)-P(3)	2.316 (2)		P(2)-C(31)	1.824(5)	
Rh(2)-P(2)	2.319 (2)		P(2)-C(41)	1.844(4)	
Rh(2)-P(4)	2.330 (2)		P(3)-C(51)	1.833(5)	
C(1)-O	1.167 (9)		P(3)-C(61)	1.840(5)	
C(1)-O[b]	1.192 (9)		P(4)-C(71)	1.835(4)	
			P(4)-C(81)	1.826(4)	

Nonbonded Distances

P(1)-P(2)	3.026(3)	Br(2)-H(42)	2.75
P(3)-P(4)	2.992(3)	H1C2-H(12)	2.17
Rh(1)-H(62)	2.65	H2C2-H(46)	2.06
Rh(2)-H(36)	2.81	H1C3-H(52)	2.19
C(12)-H(26)	2.59	H2C3-H(72)	2.15
C(56)-H(66)	2.68	H(33)-H(65)[c]	2.21
C(72)-H(86)	2.61	H(35)-H(65)[d]	2.25
Br(1)-H(56)	3.15		

[a]For averaged quantities, the estimated standard deviation is the larger of an individual standard deviation or the standard deviation of a single observation as calculated from the mean.

[b]Riding Motion Corrected; Atom O riding on atom C(1).

[c]Atom located at x, 1+y, z.

[d]Atom located at 1-x, $\bar{y}$, $\bar{z}$.

Table 33. Selected Angles (deg) in $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$

Rh(2)-Rh(1)-Br(1)	167.06(4)	Rh(1)-P(3)-C(51)	123.1(2)
Rh(2)-Rh(1)-P(1)	93.24(5)	Rh(1)-P(3)-C(61)	104.8(2)
Rh(2)-Rh(1)-P(3)	91.22(5)	Rh(2)-P(4)-C(71)	121.2(2)
Rh(2)-Rh(1)-C(1)	45.3 (2)	Rh(2)-P(4)-C(81)	110.3(2)
Br(1)-Rh(1)-C(1)	147.6 (2)	C(2)-P(1)-C(11)	105.2(3)
Br(1)-Rh(1)-P(1)	85.62(5)	C(2)-P(1)-C(21)	102.0(3)
Br(1)-Rh(1)-P(3)	87.25(5)	C(2)-P(2)-C(31)	105.8(3)
P(1)-Rh(1)-P(3)	166.78(8)	C(2)-P(2)-C(41)	102.2(3)
P(1)-Rh(1)-C(1)	95.9 (2)	C(3)-P(3)-C(51)	102.2(3)
P(3)-Rh(1)-C(1)	96.1 (2)	C(3)-P(3)-C(61)	105.5(3)
Rh(1)-Rh(2)-Br(2)	165.45(5)	C(3)-P(4)-C(71)	103.7(3)
Rh(1)-Rh(2)-P(2)	93.24(5)	C(3)-P(4)-C(81)	103.1(3)
Rh(1)-Rh(2)-P(4)	94.51(5)	C(11)-P(1)-C(21)	104.6(3)
Rh(1)-Rh(2)-C(1)	45.2 (2)	C(31)-P(2)-C(41)	103.4(3)
Br(2)-Rh(2)-C(1)	149.2 (2)	C(51)-P(3)-C(61)	105.8(3)
Br(2)-Rh(2)-P(2)	87.96(5)	C(71)-P(4)-C(81)	104.8(3)
Br(2)-Rh(2)-P(4)	83.61(5)	P(1)-C(11)-C(12)	120.7(3)
P(2)-Rh(2)-P(4)	171.41(7)	P(1)-C(11)-C(16)	119.2(3)
P(2)-Rh(2)-C(1)	92.0 (2)	P(1)-C(21)-C(22)	117.3(3)
P(4)-Rh(2)-C(1)	96.1 (2)	P(1)-C(21)-C(26)	122.7(3)
Rh(1)-C(1)-Rh(2)	89.4 (4)	P(2)-C(31)-C(32)	122.7(3)
Rh(1)-C(1)-O	135.3 (6)	P(2)-C(31)-C(36)	117.3(3)
Rh(2)-C(1)-O	135.3 (6)	P(2)-C(41)-C(42)	118.7(3)
P(1)-C(2)-P(2)	111.0 (4)	P(2)-C(41)-C(46)	121.2(3)
P(3)-C(3)-P(4)	109.9 (4)	P(3)-C(51)-C(52)	120.4(4)
Rh(1)-P(1)-C(2)	112.6 (3)	P(3)-C(51)-C(56)	119.6(4)
Rh(2)-P(2)-C(2)	114.1 (2)	P(3)-C(61)-C(62)	116.2(4)
Rh(1)-P(3)-C(3)	114.0 (2)	P(3)-C(61)-C(66)	123.8(4)
Rh(1)-P(4)-C(3)	112.1 (2)	P(4)-C(71)-C(72)	118.7(3)
Rh(1)-P(1)-C(11)	115.4 (2)	P(4)-C(71)-C(76)	121.2(3)
Rh(1)-P(1)-C(21)	115.6 (2)	P(4)-C(81)-C(82)	117.4(3)
Rh(2)-P(2)-C(31)	108.0 (2)	P(4)-C(81)-C(86)	122.6(3)
Rh(2)-P(2)-C(41)	121.8 (2)		

Torsion Angles

P(1)-Rh(1)-Rh(2)-P(2)	- 5.42(7)	C(2)-P(1)-Rh(1)-C(1)	- 17.9 (4)
P(1)-Rh(1)-Rh(2)-P(4)	170.87(7)	C(2)-P(2)-Rh(2)-C(1)	28.3 (4)
P(2)-Rh(2)-Rh(1)-P(3)	-172.97(7)	C(3)-P(3)-Rh(1)-C(1)	17.6 (4)
P(3)-Rh(1)-Rh(2)-P(4)	3.32(8)	C(3)-P(4)-Rh(2)-C(1)	- 24.8 (4)
C(11)-P(1)-Rh(1)-Br(1)	73.8 (2)	C(11)-P(1)-P(2)-C(31)	2.6 (3)
C(21)-P(1)-Rh(1)-Br(1)	- 48.7 (2)	C(11)-P(1)-P(3)-C(61)	- 6.5 (3)
C(31)-P(2)-Rh(2)-Br(2)	- 65.2 (2)	C(21)-P(1)-P(2)-C(41)	5.2 (4)
C(41)-P(2)-Rh(2)-Br(2)	54.1 (2)	C(21)-P(1)-P(3)-C(51)	- 9.3 (3)
C(51)-P(3)-Rh(1)-Br(1)	40.7 (3)	C(31)-P(2)-P(4)-C(71)	- 3.0 (3)
C(61)-P(3)-Rh(1)-Br(1)	- 80.0 (2)	C(41)-P(2)-P(4)-C(81)	- 6.6 (3)
C(71)-P(4)-Rh(2)-Br(2)	63.1 (2)	C(51)-P(3)-P(4)-C(81)	30.1 (4)
C(81)-P(4)-Rh(2)-Br(2)	- 59.7 (2)	C(61)-P(3)-P(4)-C(71)	19.1 (3)

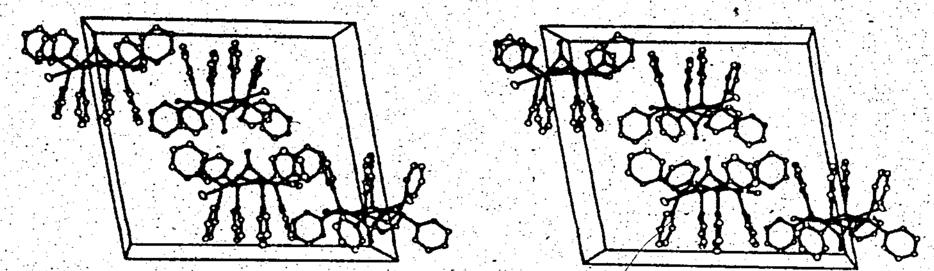


Figure 19. Cell Packing Diagram of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$.

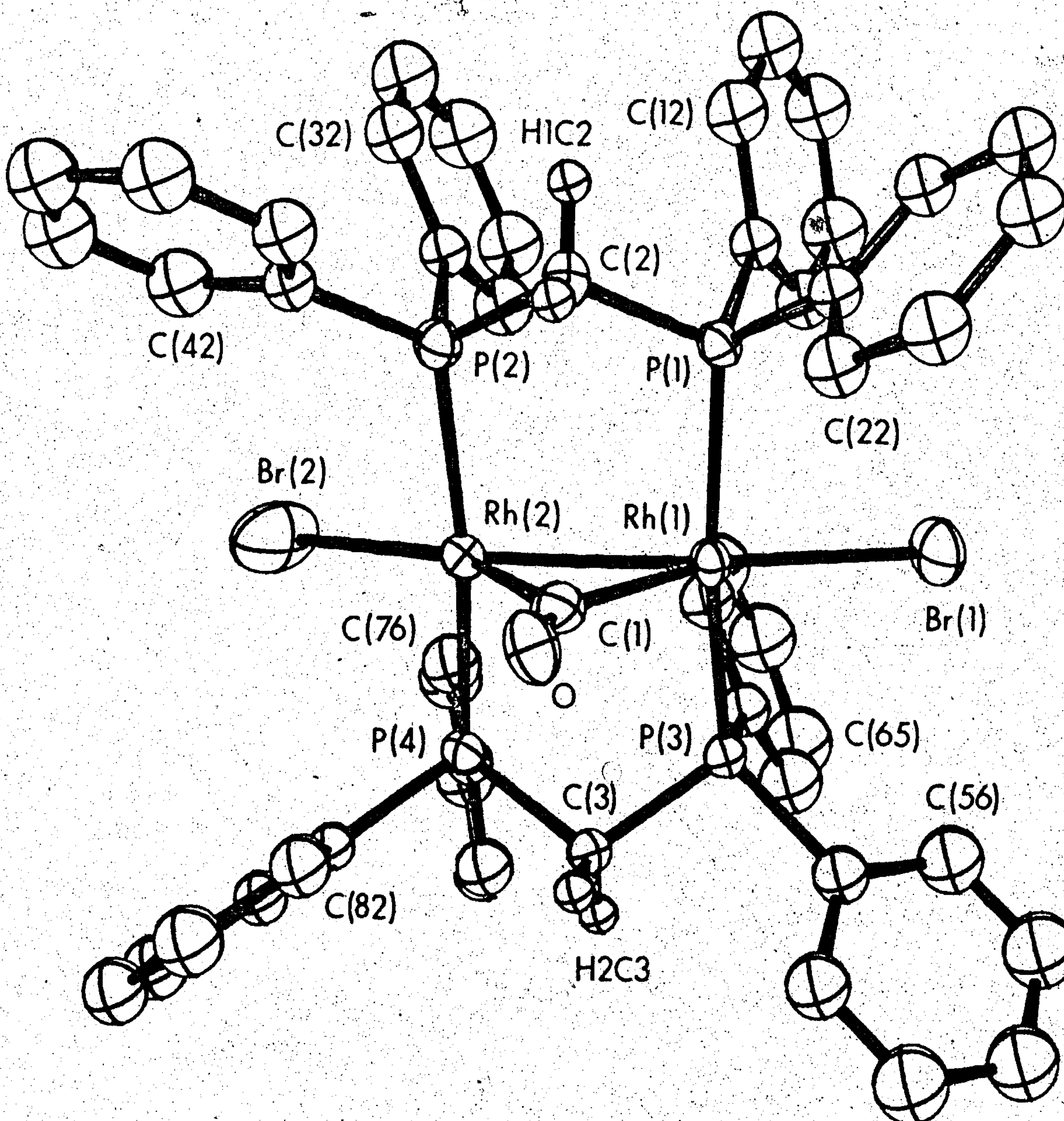


Figure 20. A Perspective View of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$.

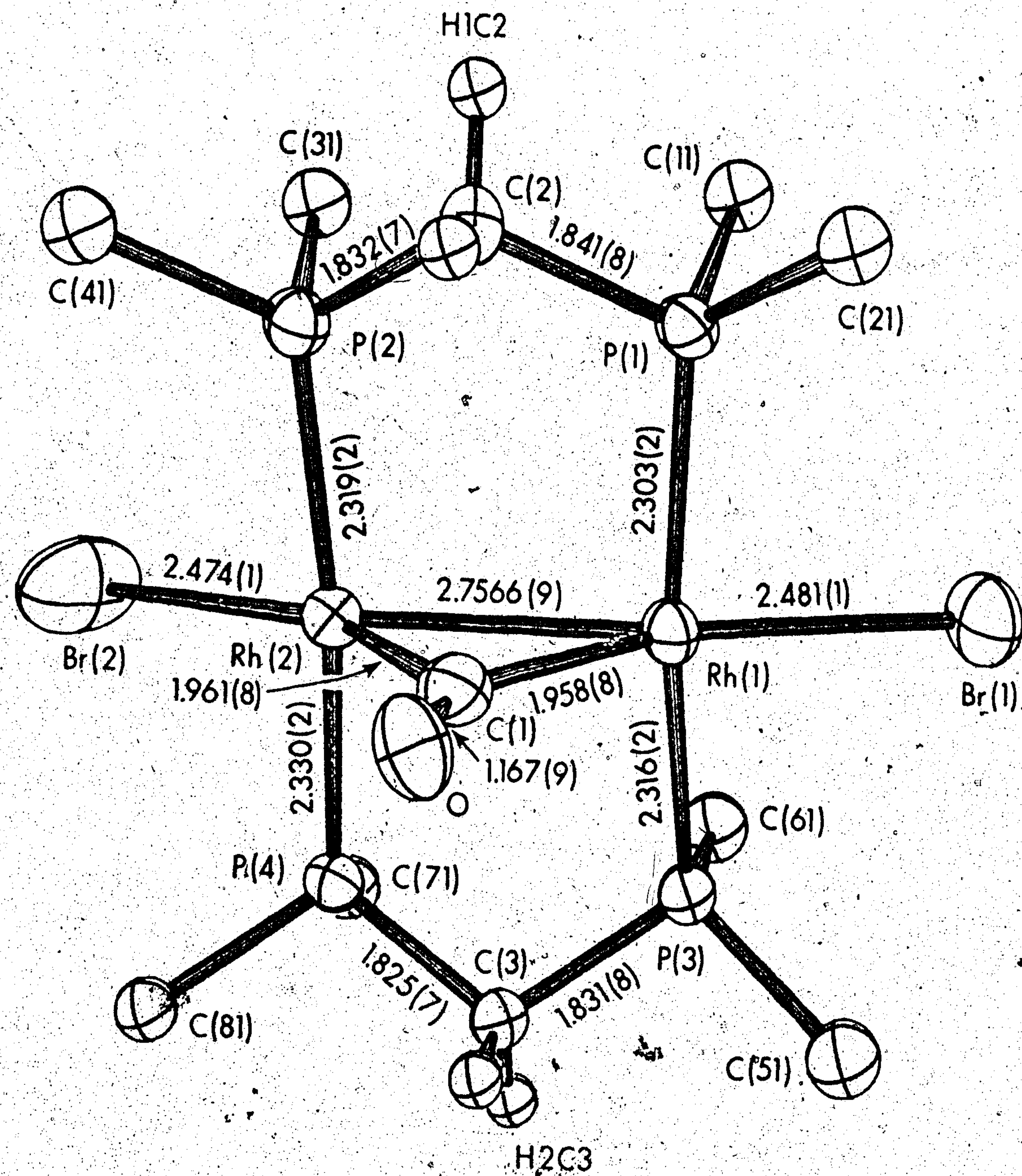


Figure 21. The Inner Coordination Sphere of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$.

DESCRIPTION OF STRUCTURE

The coordination about each rhodium atom is quasi-trigonal bipyramidal. Two transoid DPM ligands bridge the Rh atoms in the axial positions with the bridging carbonyl ligand, a terminal bromo ligand on each Rh atom and a formal Rh-Rh bond completing coordination in the equatorial plane. The resulting distorted "A-frame" geometry is similar to that observed in $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$[96] (Chapter IV). The distortions in the "A-frame" geometry arise due to steric interactions between the terminal bromo ligands and the phenyl rings of the DPM ligands (Table 32) and because of the presence of a metal-metal bond, both resulting in a flattening of the "A" configuration. Angles about each Rh atom in the equatorial plane clearly show the distortions from trigonal bipyramidal coordination (Rh-Rh-Br, Rh-Rh-C(1), and Br-Rh-C(1); 167.06(4), 45.3(2) and 147.6(2)°, respectively).

The Rh-Br distances of 2.481(1) and 2.474(1)Å are not unusual and compare well with other determinations.[149,150] Within the Rh-DPM framework most parameters are as expected. The Rh-P distances (average 2.317(11)Å) and the P-C distances both methylene and phenyl (average, 1.833(7) and 1.832(8)Å, respectively) compare well with other determinations.[35,89,96,120,126,142] The Rh-P vectors as viewed down the Rh-Rh axis are slightly staggered (see P-Rh-Rh-P torsion angles in Table 33 and least-squares planes in

Table 31). This skewing of the Rh-DPM framework results in phenyl rings 3 and 6 being forced into the open coordination site opposite the carbonyl ligand giving rise to close contacts between Rh and the ortho hydrogen atoms (2.65 and 2.81 Å). An almost identical skewing was observed in the chloro/SO_2 analogue, $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$[96] (Chapter IV). The Rh-P-C angles with the exceptions of those for rings 4 and 5 are close to the expected tetrahedral values. In contrast, the Rh-P-C angles involving ring 4 and 5 (121.8(2)° and 123.1(2)°, respectively) are significantly larger than the expected tetrahedral values. These distortions seem to arise from steric interactions between the bromo ligand and the phenyl rings, as evidenced by the short Br-H distances involving these rings (Br(1) - H(56) = 3.15 Å and Br(1) - H(42) = 2.75 Å) which are less than the sums of the van der Waal's radii.[112] In the structure of $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$[96] where the bromo ligand is replaced by the less bulky chloro ligand these distortions are somewhat less pronounced, with a maximum value for the Rh-P-C angle of 118.9(2)°. The bromo ligands in the present compound, are staggered with respect to the DPM phenyl groups, in order to minimize nonbonded contacts between these groups. This staggering is evident in the phenyl-P-Rh-Br torsion angles which range from 40.7(3)° to 80.0(2)° (Table 33).

Formally the present compound contains a Rh-Rh single bond as suggested by several structural parameters:

i) the Rh-Rh distance of 2.7566(9)Å falls within the range previously reported for similar Rh-Rh bond species (2.617(3) - 2.8415(7)Å)[35,129-133] and can be contrasted to the distances of 3.1520(8) and 3.155(4)Å, observed in the "A-frame" species $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ (Chapter II) and $[Rh_2(CO)_2(\mu\text{-}S)(DPM)_2]$,[89] respectively, where no formal metal-metal bond is present; ii) the Rh-C-Rh bond angle of 89.4(4)° compares well with other determinations in which a carbonyl ligand bridges a metal-metal bond,[35,130-133] and is significantly smaller than the values of 119(3)°, 106(3)° and 116.4(6)° observed in $[Pd_2Cl_2(\mu\text{-}CO)(DPM)_2]$,[32] $[Pt_2Cl_2(\mu\text{-}CO)(DPM)_2]$[41] and $Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-}DMA)(DPM)_2]$,[42] respectively, where no metal-metal bond is present; iii) the Rh-Rh separation is significantly less than the P···P intraligand separations of 3.026(3) and 2.992(3)Å as is usually observed in these systems when a Rh-Rh bond is present.[35]

Although the above parameters suggest a direct metal-metal bond, this formulation is by no means unambiguous. Recent molecular orbital calculations[151] on carbonyl bridged species with short metal-metal distances have shown that in some cases no metal-metal bond is actually present even though the structural parameters suggest otherwise. Furthermore, these calculations have been substantiated by experimental differential electron density determinations[152] on the compounds in question showing no significant build-up of electron density along the metal-metal axis.

The carbonyl ligand bridges the two Rh atoms symmetrically as evidenced by the Rh-C distances of 1.958(8) and 1.961(8)Å. These distances are significantly shorter than those observed in other Rh systems containing bridging carbonyl ligands where the values of 2.104(7) and 2.034(7)Å, observed in $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2][BPh_4]$,[35] are more typical. Instead, the observed distances are comparable to the values of 1.90(6) and 1.97(9) Å obtained in the Pd[32] and Pt[41] analogues $[M_2Cl_2(\mu\text{-}CO)(DAM)_2]$, (M = Pd,Pt) and that of 1.974(7) observed in $[Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-}DMA)(DPM)_2]$.[42] It is notable that these distances correspond to "ketonic" carbonyl species which show low values for ν(CO) in the infrared spectrum similar to that observed for the present compound. It is also relevant that the analogous SO_2 species $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ has short Rh-S bonds and a low value for ν(SO) in the infrared spectrum (Chapter IV).

In the title compound the C(1)-O distance is not as long as one might expect based on the low ν(CO), but rather is comparable to that observed in "normal" bridging carbonyls which have ν(CO) *ca.* 100 cm^{-1} higher. However, carbonyl C-O distances are not overly sensitive to such changes owing to the relatively large uncertainty in the atomic positions. Therefore the present distance is, within experimental error, comparable to the analogous distances in the "ketonic" carbonyl species of $[Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-}DMA)(DPM)]$[42] and $[Pd_2Cl_2(\mu\text{-}CO)(DPM)_2]$[32] where the ν(CO) values of 1700 and 1720 cm^{-1}, respectively are observed. Applying a riding motion correction the present C(1)-O distance (atom O riding on C(1)) yields a corrected value of 1.192(9) Å which is closer to the value we had expected based on spectral parameters.

DISCUSSION

The structural determination of $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ has unambiguously established it to be a monocarbonyl species having a formal Rh-Rh bond and not the alternate dicarbonyl species. The spectral parameters are consistent with both formulations (mono and dicarbonyl species), but the reaction of the compound with SO_2, yielding a dicarbonyl product, at first glance actually favours the dicarbonyl formulation. Prompted by the present structural characterization however, a reinvestigation of the $^{31}P\{^1H\}$ NMR spectra during the slow stepwise addition of SO_2 indicates the dicarbonyl species results from CO transfer from one monocarbonyl species to another (see Chapter V). A somewhat analogous, facile CO transfer has been reported[35a,91] between $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ and $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]^+$. These results clearly indicate the need for further structural and spectral characterizations of related complexes in order to yield the needed correlations between their structural and spectral parameters.

The complex, $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ is only the second structurally characterized example with rhodium[145] in which a carbonyl ligand occupies the bridging site in preference to the halide ligand. Generally the reverse is true,[153] yet in binuclear DPM-,[42,125] DAM-[32,41] and analogous diphosphazane-bridged[145] complexes of the Group VIII metals several complexes have now been characterized with bridging CO and terminal halide ligands. The closely related, SO_2 bridged species, $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ is also anomalous in this regard having bridging SO_2 and terminal chloro groups (Chapter IV). It seems that in these complexes there is a strong tendency for the better π-acceptor ligand to enter the bridging site, even when initial attack by this ligand is terminal. In the bridging site the π-acceptor ligand can accept electron density from both electron rich metals, which in the present complex would account for the low value of $\nu(CO)$ and the short rhodium carbonyl distances. In addition the build-up of electron density on the carbonyl ligand, resulting from the large degree of back donation from the metal is also reflected in the low field chemical shift (227.5 ppm) of the ^{13}C carbonyl resonance. The trend in spectral parameters with increasing metal carbonyl back bonding is seen clearly in the series of closely related complexes $[Rh_2(CO)_2(\mu\text{-}CO)(\mu\text{-}Cl)(DPM)_2]^+$, $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2][I]$ and $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$, where the observed ^{13}C chemical shifts for the bridging carbonyl ligands (203.2,[154] 212.8[154] and 227.5 ppm, respectively) directly parallel the corresponding $\nu(CO)$ values (1850, 1810 and 1745 cm^{-1}, respectively).[155] In contrast however, the "ketonic" carbonyl complexes, $[Rh_2X_2(\mu\text{-}CO)(\mu\text{-acetylene})(DPM)_2]$ (X = Cl, Br, I), which have even lower values of ν(CO) of *ca.* 1700 cm^{-1} have relatively high field ^{13}C shifts of *ca.* 190 ppm.[42] It is unclear at this time why the "ketonic" carbonyl species have such different ^{13}C chemical shifts from the present compound when the carbonyl stretching frequencies are comparable, but it is clear that the use of spectral parameters to assign the mode of carbonyl bonding is fraught with difficulties, at least until more complete spectral and structural correlations are available.

CHAPTER VII.

Carbon Disulfide Chemistry and the the Structure of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$

INTRODUCTION

Much of the recent interest in carbon disulfide chemistry stems from the close similarity of this molecule to the less reactive carbon dioxide molecule. Few species, however containing either of these ligands have been structurally characterized.[45-47,156-160] For the CS_2 molecule, the commonest coordination mode, and one of the bonding modes also observed for the analogous CO_2 molecule,[160] has the CS_2 molecule bound to the metal in a side-on manner, through the carbon atom and one of the sulfur atoms (see Chapter I).[45,156-159]

For rhodium and iridium several CS_2 containing complexes have been prepared[48,161] but until recently none had been structurally characterized.[162] In several of these complexes the C,S-η^2 bonding mode of the CS_2 molecules had been inferred based on analogies with other transition metal complexes[48,161] even though the C-S stretching frequencies observed were typically *ca.* 100 cm^{-1} lower than those observed in structurally confirmed complexes. These low values of ν(CS) suggest that the CS_2 molecule may adopt another coordination geometry in these rhodium and iridium complexes. One possibility which must be considered involves the condensation of the CS_2 molecules. Certainly rhodium has previously displayed a tendency of condensing sulfur containing ligands, for example in $[RhCl(PPh_3)_2(PhCONCS)_2]$[163] and $[RhCl(PPh_3)_2(C_2H_5OCONCS)_3]$,[164] where two molecules of PhCONCS and three molecules of $C_2H_5OCONCS$, respectively, are condensed at the metal centres. Significantly, one of the few structurally characterized "CO_2 complexes" actually contains a C_2O_4 fragment resulting from the condensation of two CO_2 molecules.[50] The CO stretching frequencies for this species are 25-75 cm^{-1} lower than those in a typical C,O-η^2 bond species.[160] Furthermore, while this work was in progress the structural determination of $[Rh(C_2S_4)(\eta^5-C_5H_5)(PMe_3)]$[162] indicated that the C_2S_4 fragment was bound in an analogous manner to the above C_2O_4 moiety and again the values of ν(CS) for this species were low.

In view of the obvious lack of structural information available on CS_2 complexes, the present study was undertaken in order to form a much needed basis for spectral and structural correlations in these complexes and to gain a better understanding of transition metal activation of CS_2 and related molecules.

EXPERIMENTAL

All reactions were performed under a dinitrogen atmosphere using degassed solvents.

Preparation of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$

A suspension of 0.200 g (0.182 mmol) of *trans*-$[RhCl(CO)(DPM)]_2$[66] (1) in 25 mL of CH_2Cl_2 was treated with 10 mL of CS_2 and allowed to react for 24 h. To the resulting red solution was added 25 mL of diethyl ether to induce crystallization. This complex may also be prepared in a manner analogous to that shown above, from the reaction of CS_2 with $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$.

Spectroscopic Studies

A solution was prepared by dissolving 0.100 g (0.072 mmol) of $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ (2) in 4 mL of CD_2Cl_2 in a 10 mm NMR tube. The $^{31}P\{^1H\}$ NMR spectrum was recorded at 233 K. Subsequent $^{31}P\{^1H\}$ NMR spectra were then recorded after each 1.5 μL (0.035 mmol) addition of CS_2 until all of 2 had been converted to $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$ (3). In addition to resonances assignable to 2 ($\delta = 19.7$ ppm: $|^1J_{Rh-P} + {}^xJ_{Rh-P}| = 115.9$ Hz)[101] and 3 ($\delta = 7.5$ ppm; AA'BB'XY multiplet), two additional resonances due to symmetric species at $\delta = 15.7$ ppm ($|^1J_{Rh-P} + {}^xJ_{Rh-P}| = 116.5$ Hz) and $\delta = 14.3$ ppm ($|^1J_{Rh-P} + {}^xJ_{Rh-P}| = 98.2$ Hz) were also observed at intermediate times in the reaction. Similarly the $^{13}C\{^{31}P\{^1H\}\}$ NMR spectra were monitored using exactly the same technique and starting with $[Rh_2Cl_2(\mu\text{-}^{13}CO)(DPM)_2]$. Carbonyl resonances assignable to 2 ($\delta = 229.0$ ppm; triplet; $|J_{Rh-C}| = 44.9$ Hz), 3 ($\delta = 191.5$ ppm; doublet; $|J_{Rh-C}| = 69.1$ Hz) and a third species ($\delta = 186.5$ ppm; doublet;

$|J_{Rh-C}| = 80.1$ Hz) were observed.

Infrared spectra were obtained in an analogous manner, by recording the solution spectrum after each stepwise addition of 7 μL (0.116 mmol) of CS_2 to a CH_2Cl_2 solution of 2 (0.500 g, 0.465 mmol) in 30 mL). Unfortunately the CS_2 stretching region was obscured by DPM and free CS_2 bands. In the bridging carbonyl region only one band was observed, which was assignable to 2 ($\nu(CO) = 1750$ cm^{-1}). In addition, two vibrations were observed in the terminal carbonyl region; the one at 2030 cm^{-1} increased in intensity throughout the experiment and was assigned to species 3, and the second at 1990 cm^{-1} was observed at intermediate times in the experiment.

<u>Crystallization of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$</u>

To a solution of 0.100 g (0.0798 mmol) of 3 in 10 mL of CH_2Cl_2 was added 2 mL of CS_2 and 7 mL of diethyl ether. Crystallization was induced from this solution by slow cooling, yielding red crystals. An infrared spectrum ($\nu(CO) = 2040$(sh), 2020(s) cm^{-1}; $\nu(C\text{-}S) = 1050$(m), 995(sh), 980(s) cm^{-1}) verified that it was species 3.

<u>X-Ray Data Collection</u>

Red crystals of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$ were mounted in glass capillaries. Preliminary film data showed that these crystals were of only mediocre quality, however repeated attempts to obtain crystals of better quality failed.

The structural investigation was therefore continued on the original crystals. These crystals belong to the monoclinic system with extinctions (h0ℓ, ℓ odd; 0k0, k odd) characteristic of the centrosymmetric space group $P2_1/c$. The density calculation, and the cell parameters, indicated that $Z = 8$, revealing that two independent dimers per asymmetric unit were present. Therefore, a cell reduction[102] was performed to rule out the possibility that the crystals might belong to a system of higher symmetry. The cell reduction confirmed the $P2_1/c$ cell as the reduced cell and the solution of the structure verified this, showing that the two independent dimers in the asymmetric unit have slight but significant differences in their geometries (vide infra).

Data collection was carried out as previously described in Chapter II. Pertinent crystal and intensity collection data are presented in Table 34. Data collection was suspended at $2\theta = 100°$, owing to the lack of diffracted intensity beyond this point. During data collection a clear colorless liquid was observed condensing on the inside of the capillary. However, by the time data collection had finished this liquid had disappeared (presumably through a pinhole in the capillary) so no identification of this liquid was possible.

Solution of Structure

Since species 3 crystallized with two independent dimers per asymmetric unit, and therefore has four inde-

Table 34. Summary of Crystal Data and Intensity Collection for $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$

Compound	$[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$
Formula	$C_{53}H_{44}Cl_2O_1P_4Rh_2S_4$
Formula Weight	
Cell Parameters	
a	22.311(3)Å
b	22.843(3)Å
c	22.828(3)Å
β	115.21(1)°
V	10526 Å^3
Z	8
Density	1.547 g·cm^{-3} (calc'd.) 1.56(2) g·cm^{-3} (expt'l. by flotation)
Space Group	C_{2h}^5 - $P2_1/c$
Crystal Dimensions	0.586 x 0.211 x 0.629
Crystal Volume	0.0458 mm^3
Crystal Faces (and distances from an arbitrary origin within the crystal (mm))	1 0 0 (0.256) 1 0 $\bar{1}$ (0.203) 5 0 $\bar{2}$ (0.252) $\bar{1}$ 0 1 (0.182) 0 1 0 (0.105) 0 $\bar{1}$ 0 (0.105)
Temperature	20°C
Radiation	CuKα (λ=1.540562 Å) filtered with 0.5 mil thick nickel foil
μ	90.85
Range in Absorption Correction Factors	0.081 - 0.230
Receiving Aperture	6 x 6 mm, 30 cm from the crystal

Table 34, continued

Takeoff Angle	6.2°
Scan Speed	2° in 2θ/min
Scan Range	1.00° below $K_{\alpha 1}$ to 1.00° above $K_{\alpha 2}$
Background Counting Time	10s ($2° < 2\theta < 80°$) 20s ($80° < 2\theta \leq 100°$)
2θ limits	$2° \leq 2\theta \leq 100°$
2θ limits for centered reflections	$50° \leq 2\theta \leq 60°$
Final number of variables	337
Unique Data Collected	11195
Unique Data Used ($F_o^2 \geq 3\sigma(F_o^2)$)	5929
Error in observation of unit weight	2.472
R	0.114
R_w	0.145

pendent rhodium atoms, structure solution was initially attempted using the direct methods program MULTAN.[148] However, efforts at solving the structure using MULTAN failed after repeated attempts, using between 500 and 700 reflections having the highest E's and generating between 2000 to 5000 unique phase relationships. In all solutions generated by MULTAN the same molecular orientations (for Rh and P) kept recurring, only with different relative positions of the dimers. This problem (of finding the molecular framework but failing to fix the origin) is not uncommon with MULTAN and is not unexpected given that in this structure we were attempting to push MULTAN far beyond its recommended limits. It is generally recommended to use about seven phase relationships per reflection and seven reflections per atom, whereas we were using at maximum 5.3 reflections per atom and generating 7.1 phase relationships per reflection. In addition, structures that require more than 500 reflections are generally too difficult for MULTAN to solve.

Our previous experience with these systems suggested that the Patterson map would be extremely difficult to interpret owing to vector build-up, especially considering that two molecules per asymmetric unit were present. This suspicion was confirmed by the calculated Patterson map, which showed severe Rh-Rh and Rh-P vector build-up. The top weighted vector, for example, at (0.44, 0.50, 0.44) was equal to approximately eleven times a singly weighted Rh-Rh vector. As a result of this vector build-up in the Patterson map even using the Rh-P frameworks found in MULTAN, again the origin could not be uniquely defined. Therefore, one of the dimers, obtained from MULTAN, was arbitrarily chosen and its Rh-P framework was shifted to all possible positions consistent with the Patterson map, maintaining the orientation given by MULTAN. Subsequent full matrix least-squares and electron density difference maps on each possible solution established that the solution having Rh(A1) at (0.77, 0.14, 0.02) and Rh(A2) at (0.78, 0.02, 0.02) was considerably better than the others. In this solution, including the four associated P atoms, $R = 0.49$ and $R_w = 0.61$[121] compared to values of near 0.53 and 0.63 for R and R_w, respectively, for other solutions. Furthermore, with this solution the Rh-P framework of the second dimer was observed at a position consistent with the Patterson map (other possible solutions did not yield this framework). The remaining atoms were located from subsequent least-squares calculations and electron density difference maps. Anomalous dispersion terms[108] for Rh, P, Cl and S were included in F_c. The phenyl carbon atoms were refined as rigid groups and hydrogen atoms were included as fixed contributions and not refined. All other nongroup atoms except hydrogens were refined with isotropic thermal parameters. An anisotropic refinement of, at least the heavy atoms (Rh, Cl, S and P), would have been appropriate on the basis of the residual electron density observed around these atoms (range -3.11 to 2.69 e/$\AA^3$). However, this was not attempted due to the extremely high cost associated with refining these atoms anisotropically.

At this point an electron density difference map revealed the presence of an unresolved tunnel of electron density in the area enclosed by the phenyl ring of P(A3), P(A4), P(B2), and P(B4). Attempts to fit this area to CS_2, CH_2Cl_2 or $(C_2H_5)_2O$ molecules were unsuccessful, however. Unreasonable geometries and thermal parameters resulted and no significant improvement in the crystallographic residuals was observed. The poorly resolved nature of this electron density probably results in part from the loss in solvent of crystallization which was observed during data collection (vide supra) and explains the poor diffraction quality of the crystals and the slight decrease in intensities of the standard reflections during data collection.

The final model with 337 parameters varied converged to $R = 0.114$ and $R_w = 0.145$.[121] At this point an electron density difference map showed the highest 20 peaks (2.69 - 1.00 e/$\AA^3$) were in the vicinities of the heavy atoms and the tunnel of electron density. A typical carbon atom of an earlier syntheses had an electron density of 3.2 e/$\AA^3$.

Results

The positional and thermal parameters for the individual isotropic atoms, rigid group atoms and idealized hydrogen atoms are given in Tables 35, 36 and 37, respectively. Least squares plane calculations are presented in Table 38 and selected bond lengths and angles are shown in Tables 39 and 40, respectively. A listing of observed and calculated structure amplitudes is available.[110]

A stereoview of both dimers is shown in Figure 22. Figure 23 shows a perspective view of dimers A and B. Phenyl carbon atoms are labelled sequentially around the ring starting at the carbon bound to phosphorus. The equatorial planes for $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$ are shown in Figure 24 and include relevant bond lengths.

TABLE 35. Positional and Thermal Parameters For The Nongroup Atoms of [Rh2Cl2(CO)(C2S4)(DPM)2].

Atom	x[a]	y	z	B(A²)	Atom	x	y	z	B(A²)
Rh(A1)	0.76980(9)	0.14301(8)	0.01950(9)	3.93(5)	P(A3)	0.8667(4)	0.1538(3)	0.1173(4)	4.8(2)
Rh(A2)	0.7819(1)	0.02064(8)	0.0180(1)	4.06(5)	P(A4)	0.8686(3)	0.0216(3)	0.1226(3)	4.5(2)
Rh(B1)	0.32896(9)	0.10029(8)	0.59006(9)	4.03(5)	P(B1)	0.3452(4)	0.2008(3)	0.5886(3)	4.6(2)
Rh(B2)	0.2210(1)	0.09592(9)	0.4676(1)	4.65(5)	P(B2)	0.2181(4)	0.1984(3)	0.4604(4)	5.4(2)
Cl(A1)	0.7146(3)	0.1599(3)	0.0895(3)	5.1(1)	P(B3)	0.3242(3)	-0.0010(3)	0.6054(3)	4.3(1)
Cl(A2)	0.8062(4)	-0.0864(3)	0.0166(4)	6.5(2)	P(B4)	0.2072(4)	-0.0069(3)	0.4692(4)	4.9(2)
Cl(B1)	0.2562(3)	0.1228(3)	0.6429(3)	5.3(2)	O(A1)	0.6919(9)	-0.0050(8)	0.0811(9)	6.8(5)
Cl(B2)	0.1467(4)	0.0905(3)	0.3476(4)	6.7(2)	O(B1)	0.118(1)	0.101(1)	0.516(1)	11.3(8)
S(A1)	0.7775(3)	0.2436(3)	0.0021(3)	4.9(2)	C(A1)	0.725(1)	0.010(1)	0.058(1)	4.8(6)
S(A2)	0.8120(5)	0.3064(4)	-0.0926(5)	8.3(2)	C(B1)	0.147(1)	0.102(1)	0.492(1)	5.8(7)
S(A3)	0.8279(4)	0.1810(3)	-0.0821(4)	5.3(2)	C(A2)	0.670(1)	0.081(1)	-0.130(1)	4.6(5)
S(A4)	0.8439(3)	0.0611(3)	-0.0354(3)	4.6(2)	C(A3)	0.875(1)	0.089(1)	0.169(1)	3.8(5)
S(B1)	0.4355(3)	0.0967(3)	0.6764(3)	4.7(1)	C(B2)	0.266(1)	0.238(1)	0.537(1)	6.2(7)
S(B2)	0.5694(4)	0.0879(4)	0.6791(4)	7.3(2)	C(B3)	0.248(1)	-0.036(1)	0.554(1)	5.5(6)
S(B3)	0.4554(3)	0.0835(3)	0.5558(3)	5.2(2)	C(A4)	0.802(1)	0.247(1)	-0.058(1)	5.1(6)
S(B4)	0.3210(3)	0.0869(3)	0.4536(3)	5.1(2)	C(A5)	0.816(1)	0.128(1)	-0.032(1)	4.9(6)
P(A1)	0.6672(3)	0.1356(3)	-0.0715(3)	4.3(1)	C(B4)	0.488(1)	0.089(1)	0.639(1)	5.1(6)
P(A2)	0.7001(3)	0.0106(3)	-0.0892(3)	4.1(1)	C(B5)	0.370(1)	0.090(1)	0.531(1)	4.0(5)

[a] Estimated standard deviations in the least signicant figure(s) are given in parentheses in this and all subsequent tables.

TABLE 36. Derived Parameters For the Rigid Group Atoms of [Rh2Cl2(CO)(C2S4)(DPM)2].

Atom	x	y	z	B(A²)	Atom	x	y	z	B(A²)
C(A11)	0.6399(9)	0.2021(7)	-0.121(1)	3.9(5)	C(B11)	0.3670(8)	0.2404(8)	0.6641(7)	4.2(5)
C(A12)	0.637(1)	0.2082(7)	-0.183(1)	6.6(7)	C(B12)	0.3828(9)	0.2127(5)	0.7231(9)	5.5(6)
C(A13)	0.610(1)	0.2586(9)	-0.2187(7)	7.8(9)	C(B13)	0.4022(8)	0.2456(8)	0.7796(7)	6.3(7)
C(A14)	0.5861(9)	0.3030(7)	-0.193(1)	7.5(8)	C(B14)	0.4057(8)	0.3063(8)	0.7770(7)	5.4(6)
C(A15)	0.589(1)	0.2969(7)	-0.131(1)	7.6(8)	C(B15)	0.3899(9)	0.3341(5)	0.7179(9)	9.0(9)
C(A16)	0.616(1)	0.2465(9)	-0.0949(7)	4.6(6)	C(B16)	0.3706(8)	0.3012(8)	0.6615(7)	6.3(7)
C(A21)	0.588(2)	0.1139(8)	-0.0710(7)	4.1(5)	C(B21)	0.410(2)	0.2249(8)	0.566(4)	4.1(5)
C(A22)	0.588(2)	0.0893(8)	-0.015(2)	5.5(7)	C(B22)	0.398(4)	0.2307(8)	0.501(2)	6.6(7)
C(A23)	0.528(2)	0.0721(8)	-0.015(2)	6.4(7)	C(B23)	0.449(5)	0.2450(8)	0.484(3)	4.7(6)
C(A24)	0.469(2)	0.0795(8)	-0.0695(7)	6.8(7)	C(B24)	0.513(2)	0.2534(8)	0.532(4)	6.7(7)
C(A25)	0.469(2)	0.1041(8)	-0.125(2)	7.6(8)	C(B25)	0.525(4)	0.2476(8)	0.597(2)	7.6(8)
C(A26)	0.528(2)	0.1213(8)	-0.126(2)	5.2(6)	C(B26)	0.474(5)	0.2334(8)	0.614(3)	5.1(6)
C(A31)	0.6253(8)	-0.0310(7)	-0.1010(6)	3.4(5)	C(B31)	0.2404(9)	0.2368(8)	0.4035(7)	4.7(6)
C(A32)	0.564(1)	-0.0191(6)	-0.1521(9)	5.3(6)	C(B32)	0.2494(9)	0.2972(8)	0.4078(7)	5.8(7)
C(A33)	0.5088(7)	-0.0521(7)	-0.1598(8)	5.0(6)	C(B33)	0.2666(9)	0.3263(6)	0.3636(9)	7.9(9)
C(A34)	0.5145(8)	-0.0970(7)	-0.1165(6)	5.6(6)	C(B34)	0.2748(9)	0.2951(8)	0.3152(7)	6.5(7)
C(A35)	0.576(1)	-0.1088(6)	-0.0654(9)	5.3(6)	C(B35)	0.2658(9)	0.2347(8)	0.3109(7)	6.1(7)
C(A36)	0.6310(7)	-0.0759(7)	-0.0576(8)	5.1(6)	C(B36)	0.2485(9)	0.2055(6)	0.3551(9)	6.0(7)
C(A41)	0.722(2)	-0.0274(9)	-0.149(2)	4.5(5)	C(B41)	0.136(1)	0.233(2)	0.437(1)	8.7(9)
C(A42)	0.681(1)	-0.0208(9)	-0.215(2)	8.7(9)	C(B42)	0.086(2)	0.220(1)	0.376(2)	10(1)
C(A43)	0.699(2)	-0.045(1)	-0.2612(9)	10(1)	C(B43)	0.024(2)	0.246(2)	0.355(2)	18(2)
C(A44)	0.758(2)	-0.0753(9)	-0.242(2)	6.5(7)	C(B44)	0.012(1)	0.287(2)	0.394(1)	13(1)
C(A45)	0.799(1)	-0.0819(9)	-0.176(2)	11(1)	C(B45)	0.062(2)	0.300(1)	0.455(2)	21(2)
C(A46)	0.781(2)	-0.058(1)	-0.1300(9)	8.9(9)	C(B46)	0.124(2)	0.274(2)	0.477(2)	18(2)
C(A51)	0.864(1)	0.2183(9)	0.167(1)	6.3(7)	C(B51)	0.3301(9)	-0.0263(7)	0.6843(6)	4.1(5)
C(A52)	0.888(1)	0.273(1)	0.1628(8)	9(1)	C(B52)	0.3401(8)	0.0128(5)	0.7344(8)	4.8(6)
C(A53)	0.888(1)	0.3179(8)	0.205(1)	10(1)	C(B53)	0.3378(8)	-0.0069(7)	0.7911(7)	6.9(7)
C(A54)	0.865(1)	0.3071(9)	0.252(1)	7.7(8)	C(B54)	0.3256(9)	-0.0657(7)	0.7978(6)	5.3(7)
C(A55)	0.841(1)	0.252(1)	0.2562(8)	9.5(9)	C(B55)	0.3156(8)	-0.1048(5)	0.7477(8)	5.0(6)
C(A56)	0.840(1)	0.2075(8)	0.214(1)	7.9(8)	C(B56)	0.3178(8)	-0.0851(7)	0.6909(7)	5.5(6)
C(A61)	0.953(2)	0.169(1)	0.128(1)	7.3(8)	C(B61)	0.392(1)	-0.0412(8)	0.598(2)	5.2(6)
C(A62)	1.006(3)	0.165(1)	0.189(3)	7.3(8)	C(B62)	0.452(2)	-0.0458(8)	0.653(2)	5.1(6)
C(A63)	1.069(2)	0.182(1)	0.197([illegible])	8.3(9)	C(B63)	0.508(1)	-0.0670(8)	0.6478(7)	6.6(7)
C(A64)	1.079(2)	0.203(1)	0.144(1)	15(2)	C(B64)	0.504(1)	-0.0836(8)	0.588(2)	7.5(7)
C(A65)	1.025(3)	0.207(1)	0.084(3)	18(2)	C(B65)	0.444(2)	-0.0789(8)	0.533(2)	4.7(6)
C(A66)	0.962(2)	0.190(1)	0.076(2)	14(2)	C(B66)	0.388(1)	-0.0577(8)	0.5378(7)	4.8(6)
C(A71)	0.8632(9)	-0.0343(7)	0.1789(8)	4.5(5)	C(B71)	0.2355(9)	-0.0542(7)	0.4222(7)	5.5(6)
C(A72)	0.8945(8)	-0.0881(8)	0.1851(7)	6.4(7)	C(B72)	0.2444(9)	-0.1134(8)	0.4378(7)	5.8(7)
C(A73)	0.8909(9)	-0.1299(6)	0.2279(9)	7.4(8)	C(B73)	0.2656(9)	-0.1511(5)	0.4026(9)	6.6(7)
C(A74)	0.8560(9)	-0.1178(7)	0.2645(8)	6.5(7)	C(B74)	0.2780(9)	-0.1296(7)	0.3518(7)	6.2(7)
C(A75)	0.8246(8)	-0.0640(8)	0.2583(7)	5.5(6)	C(B75)	0.2691(9)	-0.0703(8)	0.3361(7)	6.1(7)
C(A76)	0.8282(9)	-0.0222(6)	0.2155(9)	4.9(6)	C(B76)	0.2478(9)	-0.0326(5)	0.3713(9)	4.3(6)
C(A81)	0.953(2)	0.0071(9)	0.1294(7)	5.1(6)	C(B81)	0.122(1)	-0.033(1)	0.447(4)	5.9(7)
C(A82)	0.963(3)	-0.0185(9)	0.079(2)	5.6(6)	C(B82)	0.082(4)	-0.035(1)	0.380(5)	10(1)
C(A83)	1.026(2)	-0.0359(8)	0.088(2)	4.9(6)	C(B83)	0.017(3)	-0.053(1)	0.357(2)	13(1)
C(A84)	1.079(2)	-0.0277(9)	0.1482(7)	7.5(8)	C(B84)	-0.009(1)	-0.070(1)	0.401(4)	14(1)
C(A85)	1.069(3)	-0.0021(9)	0.199(2)	7.9(9)	C(B85)	0.031(4)	-0.069(1)	0.467(5)	21(2)
C(A86)	1.006(2)	0.0153(8)	0.189(2)	6.3(7)	C(B86)	0.097(3)	-0.050(1)	0.490(2)	23(3)

TABLE 36.(Continued)

Rigid Group Parameters

	Xc[a]	Yc	Zc	Delta[b]	Epsilon	Eta
Ring1	0.6130(5)	0.2526(6)	-0.1568(6)	-0.44(1)	1.57(1)	4.30(1)
Ring2	0.5282(6)	0.0967(5)	-0.0703(6)	1.14(1)	2.89(3)	2.39(3)
Ring3	0.5699(6)	-0.0640(5)	-0.1087(5)	3.84(1)	2.87(1)	3.93(1)
Ring4	0.7400(7)	-0.0513(6)	-0.1956(7)	2.13(1)	2.04(2)	3.98(3)
Ring5	0.8643(6)	0.2627(7)	0.2095(7)	0.28(1)	1.27(1)	5.42(2)
Ring6	1.0157(9)	0.1860(7)	0.1363(9)	4.34(2)	2.64(4)	0.86(5)
Ring7	0.8596(5)	-0.0761(5)	0.2217(5)	2.76(1)	1.11(1)	5.45(1)
Ring8	1.0160(6)	-0.0103(5)	0.1388(6)	2.01(1)	2.76(3)	5.56(3)
Ring9	0.3864(5)	0.2734(5)	0.7205(6)	3.21(1)	1.87(1)	0.57(1)
Ring10	0.4616(6)	0.2392(5)	0.5489(6)	1.33(1)	2.16(5)	4.61(5)
Ring11	0.2576(5)	0.2659(6)	0.3594(6)	3.27(1)	1.35(1)	2.64(1)
Ring12	0.074(1)	0.2600(8)	0.416(1)	-0.83(2)	2.65(3)	3.85(3)
Ring13	0.3278(5)	-0.0460(5)	0.7410(5)	0.19(1)	1.60(1)	0.34(1)
Ring14	0.4481(6)	-0.0624(5)	0.5928(6)	-1.20(1)	2.43(3)	1.26(3)
Ring15	0.2567(5)	-0.0919(5)	0.3870(6)	-0.18(1)	1.31(1)	2.46(1)
Ring16	0.0569(9)	-0.0517(7)	0.424(1)	4.37(2)	2.13(6)	4.25(6)

[a] Xc,Yc and Zc are the fractional coordinates of the centroid of the rigid group.

[b] The rigid group orientation angles Delta,Epsilon and Eta(radians) are the angles by which the rigid body is rotated with respect to a set of axes X,Y and Z. The origin is the centre of the ring; X is parallel to a* , Z is parallel to c and Y is parallel to the line defined by the intersection of the plane containing a* and b* with the plane containing b and c.

TABLE 37. Idealized Positional and Thermal Parameters For the Hydrogen Atoms of [Rh2Cl2(CO)(C2S4)(DPM)2].

Atom	x	y	z	B(A')	Atom	x	y	z	B(A')
H(A1)	0.7019	0.0928	-0.1492	5.58	H(A83)	1.0331	-0.0532	0.0542	5.85
H(A2)	0.6293	0.0749	-0.1675	5.58	H(A84)	1.1227	-0.0405	0.1554	8.49
H(A3)	0.8358	0.0931	0.1805	4.85	H(A85)	1.1059	0.0017	0.2407	8.93
H(A4)	0.9122	0.0933	0.2067	4.85	H(A86)	0.9995	0.0312	0.2248	7.31
H(B1)	0.2787	0.2769	0.5269	7.21	H(B12)	0.3804	0.1722	0.7240	6.49
H(B2)	0.2425	0.2441	0.5616	7.21	H(B13)	0.4152	0.2264	0.8199	7.32
H(B3)	0.2153	-0.0281	0.5708	6.45	H(B14)	0.4220	0.3286	0.8168	6.37
H(B4)	0.2527	-0.0751	0.5506	6.45	H(B15)	0.3940	0.3765	0.7179	9.98
H(A12)	0.6519	0.1783	-0.2020	7.61	H(B16)	0.3592	0.3222	0.6220	7.29
H(A13)	0.6073	0.2640	-0.2606	8.80	H(B22)	0.3537	0.2243	0.4661	7.59
H(A14)	0.5685	0.3384	-0.2150	8.46	H(B23)	0.4406	0.2486	0.4389	5.68
H(A15)	0.5742	0.3269	-0.1108	8.60	H(B24)	0.5475	0.2633	0.5206	7.71
H(A16)	0.6187	0.2411	-0.0522	5.64	H(B25)	0.5673	0.2537	0.6295	8.60
H(A22)	0.6277	0.0821	0.0237	6.55	H(B26)	0.4803	0.2293	0.6567	6.11
H(A23)	0.5266	0.0511	0.0211	7.44	H(B32)	0.2449	0.3186	0.4424	6.83
H(A24)	0.4282	0.0651	-0.0723	7.79	H(B33)	0.2749	0.3686	0.3694	8.92
H(A25)	0.4309	0.1103	-0.1633	8.56	H(B34)	0.2873	0.3174	0.2863	7.50
H(A26)	0.5320	0.1413	-0.1608	6.24	H(B35)	0.2697	0.2161	0.2764	7.14
H(A32)	0.5585	0.0137	-0.1800	6.32	H(B36)	0.2397	0.1660	0.3494	6.96
H(A33)	0.4660	-0.0429	-0.1937	5.99	H(B42)	0.0958	0.1907	0.3523	11.30
H(A34)	0.4769	-0.1207	-0.1230	6.64	H(B43)	-0.0092	0.2339	0.3147	19.15
H(A35)	0.5804	-0.1419	-0.0387	6.28	H(B44)	-0.0316	0.3028	0.3787	14.26
H(A36)	0.6729	-0.0852	-0.0249	6.07	H(B45)	0.0510	0.3285	0.4804	21.90
H(A42)	0.6406	0.0001	-0.2308	9.67	H(B46)	0.1560	0.2853	0.5180	19.20
H(A43)	0.6720	-0.0437	-0.3062	10.88	H(B52)	0.3476	0.0522	0.7308	5.81
H(A44)	0.7712	-0.0965	-0.2707	7.46	H(B53)	0.3456	0.0182	0.8267	7.92
H(A45)	0.8391	-0.1054	-0.1597	11.56	H(B54)	0.3259	-0.0810	0.8378	6.35
H(A46)	0.8077	-0.0616	-0.0843	9.86	H(B55)	0.3082	-0.1462	0.7528	5.99
H(A52)	0.9015	0.2779	0.1291	9.86	H(B56)	0.3101	-0.1123	0.6568	6.51
H(A53)	0.9032	0.3543	0.1981	11.26	H(B62)	0.4521	-0.0341	0.6927	6.12
H(A54)	0.8656	0.3382	0.2782	8.69	H(B63)	0.5467	-0.0705	0.6851	7.61
H(A55)	0.8264	0.2457	0.2893	10.54	H(B64)	0.5411	-0.0993	0.5844	8.54
H(A56)	0.8247	0.1693	0.2202	8.86	H(B65)	0.4410	-0.0917	0.4915	5.68
H(A62)	0.9977	0.1492	0.2253	8.28	H(B66)	0.3465	-0.0554	0.4991	5.80
H(A63)	1.1032	0.1796	0.2393	9.27	H(B72)	0.2379	-0.1269	0.4732	6.78
H(A64)	1.1198	0.2135	0.1504	15.99	H(B73)	0.2741	-0.1905	0.4145	7.62
H(A65)	1.0308	0.2169	0.0476	18.62	H(B74)	0.2940	-0.1547	0.3283	7.22
H(A66)	0.9254	0.1864	0.0336	15.41	H(B75)	0.2776	-0.0553	0.3008	7.15
H(A72)	0.9146	-0.0969	0.1560	7.45	H(B76)	0.2414	0.0083	0.3595	5.33
H(A73)	0.9093	-0.1677	0.2278	8.40	H(B82)	0.0953	-0.0238	0.3476	10.51
H(A74)	0.8540	-0.1470	0.2926	7.49	H(B83)	-0.0132	-0.0583	0.3137	14.36
H(A75)	0.8040	-0.0555	0.2855	6.46	H(B84)	-0.0509	-0.0877	0.3905	14.65
H(A76)	0.8093	0.0153	0.2136	5.92	H(B85)	0.0199	-0.0826	0.5011	21.72
H(A82)	0.9267	-0.0237	0.0382	6.55	H(B86)	0.1284	-0.0481	0.5349	24.40

Table 38. Least Squares Plane Calculations

Plane No.	Dimer	Equation[a]
1	A	0.8729X+0.1141Y-0.4743Z-14.9811 = 0.0
	B	0.8952X-0.0956Y-0.4353Z+4.0804 = 0.0
2	A	0.8862X+0.0856Y-0.4553Z-15.1615 = 0.0
	B	0.8948X-0.1440Y-0.4227Z+4.0503 = 0.0
3	A	-0.6211X-0.0716Y-0.7804Z+11.0834 = 0.0
	B	0.0947X+0.9925Y-0.0779Z-1.4659 = 0.0

deviation from planes, Å

Atom	Plane no. 1-A	1-B	2-A	2-B	3-A	3-B
Rh(1)	0.027(2)	-0.010(2)	-0.012(2)	0.002(2)	-0.015(2)	0.010(2)
Rh(2)	-0.030(2)	0.012(2)	0.013(2)	-0.003(2)	0.033(2)	-0.007(2)
P(1)	-0.326(8)	0.121(8)				
P(2)	0.312(8)	-0.143(9)				
P(3)			0.163(8)	-0.027(8)		
P(4)			-0.154(8)	0.030(8)		
S(1)					-0.110(7)	-0.065(7)
S(2)					0.26 (1)	0.012(9)
S(3)					0.141(8)	-0.018(7)
S(4)					-0.355(7)	0.035(7)
C(2)	0.67 (3)[b]	-0.63 (3)[b]				
C(3)			-0.74 (3)[b]	-0.54 (3)		
C(4)					0.14 (3)	-0.03 (3)
C(5)					-0.11 (3)	0.01 (2)

[a] X, Y, and Z are orthogonal coordinates (Å) with X along the a axis, Y in the a-b plane and Z along the c^* axis.

[b] Not included in least-squares plane calculations.

Table 39: Select Distances (Å) in $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$

Bond Distance

	Dimer A	Dimer B
Rh(1) - Rh(2)	2.810(3)	2.809(3)
Rh(1) - Cℓ(1)	2.427(6)	2.454(6)
Rh(2) - Cℓ(2)	2.507(8)	2.529(8)
Rh(1) - P(1)	2.353(7)	2.326(7)
Rh(2) - P(2)	2.359(7)	2.345(8)
Rh(1) - P(3)	2.367(8)	2.349(7)
Rh(2) - P(4)	2.346(8)	2.371(7)
Rh(1) - S(1)	2.351(7)	2.356(7)
Rh(1) - C(5)	1.89 (2)	1.95 (2)
Rh(2) - S(4)	2.388(7)	2.392(7)
Rh(2) - C(1)	1.86 (2)	1.97 (3)
S(1) - C(4)	1.67 (2)	1.73 (2)
S(2) - C(4)	1.62 (3)	1.64 (3)
S(3) - C(4)	1.79 (2)	1.73 (3)
S(3) - C(5)	1.76 (2)	1.74 (2)
S(4) - C(5)	1.68 (3)	1.63 (2)
C(1) - O(1)	1.13 (2)	1.01 (3)
P(1) - C(2)	1.85 (2)	1.86 (2)
P(2) - C(2)	1.84 (2)	1.86 (2)
P(3) - C(3)	1.85 (2)	1.78 (3)
P(4) - C(3)	1.84 (2)	1.88 (3)
P(1) - C(11)	1.84 (1)	1.82 (1)
P(1) - C(21)	1.85 (1)	1.83 (1)
P(2) - C(31)	1.84 (1)	1.80 (1)
P(2) - C(41)	1.86 (1)	1.86 (2)
P(3) - C(51)	1.89 (2)	1.84 (1)
P(3) - C(61)	1.86 (2)	1.84 (1)
P(4) - C(71)	1.85 (1)	1.82 (1)
P(4) - C(81)	1.85 (1)	1.84 (2)

Nonbonded Contacts

P(A1) - P(A2)	3.018(9)
P(B1) - P(B2)	3.088(10)
P(A3) - P(A4)	3.022(10)
P(B3) - P(B4)	3.096(10)
Cl(A2) - H(A46)	2.39
Cl(B2) - H(B42)	2.58
O(A1) - H(A22)	2.48
C(B3) - H(B22)	2.33
H(A76) - H(A3)	2.11
H(A86) - H(A4)	2.30
H(A13) - H(B25)[a]	2.29
H(A65) - H(B45)[b]	2.05

[a] Atom located at x,y,-1+3.

[b] Atom located at 1+x,½-y,-½+z.

Table 40. Selected Angles (deg) in $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$

Bond Angles

	Dimer A	Dimer B
Rh(2)-Rh(1)-S(1)	163.0(2)	164.4(2)
Rh(2)-Rh(1)-Cℓ(1)	104.1(2)	91.7(2)
Rh(2)-Rh(1)-C(5)	74.7(8)	76.3(7)
Rh(2)-Rh(1)-P(1)	88.9(2)	95.3(2)
Rh(2)-Rh(1)-P(3)	93.5(2)	92.3(2)
Rh(1)-Rh(2)-Cℓ(2)	172.9(2)	165.5(2)
Rh(1)-Rh(2)-S(4)	72.6(2)	71.5(2)
Rh(1)-Rh(2)-C(1)	91.9(8)	100.4(8)
Rh(1)-Rh(2)-P(2)	94.2(2)	91.2(2)
Rh(1)-Rh(2)-P(4)	91.2(2)	94.7(2)
Cℓ(1)-Rh(1)-S(1)	92.9(2)	103.8(2)
Cℓ(1)-Rh(1)-C(5)	177.5(8)	166.9(7)
Cℓ(1)-Rh(1)-P(1)	91.0(2)	86.6(2)
Cℓ(1)-Rh(1)-P(3)	83.0(2)	93.0(2)
Cℓ(2)-Rh(2)-S(4)	101.2(2)	94.0(2)
Cℓ(2)-Rh(2)-C(1)	94.4(8)	94.1(8)
Cℓ(2)-Rh(2)-P(2)	88.2(2)	89.2(3)
Cℓ(2)-Rh(2)-P(4)	86.1(3)	86.5(3)
S(1)-Rh(1)-C(5)	88.3(8)	88.3(7)
S(1)-Rh(1)-P(1)	92.0(2)	86.5(3)
S(1)-Rh(1)-P(3)	87.4(2)	86.3(2)
S(4)-Rh(2)-C(1)	164.3(8)	171.8(8)
S(4)-Rh(2)-P(2)	82.4(2)	94.4(2)
S(4)-Rh(2)-P(4)	96.3(2)	93.0(2)
C(5)-Rh(1)-P(1)	91.2(8)	89.3(7)
C(5)-Rh(1)-P(3)	94.8(8)	92.8(7)
C(1)-Rh(2)-P(2)	96.4(8)	87.2(8)
C(1)-Rh(2)-P(4)	86.4(8)	86.0(8)
P(1)-Rh(1)-P(3)	173.9(2)	172.4(3)
P(2)-Rh(2)-P(4)	173.8(2)	171.7(3)
Rh(1)-S(1)-C(4)	105.1(9)	104.5(9)
S(1)-C(4)-S(2)	127 (2)	123 (1)
S(1)-C(4)-S(3)	118 (1)	119 (2)
S(2)-C(4)-S(3)	115 (1)	117 (1)
C(4)-S(3)-C(5)	102 (1)	104 (1)
Rh(1)-C(5)-S(3)	124 (1)	124 (1)
Rh(1)-C(5)-S(4)	120 (1)	117 (1)
S(3)-C(5)-S(4)	116 (1)	119 (1)
Rh(2)-S(4)-C(5)	91.1(8)	95.1(8)
Rh(2)-C(1)-O(1)	169 (3)	165 (3)

Table 40, continued

Bond Angles

	Dimer A	Dimer B
Rh(1)-P(1)-C(2)	114.4(8)	110.7(9)
Rh(2)-P(2)-C(2)	113.2(8)	116 (1)
Rh(1)-P(3)-C(3)	108.5(8)	115.4(9)
Rh(2)-P(4)-C(3)	114.7(8)	110.7(8)
Rh(1)-P(1)-C(11)	115.3(6)	117.2(7)
Rh(1)-P(1)-C(21)	126.1(6)	116.7(6)
Rh(2)-P(2)-C(31)	117.1(6)	121.9(9)
Rh(2)-P(2)-C(41)	118.8(8)	116 (1)
Rh(1)-P(3)-C(51)	113.5(7)	117.8(6)
Rh(1)-P(3)-C(61)	128 (1)	112.8(6)
Rh(2)-P(4)-C(71)	115.5(6)	120.0(6)
Rh(2)-P(4)-C(81)	116.9(7)	116.6(8)
P(1)-C(2)-P(2)	110 (1)	112 (1)
P(3)-C(3)-P(4)	110 (1)	115 (1)
C(2)-P(1)-C(11)	102 (1)	100 (1)
C(2)-P(1)-C(21)	99.1(9)	110 (1)
C(2)-P(2)-C(31)	105.8(9)	102 (1)
C(2)-P(2)-C(41)	101 (1)	99 (1)
C(3)-P(3)-C(51)	105 (1)	99 (1)
C(3)-P(3)-C(61)	104 (1)	108 (1)
C(3)-P(4)-C(71)	100.9(9)	105 (1)
C(3)-P(4)-C(81)	106 (1)	99 (1)
C(11)-P(1)-C(21)	99.1(8)	101.4(8)
C(31)-P(2)-C(41)	99.1(8)	97 (1)
C(51)-P(3)-C(61)	94 (1)	102.4(8)
C(71)-P(4)-C(81)	100.5(9)	102 (1)

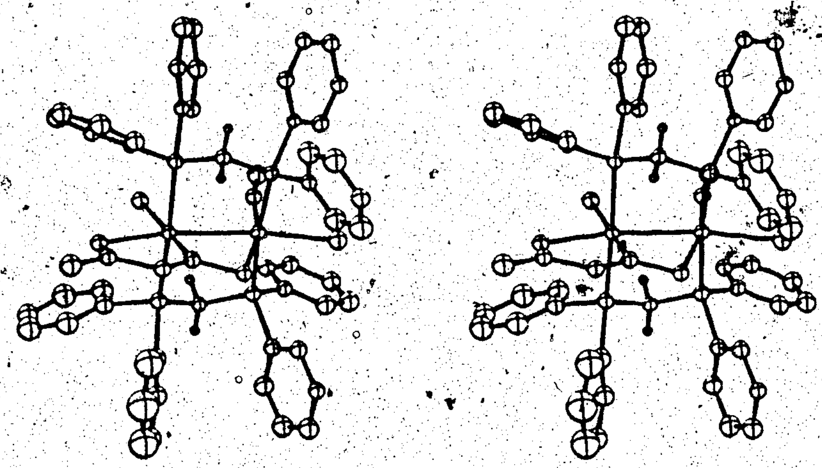
Torsion Angles

	Dimer A	Dimer B
P(1)-Rh(1)-Rh(2)-P(2)	17.0(2)	7.1(2)
P(3)-Rh(1)-Rh(2)-P(4)	8.4(2)	1.5(2)
Cℓ(1)-Rh(1)-P(1)-C(11)	98.8(7)	49.5(7)
Cℓ(1)-Rh(1)-P(1)-C(21)	25.5(8)	170.0(7)
Cℓ(1)-Rh(1)-P(3)-C(51)	45.6(8)	42.4(7)
Cℓ(1)-Rh(1)-P(3)-C(61)	162 (1)	161.4(7)
Cℓ(2)-Rh(2)-P(2)-C(31)	70.1(6)	54.4(8)
Cℓ(2)-Rh(2)-P(2)-C(41)	48.9(7)	64 (1)
Cℓ(2)-Rh(2)-P(4)-C(71)	51.9(7)	62.0(8)
Cℓ(2)-Rh(2)-P(4)-C(81)	66.0(7)	62 (1)
S(1)-Rh(1)-P(1)-C(11)	5.9(7)	54.6(7)
S(1)-Rh(1)-P(1)-C(21)	118.4(7)	65.9(7)
S(1)-Rh(1)-P(3)-C(51)	47.6(8)	61.3(7)

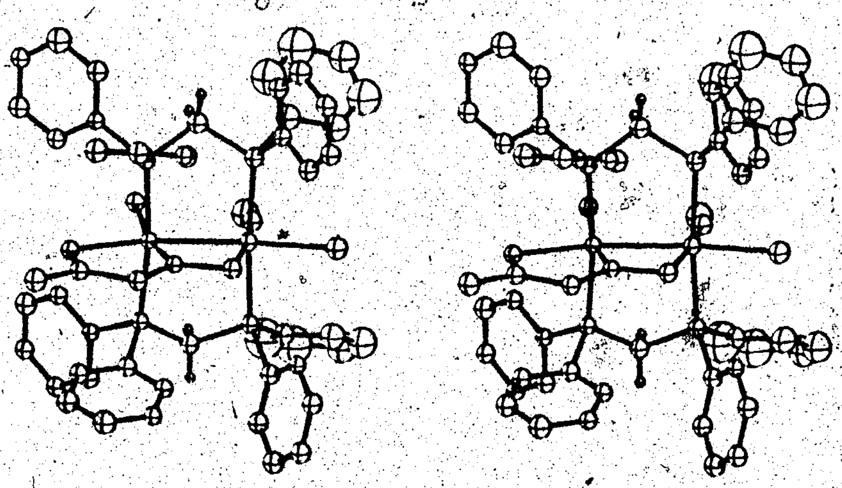
Table 40, continued

<u>Torsion Angles</u>

	Dimer A	Dimer B
S(1)-Rh(1)-P(3)-C(61)	69 (1)	57.7(7)
S(4)-Rh(2)-P(2)-C(31)	171.6(6)	39.6(8)
S(4)-Rh(2)-P(2)-C(41)	52.7(7)	158 (1)
S(4)-Rh(2)-P(4)-C(71)	152.8(7)	31.8(8)
S(4)-Rh(2)-P(4)-C(81)	34.9(7)	156 (1)
C(5)-Rh(1)-P(1)-C(11)	82 (1)	142.9(9)
C(5)-Rh(1)-P(1)-C(21)	153 (1)	22 (1)
C(5)-Rh(1)-P(3)-C(51)	136 (1)	149.4(9)
C(5)-Rh(1)-P(3)-C(61)	19 (1)	30 (1)
C(1)-Rh(2)-P(2)-C(31)	24 (1)	148 (1)
C(1)-Rh(2)-C(41)	143 (1)	30 (1)
C(1)-Rh(2)-P(4)-C(71)	[illegible]3 (1)	156 (1)
C(1)-Rh(2)-P(4)-C(81)	161 (1)	32 (1)



(A)



(B)

Figure 22. Stereoviews for Molecules A and B of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$.

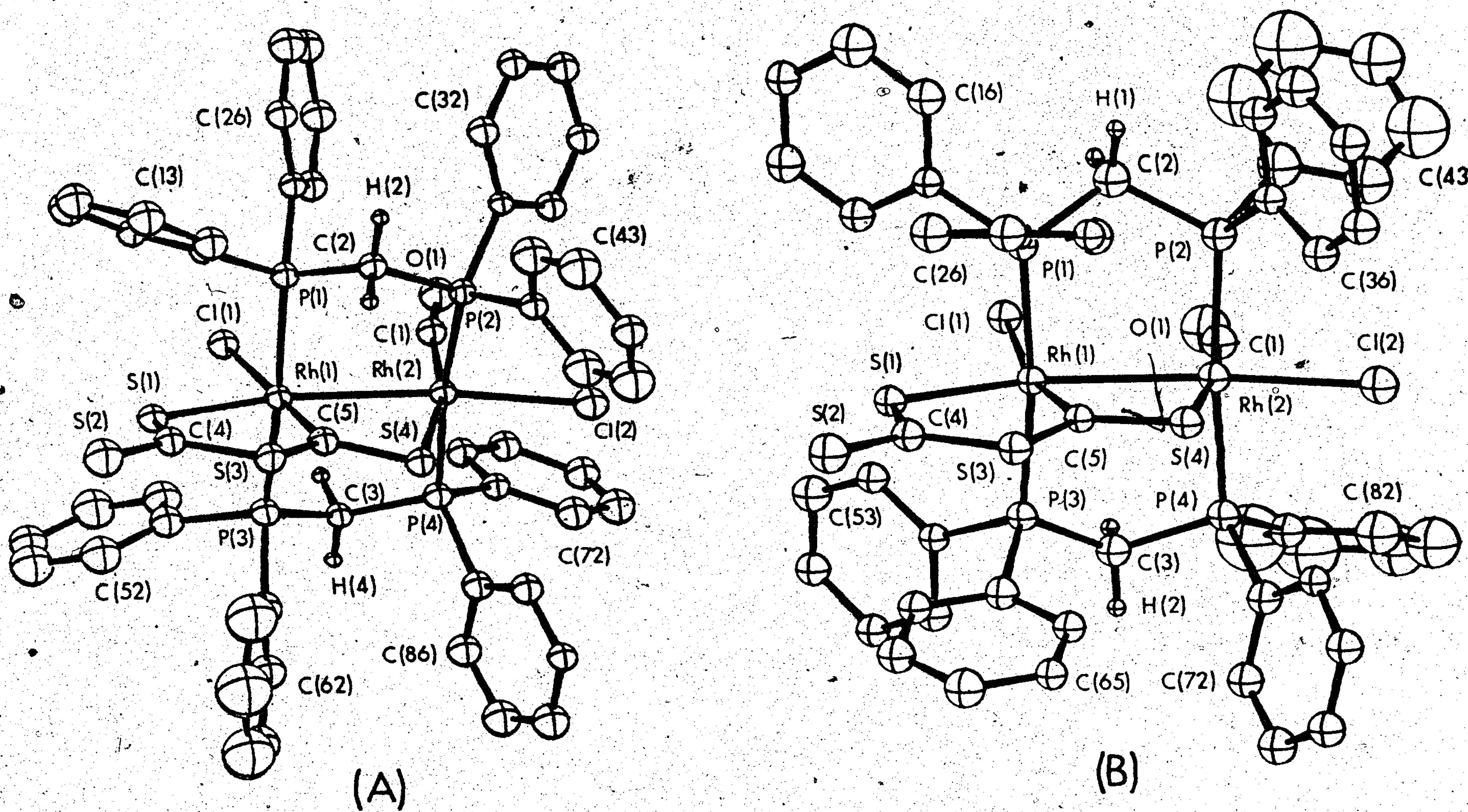


Figure 23. A Perspective View for Dimers A and B of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$.

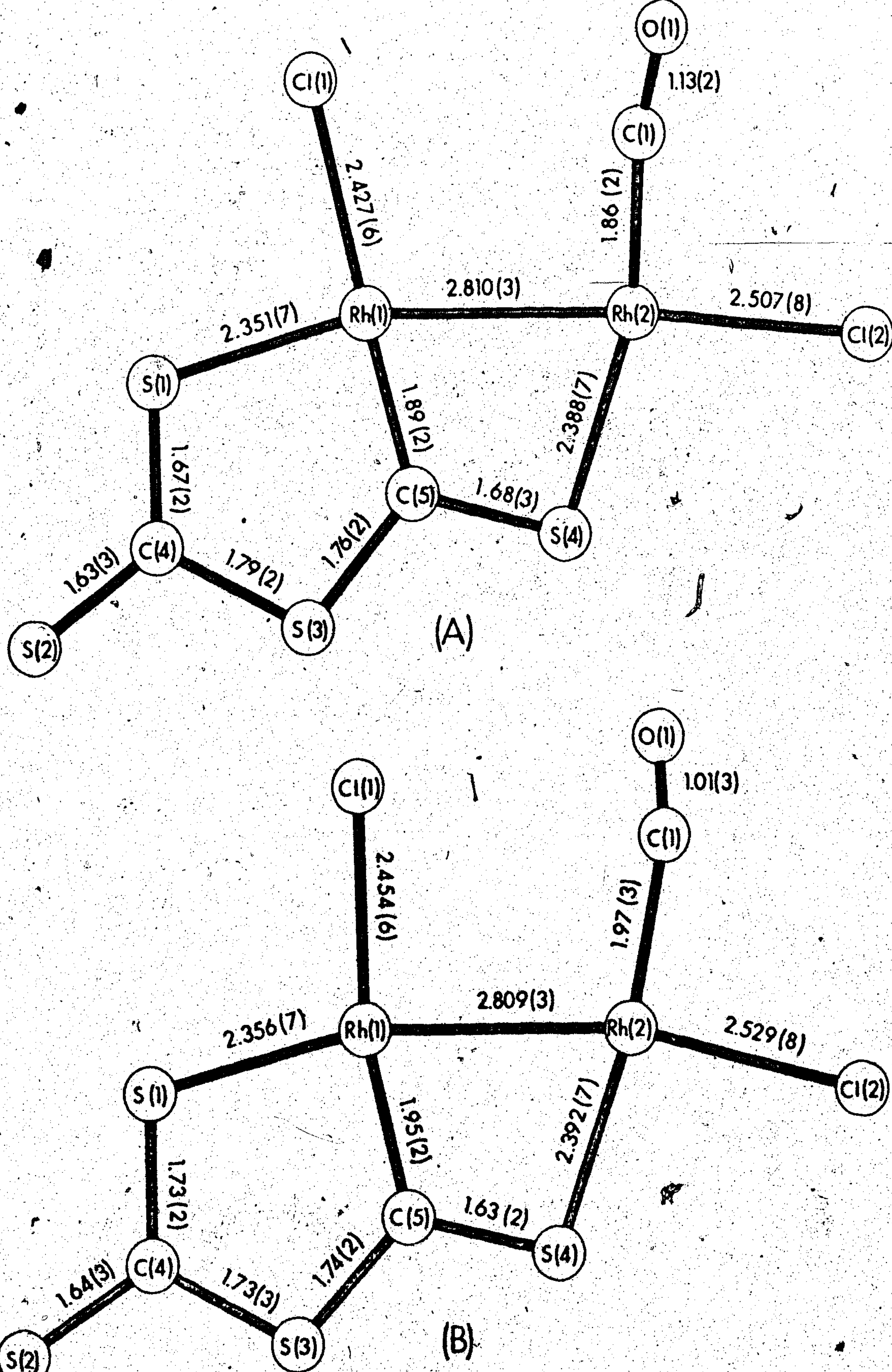


Figure 24. The Equatorial Planes of Dimers A and B of $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$.

DISCUSSION

Description of Structure

The complex, $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$ (3), crystallizes with two independent molecules per asymmetric unit. Both dimers have the same overall geometry, with the Rh centres bridged by two transoid DPM ligands, but differ slightly in the orientations of the ligands (vide infra). Within each dimer the Rh atoms display distorted octahedral coordinations. One rhodium atom of each dimer (Rh(A1),Rh(B1)) has two mutually trans P atoms in the axial sites with the equatorial positions occupied by a sulfur and a carbon atom of the C_2S_4 fragment, a chloro ligand and the other Rh atom. The second Rh atom (Rh(A2),Rh(B2)) also has mutually trans axial P atoms, with a sulfur atom of the C_2S_4 moiety, a chloro ligand, a carbonyl ligand and the other Rh atom occupying its equatorial sites.

The Rh-Rh distances of 2.810(3)Å and 2.809(3)Å, for dimers A and B, respectively, compare well with each other and are consistent with a normal Rh-Rh single bond, falling within the range previously reported for such distances (2.617(3) to 2.8415(7)Å).[129-133]

The Rh-C and C-O distances of the carbonyl ligands are not unusual, comparing acceptably with other determinations.[35,120,126] However, both carbonyl groups are significantly bent (Rh(A2)-C(A1)-O(A1) = 169(3)°, Rh(B2)-C(B1)-O(B1) = 165(3)°). A consideration of the nonbonded contacts indicates that in both dimers the carbonyl ligands bend in such a way as to minimize the contacts with the phenyl rings suggesting that the bending of these ligands is steric in origin.

The rhodium-chlorine distances (Rh(A1)-Cl(A1) = 2.427(6)Å; Rh(B1)-Cl(B1) = 2.454(6)Å) which are trans to C(A5) and C(B5), respectively, are quite long but compare well with other determinations, where the chloro ligand is trans to a σ-bound alkyl group or carbene ligand.[163-165] On the other hand, the Rh(2)-Cl(2) bond distances (2.507(8)Å and 2.529(8)Å for molecules A and B, respectively), which are opposite the rhodium atoms, Rh(A1) and Rh(B1), are significantly longer than those typically observed in these systems;[96,125,126] in fact they are even longer than those observed when a chloro ligand is opposite a ligand of high trans influence such as a carbene. These long rhodium-chloro distances probably arise as a result of steric crowding about the Rh(2) centre. Support for this comes from the short nonbonded phenyl hydrogen-chloro contacts observed for these two chloro ligands (Cl(A2)-H(A46) = 2.39 Å; Cl(B2)-H(B42) = 2.58 Å). Further, these interactions are such that they tend to force these chloro ligands away from the metal centres (see Figures 22 and 23).

The C_2S_4 fragment contains two intact CS_2 molecules (S(1)C(4)S(2) and S(3)C(5)S(4)) fused at C(4)-S(3). This fragment is then bound to one rhodium atom (Rh(1)) via S(1) and C(5) and to the other rhodium atom through S(4).

Within the resulting $Rh_2C_2S_4$ metallocycles the C-S distances (1.63(2)-1.79(2)Å) and angles (see Table 40) compare favourably with those reported for $[Rh(\eta^5-C_5H_5)(C_2S_4)(PMe_3)]$,[162] where an analogous C_2S_4 fragment was observed. These distances suggest delocalization over the carbon-sulfur framework and range from values comparable to the C-S double bond distance observed in ethylene thiourea (1.71 Å)[166] to single bond values (1.81 Å).[166] The Rh(1)-S(1) and Rh(2)-S(4) distances (average 2.354(7)Å and 2.390(7)Å, respectively), although significantly different compare favourably with other determinations.[163,164,167,168]

The C_2S_4 ligand can be considered as a carbene ligand, $C_2S_4^{2-}$, with each of the coordinated sulfur atoms functioning as a two electron donor to the rhodium atoms, leaving the carbene carbon atom as a two electron donor. Therefore the rhodium atoms are formally Rh(II). The unusually short Rh(1)-C(5) distances (1.89(2) and 1.95(2), for dimers A and B respectively) are comparable to the rhodium carbonyl distances indicating significant multiple bond character. These rhodium-carbene distances are comparable to other such distances and are especially close to those observed in $[RhCl(PPh_3)_2(PhCONCS)_2]$[163] and $[RhCl(PPh_3)_2(EtOCONCS)_3]$.[164] In these complexes five membered metallocycle rings again resulted as a consequence of condensation of sulfur-containing molecules on rhodium.

Within the DPM framework the parameters are, on the whole, not unusual and compare well with other determinations.[35,89,96,120,126] The P-C-C angles, for example, (range 125(2) to 115(2)°) do not deviate significantly from the expected value of 120° and compare favourably with other similar compounds. However it is significant that the methylene orientations in the two dimers are different. In dimer A a trans methylene arrangement is observed whereas these groups are cis in dimer B. Based on previous work it was anticipated that the methylene groups of the DPM ligands would fold in a cis manner towards the C_2S_4 fragment (i.e. towards the site of the bulkier ligand). In dimer B, where the expected cis methylene arrangement is observed the phenyl rings avoid unusually short contacts with the C_2S_4 fragment and as a result this fragment is quite planar. Here, phenyl rings 2 and 6 are parallel to the C_2S_4 moiety, instead of perpendicular to it as is typically observed for the endo phenyl groups of cis oriented methylene groups. This phenyl ring orientation minimizes interactions with the C_2S_4 moiety but tends to force the two other endo phenyl rings 3 and 7 away from their normal orientation (see Chapter VI, for example). However, in dimer A the trans methylene arrangement thrusts ring 6 close to the C_2S_4 fragment resulting in a significant puckering of this fragment (see Figure 22 and Table 38). Therefore, despite comparable bond angle and distance within the $Rh_2C_2S_4$ metallocycles, significant differences in their overall geometries are present as a result of these phenyl ring interactions.

The differences noted above between the phenyl ring orientations in dimers A and B also lead to differences in the equatorial chloro and carbonyl ligands (see Figure 24) with these ligands tending to stagger themselves with respect to the phenyl rings (see Torsion Angles, Table 40) to again minimize nonbonded contacts. This staggering of the phenyl rings with respect to the equatorial ligands is further assisted in dimer A by a skewing of the Rh-P framework. Without this skewing of the Rh-P framework the phenyl rings of P(A2) would be essentially eclipsed with the chloro and carbonyl ligands of Rh(A2). Whereas, in dimer B because of the *cis* methylene orientation and the subsequent phenyl group orientations no skewing is necessary to maintain normal nonbonded contacts. Therefore, most differences observed between the two dimers are a direct result of the differing methylene orientations.

<u>Reaction of *trans*-$[RhCl(CO)(DPM)]_2$ and $[Rh_2Cl_2(\mu\text{-}CO)\text{-}(DPM)_2]$ with CS_2</u>

The reaction of either *trans*-$[RhCl(CO)(DPM)]_2$ (1) or $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ with CS_2 results in the isolation of the final product, $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$ (3). Based on analogies with the previous studies involving SO_2[96] (Chapters IV and V) and acetylene[42] molecules we can postulate a scheme for the reaction of 1 with CS_2. Initial attack is probably terminal, since this is the only site open (see Chapter III). The resulting species $[Rh_2Cl(CO)\text{-}(CS_2)(\mu\text{-}Cl)(\mu\text{-}CO)(DPM)_2]$ (4), (see Figure 25) although not observed is analogous to that proposed for SO_2 (Chapter IV). This species we believe then rearranges to $[Rh_2(CO)_2(\mu\text{-}Cl)(\mu\text{-}CS_2)(DPM)_2][Cl]$ (5), which is a 1:1 electrolyte in acetone and dichloromethane, and has a very similar infrared spectrum ($\nu(CO) = 1990\ cm^{-1}$, the CS_2 region is obscured by bands due to the DPM ligands) and similar $^{31}P\{^1H\}$ NMR spectral parameters ($\delta = 14.3$ ppm; $|^1J_{Rh-P} + {}^xJ_{Rh-P}| = 98.2$ Hz)[101] to the well characterized SO_2 analogue[96] (Chapter IV). Chloride recoordination, loss of one carbonyl ligand and a facile rearrangement would then yield $[Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-}CS_2)(DPM)_2]$ (6), which although not observed is exactly analogous to an acetylene complex,[42] which has been prepared in our laboratory by the same route and structurally characterized. Electrophilic attack at S(3) of the bound CS_2 molecule (see Figure 24) by a second CS_2 molecule would then readily yield the final product 3.

Since the monocarbonyl species 2 is soluble, its reaction during the stepwise addition of CS_2 was carefully monitored by infrared, $^{31}P\{^1H\}$ and $^{13}C\{^{31}P\{^1H\}\}$ NMR spectroscopy. For the ^{13}C NMR experiment ^{13}CO enriched $[Rh_2Cl_2(\mu\text{-}^{13}CO)(DPM)_2]$ was used. Initially in the $^{31}P\{^1H\}$ NMR spectrum resonances assignable to unreacted 2 and two other symmetric species are observed. One resonance can be assigned to compound 5 which was previously characterized and the other is believed to be due to $[Rh_2Cl_2(\mu\text{-}CS_2)(DPM)_2]$ (7) ($\delta = 15.7$ ppm; $|^1J_{Rh-P} = {}^xJ_{Rh-P}| = 116.5$ Hz) (vide supra).

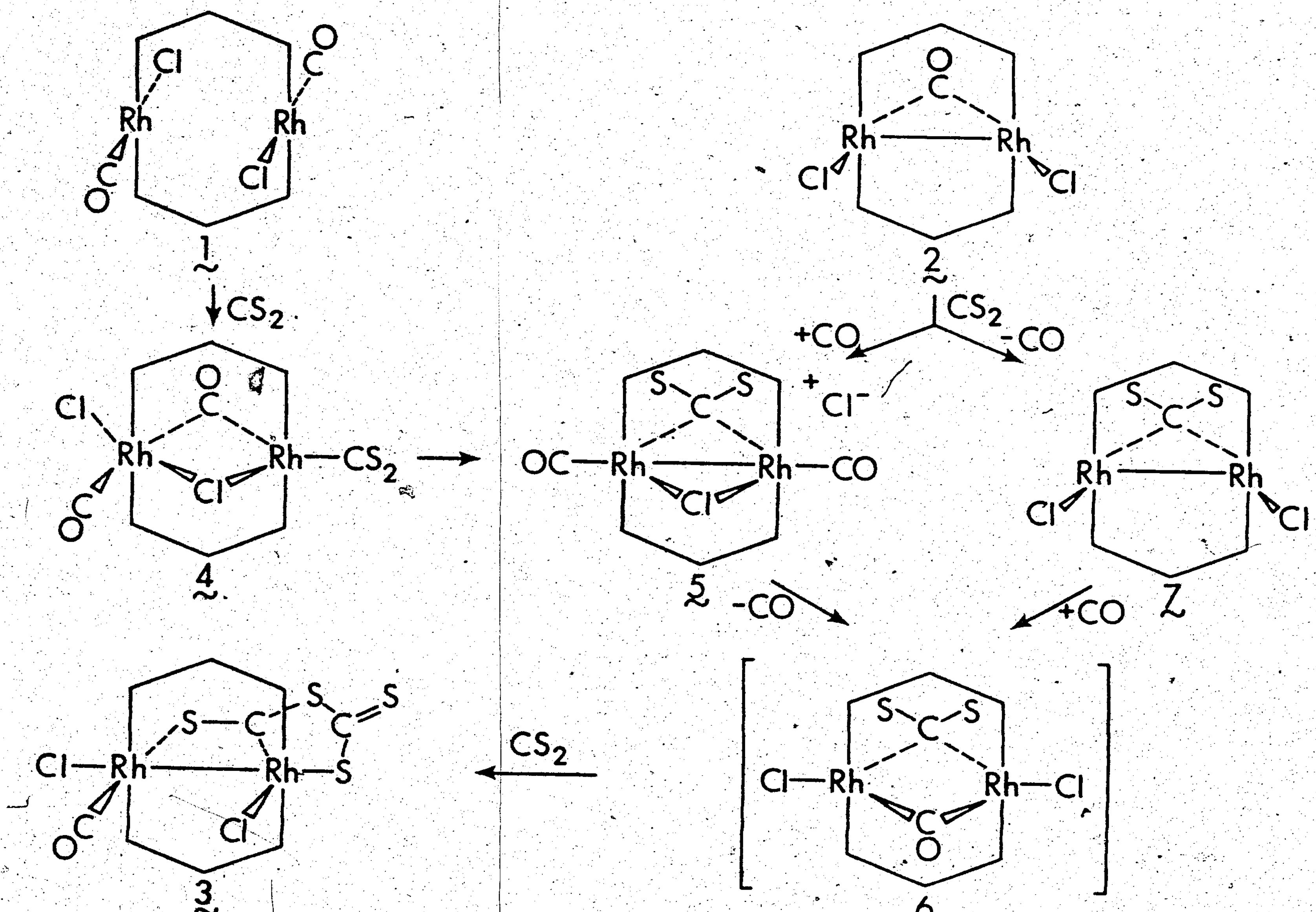


Figure 25. Proposed Scheme for the Reactions of trans-[RhCl(CO)(DPM)]$_2$ and [RhCl$_2$(μ-CO)(DPM)$_2$] with CS$_2$.

These observations are consistent with species 5 and 7, shown in Figure 25, resulting from CS_2 attack on 2 and CO transfer. Analogous species have been observed in the reaction of 2 with SO_2 (Chapter V). In these SO_2 studies we observed that these Rh dimers act as efficient CO scavengers. Therefore when 5 loses CO yielding 6, compound 7 picks up CO also giving 6, which subsequently yields the final product 3 by condensation of the second CS_2 molecule (vide supra). Complex 3 shows a complex multiplet ($\delta = 7.5$ ppm) pattern in the $^{31}P\{^1H\}$ NMR spectrum, arising from its AA'BB'XY spin system. No resonance assignable to 6 was observed.

Since in compounds 5 and 7 the four phosphorus atoms are equivalent at -50°C, it is suggested that the CS_2 ligand in species 5, 6 and 7 is coordinated solely through the carbon atom, as has been proposed for CO_2 in some of its compounds.[51] A C-S bound species would give rise to a more complex ^{31}P NMR owing to the resulting chemical inequivalence of the phosphorus atoms unless the CS_2 molecule were fluctional at this temperature. No evidence suggesting fluctionality of these species was observed.

The ^{13}C NMR spectra of the same reaction initially shows the resonance assignable to 2, as well as one additional species at $\delta = 186.5$ ppm (doublet, $|^1J_{Rh-C}| = 80.1$ Hz), characteristic of a terminal carbonyl ligand and consistent with species 5. The only other carbonyl resonance observed later in the experiment is assignable to species 3 at $\delta = 191.5$ ppm (doublet, $|J_{Rh-C}| = 69.1$ Hz). Similarly the infrared spectrum shows only bands assignable to 2, 3 and a band at 1990 cm^{-1} which is again consistent with species 5. Therefore, all the spectral parameters and the analogies to the SO_2[96] and acetylene[42] chemistry appear to support this scheme.

CONCLUSIONS

This study presents only the second structural characterization[162] of a rhodium-carbon disulfide complex and is the first such binuclear species. Based on its infrared spectrum, which is similar to other Rh-CS_2 complexes, which are believed to contain C,S-η^2 side-on bound CS_2, this work suggests that these compounds should probably be reformulated as C_2S_4 species. Certainly it is becoming apparent that rhodium has a marked tendency for activating and condensing sulfur containing molecules as has now been demonstrated by several structural determinations.[162-164] The similarities in the mode of CS_2 condensation to that of CO_2 in an iridium complex, $[IrCl(C_2O_4)(PPh_3)_3]$,[50] supports the argument that CS_2 is a useful model for studying CO_2 binding in metal complexes and suggests the possibility of analogous CO_2 binuclear chemistry.

CHAPTER VIII.

Summary and Conclusions

One reason for undertaking the present study was to obtain a better understanding of the coordination and activation of CO, CS_2, and SO_2 utilizing binuclear diphosphine and diarsine bridged complexes. Additionally, the effect of metal proximity on the chemistries of these small molecules was of interest, as well as the potential relevance of such studies to homogeneous catalysis. Although, not all these goals were met, this study was successful in extending our understanding of the chemistry of this class of binuclear complexes.

With regard to the effect of metal proximity on the chemistry of these dirhodium species, one obvious difference, compared to the analogous mononuclear species, is the possibility of bridging coordination modes for these small molecules. This possibility was realized in almost every study, and in fact, the small molecules of interest show a remarkable tendency to finally reside in the bridging site. It is believed that this site is favoured for these Lewis acids since here they are able to accept electron density from both low valent metals. Another related consequence of the metal proximity is the facile ligand rearrangements which occur in these dirhodium complexes. In almost all cases these rearrangements are preceded by halide dissociation and result in a symmetrical arrangement of the ligands with the better π-acceptor ligand coordinated in the bridging site. The few exceptions, where a symmetric species does not result, are believed to favour their observed geometries as a consequence of the high steric bulk of the ligands involved, as for example in $[Rh_2I(CO)(\mu\text{-}CO)(DPM)_2][I]$ (**1**) where the large iodo ligands are not both readily coordinated in the same compound.

The site of attack by small molecules in these species is not altogether straight forward. In *trans*-$[RhCl(CO)(DPM)]_2$ (**2**), there is probably only one site of attack at the open fifth coordination site on one of the metal centres opposite the second metal atom. However, in the "A-frame" type species attack can be either at the bridging site or at the terminal site, remote from the bridging site. In $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2]^+$ (**3**), we (Chapter IV) and others have shown,[35a,91] that SO_2 attacks the bridging site, whereas CO attacks terminally. In the distorted "A-frame" species $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$ (**4**) and $[Rh_2Br_2(\mu\text{-}CO)(DPM)_2]$ (**5**) we have observed that the bridging site is blocked in the solid state by four phenyl groups. Consistent with this, much of our chemistry indicates terminal attack. However, this is certainly not unambiguous and recent work with acetylenes seems to indicate that direct attack and insertion of the acetylenes into the Rh-Rh bond occurs.[169] The above SO_2 (**4**) and monocarbonyl (**5**) complexes are significantly different from the dicarbonyl "A-frame" species **3** however in that they have a metal-metal bond, which may serve as a site of attack for the Lewis acids. The reactivity of the metal-metal bond in these systems is shown by the facile reaction of $[Rh_2Cl_2(\mu\text{-}CO)(DPM)_2]$ (6) with CS_2, whereas the dicarbonyl "A-frame" species 3 shows no reaction. Corroborating this finding, other work in our group has shown that the metal-metal bond species 1, 5 and 6 react instantly with acetylenes, whereas species such as 3, in which no metal bond is present, do not react.[169]

Other aspects of the study regarding the activation of the small molecules and the relevance of these studies to catalysis are still in their infancy. In the carbonyl and sulfur dioxide complexes, these small molecules were certainly activated in the molecular orbital and spectroscopic sense (i.e. we noted a large drop in bond order due to a redistribution of electron density in these molecules). However these small molecules were not activated in a catalytic sense, at least not in the very limited context in which we observed them. The two species which had, spectroscopicaly, the largest activation of CO and SO_2 were 6 and 4, respectively. In the first species the carbonyl ligand behaved quite normally and attempts to oxidize the coordinated SO_2 ligand to SO_4^{2-} under mildly forcing conditions were unsuccessful. In contrast the CS_2 molecule is readily activated and undergoes a subsequent condensation reaction yielding the C_2S_4 moiety. In this area of activation further work is underway in our group. One notable success in this regard, concerns the reaction of 6 with acetylenes yielding complexes of the type $[Rh_2Cl_2(\mu\text{-}CO)(\mu\text{-acetylene})(DPM)_2]$ (8),[42] in which the acetylene molecule is activated, as seen by its structural parameters which resemble those of a cis dimetallated olefin molecule. Furthermore, as a result of the reaction of 6 with acetylenes a catalytic study using complex 6 was initiated[169] and preliminary results show that this complex catalyzes the cyclotrimerization of dimethylacetylenedicarboxylate, whereas with phenylacetylene, catalytic hydrogenation is observed.

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Appendix 1: Programs Used in Crystal Structure Solution, Refinement and Analysis.

Author	Program	Description
Northwestern University Version	AGNOST	Absorption correction program using Gaussian integration.
J.A. Ibers A.P. Gaughan	CELREF	Refines crystal alignment and cell parameters.
S.K. Dwight	DATABL	Outputs tables of position and thermal parameters for publication.
A. Zalkin	FORDAP	Fourier summation for Patterson or Fourier maps.
P.D. Cradwick	HATOM	Calculates positions of hydrogen atoms attached to atoms which are sp^3 or sp^2 hybridized.
M.J. Bennett B. Foxman	MMMR	Calculates starting parameters for rigid bodies and hindered rotors.
G. Germain P. Main M.M. Woolfson	MULTAN	General direct methods program.
P. Main C.T. Grainger	NORMAL	Calculates E's, does Wilson statistics. For input to MULTAN.
M.E. Pippy F.R. Ahmed	NRC-22	Calculates least-squares planes.

Appendix 1, continued

Author	Program	Description
W. Busing H.A. Levy	ORFFE	Calculates bond lengths, angles and associated standard deviations. Modified by W.L. Brooks and M. Elder for hindered rotors and rigid bodies.
C. Johnson	ORTEP	Thermal ellipsoids plotting program.
M.J. Bennett	PMMO	Transforms raw data to intensities, applying corrections.
A.P. Gaughan	PRCNTA	Molecular weight, % composition, density, absorption coefficient calculations from formula and cell.
M. Cowie	PUBE	Sorts data according to any desired sequence of h, k or l.
R.C. Elder	PUBTAB	Prints structure factor amplitude tables, modified by S.K. Dwight for use on the page printer.
S.K. Dwight	RIGIDH	Calculated rigid body parameters for hydrogen atoms.

Appendix 1, continued

Author	Program	Description
C.T. Prewitt	SFLS5	Structure factor calculation and least-squares refinement of parameters. Modified by B.M. Foxman and M.J. Bennett for rigid body routine, and by W.L. Hutcheon and M.J. Bennett for the hindered rotor.
S.L. Lawton	TRACERA	General Cell Reduction Program.

Appendix 2: Structure Factor Amplitudes for $[Rh_2(CO)_2(\mu\text{-}Cl)(DPM)_2][BF_4]$, *trans*-$[RhCl(CO)\text{-}(DPM)]_2$, $[Rh_2Cl_2(\mu\text{-}SO_2)(DPM)_2]$, $[Rh_2Br_2(\mu\text{-}CO)\text{-}(DPM)_2]$ and $[Rh_2Cl_2(CO)(C_2S_4)(DPM)_2]$.

Table 41. 10*(Fobs vs. Fcal) For [Rh2(CO)2(mu-Cl)(DPM)2][BF4].

K	L	FOBS	FCAL
H = -14**			
1	-3	91	78
1	0	107	107
1	1	207	185
1	2	403	408
1	3	375	352
1	4	135	147
2	-2	86	76
2	0	168	171
2	1	447	451
2	2	399	390
2	3	143	150
3	-2	133	133
3	-1	78	60
3	0	101	109
3	2	247	234
H = -13**			
1	-6	138	148
1	-4	128	131
1	-3	98	76
1	0	236	234
1	1	392	387
1	2	108	89
1	3	306	295
1	4	357	348
1	5	234	230
1	6	199	188
2	-4	330	334
2	-3	382	371
2	-2	221	225
2	-1	146	161
2	0	110	85
2	1	265	295
2	2	552	545
2	3	448	457
2	4	184	181
2	6	117	111
3	-5	296	303
3	-4	309	312
3	-3	213	221
3	0	249	254
3	1	385	367
3	2	280	286
3	5	86	85
4	-3	307	300
4	-2	375	345
4	-1	131	109
4	0	85	66
4	3	129	124
5	-4	354	323
5	-3	198	208
5	-2	201	202
5	0	137	103
6	-2	81	90
6	1	124	122
6	2	101	84
H = -12**			
1	-5	184	202
1	-4	588	591
1	-3	632	636
1	-2	323	316
1	0	215	233
1	1	601	598
1	2	638	640
1	3	228	237
1	5	270	260
1	6	224	261
1	7	133	135
2	-5	321	318
2	-4	371	360
2	-2	130	143
2	-1	140	160
2	0	345	333
2	1	315	293
2	3	309	317
2	4	342	340
2	5	159	174
3	-7	80	68
3	-6	201	199
3	-4	327	349
3	-3	574	593
3	-2	379	383
3	-1	100	87
3	0	93	105
3	1	111	96
3	2	219	227
3	3	134	126
3	4	129	138
3	6	79	73
3	7	158	175
4	-6	261	258
4	-5	419	418
4	-4	106	112
4	-3	172	194
4	3	90	88
4	4	96	114
4	6	129	117
5	-6	173	193
5	-5	93	83
5	-3	92	80
5	-2	108	86
5	1	122	105
5	2	369	385
5	3	342	353
5	6	174	157
6	-5	81	65
6	-3	101	90
6	1	416	398
6	2	483	483
6	3	216	212
6	5	196	201
7	-4	81	65
7	-2	110	106
7	0	199	200
7	1	250	242
7	2	101	133
7	3	330	331
7	4	160	166
8	-3	217	215
8	-2	109	112
8	1	359	347
8	2	463	452
H = -11**			
1	-8	322	327
1	-7	211	196
1	-6	103	118
1	-5	235	234
1	-3	620	630
1	-2	612	606
1	-1	368	381
1	2	372	369
1	3	468	485
1	4	211	215
1	5	155	141
1	6	106	130
1	8	266	255
1	9	331	347
2	-8	329	338
2	-7	152	136
2	-5	133	106
2	-4	676	677
2	-3	741	746
2	-2	248	253
2	-1	142	148
2	0	225	217
2	1	301	299
2	2	205	231
2	5	118	106
2	6	97	96
2	7	116	122
2	8	131	108
3	-8	170	149
3	-7	119	107
3	-6	211	208
3	-5	348	345
3	-4	98	83
3	-1	283	277
3	0	119	118
3	1	122	138
3	2	102	84
3	3	307	283
3	4	93	43
3	7	155	129
3	8	521	515
3	9	512	544
4	-8	215	225
4	-7	88	86
4	-6	226	203
4	-2	83	52
4	1	275	299
4	2	511	523
4	3	306	289
4	5	116	121
4	6	209	210
4	7	428	424
4	8	399	402
5	-6	126	122
5	-5	138	116
5	-4	131	136
5	-2	118	93
5	-1	88	82
5	0	120	127
5	1	253	262
5	3	330	296
5	4	309	303
5	5	228	247
5	6	158	163
5	8	217	192
6	-5	107	103
6	-3	261	251
6	-2	441	449
6	-1	184	169
6	0	108	104
6	1	304	306
6	2	660	670
6	3	634	593
6	4	241	230
6	5	93	55
6	6	177	178
6	7	277	297
7	-5	206	230
7	-4	380	348
7	-3	343	372
7	0	268	292
7	1	485	531
7	2	468	465
7	3	149	141
7	4	173	164
7	5	237	249
7	6	238	250
8	-6	96	123
8	-5	342	322
8	-4	285	293
8	-3	96	91
8	-2	248	256
8	-1	223	196
8	0	291	300
8	1	197	192
8	2	133	106
8	3	287	271
8	4	266	275
8	5	163	177
9	-4	329	344
9	-3	337	335
9	-2	106	78
9	-1	86	90
9	1	176	192
9	2	217	205

Table 41. Continued

K	L	FOBS	FCAL
H = -11**			
9	3	130	142
9	4	110	91
10	0	119	121
H = -10**			
1	-10	331	326
1	-9	531	541
1	-8	317	300
1	-6	219	241
1	-5	368	360
1	-4	634	631
1	-3	213	226
1	-2	264	276
1	-1	405	392
1	0	473	467
1	1	267	276
1	5	157	156
1	6	124	138
1	8	268	253
1	9	518	504
1	10	459	466
2	-10	209	203
2	-9	159	147
2	-8	448	435
2	-7	414	420
2	-6	221	246
2	-3	352	380
2	-2	406	407
2	-1	328	323
2	2	199	207
2	3	333	361
2	4	182	192
2	5	175	166
2	7	210	239
2	8	641	615
2	9	583	577
2	10	96	121
3	-9	463	466
3	-8	363	333
3	-7	157	141
3	-5	107	97
3	-4	156	170
3	-2	184	189
3	1	200	171
3	2	426	437
3	3	95	81
3	4	299	284
3	5	407	386
3	6	364	347
3	7	196	212
3	8	125	115
3	9	215	195
3	10	214	222
4	-9	120	128
4	-5	103	99
4	-3	160	180
4	-2	371	379
4	-1	94	89
4	2	383	406
4	3	632	638
4	4	471	469
4	5	149	156
4	8	446	388
4	9	326	346
5	-5	172	156
5	-4	453	479
5	-3	587	579
5	-2	243	259
5	-1	176	184
5	0	313	310
5	1	616	629
5	2	875	902
5	3	332	340
5	5	268	233
5	6	260	269
5	7	264	241
5	8	146	181
6	-8	98	82
6	-6	184	167
6	-5	508	496
6	-4	381	380
6	-2	242	256
6	-1	201	168
6	0	385	406
6	1	476	439
6	3	222	216
6	4	304	290
6	5	279	242
6	6	185	163
7	-8	128	115
7	-6	168	196
7	-3	548	580
7	-2	518	525
7	-1	187	195
7	1	363	366
7	2	430	438
7	3	307	342
7	4	152	159
7	6	89	101
8	-6	99	115
8	-5	364	375
8	-4	676	668
8	-3	466	464
8	0	346	347
8	1	408	388
8	2	174	192
8	3	86	71
8	4	98	89
8	5	106	111
8	7	226	208
9	-6	117	102
9	-5	198	200
9	-4	233	220
9	-3	101	106
9	-1	141	156
9	0	150	157
9	1	116	90
9	3	185	176
9	5	168	179
10	-5	90	76
10	-4	140	155
10	-3	117	94
10	0	82	93
10	1	243	233
10	2	303	263
10	3	100	110
11	0	151	154
11	1	258	262
H = -9**			
1	-10	95	118
1	-9	549	546
1	-8	738	711
1	-7	527	507
1	-5	293	290
1	-4	428	429
1	-3	541	541
1	-2	298	310
1	-1	121	110
1	0	145	146
1	1	218	197
1	2	540	540
1	3	505	500
1	4	103	73
1	5	113	76
1	6	167	116
1	7	547	545
1	8	654	677
1	9	216	186
1	10	311	300
1	11	331	335
2	-10	358	341
2	-9	408	396
2	-8	167	175
2	-6	322	324
2	-5	454	426
2	-4	127	95
2	-3	136	127
2	-2	171	169
2	1	232	260
2	2	195	211
2	3	413	438
2	4	613	629
2	5	341	360
2	6	498	527
2	8	445	440
2	9	481	500
2	10	393	390
2	11	168	176
3	-10	102	79
3	-8	143	119
3	-7	101	72
3	-6	136	143
3	-5	114	111
3	-3	485	456
3	-2	477	508
3	0	311	288
3	1	456	463
3	2	884	880
3	3	875	854
3	4	458	473
3	6	236	219
3	7	343	339
3	8	450	439
3	9	298	307
4	-10	99	130
4	-7	117	124
4	-5	157	156
4	-4	352	341
4	-3	627	622
4	-1	273	283
4	0	228	242
4	1	498	530
4	2	604	590
4	3	89	49
4	4	126	116
4	5	217	228
4	6	169	161
4	7	132	80
4	8	229	217
4	9	88	100
5	-8	268	234
5	-7	135	138
5	-6	100	83
5	-5	124	111
5	-4	148	142
5	-3	937	946
5	-2	622	613
5	-1	178	192
5	1	146	120
5	2	589	578
5	3	567	565
5	4	241	234
5	6	181	145
5	9	242	241
6	-9	426	421
6	-8	366	354
6	-7	164	162
6	-6	85	39
6	-5	218	212
6	-4	793	811
6	-3	797	825
6	-2	565	554
6	-1	116	90
6	0	269	279
6	1	534	514
6	2	556	546
6	3	276	257
6	4	91	5

K	L	FOBS	FCAL
H = -9**			
6	7	181	201
6	8	273	259
7	-9	377	377
7	-6	258	240
7	-5	528	509
7	-4	383	388
7	-3	228	225
7	-2	213	217
7	-1	298	293
7	0	256	283
7	7	85	93
7	8	280	277
8	-8	327	349
8	-7	267	265
8	-6	151	169
8	-4	225	228
8	-3	435	447
8	-2	362	362
8	-1	208	199
8	1	120	104
8	2	187	170
8	3	297	311
8	4	140	132
8	7	308	319
8	8	612	599
9	-8	255	267
9	-7	77	80
9	-6	109	93
9	-5	108	165
9	-4	214	218
9	-3	173	184
9	-2	160	141
9	1	88	50
9	2	113	104
9	3	88	101
9	4	159	149
9	6	112	156
9	7	276	287
10	-6	98	90
10	-3	204	214
10	1	157	162
10	2	302	321
10	3	526	513
10	4	235	211
11	-5	121	108
11	-4	354	353
11	-3	373	371
11	-1	115	111
11	0	281	248
11	1	473	484
11	2	479	485
11	3	178	178
11	4	104	114
12	-4	244	258
12	-2	228	246
12	-1	176	173
12	0	241	269
12	1	170	170
12	2	128	113
H = -8**			
1	-11	253	266
1	-10	294	286
1	-8	323	320
1	-7	412	438
1	-6	501	510
1	-5	146	146
1	-4	293	300
1	-3	110	106
1	-2	192	180
1	-1	448	448
1	0	176	156
1	1	501	462
1	2	268	280
1	3	1346	1365
1	4	1331	1318
1	5	535	530
1	7	246	254
1	8	993	951
1	9	759	763
1	10	310	310
1	12	120	121
2	-10	141	124
2	-9	393	365
2	-8	321	340
2	-7	171	196
2	-3	651	668
2	-2	445	474
2	1	438	443
2	2	762	785
2	3	832	872
2	5	348	333
2	6	98	86
2	7	419	408
2	8	338	352
3	-10	111	97
3	-6	126	75
3	-5	166	159
3	-4	145	85
3	-3	156	145
3	-2	768	796
3	-1	491	505
3	0	239	222
3	1	391	386
3	2	126	143
3	3	559	572
3	4	756	707
3	5	276	288
3	6	224	238
3	8	230	194
4	-10	102	106
4	-9	288	300
4	-8	510	517
4	-7	266	254
4	-5	309	318
4	-4	469	465
4	-3	1191	1268
4	-2	867	884
4	-1	119	133
4	1	348	374
4	2	390	424
4	3	491	474
4	4	349	338
4	5	245	229
4	6	103	82
4	9	183	185
4	10	85	75
4	11	110	113
5	-10	269	286
5	-9	559	574
5	-8	214	217
5	-6	357	360
5	-5	119	127
5	-4	655	653
5	-3	570	557
5	-2	129	130
5	-1	373	347
5	0	186	193
5	3	102	78
5	6	181	173
5	8	160	173
5	9	501	511
5	10	324	306
6	-10	278	290
6	-8	500	492
6	-7	573	595
6	-6	155	146
6	-5	342	342
6	-3	926	932
6	-2	655	645
6	-1	353	390
6	0	153	122
6	3	212	201
6	4	228	242
6	6	111	121
6	7	130	121
6	8	687	696
6	9	647	645
6	10	176	177
7	-10	282	291
7	-9	578	578
7	-8	528	533
7	-7	230	231
7	-5	96	101
7	-4	621	636
7	-3	317	302
7	-2	157	143
7	0	160	165
7	2	430	426
7	3	400	401
7	4	86	22
7	5	113	121
7	6	241	207
7	7	453	431
7	8	448	452
7	9	124	101
8	-9	303	309
8	-7	242	239
8	-6	213	217
8	-5	252	262
8	-4	195	194
8	-1	98	65
8	0	114	91
8	2	141	148
8	3	406	394
8	4	337	360
8	5	170	187
8	6	125	122
8	8	441	428
8	9	511	491
9	-9	168	158
9	-8	165	190
9	-7	203	190
9	-6	136	121
9	-5	98	47
9	-4	99	124
9	-2	278	276
9	-1	126	120
9	1	370	362
9	2	686	630
9	3	653	671
9	4	266	258
9	6	143	154
9	7	369	392
9	8	406	397
10	-4	350	334
10	-3	169	151
10	-2	248	241
10	-1	180	134
10	0	136	156
10	1	333	332
10	2	271	258
10	4	279	240
10	5	146	152
10	6	118	136
10	7	121	121
11	-4	120	89
11	-3	489	469
11	-2	312	334
11	1	126	122
11	2	368	374
11	3	427	424
11	4	117	104
12	-5	355	354
12	-4	616	605
12	-3	495	497
12	-1	160	142
12	0	232	255

Table 41. Continued

K	L	FOBS	FCAL
H = -8**			
12	1	323	299
12	2	308	284
12	3	87	75
12	4	79	58
13	-4	183	190
13	-3	129	125
13	-2	225	229
13	-1	209	194
13	0	131	111
H = -7**			
1	-11	236	229
1	-10	364	360
1	-9	250	251
1	-5	244	228
1	-4	278	283
1	-3	470	480
1	-2	357	312
1	-1	837	883
1	0	605	647
1	1	402	430
1	2	329	331
1	3	207	183
1	4	883	928
1	5	1227	1254
1	6	452	450
1	8	135	92
1	9	373	372
1	10	267	268
1	12	73	44
2	-12	169	163
2	-11	151	168
2	-10	191	177
2	-8	157	143
2	-7	378	382
2	-6	380	417
2	-3	766	755
2	-2	1531	1574
2	-1	882	934
2	0	281	311
2	1	332	330
2	2	582	590
2	3	1188	1214
2	4	911	941
2	5	324	298
2	8	115	78
2	12	67	57
3	-11	76	63
3	-9	293	270
3	-8	409	402
3	-7	371	385
3	-6	206	175
3	-5	232	232
3	-4	524	543
3	-3	1084	1107
3	-2	639	651
3	0	124	92
3	1	660	624
3	2	504	503
3	3	238	233
3	5	222	188
3	7	270	278
3	9	151	122
3	10	191	223
3	11	221	196
4	-12	99	106
4	-10	129	76
4	-8	237	215
4	-7	532	507
4	-6	361	376
4	-5	135	130
4	-4	119	122
4	-3	213	210
4	-2	659	675
4	-1	315	347
4	0	289	281
4	1	254	256
4	2	83	63
4	3	147	114
4	4	136	131
4	6	98	87
4	7	96	99
4	8	825	825
4	9	692	712
4	10	393	391
4	11	68	70
5	-9	582	565
5	-8	834	826
5	-7	696	650
5	-4	412	393
5	-3	610	631
5	-2	357	365
5	2	165	183
5	3	397	372
5	5	116	156
5	6	152	150
5	7	324	269
5	8	486	510
5	9	291	235
5	10	93	50
5	11	223	205
6	-11	153	152
6	-10	448	441
6	-9	539	531
6	-8	250	207
6	-7	278	274
6	-6	307	285
6	-5	342	350
6	-4	230	236
6	-2	134	105
6	1	102	126
6	2	306	320
6	3	112	101
6	4	668	672
6	5	504	509
6	6	255	231
6	7	108	152
6	8	275	249
6	9	608	613
6	10	560	575
7	-11	172	196
7	-10	209	211
7	-9	96	87
7	-8	407	409
7	-7	595	595
7	-6	224	211
7	-5	145	134
7	-4	218	205
7	-3	139	122
7	-2	183	196
7	-1	116	113
7	0	111	121
7	2	431	417
7	3	1129	1110
7	4	825	776
7	5	279	233
7	6	129	117
7	7	311	321
7	8	686	642
7	9	550	575
7	10	194	191
8	-10	234	243
8	-9	269	269
8	-8	247	260
8	-7	178	183
8	-6	96	59
8	-4	159	187
8	-3	183	187
8	-2	181	199
8	-1	347	350
8	0	129	108
8	1	285	291
8	2	694	703
8	3	461	489
8	5	248	220
8	6	296	299
8	7	434	431
8	8	158	147
9	-10	124	115
9	-8	96	83
9	-6	158	187
9	-5	178	166
9	-4	99	74
9	-3	384	391
9	-2	477	491
9	-1	301	276
9	0	137	121
9	2	193	213
9	3	517	520
9	4	365	361
9	5	213	206
9	6	145	111
9	8	179	183
10	-9	195	200
10	-8	230	249
10	-6	102	87
10	-5	264	235
10	-4	531	536
10	-3	401	428
10	-2	498	505
10	-1	177	174
10	0	141	157
10	1	319	322
10	2	514	537
10	3	319	318
10	4	118	90
10	7	98	72
11	-8	83	79
11	-7	138	103
11	-6	214	208
11	-5	282	329
11	-4	484	486
11	-3	174	146
11	-2	172	164
11	-1	326	317
11	0	230	227
11	3	133	99
11	5	89	15
11	7	79	74
12	-7	180	196
12	-6	131	133
12	-4	245	235
12	-3	480	494
12	-2	341	338
12	-1	164	173
12	0	92	76
12	1	143	121
12	2	164	149
12	4	160	136
13	-5	267	268
13	-4	346	346
13	-3	153	148
13	-2	109	109
13	-1	78	63
13	0	102	113
13	1	76	93
13	2	207	203
13	3	81	72
13	4	110	81
14	-3	78	61
14	-1	114	115
14	1	123	139
H = -6**			
1	-12	93	109
1	-8	181	174
1	-7	671	629
1	-6	363	355
1	-5	432	408

Table 41. Continued

K	L	FOBS	FCAL
H = -6**			
1	-4	187	166
1	-3	1122	1132
1	-2	1717	1753
1	-1	740	756
1	0	87	47
1	1	343	390
1	2	593	651
1	3	1180	1185
1	4	544	526
1	5	193	165
1	6	245	270
1	7	228	221
1	9	149	126
1	11	160	177
1	12	195	199
1	13	114	118
2	-12	101	69
2	-9	293	266
2	-8	109	100
2	-7	162	224
2	-6	531	523
2	-5	318	278
2	-4	225	246
2	-3	420	422
2	-2	266	295
2	-1	1138	1147
2	0	1000	998
2	1	280	336
2	2	192	180
2	3	86	76
2	4	265	272
2	5	177	165
2	9	335	344
2	10	561	582
2	11	358	371
2	12	147	149
3	-12	135	134
3	-9	344	333
3	-8	666	682
3	-7	1012	1020
3	-6	455	456
3	-5	233	216
3	-4	149	137
3	-3	549	572
3	-2	1060	1052
3	-1	548	563
3	0	105	92
3	1	209	210
3	3	286	272
3	4	91	25
3	6	138	107
3	7	133	94
3	8	717	676
3	9	559	525
3	10	116	109
3	12	137	124
4	-11	136	107
4	-10	339	330
4	-9	533	557
4	-8	777	765
4	-7	263	242
4	-6	409	440
4	-5	266	245
4	-4	236	248
4	-3	346	363
4	-2	210	226
4	-1	120	120
4	1	118	152
4	2	204	187
4	3	197	196
4	4	542	549
4	5	980	989
4	7	110	123
4	9	537	528
4	10	475	486
4	11	280	278
4	12	66	81
5	-12	282	295
5	-11	216	237
5	-10	260	259
5	-9	124	154
5	-8	208	205
5	-7	619	631
5	-6	218	240
5	-5	242	244
5	-3	137	130
5	-2	135	124
5	-1	148	135
5	0	79	78
5	3	814	823
5	4	1241	1251
5	5	496	483
5	6	116	101
5	7	142	138
5	8	893	871
5	9	745	767
5	10	391	379
5	11	81	51
6	-12	239	245
6	-11	78	44
6	-10	169	151
6	-9	291	269
6	-8	636	630
6	-7	223	229
6	-5	119	128
6	-3	348	351
6	-2	706	736
6	-1	186	174
6	1	452	441
6	2	732	774
6	3	974	963
6	4	328	350
6	5	385	319
6	6	287	327
6	7	558	508
6	8	315	303
6	10	185	204
6	11	128	148
7	-11	268	267
7	-10	354	346
7	-9	178	178
7	-7	121	90
7	-6	123	127
7	-5	144	125
7	-4	246	252
7	-3	249	246
7	-2	165	188
7	-1	403	377
7	0	494	527
7	1	264	272
7	2	339	334
7	3	350	356
7	4	941	934
7	5	639	598
7	6	301	361
7	8	266	283
7	9	282	253
7	10	187	189
8	-11	181	189
8	-8	125	136
8	-7	98	98
8	-5	177	186
8	-4	250	257
8	-3	1098	1119
8	-2	981	999
8	-1	412	434
8	0	151	198
8	2	700	717
8	3	1075	1049
8	4	698	692
8	5	92	82
8	7	195	176
8	8	279	282
9	-10	72	54
9	-9	243	225
9	-8	167	136
9	-5	131	88
9	-4	588	575
9	-3	466	484
9	-2	101	80
9	-1	146	150
9	1	293	290
9	2	567	571
9	3	199	153
9	4	93	53
9	5	193	173
9	6	113	62
9	9	122	86
10	-10	118	136
10	-8	198	206
10	-7	333	326
10	-6	108	80
10	-5	319	320
10	-4	133	138
10	-3	370	384
10	-2	495	506
10	-1	358	360
10	0	164	178
10	1	95	118
10	4	190	186
10	7	92	103
10	8	277	269
11	-9	517	514
11	-8	488	485
11	-7	179	139
11	-6	114	114
11	-5	182	162
11	-4	428	422
11	-3	386	375
11	-2	156	175
11	-1	143	145
11	2	242	229
11	3	179	183
11	5	116	120
11	6	241	258
11	7	323	304
12	-7	221	233
12	-6	239	255
12	-5	274	263
12	-4	94	125
12	-3	180	170
12	-1	89	94
12	0	89	51
12	1	243	228
12	2	110	113
12	3	244	227
12	4	350	332
12	5	180	187
13	-7	252	238
13	-6	100	108
13	-4	129	135
13	-2	106	111
13	-1	110	85
13	2	386	392
13	3	617	610
13	4	276	284
13	5	74	18
14	-4	92	106
14	-3	205	216
14	-2	75	75
14	1	255	230
14	2	460	425
14	3	118	109
H = -5**			
1	-12	150	146
1	-10	204	187
1	-9	278	270

K	L	FOBS	FCAL
**H =	-5****		
1	-8	138	123
1	-7	1063	1032
1	-6	1137	1176
1	-5	692	739
1	-4	324	335
1	-3	404	420
1	-2	1556	1591
1	-1	1285	1356
1	0	1348	1413
1	1	467	443
1	2	531	532
1	3	357	367
1	4	351	372
1	5	442	419
1	6	220	182
1	7	170	168
1	8	146	91
1	9	552	570
1	10	605	606
1	11	156	157
1	13	171	181
2	-13	226	238
2	-12	185	181
2	-11	159	162
2	-9	329	315
2	-8	976	941
2	-7	927	946
2	-6	434	472
2	-5	336	332
2	-4	656	687
2	-3	1432	1447
2	-2	902	945
2	-1	223	240
2	0	158	132
2	1	416	416
2	2	148	136
2	4	221	186
2	6	190	195
2	7	270	311
2	8	376	363
2	9	198	178
2	10	486	488
2	11	565	585
2	12	374	408
2	13	152	167
3	-12	194	179
3	-11	220	247
3	-10	435	403
3	-9	308	300
3	-8	317	301
3	-7	249	244
3	-6	338	297
3	-5	581	560
3	-4	174	191
3	-3	185	214
3	-2	221	188
3	-1	91	91
3	1	294	291
3	2	196	174
3	3	586	566
3	4	872	891
3	5	842	872
3	6	103	72
3	8	209	223
3	9	667	650
3	10	806	821
3	11	356	381
4	-13	467	468
4	-12	334	336
4	-11	105	114
4	-10	115	67
4	-9	124	147
4	-8	599	551
4	-7	333	304
4	-6	144	154
4	-5	268	278
4	-4	179	196
4	-3	158	166
4	-2	595	592
4	-1	143	144
4	0	480	458
4	1	231	250
4	2	287	313
4	3	968	970
4	4	1133	1196
4	5	222	274
4	6	127	95
4	7	168	167
4	8	496	503
4	9	624	619
4	11	149	175
4	12	66	78
5	-11	194	197
5	-10	301	277
5	-9	322	285
5	-8	289	265
5	-6	91	50
5	-3	292	285
5	-2	143	146
5	-1	615	636
5	0	701	712
5	1	577	573
5	2	726	714
5	3	272	228
5	4	759	753
5	5	1150	1153
5	6	282	278
5	9	421	415
5	10	447	445
5	11	141	138
6	-12	267	272
6	-11	314	321
6	-10	107	99
6	-8	129	121
6	-7	129	138
6	-5	280	324
6	-4	139	134
6	-3	233	251
6	-2	759	787
6	-1	1224	1267
6	0	579	563
6	1	165	142
6	2	360	339
6	3	1060	1128
6	4	1143	1112
6	5	508	504
6	6	176	217
6	7	389	423
6	8	267	244
6	9	165	135
7	-12	113	121
7	-10	135	116
7	-8	360	383
7	-7	332	315
7	-5	91	63
7	-4	433	412
7	-3	1056	1098
7	-2	1086	1132
7	-1	268	256
7	0	381	377
7	1	625	606
7	2	735	779
7	3	648	672
7	5	152	169
7	6	262	223
7	7	258	227
7	8	167	142
7	9	100	106
7	10	95	88
7	11	152	126
8	-11	109	108
8	-9	348	360
8	-8	122	103
8	-7	269	269
8	-6	261	261
8	-5	190	181
8	-4	417	425
8	-3	197	177
8	-2	352	378
8	-1	759	785
8	0	426	408
8	1	446	456
8	2	110	115
8	3	240	232
8	4	271	281
8	5	172	210
8	6	107	110
8	9	187	215
8	10	408	393
9	-11	114	134
9	-9	194	186
9	-8	565	536
9	-7	459	451
9	-6	110	135
9	-5	105	94
9	-4	102	39
9	-3	763	767
9	-2	683	683
9	-1	407	411
9	2	203	176
9	6	182	143
9	7	170	165
9	8	233	247
9	9	350	345
9	10	84	74
10	-10	322	317
10	-9	603	618
10	-8	356	368
10	-6	173	170
10	-5	291	302
10	-4	377	396
10	-3	364	350
10	-2	96	99
10	-1	249	256
10	1	96	107
10	3	95	45
10	4	136	138
10	5	155	145
10	6	160	138
10	7	103	116
10	9	308	319
11	-10	148	163
11	-8	265	242
11	-7	290	287
11	-6	165	138
11	-5	148	173
11	-4	199	200
11	-1	149	139
11	1	155	115
11	2	295	323
11	3	665	690
11	4	478	468
11	5	178	143
11	7	275	257
11	8	516	521
12	-9	381	394
12	-8	324	310
12	-5	117	143
12	-3	167	166
12	-2	168	174
12	-1	133	156
12	1	258	265
12	2	563	556
12	3	425	437
12	5	200	222
12	6	202	192
12	7	325	325

Table 41. Continued

K	L	FOBS	FCAL
H = -5**			
13	-8	84	77
13	-7	83	90
13	-6	81	91
13	-4	108	136
13	-3	290	275
13	-2	167	185
13	-1	385	369
13	0	171	197
13	1	166	159
13	3	379	395
13	4	470	471
13	5	278	289
13	6	102	102
14	-6	102	69
14	-4	147	183
14	-3	361	321
14	-2	394	398
14	-1	125	138
14	2	446	445
14	3	509	512
14	4	170	177
15	-4	386	374
15	-3	265	253
15	-1	82	70
15	0	132	144
15	1	217	220
H = -4**			
1	-13	329	345
1	-12	82	73
1	-11	92	75
1	-10	231	195
1	-9	441	477
1	-8	1009	969
1	-7	370	353
1	-6	922	925
1	-5	501	525
1	-4	490	459
1	-3	1090	1076
1	-2	76	85
1	-1	594	606
1	0	542	564
1	1	353	347
1	2	763	778
1	3	153	116
1	4	152	174
1	5	919	886
1	6	792	819
1	7	364	343
1	8	145	155
1	9	349	341
1	10	957	974
1	11	973	980
1	12	425	430
1	13	76	99
2	-13	300	304
2	-12	396	415
2	-11	416	411
2	-10	397	403
2	-9	169	175
2	-8	425	407
2	-7	1168	1181
2	-6	1046	1036
2	-5	150	158
2	-4	169	170
2	-2	107	89
2	-1	161	161
2	0	131	150
2	1	237	261
2	2	138	131
2	3	640	656
2	4	1533	1550
2	5	526	503
2	6	121	163
2	7	276	270
2	8	477	465
2	9	784	784
2	10	581	589
2	11	111	93
2	12	86	77
2	13	114	128
3	-13	598	606
3	-12	244	241
3	-10	149	176
3	-9	122	98
3	-8	808	781
3	-7	334	332
3	-6	109	104
3	-4	239	242
3	-3	301	315
3	-2	169	181
3	-1	241	228
3	0	863	861
3	1	440	450
3	2	425	416
3	3	943	942
3	4	375	346
3	5	1234	1253
3	6	484	421
3	7	316	341
3	8	208	196
3	9	125	83
3	10	307	297
3	11	409	423
3	12	157	164
3	13	85	94
4	-11	291	297
4	-10	174	157
4	-9	337	357
4	-8	165	189
4	-7	97	91
4	-4	282	242
4	-3	211	163
4	-2	469	504
4	-1	1080	1124
4	0	900	921
4	1	124	140
4	3	131	92
4	4	1446	1419
4	5	967	1033
4	6	341	309
4	7	147	154
4	8	108	38
4	9	366	378
4	10	334	312
4	11	177	166
4	13	116	86
5	-13	305	291
5	-12	263	247
5	-10	146	137
5	-8	217	220
5	-7	334	313
5	-6	268	253
5	-5	107	103
5	-4	401	392
5	-3	975	1018
5	-2	1441	1477
5	-1	1085	1119
5	0	815	765
5	1	391	386
5	2	404	436
5	3	1045	1085
5	4	585	535
5	5	124	27
5	6	401	425
5	7	274	282
5	10	96	79
5	12	164	154
6	-13	99	116
6	-9	186	193
6	-8	529	504
6	-7	161	176
6	-6	205	221
6	-5	537	504
6	-4	741	736
6	-3	754	780
6	-2	207	211
6	-1	832	850
6	0	876	916
6	1	611	645
6	2	632	629
6	4	795	800
6	5	388	386
6	9	199	155
6	10	224	248
6	11	272	275
6	12	74	81
7	-9	154	148
7	-8	332	299
7	-7	829	846
7	-6	469	457
7	-5	279	304
7	-3	635	675
7	-2	1197	1255
7	-1	1045	1099
7	0	219	227
7	1	105	42
7	2	363	378
7	3	631	619
7	4	220	196
7	5	98	91
7	6	165	175
7	7	411	366
7	8	323	273
7	9	630	614
7	10	383	403
7	11	96	77
8	-12	84	110
8	-10	98	101
8	-9	383	362
8	-8	894	891
8	-7	624	633
8	-4	665	645
8	-3	972	996
8	-2	965	988
8	-1	141	158
8	0	187	180
8	1	338	361
8	2	118	124
8	3	238	249
8	6	118	46
8	7	172	140
8	8	142	93
8	10	270	289
8	11	344	360
9	-10	250	217
9	-9	437	425
9	-7	370	376
9	-6	273	232
9	-5	153	101
9	-4	279	271
9	-3	149	165
9	-1	213	204
9	0	212	238
9	2	131	149
9	3	341	311
9	4	471	419
9	5	192	251
9	7	89	27
9	8	255	262
9	9	499	504
9	10	573	579
10	-9	285	276
10	-8	509	528
10	-7	321	330
10	-6	141	132
10	-4	151	138
10	-3	107	80

K	L	FOBS	FCAL
H = -4**			
10	-2	344	347
10	-1	116	111
10	2	551	562
10	3	806	797
10	4	290	282
10	5	265	228
10	6	241	245
10	7	221	231
10	8	355	345
10	9	281	278
11	-10	226	222
11	-9	318	298
11	-8	136	145
11	-5	189	180
11	-4	303	305
11	-3	188	191
11	-2	366	380
11	1	282	282
11	2	411	381
11	3	153	117
11	4	655	645
11	5	450	430
11	6	133	136
11	8	128	136
12	-8	152	151
12	-6	100	73
12	-4	170	203
12	-3	383	374
12	-2	672	733
12	-1	565	546
12	0	183	183
12	1	94	115
12	2	564	570
12	3	791	772
12	4	598	580
12	5	101	92
12	6	137	130
12	7	239	230
13	-8	209	192
13	-7	144	165
13	-6	95	43
13	-5	141	129
13	-4	402	412
13	-3	522	535
13	-2	374	386
13	0	216	233
13	1	308	304
13	2	500	509
13	3	248	229
13	4	90	79
13	5	252	239
13	6	142	163
14	-7	102	72
14	-5	175	175
14	-4	230	239
14	-2	210	231
14	-1	305	306
14	0	265	278
14	1	212	216
14	3	161	164
14	4	197	164
14	5	123	123
15	-4	181	167
15	-3	431	430
15	-2	339	336
15	-1	124	116
15	1	124	102
15	2	222	232
H = -3**			
1	-13	615	594
1	-12	826	872
1	-11	570	570
1	-10	126	106
1	-9	283	279
1	-8	1043	1081
1	-7	1346	1313
1	-6	1029	990
1	-5	125	111
1	-4	528	546
1	-3	798	856
1	-2	700	732
1	-1	753	756
1	0	260	282
1	1	608	601
1	2	576	586
1	3	987	1002
1	4	789	786
1	5	183	156
1	6	318	375
1	7	873	857
1	8	834	789
1	9	530	545
1	11	579	590
1	12	465	484
1	13	170	178
2	-13	506	518
2	-11	431	358
2	-9	363	400
2	-8	411	391
2	-7	305	335
2	-5	107	146
2	-4	325	333
2	-3	186	218
2	-2	206	214
2	-1	231	250
2	0	790	803
2	1	274	308
2	2	459	484
2	3	687	756
2	4	1124	1185
2	5	1261	1282
2	6	1026	1006
2	7	261	305
2	8	189	171
2	9	188	162
2	10	594	616
2	11	451	471
2	12	95	76
3	-13	281	280
3	-12	277	284
3	-11	222	205
3	-10	266	223
3	-8	144	187
3	-7	199	181
3	-6	282	313
3	-5	92	80
3	-4	365	389
3	-3	858	887
3	-2	1192	1228
3	-1	1174	1230
3	0	962	978
3	1	360	380
3	2	836	844
3	3	720	677
3	4	1459	1499
3	5	648	646
3	6	97	106
3	7	217	164
3	8	273	273
3	9	408	405
3	10	301	291
3	11	170	187
3	12	109	112
4	-13	340	346
4	-12	252	261
4	-11	93	37
4	-9	130	133
4	-8	245	217
4	-6	283	278
4	-5	143	172
4	-4	621	643
4	-3	742	745
4	-2	818	815
4	-1	121	133
4	0	757	802
4	1	813	793
4	2	340	274
4	3	341	327
4	4	138	127
4	5	243	202
4	6	565	592
4	10	268	261
4	11	363	374
4	12	103	111
4	13	66	50
5	-9	172	184
5	-8	149	117
5	-7	602	639
5	-6	704	738
5	-5	843	852
5	-4	328	341
5	-3	882	852
5	-2	784	832
5	-1	1422	1507
5	0	968	983
5	2	165	165
5	3	664	681
5	4	656	646
5	5	289	258
5	7	123	145
5	8	194	186
5	9	289	279
5	10	555	546
5	11	173	193
5	12	99	130
6	-13	168	146
6	-12	243	219
6	-9	206	188
6	-8	1054	1028
6	-7	1133	1106
6	-6	528	556
6	-4	531	541
6	-3	1011	1036
6	-2	1530	1589
6	-1	649	655
6	0	115	119
6	1	302	306
6	2	551	556
6	3	264	248
6	5	119	121
6	6	170	177
6	8	178	200
6	9	559	527
6	11	508	523
6	12	314	344
7	-13	248	253
7	-12	101	91
7	-11	83	65
7	-10	231	208
7	-9	617	588
7	-8	715	669
7	-6	411	453
7	-5	700	706
7	-4	496	494
7	-3	265	256
7	-2	185	178
7	-1	601	607
7	0	308	333
7	1	109	132
7	2	411	415
7	3	132	133
7	4	207	211
7	5	547	506
7	6	516	518
7	9	626	603
7	10	854	875
7	11	450	436

Table 41. Continued

K	L	FOBS	FCAL
H = -3**			
7	12	123	133
8	-12	269	261
8	-11	156	164
8	-10	92	128
8	-8	550	524
8	-7	977	981
8	-6	560	586
8	-5	305	351
8	-4	135	136
8	-3	221	235
8	-2	426	435
8	-1	88	78
8	1	100	98
8	2	171	163
8	3	285	303
8	4	654	682
8	5	424	361
8	6	92	89
8	7	168	136
8	8	618	601
8	9	693	691
8	10	404	397
9	-12	200	196
9	-10	139	114
9	-9	316	300
9	-8	569	562
9	-7	376	354
9	-6	110	139
9	-5	96	90
9	-4	204	207
9	-3	200	[illegible]
9	-2	224	[illegible]
9	-1	91	[illegible]
9	0	116	[illegible]
9	2	348	384
9	3	289	276
9	5	391	404
9	6	360	346
9	7	398	342
9	8	172	173
9	10	390	379
10	-11	121	124
10	-10	121	133
10	-9	158	133
10	-7	94	88
10	-3	119	141
10	-2	547	608
10	-1	610	607
10	2	132	111
10	3	602	626
10	4	838	834
10	5	412	373
10	6	222	204
10	7	127	116
10	8	225	242
10	9	354	331

K	L	FOBS	FCAL
10	10	145	147
11	-10	102	80
11	-7	277	262
11	-5	127	127
11	-3	743	728
11	-2	1058	1069
11	-1	228	239
11	0	219	212
11	1	282	276
11	2	590	606
11	3	642	665
11	4	130	149
11	5	208	206
11	6	234	248
11	8	139	140
12	-9	208	195
12	-8	156	183
12	-6	168	177
12	-5	295	310
12	-4	475	440
12	-3	238	225
12	-2	329	331
12	-1	663	673
12	0	254	281
12	1	177	161
12	2	156	154
12	3	319	303
12	4	397	394
12	5	196	208
12	7	91	125
13	-8	274	262
[illegible]	-7	305	293
[illegible]	-6	193	197
[illegible]	-5	186	178
[illegible]	-3	498	522
[illegible]	-2	604	628
[illegible]	-1	408	412
[illegible]	2	387	424
[illegible]	3	303	278
14	-8	430	439
14	-7	177	158
14	-5	213	216
14	-4	388	407
14	-3	535	523
14	-2	315	335
14	-1	188	206
14	1	296	288
14	2	186	191
14	4	76	60
15	-6	103	120
15	-5	136	130
15	-4	179	177
15	-2	252	257
15	1	95	100
15	3	135	142
15	4	222	208
16	0	77	91

K	L	FOBS	FCAL
H = -2**			
1	-14	226	234
1	-12	456	472
1	-11	981	957
1	-10	233	213
1	-9	94	37
1	-8	108	135
1	-7	530	552
1	-6	387	444
1	-4	902	939
1	-3	723	759
1	-2	82	38
1	-1	1736	1819
1	0	1587	1691
1	1	1315	1286
1	2	66	15
1	3	175	162
1	4	2653	2753
1	5	1989	1982
1	6	843	860
1	7	88	86
1	8	605	590
1	9	541	538
1	10	550	552
1	11	161	157
1	12	96	129
2	-14	203	187
2	-13	397	394
2	-12	652	679
2	-11	255	250
2	-10	349	328
2	-9	140	98
2	-8	215	197
2	-7	132	132
2	-6	120	83
2	-5	379	379
2	-3	466	480
2	-2	1215	1303
2	-1	1541	1592
2	0	206	140
2	1	2269	2383
2	2	171	184
2	3	1401	1390
2	4	830	851
2	6	594	575
2	7	479	472
2	8	238	221
2	12	152	145
3	-14	109	130
3	-13	273	271
3	-11	171	177
3	-7	109	111
3	-6	621	573
3	-5	264	273
3	-4	560	528
3	-3	454	486
3	-2	376	403

K	L	FOBS	FCAL
3	-1	624	691
3	0	1457	1519
3	1	318	353
3	2	81	44
3	3	374	409
3	4	233	205
3	5	927	954
3	6	704	697
3	7	348	319
3	8	244	240
3	9	158	135
3	10	258	250
3	11	369	337
4	-13	121	140
4	-12	189	191
4	-11	85	26
4	-9	128	159
4	-8	837	823
4	-7	1358	1314
4	-6	860	843
4	-5	395	310
4	-4	403	377
4	-3	876	879
4	-2	1290	1324
4	-1	1220	1294
4	0	620	626
4	1	68	24
4	3	666	694
4	4	148	146
4	5	530	489
4	6	384	364
4	7	298	320
4	8	275	261
4	9	201	194
4	10	235	263
4	11	300	305
4	12	334	354
4	13	124	142
5	-13	267	295
5	-12	133	151
5	-11	85	60
5	-10	166	164
5	-9	418	408
5	-8	865	856
5	-7	621	633
5	-6	512	494
5	-5	106	127
5	-4	441	458
5	-3	626	619
5	-2	361	360
5	-1	513	547
5	0	937	952
5	1	330	335
5	2	149	145
5	4	380	327
5	5	341	346
5	6	477	450

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FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**	10	10	145	147	**H =		-2****		3	-1	624	691
133	11	-10	102	80	1	-14	226	234	3	0	1457	1519
261	11	-7	277	262	1	-12	456	472	3	1	318	353
164	11	-5	127	127	1	-11	981	957	3	2	81	44
128	11	-3	743	728	1	-10	233	213	3	3	374	409
524	11	-2	1058	1069	1	-9	94	37	3	4	233	205
981	11	-1	228	239	1	-8	108	135	3	5	927	954
586	11	0	219	212	1	-7	530	552	3	6	704	697
351	11	1	282	276	1	-6	387	444	3	7	348	319
136	11	2	590	606	1	-4	902	939	3	8	244	240
235	11	3	642	665	1	-3	723	759	3	9	158	135
435	11	4	130	149	1	-2	82	38	3	10	258	250
78	11	5	208	206	1	-1	1736	1819	3	11	369	337
98	11	6	234	248	1	0	1587	1691	4	-13	121	140
163	11	8	139	140	1	1	1315	1286	4	-12	189	191
303	12	-9	208	195	1	2	66	15	4	-11	85	26
682	12	-8	156	183	1	3	175	162	4	-9	128	159
361	12	-6	168	177	1	4	2653	2753	4	-8	837	823
89	12	-5	295	310	1	5	1989	1982	4	-7	1358	1314
136	12	-4	475	440	1	6	843	860	4	-6	860	843
601	12	-3	238	225	1	7	88	86	4	-5	395	310
691	12	-2	329	331	1	8	605	590	4	-4	403	377
397	12	-1	663	673	1	9	541	538	4	-3	876	879
196	12	0	254	281	1	10	550	552	4	-2	1290	1324
114	12	1	177	161	1	11	161	157	4	-1	1220	1294
300	12	2	156	154	1	12	96	129	4	0	620	626
562	12	3	319	303	2	-14	203	187	4	1	68	24
354	12	4	397	394	2	-13	397	394	4	3	666	694
139	12	5	196	208	2	-12	652	679	4	4	148	146
90	12	7	91	125	2	-11	255	250	4	5	530	489
207	13	-8	274	262	2	-10	349	328	4	6	384	364
[illegible]	[illegible]	-7	305	293	2	-9	140	98	4	7	298	320
[illegible]	[illegible]	-6	193	197	2	-8	215	197	4	8	275	261
[illegible]	[illegible]	-5	186	178	2	-7	132	132	4	9	201	194
[illegible]	[illegible]	-3	498	522	2	-6	120	83	4	10	235	263
384	[illegible]	-2	604	628	2	-5	379	379	4	11	300	305
276	[illegible]	-1	408	412	2	-3	466	480	4	12	334	354
104	[illegible]	2	387	424	2	-2	1215	1303	4	13	124	142
346	[illegible]	3	303	278	2	-1	1541	1592	5	-13	267	295
342	[illegible]	-8	430	439	2	0	206	140	5	-12	133	151
73	[illegible]	-7	177	158	2	1	2269	2383	5	-11	85	60
179	[illegible]	-5	213	216	2	2	171	184	5	-10	166	164
24	[illegible]	-4	388	407	2	3	1401	1390	5	-9	418	408
33	[illegible]	-3	535	523	2	4	830	851	5	-8	865	856
33	14	-2	315	335	2	6	594	575	5	-7	621	633
88	14	-1	188	206	2	7	479	472	5	-6	512	494
41	14	1	296	288	2	8	238	221	5	-5	106	127
08	14	2	186	191	2	12	152	145	5	-4	441	458
07	14	4	76	60	3	-14	109	130	5	-3	626	619
11	15	-6	103	120	3	-13	273	271	5	-2	361	360
26	15	-5	136	130	3	-11	171	177	5	-1	513	547
34	15	-4	179	177	3	-7	109	111	5	0	937	952
73	15	-2	252	257	3	-6	621	573	5	1	330	335
04	15	1	95	100	3	-5	264	273	5	2	149	145
16	15	3	135	142	3	-4	560	528	5	4	380	327
42	15	4	222	208	3	-3	454	486	5	5	341	346
31	16	0	77	91	3	-2	376	403	5	6	477	450

Table 41. Continued

K	L	FOBS	FCAL
H = -2**			
5	7	234	243
5	10	618	603
5	11	823	821
5	12	291	324
6	-12	296	301
6	-11	335	353
6	-10	345	296
6	-9	251	209
6	-8	327	279
6	-7	1024	1034
6	-6	1005	1002
6	-5	820	835
6	-4	94	90
6	-3	235	209
6	-2	1019	1023
6	-1	664	662
6	0	241	237
6	1	269	277
6	2	248	261
6	3	322	366
6	4	1022	960
6	5	920	933
6	6	396	421
6	7	219	235
6	8	484	485
6	9	878	867
6	10	1025	1008
6	11	222	214
6	12	167	161
7	-13	631	651
7	-12	598	623
7	-11	259	260
7	-9	363	390
7	-8	1027	1023
7	-7	886	849
7	-6	353	321
7	-5	172	177
7	-4	292	291
7	-3	381	397
7	-2	119	109
7	-1	302	273
7	0	131	163
7	2	195	171
7	3	665	622
7	4	439	450
7	5	252	263
7	6	429	434
7	7	259	232
7	8	340	335
7	9	512	497
7	10	114	99
7	11	465	469
7	12	297	302
8	-11	208	217
8	-10	241	237
8	-9	410	407

K	L	FOBS	FCAL
8	-8	384	361
8	-6	258	262
8	-5	170	175
8	-4	208	220
8	-3	87	80
8	-2	132	144
8	-1	459	453
8	1	80	65
8	2	387	371
8	3	118	130
8	4	1130	1103
8	5	1057	1051
8	6	446	478
8	7	138	113
8	8	102	65
8	9	307	311
8	10	597	616
8	11	352	339
9	-12	328	332
9	-11	219	212
9	-10	138	126
9	-8	210	204
9	-6	149	132
9	-5	97	102
9	-3	305	331
9	-2	864	879
9	-1	694	703
9	2	339	321
9	3	943	961
9	4	894	877
9	5	134	132
9	7	338	309
9	8	336	394
9	9	192	204
9	10	163	142
10	-12	93	90
10	-9	108	132
10	-8	103	141
10	-7	172	160
10	-6	265	278
10	-3	496	530
10	-2	525	560
10	-1	317	327
10	0	528	526
10	1	336	338
10	2	250	257
10	3	361	353
10	4	246	233
10	5	414	416
10	6	270	268
10	9	177	153
10	10	94	82
11	-9	154	163
11	-8	111	74
11	-7	542	573
11	-6	582	554
11	-5	138	151

K	L	FOBS	FCAL
11	-3	244	267
11	-2	967	944
11	-1	942	982
11	0	107	108
11	1	255	251
11	2	319	311
11	3	455	452
11	4	349	337
11	5	145	132
11	7	147	101
11	8	83	83
11	9	169	199
12	-9	282	258
12	-8	689	687
12	-7	466	481
12	-6	131	119
12	-4	456	427
12	-3	774	796
12	-2	711	712
12	-1	91	83
12	0	195	194
12	1	312	305
12	2	298	302
12	3	111	88
12	4	101	101
12	7	144	124
12	8	159	162
13	-9	411	426
13	-8	298	284
13	-7	145	105
13	-6	257	255
13	-5	249	255
13	-4	328	314
13	-1	327	355
13	0	261	239
13	4	152	137
13	5	165	175
13	6	91	97
13	7	87	81
14	-8	376	375
14	-7	428	425
14	-6	196	174
14	-3	328	321
14	-2	391	407
14	1	99	103
14	2	95	74
14	3	203	191
14	4	256	273
14	5	129	134
15	-7	166	174
15	-5	115	100
15	-3	150	131
16	-2	110	107
16	-1	232	223
16	0	89	76
16	2	211	213
H = -1**			

K	L	FOBS	FCAL
1	-14	308	307
1	-13	347	369
1	-12	214	228
1	-9	246	245
1	-7	549	525
1	-6	200	219
1	-4	466	443
1	-3	92	78
1	-2	1047	1014
1	-1	410	412
1	0	1916	2161
1	1	1269	1293
1	2	501	403
1	3	805	809
1	4	485	479
1	5	1608	1557
1	6	860	877
1	7	373	395
1	10	83	18
1	11	156	125
1	12	262	240
2	-13	72	56
2	-12	168	156
2	-10	85	59
2	-8	301	333
2	-7	661	692
2	-6	1395	1406
2	-5	1199	1201
2	-4	154	157
2	-3	1214	1286
2	-2	2359	2546
2	-1	1841	1949
2	0	1612	1718
2	1	1368	1377
2	2	59	76
2	3	630	604
2	4	689	662
2	5	870	813
2	7	111	87
2	8	251	238
2	10	211	219
2	11	169	162
2	13	166	158
2	14	105	116
3	-13	80	85
3	-12	252	247
3	-10	136	116
3	-8	648	642
3	-7	826	863
3	-6	831	811
3	-5	307	342
3	-4	562	523
3	-3	197	225
3	-2	636	677
3	-1	856	845
3	0	582	571
3	1	193	171

Table 41. Continued

K	L	FOBS	FCAL
H = -1**			
3	2	1166	1214
3	3	409	408
3	4	458	452
3	5	529	493
3	6	229	234
3	7	210	206
3	11	637	650
3	12	521	513
4	-14	72	58
4	-13	111	93
4	-12	267	309
4	-11	624	631
4	-10	112	68
4	-8	129	82
4	-7	683	730
4	-6	1077	1089
4	-5	718	768
4	-4	418	402
4	-3	149	159
4	-2	459	454
4	-1	775	798
4	0	809	820
4	2	752	743
4	3	452	456
4	4	473	452
4	5	726	747
4	6	798	754
4	8	431	412
4	9	340	348
4	10	838	842
4	11	711	718
4	12	82	94
4	13	96	80
5	-13	487	491
5	-12	797	810
5	-11	286	325
5	-10	384	415
5	-9	149	161
5	-8	933	905
5	-7	1478	1461
5	-6	1088	1106
5	-5	340	329
5	-4	231	262
5	-3	492	529
5	-2	729	728
5	-1	304	306
5	1	332	350
5	2	316	324
5	3	548	569
5	4	694	701
5	5	515	513
5	6	320	302
5	7	574	560
5	8	344	334
5	9	445	448
5	10	213	196
5	11	339	339
5	12	336	337
5	13	144	135
6	-13	607	606
6	-12	269	217
6	-11	256	221
6	-10	378	363
6	-9	477	450
6	-8	616	593
6	-7	103	77
6	-6	464	447
6	-5	643	616
6	-4	227	236
6	-2	385	407
6	0	461	467
6	1	1100	1097
6	2	177	167
6	3	266	193
6	4	380	381
6	5	1363	1364
6	6	1346	1297
6	7	448	449
6	9	238	236
6	10	687	681
6	11	522	533
6	12	177	185
7	-13	159	167
7	-12	522	520
7	-11	388	416
7	-10	238	225
7	-9	188	191
7	-8	147	126
7	-7	433	390
7	-6	540	521
7	-5	143	138
7	-4	307	319
7	-2	272	268
7	-1	863	906
7	0	879	876
7	1	497	506
7	3	718	716
7	4	1636	1634
7	5	1476	1468
7	6	458	430
7	7	375	376
7	8	312	284
7	9	653	638
7	10	466	501
7	11	85	78
7	12	135	129
8	-13	493	508
8	-12	430	439
8	-11	179	145
8	-9	285	280
8	-8	144	153
8	-6	122	132
8	-5	111	47
8	-3	171	54
8	-2	626	639
8	-1	585	603
8	0	336	338
8	1	337	338
8	2	315	330
8	3	980	1006
8	4	327	340
8	6	370	358
8	7	314	331
8	8	440	408
8	10	126	106
8	11	68	57
9	-9	124	81
9	-8	131	104
9	-7	190	140
9	-6	417	403
9	-5	186	213
9	-3	164	128
9	-2	323	311
9	-1	861	885
9	0	766	775
9	1	238	216
9	2	210	165
9	3	224	189
9	4	676	653
9	5	668	667
9	6	117	128
9	7	137	89
9	10	145	163
10	-9	103	85
10	-8	295	290
10	-7	766	741
10	-6	571	566
10	-5	151	126
10	-4	330	317
10	-3	494	511
10	-2	1098	1136
10	-1	751	789
10	0	150	128
10	1	162	195
10	2	273	302
10	3	460	471
10	4	386	360
10	5	131	146
10	6	139	137
10	9	93	113
11	-11	113	109
11	-10	193	233
11	-9	401	366
11	-8	426	403
11	-7	123	120
11	-6	256	287
11	-5	388	353
11	-4	164	158
11	-3	253	236
11	-1	574	587
11	0	172	85
11	1	99	111
11	2	108	121
11	3	190	205
11	5	282	254
11	6	372	370
11	7	260	255
11	9	325	313
12	-10	89	110
12	-9	145	131
12	-8	401	391
12	-7	763	749
12	-6	531	539
12	-5	192	196
12	-4	234	242
12	-3	299	305
12	-2	668	691
12	-1	300	290
12	0	111	105
12	2	108	91
12	4	413	417
12	5	238	221
12	7	125	107
12	8	298	312
13	-10	80	63
13	-9	383	391
13	-8	615	600
13	-7	450	424
13	-4	145	103
13	-3	332	360
13	-1	88	73
13	2	251	263
13	3	466	437
13	4	171	165
13	5	231	200
13	6	281	284
13	7	151	160
14	-8	112	116
14	-7	100	133
14	-6	326	345
14	-5	202	200
14	-3	123	84
14	-1	116	127
14	0	163	165
14	2	131	118
14	3	145	149
14	4	515	505
14	5	453	451
14	6	145	136
15	-7	187	228
15	-6	140	144
15	-3	131	99
15	-2	211	249
15	-1	131	140
15	0	111	111
15	2	261	273
15	3	531	531

Table 41. Continued

K	L	FOBS	FCAL
H = -1**			
15	-4	394	375
16	-4	213	229
16	-3	196	179
16	-1	223	223
16	0	179	190
16	1	131	130
16	2	110	100
H = 0**			
0	1	1810	1813
0	2	125	95
0	3	373	368
0	4	1266	1228
0	5	1563	1545
0	6	957	984
0	7	211	196
0	8	488	540
0	10	148	163
0	11	281	316
0	12	262	260
0	13	148	134
0	14	148	148
1	-14	82	54
1	-13	141	147
1	-12	190	168
1	-10	244	259
1	-9	143	171
1	-7	874	873
1	-6	1160	1175
1	-5	535	548
1	-4	226	224
1	-3	114	83
1	-2	268	238
1	-1	1631	1800
1	0	723	733
1	1	768	688
1	2	241	211
1	3	226	207
1	4	547	535
1	6	223	193
1	8	126	71
1	9	284	261
1	10	170	143
1	11	159	180
1	12	475	481
1	13	354	368
1	14	246	242
2	-11	189	172
2	-10	197	206
2	-9	151	181
2	-8	268	273
2	-6	486	539
2	-5	1298	1354
2	-4	1389	1406
2	-3	246	248
2	-2	1224	1203
2	-1	626	614
2	0	1294	1397
2	1	1160	1121
2	2	1079	1027
2	4	106	107
2	5	548	513
2	6	420	436
2	7	100	33
2	10	482	516
2	11	829	853
2	12	600	594
2	13	121	134
2	14	63	73
3	-13	95	81
3	-12	460	457
3	-11	789	790
3	-10	315	321
3	-8	115	49
3	-7	931	857
3	-6	1214	1199
3	-5	1076	1067
3	-4	288	322
3	-1	1391	1419
3	0	776	814
3	1	1067	1027
3	2	750	727
3	3	495	469
3	4	116	111
3	5	542	480
3	6	273	282
3	8	293	283
3	9	231	183
3	10	382	365
3	11	170	179
3	12	215	220
3	13	165	178
4	-14	126	135
4	-13	421	394
4	-12	591	585
4	-11	85	49
4	-10	132	207
4	-9	144	132
4	-8	661	648
4	-7	524	525
4	-6	265	237
4	-5	554	540
4	-4	232	234
4	-3	521	522
4	-1	441	457
4	0	200	229
4	1	836	831
4	2	509	529
4	3	359	349
4	5	968	916
4	6	1045	1044
4	7	786	779
4	8	117	128
4	10	382	360
4	11	707	712
4	12	430	458
4	13	82	64
5	-14	187	199
5	-13	218	238
5	-12	304	320
5	-11	894	896
5	-10	393	379
5	-9	149	197
5	-7	492	493
5	-6	644	617
5	-5	180	172
5	-4	122	122
5	-3	187	198
5	-2	72	55
5	-1	824	838
5	0	1046	1082
5	1	894	964
5	2	201	178
5	3	322	358
5	4	1212	1183
5	5	1596	1589
5	6	1181	1118
5	8	221	217
5	9	442	426
5	10	658	656
5	11	480	476
5	13	99	108
6	-13	548	533
6	-12	757	745
6	-11	239	244
6	-9	106	124
6	-8	353	355
6	-7	388	390
6	-5	166	161
6	-4	195	180
6	-3	254	249
6	-2	1413	1430
6	-1	344	370
6	0	83	83
6	1	311	305
6	2	613	646
6	3	889	920
6	4	976	985
6	5	433	451
6	6	512	500
6	7	568	533
6	8	115	73
6	9	111	147
6	11	115	113
7	-13	404	414
7	-12	140	140
7	-11	207	193
7	-10	338	326
7	-9	225	225
7	-7	216	234
7	-5	211	209
7	-3	553	566
7	-2	442	426
7	-1	934	937
7	0	1372	1421
7	1	1053	1095
7	2	422	412
7	3	85	91
7	4	626	669
7	5	976	955
7	6	870	830
7	7	186	208
7	8	166	172
7	9	178	200
7	10	124	129
7	12	95	107
8	-12	238	242
8	-11	108	98
8	-10	93	121
8	-7	447	426
8	-6	413	443
8	-5	363	342
8	-4	385	364
8	-3	329	302
8	-2	1004	1048
8	-1	1692	1767
8	0	1015	1059
8	2	108	111
8	3	596	603
8	4	721	746
8	5	720	746
8	6	136	98
8	7	197	155
8	10	231	186
9	-10	207	228
9	-9	160	121
9	-8	266	282
9	-7	703	673
9	-6	136	119
9	-5	331	336
9	-4	244	265
9	-3	475	457
9	-2	615	649
9	-1	341	357
9	0	463	475
9	1	288	269
9	2	323	292
9	3	219	231
9	9	182	157
9	10	147	103
9	11	387	375
10	-12	114	105
10	-11	185	188
10	-10	179	162
10	-9	140	125
10	-7	375	349
10	-6	742	732
10	-5	529	523

K	L	FOBS	FCAL
H = 0**			
10	-2	552	558
10	-1	600	603
10	0	503	523
10	1	353	364
10	3	161	135
10	4	320	310
10	5	250	232
10	6	136	130
10	9	436	450
10	10	612	618
11	-11	127	140
11	-9	213	244
11	-8	706	673
11	-7	745	778
11	-6	411	404
11	-5	93	58
11	-4	353	386
11	-3	257	275
11	-2	341	323
11	1	173	196
11	2	206	218
11	3	542	542
11	4	392	398
11	6	327	324
11	7	181	173
11	8	324	327
11	9	227	236
12	-11	171	168
12	-10	240	218
12	-9	296	297
12	-8	335	302
12	-6	340	293
12	-5	241	285
12	-3	137	150
12	-2	252	260
12	-1	88	88
12	0	172	155
12	1	128	116
12	2	108	91
12	4	331	336
12	5	689	684
12	6	427	432
12	7	130	128
12	8	85	113
13	-10	148	136
13	-8	225	225
13	-7	253	216
13	-6	284	253
13	-2	334	371
13	-1	564	557
13	0	154	170
13	2	179	170
13	3	497	492
13	4	825	834
13	5	458	436
13	7	108	96
14	-9	136	167
14	-8	98	72
14	-4	121	113
14	-3	127	105
14	-2	411	426
14	2	229	229
14	3	412	425
14	4	148	134
14	5	243	255
14	6	242	236
15	-7	92	68
15	-4	123	124
15	-2	382	388
15	-1	431	425
15	0	404	435
15	1	89	72
15	3	241	222
15	4	466	467
15	5	312	323
16	-4	105	84
16	-3	386	389
16	-2	420	428
16	-1	189	199
16	2	149	133
H = 1**			
0	-14	101	138
0	-13	120	103
0	-12	176	173
0	-11	236	268
0	-9	266	263
0	-8	298	288
0	-7	647	673
0	-6	377	395
0	-5	1480	1443
0	-4	2085	2078
0	-3	2739	2826
0	-2	504	484
0	-1	481	423
0	0	1077	1104
0	1	1257	1348
0	2	869	849
0	3	382	334
0	4	152	135
0	5	482	494
0	6	197	188
0	7	401	370
0	8	294	324
0	9	199	198
0	10	205	219
0	11	787	745
0	12	830	831
0	13	414	432
0	14	118	106
1	-13	89	93
1	-11	484	482
1	-10	582	601
1	-9	422	400
1	-8	116	115
1	-7	318	341
1	-6	1493	1486
1	-5	2034	2001
1	-4	1390	1317
1	-3	90	112
1	-2	155	117
1	-1	1073	990
1	0	1937	2006
1	1	621	583
1	2	148	122
1	4	439	415
1	5	545	505
1	6	783	751
1	8	158	153
1	9	142	159
1	10	581	573
1	11	642	638
1	12	97	73
1	13	158	176
1	14	249	263
2	-13	190	192
2	-12	520	562
2	-11	500	473
2	-10	203	191
2	-9	138	130
2	-8	562	619
2	-7	1086	1116
2	-6	1138	1150
2	-5	102	59
2	-4	398	412
2	-3	482	435
2	-2	1198	1126
2	-1	408	417
2	0	191	174
2	1	503	467
2	2	626	534
2	3	561	525
2	4	132	106
2	5	188	198
2	6	109	133
2	7	981	993
2	8	308	308
2	9	391	376
2	10	115	127
2	11	477	473
2	12	655	675
2	13	425	416
3	-14	99	108
3	-13	300	300
3	-11	376	348
3	-10	353	336
3	-9	222	209
3	-8	345	344
3	-7	232	239
3	-6	291	308
3	-5	546	530
3	-4	546	514
3	-3	661	622
3	-2	1080	1043
3	-1	481	470
3	0	1418	1456
3	1	531	531
3	2	1082	1006
3	3	217	172
3	4	413	388
3	5	1170	1130
3	6	1267	1247
3	7	292	303
3	8	129	92
3	10	526	527
3	11	739	732
3	12	378	379
3	13	143	140
4	-13	181	186
4	-12	624	645
4	-11	864	871
4	-10	323	303
4	-9	103	107
4	-8	303	305
4	-7	504	525
4	-6	845	816
4	-5	204	191
4	-4	365	330
4	-3	175	171
4	-2	642	659
4	-1	747	783
4	0	244	232
4	1	262	257
4	2	315	330
4	3	796	773
4	4	623	630
4	5	754	728
4	6	92	66
4	7	411	426
4	8	126	145
4	9	247	198
4	10	259	249
4	12	124	147
5	-14	199	214
5	-13	467	452
5	-12	386	411
5	-11	180	177
5	-10	133	148
5	-9	133	118
5	-5	107	76
5	-4	361	352
5	-3	602	587
5	-2	823	867
5	-1	242	246
5	0	641	673
5	1	1691	1713
5	2	1215	1198
5	3	449	426

Table 41. Continued

K	L	FOBS	FCAL
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5	4	410	342
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5	9	171	152
5	10	238	245
5	11	160	165
5	12	149	131
5	13	80	98
6	-12	194	211
6	-11	319	315
6	-10	266	288
6	-8	161	212
6	-6	753	701
6	-5	912	873
6	-4	316	264
6	-3	263	214
6	-2	570	581
6	-1	1891	2005
6	0	2088	2225
6	1	981	997
6	2	162	171
6	3	855	822
6	4	1043	990
6	5	1071	1025
6	6	433	431
6	7	138	143
6	8	159	181
6	9	151	120
6	11	165	151
7	-13	197	202
7	-9	386	398
7	-8	422	432
7	-7	857	843
7	-6	734	727
7	-4	140	153
7	-3	434	446
7	-2	1565	1652
7	-1	1362	1393
7	0	184	166
7	1	199	231
7	2	487	499
7	3	508	494
7	4	353	320
7	5	121	100
7	6	210	196
7	9	141	164
7	10	139	149
7	11	141	133
7	12	352	360
8	-12	123	103
8	-10	103	61
8	-9	100	137
8	-8	236	228
8	-7	126	120
8	-6	638	617
8	-5	794	792
8	-4	414	379
8	-3	211	237
8	-2	246	251
8	-1	608	634
8	0	1055	1097
8	1	402	427
8	2	370	375
8	3	253	251
8	4	188	170
8	5	218	176
8	6	115	80
8	8	176	176
8	9	127	128
8	10	349	373
8	11	484	483
9	-12	324	308
9	-11	173	198
9	-10	146	160
9	-8	240	257
9	-7	768	766
9	-6	991	995
9	-5	590	631
9	-4	111	85
9	-2	626	661
9	-1	848	838
9	0	345	342
9	1	345	336
9	4	259	276
9	5	413	417
9	6	159	128
9	7	142	120
9	8	148	151
9	9	325	308
9	10	386	399
10	-12	243	241
10	-10	134	120
10	-9	380	345
10	-8	525	483
10	-7	271	267
10	-5	415	423
10	-3	292	327
10	-2	137	128
10	-1	244	206
10	1	415	407
10	3	146	136
10	4	153	151
10	5	708	710
10	6	643	628
10	7	143	101
10	10	538	539
11	-11	375	364
11	-10	171	177
11	-8	190	182
11	-7	429	421
11	-6	488	524
11	-4	130	149
11	-2	135	133
11	-1	529	534
11	0	558	563
11	1	151	129
11	3	364	391
11	4	887	839
11	5	959	925
11	6	233	260
11	7	154	156
11	9	437	422
12	-11	101	93
12	-10	88	96
12	-9	203	167
12	-8	281	300
12	-7	191	181
12	-5	212	225
12	-3	138	111
12	-2	568	572
12	-1	430	447
12	1	294	324
12	2	323	326
12	3	480	474
12	4	447	445
12	5	220	254
12	6	419	389
12	7	118	96
12	8	184	184
13	-10	158	161
13	-9	143	120
13	-7	90	62
13	-3	212	207
13	-2	150	136
13	-1	438	436
13	0	590	585
13	1	334	324
13	2	188	198
13	4	376	362
13	5	746	732
13	6	390	385
14	-7	195	201
14	-6	203	159
14	-4	100	97
14	-3	110	72
14	-2	608	627
14	-1	714	712
14	0	375	385
14	2	140	149
14	3	295	295
14	4	475	483
14	5	262	238
15	-7	176	173
15	-6	118	117
15	-5	134	147
15	-3	451	443
15	-2	265	253
15	0	205	206
15	1	217	229
15	2	94	109
15	3	117	126
15	5	80	82
16	-5	112	120
16	-2	308	317
16	-1	214	220
16	0	204	204
**H =		2****	
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0	-11	686	671
0	-10	551	560
0	-9	114	119
0	-8	607	593
0	-7	779	821
0	-6	1396	1472
0	-5	2152	2110
0	-4	540	538
0	-3	915	898
0	-2	238	261
0	-1	813	792
0	0	394	435
0	1	555	560
0	2	1101	1107
0	3	787	808
0	5	657	612
0	6	160	141
0	7	650	647
0	8	813	786
0	9	444	423
0	10	399	413
0	12	601	588
0	13	564	569
0	14	338	360
1	-13	336	337
1	-12	449	441
1	-11	90	62
1	-10	362	376
1	-9	623	592
1	-8	692	656
1	-7	704	699
1	-6	359	354
1	-5	1063	1068
1	-4	1337	1292
1	-3	220	222
1	-2	339	311
1	-1	142	137
1	0	303	283
1	1	820	799
1	2	375	373
1	3	370	373
1	4	248	211
1	5	277	263
1	6	1132	1158
1	7	1465	1450
1	8	469	468
1	10	217	230

K	L	FOBS	FCAL
**H =		2****	
1	11	872	834
1	12	704	711
1	13	396	384
2	-14	68	87
2	-13	115	106
2	-12	377	359
2	-11	867	878
2	-10	633	655
2	-9	465	454
2	-7	114	131
2	-6	823	826
2	-5	774	763
2	-4	721	720
2	-3	388	376
2	-2	170	174
2	-1	665	634
2	0	1194	1259
2	1	1079	1082
2	2	1561	1511
2	3	210	181
2	4	547	536
2	5	969	968
2	6	1123	1113
2	7	275	228
2	8	341	348
2	9	165	179
2	10	348	383
2	11	422	436
3	-14	77	95
3	-13	299	299
3	-12	595	620
3	-11	451	417
3	-10	127	134
3	-9	183	178
3	-8	168	164
3	-7	442	435
3	-6	560	537
3	-5	494	493
3	-4	563	540
3	-3	542	530
3	-2	678	619
3	-1	1069	951
3	0	1290	1277
3	1	1067	965
3	2	817	734
3	3	182	177
3	4	452	439
3	5	257	249
3	6	976	949
3	7	868	847
3	8	315	281
3	9	144	138
3	10	175	196
3	11	164	153
3	12	288	293
3	13	83	85
4	-14	66	77
4	-13	220	190
4	-12	93	65
4	-11	339	322
4	-10	165	141
4	-8	106	147
4	-7	133	142
4	-6	379	337
4	-5	607	633
4	-4	657	621
4	-3	441	423
4	-2	329	341
4	-1	521	511
4	0	2076	2258
4	1	1302	1325
4	2	923	887
4	4	584	594
4	5	1395	1363
4	6	1180	1168
4	7	416	403
4	8	96	73
4	11	159	136
5	-14	77	80
5	-13	169	184
5	-12	311	330
5	-11	193	182
5	-7	399	362
5	-6	1230	1211
5	-5	659	689
5	-4	126	122
5	-3	601	617
5	-2	1419	1406
5	-1	1595	1660
5	0	477	527
5	1	283	282
5	2	302	333
5	3	330	359
5	4	228	248
5	5	298	291
5	7	282	293
5	8	98	69
5	9	349	353
5	11	106	83
5	12	268	274
5	13	279	283
6	-13	129	132
6	-12	202	209
6	-10	151	186
6	-9	172	172
6	-8	345	296
6	-7	782	803
6	-5	863	832
6	-4	1027	1027
6	-3	679	710
6	-2	748	731
6	-1	99	69
6	0	1585	1613
6	1	959	964
6	2	499	501
6	3	102	91
6	4	613	579
6	5	307	318
6	8	167	154
6	10	250	252
6	11	571	576
6	12	610	653
7	-11	474	499
7	-10	344	288
7	-8	107	113
7	-7	591	595
7	-6	1553	1526
7	-5	1346	1357
7	-4	442	432
7	-3	113	142
7	-2	276	337
7	-1	1202	1226
7	0	1213	1263
7	1	405	397
7	2	170	165
7	3	178	156
7	5	111	91
7	6	328	343
7	7	114	114
7	9	239	230
7	10	471	456
7	11	440	431
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8	-11	163	138
8	-8	385	377
8	-7	875	825
8	-6	813	798
8	-4	157	155
8	-3	385	402
8	-2	417	407
8	-1	343	372
8	0	103	109
8	1	305	273
8	2	419	398
8	3	95	48
8	4	202	179
8	6	298	285
8	7	491	483
8	8	203	210
8	9	205	213
8	11	410	431
9	-11	236	248
9	-10	297	322
9	-9	400	399
9	-8	319	352
9	-6	593	583
9	-5	616	607
9	-4	398	427
9	-3	366	335
9	-2	200	165
9	-1	222	203
9	0	94	118
9	1	212	233
9	2	124	147
9	3	108	124
9	4	258	274
9	5	867	858
9	6	741	695
9	7	194	182
9	9	160	188
9	10	479	491
9	11	476	477
10	-12	545	542
10	-11	316	322
10	-8	220	248
10	-7	363	335
10	-6	337	325
10	-3	101	100
10	-2	439	473
10	-1	414	429
10	0	305	321
10	1	238	242
10	2	347	348
10	3	225	247
10	4	556	536
10	5	398	390
10	6	182	167
10	7	434	438
10	9	169	151
11	-11	113	126
11	-10	197	186
11	-9	141	148
11	-8	124	117
11	-6	151	116
11	-5	186	205
11	-4	255	208
11	-3	207	178
11	-2	105	119
11	-1	138	102
11	0	610	612
11	1	683	712
11	2	203	203
11	3	125	137
11	4	228	203
11	5	777	793
11	6	678	642
11	8	113	125
12	-11	184	201
12	-9	91	92
12	-7	154	178
12	-6	356	351
12	-5	378	411
12	-4	101	103
12	-2	569	565
12	-1	883	877
12	0	695	707

Table 41. Continued

K	L	FOBS	FCAL
H = 2**			
12	1	144	141
12	2	243	228
12	3	309	321
12	4	501	482
12	5	545	517
12	7	137	165
13	-10	71	84
13	-8	140	141
13	-7	396	400
13	-6	378	395
13	-4	174	183
13	-3	467	495
13	-2	592	585
13	-1	508	529
13	0	108	102
13	1	395	409
13	2	384	372
13	3	265	276
13	4	141	145
13	5	113	79
13	6	176	173
14	-9	87	64
14	-8	243	224
14	-6	341	333
14	-5	259	272
14	-4	248	233
14	-3	219	210
14	-1	389	423
14	0	499	488
14	1	283	297
14	2	128	98
14	4	246	250
14	5	129	114
15	-7	476	448
15	-6	366	352
15	-5	111	138
15	-3	257	283
15	-2	434	425
15	-1	265	273
15	4	87	82
16	-5	171	178
16	-3	145	159
H = 3**			
0	-14	103	117
0	-13	235	247
0	-11	704	733
0	-10	964	949
0	-9	902	901
0	-8	620	603
0	-6	880	853
0	-5	1523	1491
0	-4	550	527
0	-3	193	185
0	-2	498	489
0	-1	1155	1142
0	0	269	279
0	1	140	117
0	2	1248	1294
0	4	837	830
0	5	900	933
0	6	1464	1426
0	7	696	678
0	8	199	215
0	9	220	190
0	10	448	441
0	11	640	656
0	12	237	239
0	13	131	120
1	-13	133	153
1	-12	741	764
1	-11	935	949
1	-10	527	541
1	-8	478	483
1	-7	635	645
1	-6	449	441
1	-5	403	394
1	-4	462	412
1	-3	327	296
1	-2	288	274
1	-1	349	367
1	0	1045	1056
1	1	1578	1602
1	2	1021	1030
1	3	1433	1446
1	4	743	759
1	5	843	823
1	7	951	944
1	8	921	864
1	9	350	347
1	10	277	269
1	11	118	142
1	12	349	351
1	13	336	322
2	-14	138	147
2	-13	379	394
2	-12	392	402
2	-10	221	241
2	-9	299	284
2	-8	149	150
2	-7	538	512
2	-5	406	391
2	-4	185	179
2	-3	131	116
2	-2	665	644
2	-1	1213	1169
2	0	529	562
2	1	1360	1425
2	2	707	711
2	3	154	117
2	4	105	106
2	5	329	352
2	6	1464	1450
2	7	1022	1063
2	8	465	459
2	9	206	175
2	11	302	320
2	12	265	266
3	-12	285	287
3	-11	458	452
3	-10	366	375
3	-9	236	238
3	-8	266	251
3	-7	228	228
3	-6	431	475
3	-5	572	552
3	-4	125	102
3	-2	127	108
3	-1	315	289
3	0	2031	2090
3	1	1556	1643
3	2	568	575
3	3	321	310
3	4	162	108
3	5	1029	991
3	6	528	531
3	7	120	117
3	11	133	109
3	13	149	165
4	-13	108	99
4	-12	218	235
4	-11	204	223
4	-9	152	124
4	-8	277	293
4	-7	507	520
4	-6	603	571
4	-5	712	665
4	-4	521	497
4	-3	514	513
4	-2	846	821
4	-1	942	860
4	0	1232	1157
4	1	1535	1455
4	2	1304	1232
4	5	159	165
4	6	602	617
4	7	197	189
4	9	108	103
4	11	373	377
4	12	437	445
4	13	275	272
5	-13	64	60
5	-11	300	290
5	-10	362	330
5	-9	310	332
5	-6	1148	1128
5	-5	1562	1580
5	-4	773	755
5	-3	147	133
5	-2	245	213
5	-1	992	980
5	0	1230	1283
5	1	680	678
5	2	387	363
5	4	123	141
5	5	108	61
5	6	450	407
5	9	235	231
5	10	361	355
5	11	501	494
5	12	250	252
6	-13	72	56
6	-12	298	332
6	-11	655	642
6	-10	418	413
6	-9	315	331
6	-8	485	464
6	-7	1093	1081
6	-6	1550	1568
6	-5	722	696
6	-4	740	673
6	-3	747	738
6	-2	529	537
6	-1	668	651
6	0	111	57
6	1	402	410
6	2	550	573
6	3	121	146
6	4	118	75
6	5	260	240
6	7	301	302
6	8	404	413
6	9	383	404
6	10	108	133
6	11	120	145
6	12	472	479
7	-13	281	284
7	-12	405	406
7	-10	530	547
7	-9	241	237
7	-8	347	335
7	-7	693	714
7	-5	756	769
7	-4	803	763
7	-3	396	389
7	-2	283	311
7	-1	169	174
7	0	123	140
7	1	171	166
7	2	173	159
7	4	111	102
7	5	421	404
7	6	841	832
7	7	701	687
7	8	232	243
7	9	91	60
7	10	424	417
7	11	639	666

Table 41. Continued

K	L	FOBS	FCAL
H = 3**			
7	-12	471	491
8	-12	349	349
8	-11	583	607
8	-10	546	532
8	-9	308	309
8	-7	305	291
8	-6	1113	1127
8	-5	458	448
8	-4	181	180
8	-3	206	177
8	-2	465	435
8	0	375	353
8	1	238	240
8	3	235	226
8	4	563	567
8	5	770	776
8	6	532	503
8	7	153	133
8	8	174	184
8	9	387	380
8	10	354	367
8	11	182	182
9	-12	527	524
9	-11	158	163
9	-9	263	265
9	-8	218	167
9	-7	302	320
9	-6	422	401
9	-4	108	44
9	-2	245	264
9	-1	291	312
9	0	368	386
9	1	352	328
9	2	317	296
9	3	219	212
9	4	212	198
9	5	152	127
9	6	739	708
9	7	467	476
9	8	277	268
9	9	121	142
10	-12	94	103
10	-11	245	238
10	-10	131	163
10	-7	171	196
10	-6	93	61
10	-5	398	439
10	-4	240	230
10	-3	145	152
10	-2	386	405
10	-1	828	836
10	0	1037	1042
10	1	588	579
10	2	107	144
10	3	139	109
10	4	517	523
10	5	903	872
10	6	396	386
11	-11	105	104
11	-9	134	146
11	-8	206	209
11	-7	278	240
11	-6	538	517
11	-5	122	137
11	-3	307	323
11	-2	777	770
11	-1	841	859
11	0	248	205
11	1	426	411
11	2	399	414
11	3	230	220
11	4	419	397
11	5	148	141
11	6	246	239
11	7	98	101
11	9	106	91
12	-9	158	135
12	-8	232	245
12	-7	139	139
12	-6	126	92
12	-5	466	471
12	-4	330	318
12	-3	306	327
12	-2	238	240
12	-1	231	247
12	0	664	661
12	1	483	486
12	2	95	73
12	4	106	130
12	5	153	157
13	-7	431	408
13	-6	663	676
13	-5	364	350
13	-4	103	69
13	-3	121	127
13	-2	386	396
13	-1	631	636
13	0	444	451
13	1	106	111
13	3	281	270
13	6	86	95
14	-8	379	383
14	-7	600	615
14	-6	228	194
14	-4	158	170
14	-3	339	360
14	-2	360	355
14	-1	158	137
14	0	119	124
14	1	166	179
14	4	143	144
14	6	217	243
15	-7	118	105
15	-6	365	379
15	-5	162	179
15	-4	106	103
15	4	221	210
16	-2	115	124
16	-1	211	224
16	2	107	113
H = 4**			
0	-13	269	275
0	-12	627	645
0	-11	505	521
0	-9	495	485
0	-8	381	366
0	-6	91	65
0	-5	380	345
0	-4	162	175
0	-3	352	346
0	-2	358	366
0	-1	404	405
0	0	92	91
0	1	1376	1386
0	2	1599	1673
0	3	1177	1182
0	5	172	169
0	6	1172	1147
0	7	1594	1580
0	8	735	731
0	10	124	92
0	11	208	226
0	12	390	374
0	13	198	203
1	-13	209	224
1	-12	98	88
1	-11	534	568
1	-10	662	641
1	-9	308	295
1	-8	152	164
1	-6	95	61
1	-5	101	68
1	-4	720	669
1	-3	96	120
1	-2	121	109
1	-1	945	965
1	0	1808	1882
1	1	785	807
1	2	768	776
1	3	413	417
1	4	428	446
1	5	786	779
1	6	987	981
1	7	344	336
1	8	258	260
1	10	230	226
1	11	100	94
2	-12	306	290
2	-11	325	319
2	-10	256	246
2	-8	226	236
2	-7	180	143
2	-6	217	223
2	-5	482	472
2	-4	139	129
2	-3	727	701
2	-2	274	262
2	-1	183	200
2	0	1012	1019
2	1	801	798
2	2	1191	1198
2	3	1025	1027
2	4	619	630
2	5	579	535
2	7	444	449
2	8	475	459
2	10	127	101
2	11	141	168
2	12	182	176
2	13	209	202
3	-13	97	118
3	-12	143	155
3	-11	174	144
3	-10	166	171
3	-9	253	290
3	-7	192	164
3	-6	151	125
3	-5	1084	1040
3	-4	1171	1150
3	-3	391	375
3	-2	187	183
3	-1	676	675
3	0	960	1004
3	1	1516	1619
3	2	1113	1125
3	3	197	177
3	4	160	147
3	5	185	176
3	6	241	263
3	7	321	287
3	9	95	101
3	10	103	115
3	11	346	362
3	12	300	283
3	13	106	103
4	-12	198	190
4	-11	481	494
4	-10	438	455
4	-8	300	314
4	-7	563	578
4	-6	1310	1336
4	-5	1290	1273
4	-4	117	121
4	-3	423	400
4	-2	146	129
4	-1	1229	1188
4	0	971	1007

Table 41. Continued

K	L	FOBS	FCAL
**H =		4****	
4	2	243	257
4	3	251	241
4	4	122	120
4	5	396	335
4	7	281	251
4	8	486	452
4	9	199	185
4	10	114	123
4	11	131	147
4	12	291	286
5	-13	154	124
5	-12	379	397
5	-11	315	352
5	-9	395	377
5	-8	426	462
5	-7	653	633
5	-6	740	708
5	-5	291	290
5	-4	1046	995
5	-3	343	362
5	-2	467	435
5	0	442	405
5	1	161	156
5	2	404	421
5	4	348	331
5	5	399	420
5	6	833	835
5	7	837	833
5	8	382	382
5	10	185	192
5	11	553	544
5	12	688	717
6	-12	114	146
6	-11	694	664
6	-10	870	855
6	-9	331	353
6	-7	269	270
6	-6	788	821
6	-5	1004	971
6	-4	415	419
6	-3	332	316
6	-1	580	576
6	1	315	338
6	2	614	518
6	3	395	358
6	4	537	516
6	5	1045	1020
6	6	1047	1019
6	7	272	299
6	8	164	149
6	9	362	353
6	10	476	501
6	11	481	484
6	12	157	157
7	-13	322	317
7	-12	580	590
7	-11	755	776
7	-10	454	477
7	-9	105	110
7	-8	306	310
7	-7	732	744
7	-6	687	627
7	-5	101	102
7	-4	135	165
7	-3	101	46
7	-2	344	307
7	-1	329	323
7	0	109	66
7	1	156	145
7	2	327	335
7	3	375	381
7	4	556	543
7	5	321	313
7	6	310	307
7	7	648	629
7	8	553	565
7	9	259	264
7	10	166	137
7	11	108	106
8	-12	249	241
8	-11	184	197
8	-10	270	258
8	-9	325	339
8	-8	161	161
8	-6	112	125
8	-2	142	146
8	-1	94	110
8	0	571	607
8	1	824	872
8	2	601	571
8	3	333	309
8	4	108	96
8	5	682	679
8	6	996	970
8	7	495	493
8	8	199	199
8	10	224	239
8	11	312	332
9	-12	301	308
9	-11	369	349
9	-10	226	236
9	-7	108	116
9	-6	234	236
9	-5	307	286
9	-3	163	187
9	-2	209	197
9	-1	736	740
9	0	895	938
9	1	205	224
9	2	265	282
9	3	341	336
9	4	457	470
9	5	721	721
9	6	188	197
9	8	122	113
9	10	121	110
10	-12	79	93
10	-11	79	78
10	-10	126	132
10	-8	112	141
10	-7	370	356
10	-6	112	94
10	-5	445	416
10	-4	275	264
10	-3	259	249
10	-2	288	283
10	-1	154	159
10	0	281	274
10	1	760	771
10	2	220	200
10	4	131	91
10	5	176	160
10	6	238	235
11	-11	149	178
11	-10	152	143
11	-9	276	280
11	-7	251	250
11	-6	967	948
11	-5	689	665
11	-4	231	283
11	-3	223	235
11	-2	520	540
11	-1	727	709
11	0	806	813
11	1	278	273
11	2	345	353
11	6	216	190
11	9	225	215
12	-9	96	94
12	-8	326	359
12	-7	667	672
12	-6	608	577
12	-5	186	216
12	-4	165	186
12	-3	464	482
12	-2	422	399
12	-1	351	329
12	1	150	168
12	3	108	128
12	5	138	116
12	7	204	192
12	8	168	175
13	-9	131	139
13	-8	372	350
13	-7	238	229
13	-6	242	240
13	-5	331	320
13	-4	356	343
13	-3	245	242
13	-1	207	200
13	0	361	380
13	4	111	118
13	5	306	310
13	6	520	529
13	7	199	183
14	-8	77	91
14	-7	444	451
14	-6	517	491
14	-5	239	246
14	-3	104	108
14	-2	249	243
14	-1	126	108
14	3	102	63
14	4	243	245
14	5	352	337
15	-7	237	251
15	-2	87	50
15	1	211	212
15	2	90	95
15	3	177	169
16	-2	119	120
16	-1	381	390
16	0	431	431
**H =		5****	
0	-12	355	371
0	-11	564	572
0	-10	376	352
0	-9	110	123
0	-8	161	168
0	-6	136	147
0	-5	787	782
0	-4	446	445
0	-3	165	151
0	-2	635	650
0	-1	1315	1326
0	0	1467	1527
0	1	677	702
0	2	175	201
0	3	1315	1354
0	4	511	528
0	5	629	658
0	6	292	293
0	7	557	561
0	8	589	584
0	9	205	196
0	10	108	75
0	12	170	152
0	13	165	153
1	-13	111	130
1	-12	146	157
1	-11	123	131
1	-7	351	358
1	-5	271	284
1	-4	548	594
1	-3	764	779
1	-2	471	515
1	-1	256	257

Table 41. Continued

K	L	FOBS	FCAL
**H =	5****		
1	0	267	281
1	1	1190	1235
1	2	1413	1481
1	3	460	513
1	4	289	266
1	5	89	75
1	6	357	371
1	7	677	681
1	8	146	150
1	9	260	236
1	10	133	155
1	11	218	203
1	12	306	318
1	13	315	322
2	-13	121	114
2	-11	130	138
2	-10	209	191
2	-9	151	98
2	-6	856	846
2	-5	1186	1166
2	-4	1384	1388
2	-3	369	357
2	-2	169	155
2	-1	1040	1038
2	0	1273	1286
2	1	1686	1724
2	2	615	613
2	3	166	156
2	5	269	268
2	6	276	242
2	7	224	212
2	8	100	80
2	9	120	120
2	11	234	213
2	12	133	118
3	-12	244	281
3	-11	323	291
3	-10	192	188
3	-9	116	65
3	-7	290	289
3	-6	511	526
3	-5	342	357
3	-4	167	176
3	-3	153	174
3	-2	77	69
3	-1	245	250
3	0	672	704
3	1	285	228
3	2	209	197
3	3	106	103
3	4	375	356
3	5	113	86
3	6	292	293
3	7	431	443
3	8	572	557
3	9	136	151
3	11	206	217
3	12	532	546
4	-13	140	135
4	-11	406	450
4	-10	764	782
4	-9	525	520
4	-6	206	207
4	-5	1367	1323
4	-4	1238	1221
4	-3	222	256
4	-2	121	110
4	-1	318	295
4	0	140	140
4	2	211	172
4	3	513	460
4	5	300	276
4	6	664	666
4	7	592	558
4	9	244	246
4	10	233	230
4	11	415	396
4	12	442	443
5	-13	121	126
5	-12	459	477
5	-11	953	976
5	-10	737	735
5	-8	320	314
5	-7	549	505
5	-6	772	778
5	-5	731	709
5	-4	239	210
5	-3	412	391
5	0	165	109
5	1	743	790
5	2	569	535
5	3	618	630
5	4	435	440
5	5	664	681
5	6	252	245
5	7	584	572
5	8	692	669
5	9	403	406
5	10	191	181
5	12	131	134
6	-13	341	331
6	-12	386	428
6	-11	284	293
6	-10	135	162
6	-9	469	493
6	-8	178	159
6	-7	240	218
6	-5	315	278
6	-4	169	197
6	-3	194	141
6	-2	351	340
6	-1	516	467
6	0	356	368
6	1	1455	1494
6	2	668	687
6	3	259	239
6	5	323	313
6	6	1147	1150
6	7	901	908
6	8	303	294
6	10	246	239
6	11	279	279
7	-13	98	98
7	-12	237	248
7	-11	534	533
7	-10	592	625
7	-9	179	130
7	-6	205	220
7	-4	224	208
7	-3	120	135
7	-1	575	528
7	0	1020	959
7	1	996	939
7	2	339	323
7	4	403	380
7	5	1302	1300
7	6	705	677
7	8	90	86
7	9	214	217
7	10	229	240
7	11	165	166
8	-12	323	324
8	-11	358	364
8	-7	166	175
8	-6	285	292
8	-5	175	172
8	-3	270	255
8	-2	413	405
8	-1	736	699
8	0	306	335
8	1	314	290
8	2	703	687
8	3	313	299
8	4	422	414
8	5	294	301
8	6	431	397
8	7	335	350
8	8	285	271
9	-10	163	150
9	-9	86	104
9	-7	209	215
9	-6	229	245
9	-5	729	712
9	-4	518	530
9	-1	315	344
9	0	1057	1072
9	1	1003	1003
9	2	187	173
9	5	477	463
9	6	183	175
9	7	105	71
9	9	87	100
9	10	109	109
10	-11	197	203
10	-10	153	164
10	-7	493	482
10	-6	1016	1017
10	-5	648	631
10	-3	149	163
10	-2	420	425
10	-1	589	588
10	0	736	748
10	1	101	84
10	2	348	322
10	7	186	197
10	8	176	193
10	9	156	156
11	-11	62	20
11	-10	240	240
11	-9	262	271
11	-8	165	156
11	-7	326	323
11	-6	112	81
11	-5	394	402
11	-4	333	323
11	-3	110	99
11	-2	93	48
11	-1	97	107
11	1	100	91
11	3	173	166
11	5	176	165
11	6	425	407
11	7	278	310
11	8	120	114
12	-10	278	289
12	-9	91	88
12	-7	265	244
12	-6	761	782
12	-5	493	487
12	-4	131	85
12	-3	133	115
12	-1	144	140
12	0	189	207
12	4	148	154
12	5	580	569
12	6	378	401
13	-9	94	116
13	-8	253	235
13	-7	506	516
13	-6	300	291
13	-4	105	135
13	-3	138	159
13	-1	126	138
13	0	125	152
13	2	194	176
13	3	204	216
13	4	212	197

K	L	FOBS	FCAL
**H =	5****		
13	5	111	108
13	6	240	226
14	-8	108	118
14	-6	176	184
14	-5	213	190
14	-2	103	78
14	0	327	300
14	1	291	316
14	2	174	187
14	3	112	123
14	4	221	195
14	5	489	485
15	-2	206	195
15	-1	431	414
15	0	327	326
15	3	193	221
16	-3	90	99
16	-2	139	139
16	0	293	298
**H =	6****		
0	-12	86	90
0	-9	185	209
0	-8	294	299
0	-7	200	168
0	-6	190	178
0	-5	1172	1134
0	-4	1584	1566
0	-3	1141	1127
0	-2	415	401
0	-1	324	311
0	0	1384	1411
0	1	1717	1741
0	2	1215	1198
0	3	91	105
0	4	301	331
0	5	315	278
0	6	233	250
0	7	242	223
0	9	96	85
0	10	356	324
0	11	399	394
0	12	265	265
1	-11	180	172
1	-10	431	457
1	-9	145	123
1	-7	158	162
1	-6	606	594
1	-5	1058	1030
1	-4	404	413
1	-3	226	228
1	-2	422	466
1	-1	404	428
1	0	381	425
1	1	388	373
1	2	482	474
1	3	438	447
1	7	144	134
1	8	286	273
1	9	235	239
1	10	129	146
2	-12	71	61
2	-11	153	184
2	-10	263	290
2	-9	571	593
2	-8	309	300
2	-7	413	403
2	-6	123	105
2	-5	723	718
2	-4	1217	1206
2	-3	958	928
2	-2	718	701
2	-1	185	212
2	0	241	237
2	1	433	459
2	2	432	434
2	3	343	310
2	6	276	267
2	7	591	566
2	8	348	334
2	11	256	231
2	12	543	565
3	-11	556	549
3	-10	877	886
3	-9	409	408
3	-6	472	484
3	-5	1250	1241
3	-4	863	841
3	-3	526	496
3	-2	180	163
3	-1	436	429
3	0	114	15
3	1	177	196
3	2	231	207
3	3	235	222
3	4	242	233
3	5	409	404
3	6	289	289
3	8	539	508
3	9	303	305
3	10	114	119
3	11	291	297
3	12	146	148
4	-13	123	123
4	-12	275	294
4	-11	491	476
4	-10	182	201
4	-9	221	204
4	-8	292	276
4	-7	175	201
4	-6	356	346
4	-4	411	398
4	-3	274	278
4	-2	139	148
4	-1	90	70
4	0	385	364
4	1	215	177
4	2	548	535
4	3	838	848
4	4	100	79
4	6	534	556
4	7	952	926
4	8	773	761
4	9	207	194
4	11	155	154
4	12	236	235
5	-13	117	122
5	-11	349	349
5	-10	672	665
5	-9	388	388
5	-6	208	233
5	-5	196	204
5	-4	544	511
5	-2	101	87
5	-1	272	254
5	0	1067	1094
5	1	1433	1491
5	2	852	887
5	3	314	333
5	4	601	581
5	5	627	613
5	6	999	976
5	7	730	732
5	9	144	180
5	10	206	220
5	11	94	115
6	-12	413	419
6	-11	478	464
6	-10	258	240
6	-9	178	166
6	-8	135	119
6	-5	398	392
6	-3	263	266
6	-2	485	462
6	-1	323	348
6	0	815	840
6	1	185	173
6	2	545	537
6	3	395	391
6	4	301	320
6	5	510	505
6	6	113	99
6	7	430	426
6	8	357	339
6	9	124	106
7	-12	139	147
7	-11	110	92
7	-10	188	166
7	-9	135	125
7	-8	144	93
7	-7	139	154
7	-6	223	192
7	-5	147	91
7	-4	704	685
7	-3	521	513
7	-2	637	604
7	-1	282	297
7	0	642	660
7	1	1366	1398
7	2	1087	1106
7	3	303	298
7	5	278	295
7	6	627	635
7	7	534	532
7	8	88	88
7	10	105	110
8	-12	99	102
8	-9	116	136
8	-8	106	106
8	-6	596	558
8	-5	831	820
8	-4	612	613
8	-1	498	462
8	0	1230	1188
8	1	758	774
8	3	130	103
8	4	128	127
8	5	429	409
8	6	200	216
8	9	125	119
8	10	108	126
9	-11	106	123
9	-10	152	152
9	-9	173	184
9	-7	351	344
9	-6	567	522
9	-4	381	365
9	-3	460	440
9	-2	187	173
9	-1	253	226
9	1	106	101
9	2	295	289
9	3	219	171
9	4	147	113
9	6	259	231
9	7	163	155
9	8	201	218
10	-11	292	297
10	-10	558	583
10	-9	211	201
10	-7	255	284
10	-6	505	493
10	-5	696	659
10	-4	476	478
10	-2	301	283
10	-1	309	285
10	0	121	153
10	4	204	211

Table 41. Continued

K	L	FOBS	FCAL
**H =	6****		
10	5	409	400
10	6	379	369
10	7	251	244
10	8	93	97
10	9	193	195
11	-10	203	208
11	-8	123	114
11	-7	471	454
11	-6	506	479
11	-5	400	397
11	0	242	200
11	2	270	254
11	3	219	225
11	4	276	256
11	5	203	230
11	7	318	339
11	8	377	397
12	-9	165	188
12	-8	200	194
12	-6	143	123
12	-5	167	184
12	-4	201	174
12	-3	108	83
12	0	104	106
12	1	358	401
12	2	412	380
12	5	348	364
12	6	577	570
12	7	479	479
13	-8	91	65
13	-7	78	81
13	-6	173	157
13	-4	120	86
13	-3	131	140
13	-1	330	311
13	0	514	527
13	1	357	342
13	2	129	111
13	3	152	144
13	4	349	330
13	5	543	581
13	6	352	370
14	-6	85	53
14	-3	101	118
14	-2	180	193
14	-1	296	311
14	1	270	268
14	2	156	159
14	3	193	197
14	4	174	183
15	-5	310	272
15	-4	180	191
15	-1	281	278
15	0	571	604
15	1	341	349
15	2	81	79

K	L	FOBS	FCAL
**H =	7****		
0	-12	100	99
0	-11	162	152
0	-10	133	113
0	-9	312	301
0	-8	537	505
0	-7	465	472
0	-6	494	487
0	-4	933	933
0	-3	1470	1468
0	-2	851	858
0	-1	80	52
0	1	503	534
0	2	1114	1133
0	3	400	416
0	4	108	63
0	6	440	433
0	7	283	304
0	8	543	511
0	9	390	381
0	11	212	211
0	12	290	308
1	-11	109	112
1	-10	640	637
1	-9	738	737
1	-8	351	369
1	-7	277	233
1	-6	171	133
1	-5	1055	1027
1	-4	1161	1191
1	-3	733	761
1	-2	233	240
1	-1	183	191
1	1	488	502
1	2	317	319
1	5	114	115
1	6	359	362
1	7	628	604
1	8	146	136
1	9	165	146
1	10	315	305
1	11	255	273
1	12	352	350
2	-12	92	105
2	-11	461	478
2	-10	619	624
2	-8	133	141
2	-6	483	476
2	-5	862	843
2	-4	201	214
2	-2	230	222
2	-1	223	231
2	0	185	176
2	1	81	84
2	2	422	417
2	3	173	201
2	4	318	326

K	L	FOBS	FCAL
2	7	391	408
2	8	911	872
2	9	395	415
2	11	112	92
2	12	142	139
3	-10	443	430
3	-9	641	654
3	-8	341	322
3	-6	167	154
3	-4	310	279
3	-3	129	136
3	-2	242	218
3	-1	356	309
3	0	301	306
3	1	637	631
3	2	805	806
3	3	216	228
3	5	278	268
3	6	598	591
3	7	910	875
3	8	691	688
3	9	129	103
3	10	123	69
4	-12	134	120
4	-11	473	484
4	-10	690	692
4	-9	226	215
4	-8	143	152
4	-7	111	98
4	-4	197	180
4	-2	142	172
4	-1	437	416
4	0	868	878
4	1	458	476
4	3	774	774
4	4	509	501
4	5	353	407
4	6	271	285
4	8	246	230
4	9	104	86
4	11	75	75
5	-12	146	144
5	-11	198	206
5	-9	183	199
5	-7	257	268
5	-4	432	419
5	-3	797	780
5	-2	513	519
5	0	162	186
5	1	609	608
5	2	1241	1242
5	3	478	449
5	4	164	191
5	5	184	199
5	6	522	502
5	7	507	500
5	8	227	229

K	L	FOBS	FCAL
5	10	102	86
6	-12	109	99
6	-10	159	173
6	-8	91	112
6	-6	151	140
6	-5	779	766
6	-4	1083	1081
6	-3	559	543
6	-1	417	398
6	0	1022	1036
6	1	1503	1534
6	2	662	689
6	3	191	154
6	4	208	229
6	5	525	500
6	6	312	300
6	7	215	205
6	10	111	113
7	-11	84	58
7	-10	236	244
7	-9	91	97
7	-7	315	319
7	-6	670	650
7	-5	751	733
7	-3	475	495
7	-2	267	247
7	-1	264	240
7	0	873	882
7	2	631	654
7	4	229	206
7	5	107	97
7	7	86	25
7	8	180	175
7	9	188	203
7	10	152	145
8	-10	154	159
8	-9	285	301
8	-8	178	181
8	-7	215	218
8	-5	546	570
8	-4	877	850
8	-3	679	680
8	0	441	442
8	1	797	748
8	2	275	276
8	3	201	220
8	4	112	98
8	6	314	316
8	7	293	286
8	8	135	130
9	-11	408	400
9	-10	581	588
9	-9	196	194
9	-7	255	241
9	-6	665	660
9	-5	766	756
9	-4	559	534

Table 41. Continued

K	L	FOBS	FCAL
H = 7**			
9	0	206	216
9	1	391	359
9	5	396	398
9	6	186	192
9	7	117	142
9	8	232	221
9	9	115	116
10	-10	116	118
10	-9	177	167
10	-7	95	116
10	-6	115	92
10	-5	136	109
10	-4	139	140
10	-2	115	132
10	1	468	422
10	2	393	392
10	5	248	244
10	6	480	492
10	7	564	558
10	8	275	283
11	-10	439	491
11	-9	88	91
11	-8	157	158
11	-7	153	173
11	-6	251	257
11	-2	121	102
11	-1	239	205
11	0	449	480
11	1	575	563
11	3	185	193
11	4	247	236
11	5	458	501
11	6	496	496
11	7	243	244
12	-9	79	65
12	-8	90	101
12	-6	167	161
12	-5	172	145
12	-2	218	216
12	-1	499	496
12	0	280	288
12	1	106	51
12	2	398	391
12	3	335	308
12	4	179	187
12	5	90	111
12	6	86	93
13	-7	126	120
13	-5	191	200
13	-4	202	164
13	-3	148	132
13	-2	231	243
13	0	556	539
13	1	653	640
13	2	452	459
13	3	95	109

K	L	FOBS	FCAL
13	5	256	286
14	-6	382	397
14	-5	433	429
14	-4	178	156
14	-1	416	422
14	0	573	584
14	1	265	282
14	3	108	94
15	-3	123	146
15	-2	176	168
15	-1	160	138
15	0	142	144
H = 8**			
0	-11	338	343
0	-10	652	683
0	-9	508	490
0	-8	125	133
0	-7	171	189
0	-6	237	219
0	-5	706	690
0	-4	476	468
0	-2	428	453
0	-1	171	146
0	2	261	221
0	3	398	395
0	4	177	169
0	5	354	377
0	6	403	399
0	8	430	408
0	9	521	524
0	10	391	376
0	11	84	87
1	-12	213	201
1	-11	299	312
1	-9	572	567
1	-8	720	686
1	-7	356	358
1	-6	374	381
1	-4	621	640
1	-3	388	423
1	-2	214	227
1	-1	82	92
1	0	207	188
1	1	179	165
1	2	457	453
1	3	611	634
1	4	604	595
1	6	298	309
1	7	811	810
1	8	926	888
1	9	364	365
1	11	97	108
2	-11	138	134
2	-10	582	564
2	-9	775	761
2	-8	353	342
2	-7	106	99

K	L	FOBS	FCAL
2	-5	479	461
2	-4	353	335
2	-3	175	143
2	0	139	135
2	1	504	533
2	2	303	297
2	3	150	107
2	4	215	199
2	5	237	234
2	6	327	352
2	7	532	527
2	8	236	224
2	9	267	258
2	10	221	203
2	11	101	82
3	-12	78	84
3	-11	327	334
3	-10	341	336
3	-9	144	153
3	-7	171	139
3	-6	140	139
3	-4	225	200
3	-3	316	320
3	-2	450	431
3	-1	247	230
3	1	244	244
3	2	695	727
3	3	804	774
3	4	453	449
3	5	180	174
3	7	440	426
3	8	450	445
3	9	270	259
3	11	101	87
4	-10	152	177
4	-5	569	570
4	-4	681	675
4	-3	628	630
4	-2	165	162
4	-1	375	352
4	0	718	720
4	1	1066	1108
4	2	916	931
4	3	300	322
4	5	96	90
4	6	368	357
4	7	338	321
4	8	278	265
5	-10	146	161
5	-9	157	124
5	-7	252	260
5	-6	455	444
5	-5	736	722
5	-4	502	489
5	-2	364	375
5	-1	631	637
5	0	525	515

K	L	FOBS	FCAL
5	1	425	416
5	2	177	183
5	3	323	325
5	8	124	132
5	9	203	194
5	10	138	133
6	-11	135	133
6	-9	192	182
6	-8	316	316
6	-7	440	456
6	-6	337	335
6	-5	176	163
6	-4	951	925
6	-3	1083	1074
6	-2	336	335
6	0	253	207
6	1	756	757
6	2	1031	1040
6	3	111	58
6	5	106	78
6	7	190	185
6	8	355	348
6	9	236	218
7	-11	201	182
7	-10	561	569
7	-9	436	409
7	-8	226	238
7	-6	316	307
7	-5	896	863
7	-4	1074	1016
7	-3	567	568
7	-1	117	173
7	0	377	388
7	1	534	517
7	3	287	265
7	5	139	140
7	6	208	230
7	7	329	320
7	9	214	228
8	-11	431	447
8	-10	292	288
8	-8	156	164
8	-7	279	271
8	-6	365	372
8	-5	226	227
8	-3	460	446
8	-2	280	247
8	-1	182	137
8	0	201	200
8	1	140	119
8	2	198	179
8	5	143	171
8	6	113	77
8	7	440	452
8	8	502	508
8	9	172	178
9	-10	403	390

Table 41. Continued

K	L	FOBS	FCAL
**H =		8****	
9	-9	381	393
9	-8	248	250
9	-7	118	85
9	-5	278	262
9	-4	227	211
9	-3	193	190
9	-2	186	140
9	0	160	196
9	1	599	555
9	2	425	[illegible]
9	4	163	[illegible]
9	5	365	[illegible]
9	6	516	514
9	7	604	636
9	8	118	123
10	-10	248	259
10	-2	335	316
10	-1	165	204
10	0	396	388
10	1	216	163
10	2	227	249
10	3	260	252
10	4	210	184
10	5	164	171
10	6	186	199
10	7	186	206
11	-9	99	91
11	-6	97	82
11	-4	213	198
11	-3	278	318
11	-2	136	122
11	0	266	270
11	1	503	505
11	2	548	566
11	3	368	348
11	5	115	113
11	6	321	318
12	-6	221	224
12	-5	443	446
12	-4	429	449
12	-1	329	336
12	0	629	636
12	1	457	470
12	2	160	139
12	4	160	180
12	5	205	203
13	-7	108	123
13	-6	404	404
13	-5	312	367
13	-4	97	118
13	-3	245	256
13	-2	194	195
13	-1	420	440
13	0	221	214
13	1	131	142
13	2	302	315

K	L	FOBS	FCAL
13	3	173	196
14	-5	413	411
14	-4	406	420
14	-3	131	116
14	-2	105	118
[illegible]	[illegible]	98	104
[illegible]	[illegible]	309	365
[illegible]	[illegible]	[illegible]	339
[illegible]	[illegible]	[illegible]	133
[illegible]		9****	
0	[illegible]	381	395
0	[illegible]	723	744
0	[illegible]	617	605
0	[illegible]	202	200
0	-5	364	366
0	-4	436	420
0	-3	535	497
[illegible]	-1	218	200
[illegible]	0	97	107
[illegible]	1	342	351
[illegible]	2	675	708
[illegible]	3	445	424
[illegible]	5	177	163
[illegible]	6	408	398
0	7	661	625
0	8	290	278
0	9	181	173
0	10	266	265
1	-11	295	297
1	-10	556	559
1	-9	352	368
1	[illegible]	133	163
1	[illegible]	105	73
1	[illegible]	114	97
1	-3	113	164
1	-2	178	180
1	-1	197	184
1	0	339	328
1	1	620	622
1	2	249	255
1	3	738	756
1	4	564	542
1	5	258	269
1	6	135	130
1	8	400	394
1	9	596	568
1	10	211	210
2	-11	187	176
2	-9	282	296
2	-8	205	216
2	-5	186	168
2	-4	266	279
2	-3	432	443
2	-2	326	348
2	-1	86	82
2	0	126	48
2	1	486	501

K	L	FOBS	FCAL
2	2	1055	1063
2	3	892	906
2	4	384	377
2	5	95	101
2	6	178	151
2	7	471	469
2	8	544	535
2	9	225	238
2	10	101	94
3	-5	566	533
3	-4	571	557
3	-3	217	226
3	-2	197	181
3	-1	192	199
3	0	438	419
3	1	826	831
3	2	448	421
4	-10	78	80
4	-9	98	100
4	-8	334	351
4	-7	197	174
4	-6	283	286
4	-5	194	206
4	-4	313	298
4	-3	722	718
4	-2	641	650
4	-1	244	252
4	0	208	232
4	1	170	191
4	2	758	728
4	3	469	445
4	4	130	118
4	8	171	157
4	9	173	161
4	10	71	56
5	-10	330	341
5	-9	512	508
5	-8	294	299
5	-6	164	137
5	-5	746	744
5	-4	1093	1091
5	-3	755	747
5	-1	122	153
5	1	496	518
5	2	212	211
5	5	219	234
5	6	235	214
5	7	265	279
5	8	125	132
6	-11	396	420
6	-10	626	655
6	-9	250	260
6	-8	174	174
6	-7	278	283
6	-6	385	389
6	-5	585	568
6	-4	348	351

K	L	FOBS	FCAL
6	-3	449	425
6	-2	359	334
6	-1	201	191
6	0	147	148
6	1	98	93
6	2	135	140
6	4	298	296
6	5	312	305
6	6	178	174
6	7	102	97
6	8	449	437
6	9	442	433
7	-10	139	151
7	-9	438	437
7	-8	446	436
7	-7	349	321
7	-6	157	174
7	-5	93	18
7	-4	538	573
7	-3	630	623
7	0	261	235
7	2	260	241
7	3	241	251
7	4	208	201
7	6	310	323
7	7	634	615
7	8	547	559
8	-10	508	514
8	-9	374	369
8	-8	104	99
8	-6	234	218
8	-5	378	363
8	-4	115	130
8	-1	101	63
8	0	172	155
8	1	591	585
8	2	322	337
8	4	194	219
8	5	190	220
8	6	390	373
8	7	291	301
8	8	160	154
9	-8	84	66
9	-6	93	55
9	-5	127	85
9	-3	340	305
9	-2	185	161
9	-1	159	94
9	1	339	303
9	2	729	759
9	3	269	248
9	7	315	334
10	-8	97	85
10	-6	152	158
10	-5	322	321
10	-4	427	426
10	-3	280	242

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**H =	9****			1	-4	392	386	5	-10	194	184	9	-7	108	90
10	-1	171	145	1	-3	591	582	5	-9	251	248	9	-6	171	186
10	0	445	463	1	-2	416	408	5	-8	532	532	9	-5	190	178
10	1	735	738	1	-1	192	216	5	-7	337	328	9	-4	239	248
10	2	361	339	1	0	247	223	5	-6	200	182	9	-2	210	156
10	4	133	132	1	1	535	543	5	-5	183	174	9	-1	234	228
10	5	88	108	1	2	805	811	5	-4	274	265	9	0	311	315
10	6	173	172	1	3	515	505	5	-3	483	503	9	1	449	466
11	-8	90	64	1	5	197	172	5	-2	243	252	9	2	228	203
11	-7	183	168	1	6	246	228	5	0	155	135	9	3	102	94
11	-6	311	318	1	7	213	223	5	2	196	180	9	4	117	113
11	-5	365	350	1	8	215	222	5	3	224	229	9	5	133	126
11	-3	281	280	1	9	133	123	5	4	384	383	9	6	136	145
11	-2	254	283	2	-10	106	111	5	6	165	163	10	-8	129	138
11	-1	379	338	2	-8	158	166	5	7	460	462	10	-7	193	198
11	0	400	397	2	-7	176	175	5	8	702	690	10	-6	157	152
11	2	194	222	2	-5	227	218	6	-10	518	524	10	-4	303	308
11	3	283	278	2	-4	262	256	6	-9	607	603	10	-3	406	414
12	-7	146	138	2	-3	224	251	6	-8	381	366	10	-2	276	305
12	-6	182	183	2	-2	331	331	6	-6	276	277	10	1	150	171
12	-5	127	120	2	-1	255	235	6	-5	264	243	10	2	340	374
12	-4	498	491	2	0	268	271	6	-4	529	499	10	3	169	193
12	-3	367	368	2	1	352	360	6	-3	394	373	11	-7	101	98
12	-2	150	136	2	2	136	125	6	-2	288	243	11	-6	203	217
12	-1	112	92	2	3	488	496	6	0	121	124	11	-5	467	491
12	0	196	193	2	4	371	355	6	1	335	343	11	-4	557	562
12	1	436	446	2	5	255	248	6	2	326	317	11	-3	159	152
12	2	330	333	2	8	128	123	6	3	243	218	11	0	283	282
13	-5	613	603	2	9	158	143	6	5	171	164	11	1	281	261
13	-4	407	419	3	-10	149	133	6	6	325	327	11	2	86	70
13	-2	98	85	3	-9	239	243	6	7	351	351	12	-5	404	426
13	-1	248	256	3	-8	414	396	6	8	115	116	12	-3	190	214
13	0	326	340	3	-7	147	135	7	-9	181	194	12	-2	190	182
13	1	223	182	3	-5	322	306	7	-8	121	117	12	-1	100	134
**H =	10****			3	-4	773	763	7	-7	215	235	**H =	11****		
0	-10	163	170	3	-3	991	961	7	-6	166	138	0	-9	84	107
0	-9	195	211	3	-2	460	459	7	-5	119	133	0	-6	376	364
0	-8	457	457	3	-1	196	203	7	-4	96	49	0	-5	395	383
0	-7	140	115	3	0	109	139	7	-1	132	163	0	-4	296	277
0	-6	122	105	3	1	286	302	7	0	272	273	0	-3	408	409
0	-5	118	112	3	2	473	480	7	1	173	169	0	-2	276	257
0	-4	145	170	3	3	326	348	7	2	187	141	0	-1	448	460
0	-3	293	293	3	6	209	208	7	3	537	499	0	0	343	377
0	-2	514	544	4	-10	397	375	7	4	547	532	0	1	230	221
0	-1	361	365	4	-9	435	456	7	5	182	202	0	3	376	383
0	0	262	306	4	-7	154	147	7	6	114	104	0	4	568	574
0	2	513	524	4	-6	293	309	7	7	250	241	0	5	400	386
0	3	1017	1011	4	-5	608	599	8	-9	226	249	0	8	74	60
0	4	608	617	4	-4	605	594	8	-8	202	222	0	9	165	168
0	6	118	119	4	-3	134	130	8	-4	135	125	1	-8	180	178
0	7	392	387	4	-2	226	238	8	-3	463	446	1	-7	276	294
0	8	623	585	4	-1	110	81	8	-2	271	279	1	-6	92	77
0	9	433	415	4	1	216	175	8	1	424	429	1	-4	105	75
1	-10	123	104	4	4	126	140	8	2	642	689	1	-3	703	676
1	-9	338	315	4	5	160	182	8	3	551	519	1	-2	902	912
1	-7	123	116	4	8	174	163	8	6	251	242	1	-1	343	339
1	-6	116	119	4	9	327	318	8	7	428	439	1	2	539	525

K	L	FOBS	FCAL
H = 11**			
1	3	653	659
1	4	335	350
1	5	146	133
1	6	98	89
2	-9	301	315
2	-8	304	299
2	-7	214	177
2	-5	144	148
2	-4	722	720
2	-3	866	867
2	-2	252	256
2	-1	146	144
2	1	353	371
2	2	384	389
2	3	182	161
2	5	107	120
3	-8	313	307
3	-7	312	305
3	-6	165	159
3	-5	229	223
3	-4	291	275
3	-3	142	127
3	-2	440	409
3	0	128	89
3	3	137	112
3	7	230	232
3	8	352	335
4	-9	519	536
4	-8	499	482
4	-7	108	101
4	-4	314	310
4	-3	526	546
4	0	149	158
4	1	223	232
4	2	171	164
4	5	118	127
4	6	268	260
4	7	305	299
4	8	344	345
5	-9	391	410
5	-7	220	210
5	-6	171	167
5	-4	195	166
5	-2	130	125
5	-1	211	221
5	0	233	227
5	1	380	382
5	3	366	343
5	4	480	450
5	5	335	347
5	6	148	151
6	-9	198	203
6	-8	242	221
6	-7	182	180
6	-3	102	86
6	-2	238	263
6	-1	243	256
6	0	273	245
6	1	154	178
6	2	483	525
6	3	599	608
6	4	246	284
6	6	117	118
6	7	473	474
7	-8	113	119
7	-5	93	97
7	-4	321	340
7	-3	349	326
7	-1	139	124
7	0	372	335
7	1	615	597
7	2	485	485
7	3	120	115
7	4	273	273
7	5	189	178
7	6	224	249
8	-7	125	113
8	-6	181	176
8	-5	149	154
8	-3	135	165
8	-2	242	229
8	-1	119	124
8	0	290	306
8	2	128	127
8	3	408	408
8	4	176	208
8	6	91	99
9	-5	276	260
9	-4	567	565
9	-3	513	546
9	-2	142	173
9	0	205	173
9	1	274	267
9	2	427	427
9	3	105	153
10	-6	194	216
10	-5	481	493
10	-4	329	278
10	-3	85	62
10	0	138	162
10	1	188	156
11	-4	276	283
11	-3	261	243
11	-1	84	46
11	2	111	131
H = 12**			
0	-8	356	361
0	-7	284	295
0	-6	116	102
0	-5	228	210
0	-4	330	336
0	-3	614	608
0	-2	490	473
0	-1	118	108
0	0	169	181
0	1	257	231
0	2	466	481
0	3	260	273
0	5	101	74
0	7	89	75
1	-8	122	114
1	-6	277	267
1	-5	305	312
1	-4	387	357
1	-3	281	262
1	-2	213	200
1	-1	298	281
1	0	228	216
1	1	210	199
1	2	129	121
1	3	176	160
2	-8	484	479
2	-7	426	439
2	-6	111	86
2	-4	249	229
2	-3	395	387
2	-2	386	401
2	-1	111	103
2	2	107	106
2	5	115	105
2	6	112	113
2	7	209	205
3	-8	405	397
3	-5	102	64
3	-4	291	272
3	-3	334	328
3	0	133	139
3	4	233	241
3	5	243	250
3	6	146	161
3	7	211	215
4	-8	169	162
4	-7	153	174
4	-4	112	87
4	-2	180	180
4	0	100	105
4	2	311	293
4	3	521	536
4	4	353	368
4	5	80	79
4	6	124	111
5	-8	224	206
5	-6	153	146
5	-4	252	265
5	-3	264	245
5	-2	206	203
5	0	148	142
5	1	519	518
5	2	570	576
5	3	388	361
5	5	245	242
5	6	154	163
6	-5	245	251
6	-4	342	342
6	-2	231	222
6	-1	187	216
6	0	300	317
6	1	163	176
6	3	444	432
6	4	412	428
6	5	91	105
7	-7	181	186
7	-6	97	71
7	-4	248	234
7	-3	600	574
7	-2	435	432
7	-1	229	217
7	1	320	307
7	2	540	539
7	3	529	547
7	4	144	141
8	-5	313	299
8	-4	479	491
8	-3	446	468
8	-1	104	126
8	0	204	233
8	1	306	293
8	2	271	300
9	-5	190	169
9	-3	222	224
9	-2	107	90
9	2	84	41
10	-3	235	253
10	0	82	63
H = 13**			
0	-7	323	305
0	-6	254	256
0	-5	135	140
0	-3	381	381
0	-2	660	643
0	-1	358	378
0	2	128	118
0	5	91	85
1	-7	408	410
1	-5	95	106
1	-4	269	246
1	-3	615	580
1	-2	284	247
1	-1	88	77
1	0	97	98
1	5	96	85
1	6	110	106
2	-7	106	97
2	-4	280	285
2	-3	118	111
2	2	110	125
2	3	231	213

Table 41. Continued

K	L	FOBS	FCAL
H = 13**			
2	4	331	330
2	5	238	237
3	-7	203	191
3	-5	79	78
3	-2	105	122
3	-1	97	93
3	0	118	139
3	1	201	198
3	2	330	328
3	3	440	447
3	4	265	260
4	-5	189	193
4	-4	176	172
4	-3	235	246
4	-2	154	145
4	-1	254	251
4	0	243	222
4	1	212	219
4	2	206	211
4	3	122	102
4	4	302	303
4	5	224	221
5	-6	102	99
5	-5	101	89
5	-3	385	382
5	-2	534	555
5	-1	228	212
5	1	97	94
5	2	395	396
5	3	593	586
5	4	363	351
6	-5	134	118
6	-4	423	420
6	-3	646	657
6	-2	210	207
6	0	195	189
6	1	286	294
6	2	435	453
6	3	314	336
7	-5	266	268
7	-4	253	256
7	-2	248	265
7	-1	223	223
7	0	118	113
7	3	147	157
8	-3	445	455
8	-2	263	273
H = 14**			
0	-4	118	133
0	-3	90	108
0	-1	77	67
0	0	110	93
0	1	95	90
1	-3	118	123
1	-2	168	156
1	2	146	145
1	3	343	343
2	0	147	131
2	1	178	181
2	2	217	201
2	3	222	231
3	-4	85	95
3	-3	96	108
3	-2	254	259
3	-1	280	296
3	0	185	202
3	2	101	77
3	3	286	283
4	-4	233	222
4	-3	504	469
4	-2	383	371
4	-1	146	150
4	0	208	203
4	1	130	133
4	2	302	301
5	-3	214	230
5	-2	81	67
5	-1	331	336
5	0	145	151
6	-1	282	300

Table 42. 10*(Fobs vs. Fcal) For Trans-[RhCl(CO)(DPM)]2.

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = -10**				-8	-2	29	37	-7	-2	326	329	-11	-2	202	197
-9	-1	65	75	-8	-1	416	421	-7	-1	572	569	-11	-1	204	191
-8	-1	27	23	-7	-4	49	67	-6	-4	317	324	-10	-4	95	83
-7	-1	111	124	-7	-3	203	197	-6	-3	75	52	-10	-3	67	59
-6	-2	172	152	-7	-1	85	98	-6	-2	39	39	-10	-2	134	135
-6	-1	140	140	-6	-4	87	79	-6	-1	188	182	-10	-1	208	211
-5	-2	231	223	-6	-3	268	276	-5	-5	25	17	-9	-5	185	193
-5	-1	83	88	-6	-2	107	108	-5	-4	172	177	-9	-4	193	195
-4	-2	211	219	-6	-1	181	190	-5	-3	184	185	-9	-3	26	2
-4	-1	63	56	-5	-4	226	210	-5	-2	54	36	-9	-2	358	352
-3	-1	74	75	-5	-3	350	368	-5	-1	126	108	-9	-1	357	347
-2	-1	79	94	-5	-2	177	176	-4	-5	28	11	-8	-5	273	288
-1	-1	114	110	-5	-1	369	368	-4	-4	145	142	-8	-4	532	525
H = -9**				-4	-4	[illegible]71	275	-4	-3	317	294	-8	-3	61	63
-11	-1	238	258	-4	-3	461	457	-4	-2	76	67	-8	-2	278	295
-10	-1	174	173	-4	-2	255	258	-4	-1	168	163	-8	-1	417	416
-9	-2	33	23	-4	-1	356	379	-3	-4	280	276	-7	-6	27	13
-9	-1	144	160	-3	-4	199	207	-3	-3	372	380	-7	-5	325	306
-8	-2	84	75	-3	-3	540	556	-3	-2	428	451	-7	-4	383	398
-8	-1	80	78	-3	-2	166	165	-3	-1	169	155	-7	-3	208	204
-7	-3	137	143	-3	-1	79	84	-2	-5	206	211	-7	-2	568	565
-7	-2	97	85	-2	-4	81	82	-2	-4	159	146	-7	-1	806	829
-7	-1	28	31	-2	-3	235	234	-2	-3	336	326	-6	-6	167	165
-6	-3	280	287	-2	-2	135	110	-2	-2	380	373	-6	-5	252	260
-6	-2	143	139	-1	-4	26	6	-2	-1	130	118	-6	-4	432	430
-6	-1	213	218	-1	-2	151	143	-1	-5	190	177	-6	-3	385	398
-5	-3	332	336	0	-4	57	63	-1	-4	52	36	-6	-2	263	272
-5	-2	144	135	0	-2	95	92	-1	-3	243	230	-6	-1	388	384
-5	-1	300	310	0	-1	307	311	-1	-2	209	237	-5	-6	136	146
-4	-3	386	403	1	-2	116	109	-1	-1	269	261	-5	-5	106	108
-4	-2	252	250	1	-1	326	319	0	-5	131	128	-5	-4	270	253
-4	-1	179	161	2	-3	76	78	0	-4	163	182	-5	-3	40	38
-3	-3	231	231	2	-2	305	293	0	-3	34	29	-5	-1	152	143
-3	-2	199	180	2	-1	514	535	0	-2	311	312	-4	-6	115	113
-3	-1	44	41	3	-2	260	258	0	-1	221	220	-4	-5	51	55
-2	-3	88	81	3	-1	440	442	1	-4	169	171	-4	-4	111	115
-2	-2	160	165	4	-1	324	321	1	-3	86	78	-4	-3	30	33
-2	-1	98	91	**H = -7****				1	-2	290	294	-4	-2	55	49
-1	-3	76	80	-12	-2	34	38	1	-1	82	85	-4	-1	46	42
-1	-2	143	143	-12	-1	123	125	2	-4	181	190	-3	-6	118	109
-1	-1	204	200	-11	-3	60	67	2	-2	182	176	-3	-4	38	36
0	-2	227	220	-11	-2	51	35	2	-1	431	413	-3	-3	326	328
0	-1	165	181	-11	-1	144	137	3	-4	300	310	-3	-2	127	123
1	-2	288	295	-10	-3	82	66	3	-3	34	29	-3	-1	28	31
1	-1	288	289	-10	-2	180	199	3	-2	376	383	-2	-6	186	193
2	-1	371	378	-10	-1	303	288	3	-1	577	565	-2	-5	131	136
H = -8**				-9	-4	331	358	4	-3	97	93	-2	-4	64	68
-12	-1	91	91	-9	-3	98	83	4	-2	313	316	-2	-3	499	508
-11	-2	203	204	-9	-2	282	279	4	-1	324	321	-2	-2	438	433
-11	-1	229	233	-9	-1	423	442	5	-2	129	132	-2	-1	100	102
-10	-2	277	268	-8	-4	326	320	5	-1	241	244	-1	-6	340	349
-10	-1	407	421	-8	-3	187	177	6	-1	123	121	-1	-5	325	329
-9	-3	40	34	-8	-2	231	256	**H = -6****				-1	-4	56	61
-9	-2	75	76	-8	-1	680	688	-13	-1	77	76	-1	-3	363	353
-9	-1	322	330	-7	-5	132	142	-12	-2	255	263	-1	-2	751	756
-8	-4	138	125	-7	-4	289	310	-12	-1	221	206	-1	-1	181	187
-8	-3	150	143	-7	-3	225	222	-11	-3	55	54	0	-6	248	239

K	L	FOBS	FCAL
**H =	-6****		
0	-5	313	304
0	-4	158	158
0	-3	302	289
0	-2	504	489
0	-1	381	376
1	-6	41	47
1	-5	303	302
1	-4	216	202
1	-3	202	200
1	-2	409	425
1	-1	320	330
2	-5	172	179
2	-4	206	203
2	-2	97	91
2	-1	110	124
3	-5	141	138
3	-4	114	104
3	-3	129	134
3	-2	282	280
3	-1	360	377
4	-4	224	233
4	-2	331	334
4	-1	379	361
5	-4	303	316
5	-3	97	101
5	-2	201	200
5	-1	401	405
6	-3	161	173
6	-1	287	296
7	-1	112	116
**H =	-5****		
-13	-2	297	296
-13	-1	30	40
-12	-3	331	322
-12	-2	383	368
-12	-1	149	142
-11	-4	130	127
-11	-3	181	191
-11	-2	362	363
-11	-1	105	116
-10	-5	139	143
-10	-4	199	192
-10	-3	147	147
-10	-2	370	378
-10	-1	82	80
-9	-5	107	100
-9	-4	108	122
-9	-3	162	172
-9	-2	289	280
-9	-1	173	170
-8	-5	320	343
-8	-4	234	224
-8	-3	81	83
-8	-2	212	214
-8	-1	281	290
-7	-5	441	433
-7	-4	261	273
-7	-3	66	73
-7	-2	328	323
-7	-1	419	405
-6	-7	303	283
-6	-6	41	44
-6	-5	236	246
-6	-4	558	572
-6	-3	252	236
-6	-2	240	237
-6	-1	512	532
-5	-7	314	319
-5	-6	128	146
-5	-5	196	206
-5	-4	494	476
-5	-3	322	329
-5	-2	104	98
-5	-1	459	452
-4	-7	197	204
-4	-6	218	208
-4	-5	104	108
-4	-4	44	37
-4	-3	276	268
-4	-2	247	249
-4	-1	153	155
-3	-7	65	66
-3	-6	164	177
-3	-5	133	136
-3	-4	28	20
-3	-3	91	71
-3	-2	361	360
-3	-1	303	298
-2	-6	116	113
-2	-5	127	107
-2	-4	92	80
-2	-3	405	428
-2	-2	439	444
-2	-1	159	140
-1	-7	98	103
-1	-6	272	280
-1	-5	258	285
-1	-4	50	44
-1	-3	636	634
-1	-2	463	472
-1	-1	100	83
0	-7	79	75
0	-6	385	376
0	-5	350	328
0	-4	43	23
0	-3	578	566
0	-2	753	762
1	-6	342	327
1	-5	339	338
1	-4	95	108
1	-3	411	422
1	-2	700	697
1	-1	181	201
2	-6	174	160
2	-5	337	340
2	-4	286	278
2	-3	140	135
2	-2	251	244
2	-1	50	67
3	-5	190	193
3	-4	116	114
3	-3	144	160
3	-2	34	35
3	-1	75	83
4	-5	116	129
4	-4	142	128
4	-3	34	28
4	-2	221	219
4	-1	278	265
5	-5	201	221
5	-4	321	327
5	-2	270	271
5	-1	392	402
6	-4	325	325
6	-3	168	167
6	-2	150	143
6	-1	499	494
7	-3	228	224
7	-2	59	53
7	-1	401	402
8	-2	210	216
8	-1	135	131
**H =	-4****		
-13	-2	169	166
-13	-1	23	10
-12	-3	333	318
-12	-2	365	354
-11	-5	316	302
-11	-4	47	45
-11	-3	365	351
-11	-2	427	428
-11	-1	38	39
-10	-5	385	381
-10	-4	74	73
-10	-3	321	321
-10	-2	468	459
-10	-1	185	178
-9	-6	105	108
-9	-5	319	299
-9	-4	160	151
-9	-3	197	194
-9	-2	336	343
-9	-1	114	114
-8	-7	173	160
-8	-6	93	112
-8	-5	85	86
-8	-4	142	143
-8	-3	36	34
-8	-2	210	223
-8	-1	118	114
-7	-7	167	183
-7	-6	110	127
-7	-5	244	232
-7	-4	206	201
-7	-3	56	59
-7	-2	138	127
-7	-1	280	273
-6	-7	218	214
-6	-5	247	238
-6	-4	72	73
-6	-3	101	98
-6	-2	273	273
-6	-1	515	525
-5	-7	206	193
-5	-6	79	79
-5	-5	226	222
-5	-4	763	772
-5	-3	421	444
-5	-2	177	170
-5	-1	662	655
-4	-8	219	221
-4	-7	217	226
-4	-6	216	207
-4	-5	49	32
-4	-4	527	534
-4	-3	477	479
-4	-2	72	80
-4	-1	486	513
-3	-8	71	83
-3	-7	144	144
-3	-6	244	240
-3	-5	177	196
-3	-4	153	152
-3	-3	473	494
-3	-2	246	243
-3	-1	460	450
-2	-8	160	153
-2	-6	226	233
-2	-5	315	316
-2	-4	55	69
-2	-3	432	425
-2	-2	457	454
-2	-1	144	142
-1	-8	139	138
-1	-7	47	43
-1	-6	294	309
-1	-5	359	377
-1	-4	135	142
-1	-3	398	401
-1	-2	156	155
-1	-1	31	40
0	-8	149	159
0	-6	491	501
0	-5	354	358
0	-4	287	305
0	-3	491	508
0	-2	530	522

Table 42. Continued

K	L	FOBS	FCAL
H = -4**			
0	-1	138	126
1	-7	140	146
1	-6	513	531
1	-5	396	383
1	-4	276	269
1	-3	610	611
1	-2	694	655
2	-7	109	111
2	-6	463	445
2	-5	328	311
2	-4	102	131
2	-3	467	452
2	-2	623	634
2	-1	287	266
3	-7	53	40
3	-6	343	346
3	-5	248	249
3	-4	205	213
3	-3	76	74
3	-2	168	142
3	-1	210	207
4	-4	85	98
4	-3	184	183
4	-2	133	120
4	-1	195	208
5	-6	60	54
5	-5	30	24
5	-4	254	260
5	-3	359	371
5	-2	131	137
5	-1	365	361
6	-5	36	46
6	-4	412	421
6	-3	225	232
6	-2	157	143
6	-1	534	534
7	-4	450	454
7	-3	333	342
7	-2	240	250
7	-1	588	590
8	-3	376	374
8	-2	76	77
8	-1	425	435
9	-1	184	188
H = -3**			
-13	-2	58	59
-13	-1	137	128
-12	-4	43	51
-12	-3	253	260
-12	-2	63	73
-12	-1	115	115
-11	-5	206	216
-11	-4	153	150
-11	-3	482	468
-11	-2	301	284
-11	-1	115	97
-10	-6	450	444
-10	-5	369	364
-10	-4	121	125
-10	-3	373	366
-10	-2	461	459
-10	-1	86	73
-9	-6	414	401
-9	-5	360	364
-9	-4	58	35
-9	-3	349	340
-9	-2	463	455
-9	-1	411	401
-8	-6	111	100
-8	-5	267	283
-8	-4	100	98
-8	-3	83	78
-8	-2	49	48
-8	-1	343	358
-7	-5	133	136
-7	-4	165	154
-7	-3	257	260
-7	-2	85	90
-7	-1	304	308
-6	-8	69	72
-6	-7	224	251
-6	-6	179	173
-6	-5	63	55
-6	-4	32	44
-6	-3	263	269
-6	-2	138	120
-6	-1	230	246
-5	-8	104	106
-5	-7	279	279
-5	-5	84	115
-5	-4	485	460
-5	-3	449	467
-5	-2	140	149
-5	-1	1205	1225
-4	-8	161	157
-4	-7	361	393
-4	-6	337	332
-4	-5	285	286
-4	-4	846	855
-4	-3	730	737
-4	-2	317	313
-4	-1	1252	1268
-3	-8	142	139
-3	-7	518	533
-3	-6	405	381
-3	-5	253	250
-3	-4	732	734
-3	-3	954	948
-3	-2	179	163
-3	-1	761	773
-2	-8	71	78
-2	-7	338	340
-2	-6	288	287
-2	-5	54	49
-2	-4	421	397
-2	-3	554	561
-2	-2	92	81
-2	-1	635	623
-1	-8	90	95
-1	-7	161	164
-1	-6	138	118
-1	-5	141	126
-1	-4	192	174
-1	-3	369	375
-1	-2	47	42
-1	-1	69	68
0	-8	87	69
0	-7	100	109
0	-6	140	128
0	-5	213	232
0	-4	57	56
0	-3	49	43
0	-2	431	389
0	-1	74	49
1	-8	144	153
1	-7	47	46
1	-6	314	319
1	-5	206	207
1	-4	49	33
1	-3	414	426
1	-2	288	282
1	-1	166	153
2	-8	213	214
2	-7	81	94
2	-6	345	322
2	-5	397	393
2	-4	141	136
2	-3	506	539
2	-2	848	862
2	-1	312	335
3	-8	260	246
3	-7	86	77
3	-6	381	388
3	-5	649	657
3	-4	269	298
3	-3	363	356
3	-2	906	893
3	-1	943	918
4	-7	138	132
4	-6	136	121
4	-5	423	415
4	-4	232	211
4	-3	187	207
4	-2	372	378
4	-1	763	779
5	-7	132	121
5	-6	57	54
5	-5	166	171
5	-4	179	179
5	-3	248	261
5	-2	242	232
5	-1	403	390
6	-6	111	107
6	-5	79	65
6	-4	266	268
6	-3	230	203
6	-2	146	134
6	-1	204	217
7	-6	153	154
7	-5	128	133
7	-4	262	254
7	-3	193	197
7	-2	144	131
7	-1	382	366
8	-5	133	129
8	-4	360	357
8	-3	291	276
8	-2	168	158
8	-1	535	531
9	-4	379	373
9	-3	372	383
9	-2	29	19
9	-1	364	372
10	-1	146	146
H = -2**			
-13	-2	45	28
-13	-1	194	195
-12	-4	98	97
-12	-3	64	73
-12	-2	26	17
-12	-1	78	82
-11	-5	40	49
-11	-4	108	97
-11	-3	164	153
-11	-2	122	111
-11	-1	27	19
-10	-6	222	220
-10	-5	200	189
-10	-3	250	261
-10	-2	244	230
-10	-1	106	104
-9	-7	86	105
-9	-6	346	335
-9	-5	250	258
-9	-4	76	78
-9	-3	313	319
-9	-2	549	534
-9	-1	426	428
-8	-7	48	46
-8	-6	290	289
-8	-5	449	441
-8	-4	257	261
-8	-3	180	178
-8	-2	660	645
-8	-1	572	578
-7	-8	196	194
-7	-7	53	34

K	L	FOBS	FCAL
**H =	-2****		
-7	-6	154	138
-7	-5	367	383
-7	-4	356	359
-7	-3	36	2
-7	-2	393	400
-7	-1	696	700
-6	-8	66	69
-6	-7	65	63
-6	-6	85	91
-6	-5	184	190
-6	-4	376	394
-6	-3	120	118
-6	-2	411	388
-6	-1	434	462
-5	-8	44	43
-5	-7	253	246
-5	-6	202	224
-5	-5	33	29
-5	-4	268	264
-5	-3	168	173
-5	-2	136	151
-5	-1	363	379
-4	-9	129	113
-4	-8	82	70
-4	-7	109	112
-4	-6	244	249
-4	-5	186	190
-4	-4	527	553
-4	-3	326	338
-4	-2	405	388
-4	-1	1061	1077
-3	-9	140	131
-3	-8	130	120
-3	-7	491	505
-3	-6	550	571
-3	-5	299	299
-3	-4	858	866
-3	-3	538	539
-3	-2	192	183
-3	-1	776	801
-2	-9	191	202
-2	-8	60	67
-2	-7	666	662
-2	-6	424	437
-2	-5	178	186
-2	-4	754	763
-2	-3	533	543
-2	-2	52	42
-2	-1	664	652
-1	-9	277	274
-1	-8	43	30
-1	-7	414	401
-1	-6	405	409
-1	-5	296	301
-1	-4	416	438
-1	-3	929	892
-1	-2	253	253
-1	-1	165	150
0	-9	216	200
0	-8	59	54
0	-7	268	277
0	-6	276	275
0	-5	55	35
0	-4	151	148
0	-3	106	89
0	-2	36	37
0	-1	22	15
1	-9	82	88
1	-8	29	32
1	-7	177	164
1	-6	129	143
1	-5	68	42
1	-4	155	150
1	-3	134	116
1	-2	420	414
1	-1	59	58
2	-9	122	120
2	-8	150	146
2	-7	124	134
2	-6	170	177
2	-5	156	153
2	-4	235	215
2	-3	481	455
2	-2	408	427
2	-1	252	242
3	-8	169	173
3	-6	286	278
3	-5	429	413
3	-4	370	367
3	-3	528	495
3	-2	913	936
3	-1	704	691
4	-8	312	301
4	-7	111	103
4	-6	224	223
4	-5	720	683
4	-4	533	546
4	-3	290	313
4	-2	1161	1160
4	-1	795	817
5	-8	362	371
5	-7	293	298
5	-5	480	483
5	-4	370	350
5	-3	69	35
5	-2	520	541
5	-1	540	550
6	-7	172	170
6	-5	269	231
6	-4	365	385
6	-2	220	238
6	-1	424	426
7	-7	163	160
7	-6	108	122
7	-5	193	196
7	-4	255	273
7	-2	107	103
7	-1	47	44
8	-6	71	74
8	-5	162	167
8	-4	227	225
8	-3	30	21
8	-2	141	155
8	-1	193	199
9	-5	203	207
9	-4	307	319
9	-3	289	278
9	-2	36	26
9	-1	430	421
10	-4	237	250
10	-3	338	336
10	-2	44	35
10	-1	310	320
11	-2	210	196
11	-1	100	101
**H =	-1****		
-13	-1	250	267
-12	-4	211	205
-12	-3	260	268
-12	-2	95	98
-12	-1	64	53
-11	-5	29	14
-11	-3	99	102
-11	-2	127	134
-11	-1	117	82
-10	-6	34	60
-10	-5	123	107
-10	-4	39	35
-10	-3	58	45
-10	-2	266	266
-10	-1	45	48
-9	-6	154	146
-9	-5	190	175
-9	-4	92	101
-9	-3	225	216
-9	-2	304	315
-9	-1	207	202
-8	-8	214	226
-8	-7	40	41
-8	-6	221	215
-8	-5	282	270
-8	-4	232	235
-8	-3	402	390
-8	-2	706	678
-8	-1	426	424
-7	-8	298	302
-7	-7	173	171
-7	-6	225	231
-7	-5	624	613
-7	-4	437	448
-7	-3	294	283
-7	-2	770	799
-7	-1	604	603
-6	-9	49	47
-6	-8	267	270
-6	-7	185	193
-6	-6	110	111
-6	-5	603	612
-6	-4	442	484
-6	-3	107	105
-6	-2	803	795
-6	-1	742	722
-5	-8	248	272
-5	-7	414	404
-5	-6	100	108
-5	-5	300	315
-5	-4	666	675
-5	-3	110	98
-5	-2	121	133
-5	-1	79	53
-4	-9	145	153
-4	-8	105	106
-4	-7	231	231
-4	-6	59	63
-4	-5	120	122
-4	-4	331	341
-4	-3	70	71
-4	-2	59	46
-4	-1	521	507
-3	-9	40	27
-3	-8	239	248
-3	-7	219	231
-3	-6	291	276
-3	-5	340	322
-3	-4	251	273
-3	-3	278	255
-3	-2	109	108
-3	-1	745	759
-2	-9	110	120
-2	-8	234	246
-2	-7	526	521
-2	-6	283	284
-2	-5	396	398
-2	-4	559	558
-2	-3	133	130
-2	-2	265	244
-2	-1	958	928
-1	-10	356	367
-1	-9	231	232
-1	-8	258	271
-1	-7	543	537
-1	-6	247	257
-1	-5	167	157
-1	-4	806	791
-1	-3	415	417
-1	-2	146	144
-1	-1	672	656

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**H =		-1****		6	-5	413	424	-8	-5	299	291	-2	-1	654	660
0	-10	345	348	6	-4	320	320	-8	-4	179	173	-1	-10	216	213
0	-9	237	237	6	-3	296	298	-8	-3	243	241	-1	-9	84	83
0	-8	96	86	6	-2	593	598	-8	-2	338	368	-1	-8	222	226
0	-7	343	341	6	-1	410	410	-8	-1	121	136	-1	-7	457	468
0	-6	308	287	7	-7	196	191	-7	-8	338	337	-1	-6	400	381
0	-5	39	19	7	-6	63	48	-7	-7	91	100	-1	-5	49	49
0	-4	412	399	7	-5	215	216	-7	-6	272	279	-1	-4	451	463
0	-3	1041	1019	7	-4	235	231	-7	-5	604	578	-1	-3	709	706
0	-2	591	568	7	-3	64	56	-7	-4	330	313	-1	-2	654	623
0	-1	981	935	7	-2	155	154	-7	-3	358	338	-1	-1	528	523
1	-9	177	180	7	-1	280	260	-7	-2	1121	1118	0	-10	321	337
1	-7	113	107	8	-7	135	145	-7	-1	338	337	0	-9	210	203
1	-6	344	323	8	-6	80	73	-6	-9	238	233	0	-8	152	147
1	-5	249	265	8	-5	214	208	-6	-8	403	399	0	-7	434	422
1	-4	56	33	8	-4	32	33	-6	-7	313	306	0	-6	526	531
1	-3	496	475	8	-2	56	36	-6	-6	433	436	0	-5	69	38
1	-2	807	805	8	-1	45	40	-6	-5	715	694	0	-4	885	882
1	-1	18	39	9	-5	76	69	-6	-4	369	368	0	-3	1249	1240
2	-9	88	81	9	-4	172	173	-6	-3	395	390	0	-2	309	297
2	-8	110	109	9	-3	76	80	-6	-2	1169	1211	0	-1	870	827
2	-7	41	47	9	-2	102	138	-6	-1	543	529	1	-10	278	266
2	-6	188	203	9	-1	139	146	-5	-9	181	180	1	-9	261	252
2	-5	255	260	10	-5	39	39	-5	-8	429	433	1	-7	351	355
2	-4	222	229	10	-4	315	297	-5	-7	336	334	1	-6	760	742
2	-3	218	239	10	-3	363	367	-5	-6	258	260	1	-5	692	679
2	-2	1086	1069	10	-2	132	118	-5	-5	600	622	1	-4	812	766
2	-1	368	360	10	-1	350	357	-5	-4	527	522	1	-3	1282	1275
3	-9	102	113	11	-4	198	214	-5	-3	308	289	1	-2	1463	1420
3	-8	202	202	11	-3	456	463	-5	-2	606	616	1	-1	634	638
3	-7	115	114	11	-2	124	134	-5	-1	428	423	1	0	883	1214
3	-6	228	205	11	-1	324	317	-4	-8	312	320	2	-10	136	136
3	-5	466	481	12	-1	197	218	-4	-7	224	236	2	-9	231	232
3	-4	371	337	**H =		0****		-4	-6	59	58	2	-8	226	240
3	-3	269	281	-12	-3	348	338	-4	-5	391	385	2	-7	28	23
3	-2	557	571	-12	-2	168	161	-4	-4	286	294	2	-6	528	504
3	-1	153	154	-12	-1	255	230	-4	-3	263	235	2	-5	302	307
4	-9	172	166	-11	-5	65	65	-4	-2	40	44	2	-4	308	291
4	-8	223	196	-11	-4	155	169	-4	-1	507	514	2	-3	802	813
4	-7	32	32	-11	-3	307	271	-3	-10	200	213	2	-2	731	736
4	-6	375	389	-11	-2	265	258	-3	-9	80	79	2	-1	611	592
4	-5	681	698	-11	-1	77	69	-3	-8	187	185	2	0	521	548
4	-4	410	410	-10	-6	98	117	-3	-7	38	38	3	-10	85	88
4	-3	648	651	-10	-5	109	111	-3	-6	105	118	3	-9	143	142
4	-2	950	953	-10	-3	49	41	-3	-5	66	67	3	-8	343	350
4	-1	677	656	-10	-2	293	300	-3	-4	100	68	3	-6	208	203
5	-8	455	459	-10	-1	40	7	-3	-3	82	75	3	-5	310	316
5	-7	282	298	-9	-7	68	76	-3	-2	208	203	3	-4	118	123
5	-6	210	193	-9	-6	138	140	-3	-1	991	1021	3	-3	275	284
5	-5	790	779	-9	-5	237	236	-2	-10	150	142	3	-2	308	308
5	-4	402	370	-9	-4	189	179	-2	-9	111	121	3	-1	90	114
5	-3	392	408	-9	-3	186	137	-2	-8	118	125	3	0	461	471
5	-2	824	854	-9	-2	386	381	-2	-7	203	201	4	-9	124	133
5	-1	145	164	-9	-1	104	93	-2	-5	43	18	4	-8	234	226
6	-8	372	362	-8	-8	197	195	-2	-4	336	336	4	-7	46	35
6	-7	289	288	-8	-7	113	110	-2	-3	232	251	4	-6	326	348
6	-6	306	339	-8	-6	116	120	-2	-2	307	293	4	-5	254	255

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 0**				11	-5	59	50	-6	-4	246	221	0	-10	175	193
4	-4	46	15	11	-4	381	364	-6	-3	215	208	0	-9	291	273
4	-3	86	116	11	-3	326	317	-6	-2	371	387	0	-8	163	167
4	-2	240	243	11	-2	58	40	-6	-1	494	504	0	-7	354	366
4	-1	56	60	11	-1	229	236	-6	0	63	54	0	-6	444	447
4	0	287	289	11	0	335	364	-5	-9	271	264	0	-5	136	125
5	-9	252	245	12	-3	435	423	-5	-8	490	476	0	-4	488	495
5	-8	290	293	12	-2	123	134	-5	-7	270	270	0	-3	968	1034
5	-7	100	54	12	-1	294	278	-5	-6	339	341	0	-2	129	127
5	-6	465	424	12	0	444	422	-5	-5	497	518	0	-1	892	863
5	-5	461	476	**H = 1****				-5	-4	159	175	0	0	955	890
5	-4	151	138	-12	-2	86	74	-5	-3	146	142	1	-10	350	349
5	-3	199	210	-12	-1	207	213	-5	-2	945	950	1	-9	263	257
5	-2	598	614	-12	0	435	436	-5	-1	673	698	1	-7	613	615
5	-1	132	132	-11	-5	126	137	-5	0	250	255	1	-6	717	714
5	0	37	31	-11	-4	322	338	-4	-10	64	55	1	-5	502	505
6	-9	341	355	-11	-3	594	584	-4	-9	285	285	1	-4	539	555
6	-8	457	452	-11	-2	223	221	-4	-8	481	485	1	-3	1275	1311
6	-7	145	152	-11	-1	259	237	-4	-7	358	368	1	-2	885	985
6	-6	303	330	-11	0	524	524	-4	-6	355	338	1	-1	765	763
6	-5	680	705	-10	-6	318	311	-4	-5	613	624	1	0	1462	1578
6	-4	294	296	-10	-5	179	185	-4	-4	615	589	2	-10	346	342
6	-3	221	220	-10	-4	264	255	-4	-3	208	217	2	-9	352	353
6	-2	565	599	-10	-3	524	530	-4	-2	500	521	2	-8	192	156
6	-1	475	498	-10	-2	235	239	-4	-1	999	1069	2	-7	381	350
6	0	208	198	-10	-1	215	209	-4	0	228	263	2	-6	893	895
7	-8	401	412	-10	0	525	532	-3	-10	199	216	2	-5	655	630
7	-7	98	99	-9	-7	109	104	-3	-9	36	31	2	-4	615	627
7	-6	198	207	-9	-6	265	254	-3	-8	312	299	2	-3	1158	1206
7	-5	363	339	-9	-5	223	232	-3	-7	212	220	2	-2	374	404
7	-4	394	421	-9	-4	119	131	-3	-5	416	410	2	-1	136	124
7	-2	561	545	-9	-3	405	397	-3	-4	86	97	2	0	820	864
7	-1	631	655	-9	-2	385	339	-3	-3	96	76	3	-10	183	186
7	0	363	369	-9	-1	127	118	-3	-2	137	137	3	-9	388	357
8	-8	206	209	-9	0	345	335	-3	-1	1301	1448	3	-8	211	223
8	-7	179	159	-8	-8	108	107	-3	0	120	138	3	-6	617	596
8	-6	31	13	-8	-7	83	81	-2	-10	160	154	3	-5	289	280
8	-5	83	110	-8	-6	237	220	-2	-9	115	106	3	-4	319	302
8	-4	391	385	-8	-5	285	289	-2	-8	91	104	3	-3	655	683
8	-3	176	187	-8	-4	117	126	-2	-7	56	50	3	-2	119	133
8	-2	293	295	-8	-3	227	211	-2	-6	57	53	3	-1	175	167
8	-1	487	473	-8	-2	40	40	-2	-5	192	169	3	0	325	340
8	0	465	458	-8	-1	34	1	-2	-4	304	312	4	-9	223	221
9	-7	120	141	-8	0	134	150	-2	-3	631	645	4	-8	234	237
9	-6	131	128	-7	-8	205	189	-2	-2	709	727	4	-7	71	61
9	-5	38	18	-7	-7	78	83	-2	-1	341	344	4	-6	168	165
9	-4	73	80	-7	-6	168	162	-2	0	568	553	4	-5	318	331
9	-3	175	159	-7	-5	286	300	-1	-10	81	90	4	-4	147	152
9	-2	45	31	-7	-3	93	90	-1	-9	46	57	4	-3	422	432
9	-1	156	162	-7	-2	93	94	-1	-7	242	238	4	-2	153	146
9	0	36	55	-7	-1	185	169	-1	-6	133	144	4	-1	46	65
10	-6	135	137	-7	0	108	115	-1	-5	169	157	4	0	143	143
10	-5	106	98	-6	-9	233	226	-1	-4	556	558	5	-10	84	89
10	-4	152	153	-6	-8	313	311	-1	-3	888	966	5	-9	53	54
10	-3	207	208	-6	-7	80	80	-1	-2	372	345	5	-8	228	214
10	-1	283	273	-6	-6	239	233	-1	-1	271	268	5	-7	166	142
10	0	475	421	-6	-5	510	503	-1	0	208	195	5	-6	124	144

Table 42. Continued

K	L	FOBS	FCAL
**H =	1****		
5	-5	138	127
5	-4	306	302
5	-3	221	205
5	-2	325	324
5	-1	329	328
5	0	244	247
6	-9	231	250
6	-8	235	254
6	-7	123	123
6	-6	444	449
6	-5	377	398
6	-4	262	261
6	-3	47	16
6	-2	477	503
6	-1	363	389
6	0	140	133
7	-9	213	211
7	-8	342	353
7	-7	212	223
7	-6	331	359
7	-5	475	470
7	-4	320	334
7	-3	78	76
7	-2	388	398
7	-1	903	917
7	0	137	106
8	-8	436	452
8	-7	104	98
8	-6	33	32
8	-5	497	502
8	-4	503	501
8	-3	267	283
8	-2	465	475
8	-1	894	897
8	0	450	440
9	-8	211	200
9	-7	243	249
9	-6	138	138
9	-5	109	102
9	-4	463	452
9	-3	323	311
9	-2	240	242
9	-1	447	434
9	0	156	146
10	-7	171	164
10	-6	83	77
10	-5	56	45
10	-4	208	215
10	-3	164	166
10	-2	175	154
10	-1	328	324
10	0	108	99
11	-6	164	155
11	-5	77	51
11	-4	171	155
11	-3	232	221
11	-2	54	84
11	-1	324	308
11	0	193	186
12	-4	338	348
12	-3	283	292
12	-2	28	8
12	-1	232	218
12	0	221	229
13	-2	128	114
13	-1	150	161
13	0	312	316
**H =	2****		
-11	-4	185	171
-11	-3	281	304
-11	-2	84	84
-11	-1	288	263
-11	0	391	362
-10	-6	396	387
-10	-5	178	180
-10	-4	400	364
-10	-3	537	501
-10	-2	236	233
-10	-1	245	259
-10	0	478	474
-9	-7	243	244
-9	-6	443	425
-9	-5	248	246
-9	-4	194	182
-9	-3	482	517
-9	-2	317	327
-9	-1	234	204
-9	0	407	383
-8	-8	167	184
-8	-7	164	169
-8	-6	374	365
-8	-5	127	140
-8	-4	62	22
-8	-3	777	742
-8	-2	388	358
-8	-1	50	55
-8	0	99	123
-7	-8	267	247
-7	-7	77	73
-7	-6	224	224
-7	-5	263	249
-7	-4	88	79
-7	-3	63	35
-7	-2	49	37
-7	-1	47	39
-7	0	25	18
-6	-9	158	158
-6	-8	78	77
-6	-7	97	91
-6	-6	186	168
-6	-5	115	131
-6	-4	160	156
-6	-2	118	119
-6	-1	99	106
-5	-9	246	250
-5	-8	176	183
-5	-6	167	151
-5	-5	218	216
-5	-4	253	256
-5	-3	435	434
-5	-2	63	68
-5	-1	528	536
-5	0	41	51
-4	-9	373	368
-4	-8	406	395
-4	-7	47	53
-4	-6	212	213
-4	-5	495	496
-4	-4	608	593
-4	-3	123	111
-4	-2	633	661
-4	-1	610	656
-4	0	228	223
-3	-10	88	80
-3	-9	230	235
-3	-8	453	447
-3	-7	357	361
-3	-6	93	78
-3	-5	631	618
-3	-4	657	669
-3	-3	365	376
-3	-2	863	890
-3	-1	1245	1295
-3	0	665	652
-2	-10	147	145
-2	-8	292	292
-2	-7	441	432
-2	-6	223	224
-2	-5	390	395
-2	-4	678	700
-2	-3	524	521
-2	-2	155	153
-2	-1	1561	1644
-2	0	514	511
-1	-11	103	110
-1	-10	100	98
-1	-9	45	44
-1	-8	114	121
-1	-7	303	310
-1	-6	396	403
-1	-5	159	145
-1	-4	747	781
-1	-3	468	486
-1	-2	246	218
-1	-1	1257	1245
-1	0	455	453
0	-11	34	30
0	-10	104	89
0	-9	206	227
0	-8	139	137
0	-7	353	358
0	-6	520	530
0	-5	160	147
0	-4	755	790
0	-3	1099	1096
0	-2	198	178
0	-1	307	288
0	0	239	227
1	-11	59	65
1	-10	201	213
1	-9	421	428
1	-8	43	33
1	-7	398	394
1	-6	490	501
1	-5	41	35
1	-4	526	520
1	-3	158	134
1	-2	226	227
1	-1	856	808
1	0	739	716
2	-10	272	264
2	-9	450	444
2	-8	142	137
2	-7	696	716
2	-6	707	721
2	-4	627	682
2	-3	1280	1326
2	-2	1094	1080
2	-1	899	891
2	0	79	88
3	-10	443	443
3	-9	441	459
3	-8	263	243
3	-7	621	611
3	-6	722	748
3	-5	111	108
3	-4	191	230
3	-3	552	569
3	-2	285	263
3	-1	234	224
3	0	729	717
4	-10	297	297
4	-9	434	426
4	-8	145	135
4	-7	316	332
4	-6	474	478
4	-5	238	245
4	-4	141	145
4	-3	217	244
4	-2	634	652
4	-1	118	118
4	0	436	436
5	-10	80	80
5	-9	299	286
5	-8	50	35
5	-7	88	81
5	-6	85	80

K	L	FOBS	FCAL
H = 2**			
5	-5	110	109
5	-3	233	233
5	-2	401	406
5	-1	541	553
5	0	58	58
6	-10	60	52
6	-9	85	102
6	-8	87	80
6	-7	72	51
6	-6	75	85
6	-5	176	184
6	-4	358	361
6	-3	92	65
6	-2	449	466
6	-1	373	392
6	0	60	64
7	-9	55	45
7	-8	178	159
7	-7	140	150
7	-6	80	81
7	-5	358	357
7	-4	449	468
7	-3	103	105
7	-2	657	665
7	-1	451	467
7	0	52	34
8	-9	89	76
8	-8	285	325
8	-7	338	316
8	-6	215	190
8	-5	521	538
8	-4	509	518
8	-3	32	41
8	-2	645	684
8	-1	655	682
8	0	64	72
9	-8	349	320
9	-7	353	368
9	-5	575	568
9	-4	652	662
9	-3	46	48
9	-2	505	506
9	-1	790	785
9	0	168	136
10	-7	393	403
10	-6	187	175
10	-5	333	341
10	-4	532	526
10	-3	186	164
10	-2	220	237
10	-1	263	285
10	0	54	61
11	-6	82	88
11	-5	73	91
11	-4	175	160
11	-3	45	28
11	-2	244	239
11	-1	178	146
11	0	310	281
12	-5	36	19
12	-4	159	162
12	-3	161	134
12	-2	119	99
12	-1	107	109
12	0	95	102
13	-3	148	146
13	-2	80	92
13	-1	114	116
13	0	224	216
H = 3**			
-10	-5	79	69
-10	-4	221	226
-10	-3	276	271
-10	-2	68	60
-10	-1	248	242
-10	0	272	264
-9	-6	449	452
-9	-5	117	97
-9	-4	297	285
-9	-3	246	256
-9	-2	158	163
-9	-1	137	165
-9	0	402	395
-8	-7	248	251
-8	-6	358	352
-8	-5	114	134
-8	-4	274	280
-8	-3	429	421
-8	-2	426	406
-8	0	397	392
-7	-8	130	135
-7	-7	130	126
-7	-6	249	252
-7	-5	279	238
-7	-4	58	58
-7	-3	358	348
-7	-2	253	243
-7	-1	106	95
-7	0	79	84
-6	-9	143	137
-6	-8	145	136
-6	-7	49	47
-6	-6	173	158
-6	-5	56	35
-6	-4	59	71
-6	-3	36	24
-6	-2	213	205
-6	-1	133	141
-6	0	51	29
-5	-9	67	63
-5	-6	92	88
-5	-5	101	95
-5	-4	122	101
-5	-3	94	93
-5	-2	421	415
-5	-1	306	315
-5	0	249	236
-4	-10	44	37
-4	-9	77	83
-4	-8	200	196
-4	-7	222	177
-4	-6	200	182
-4	-5	445	450
-4	-4	386	411
-4	-3	99	104
-4	-2	789	774
-4	-1	576	607
-4	0	45	28
-3	-10	43	52
-3	-9	182	194
-3	-8	425	419
-3	-7	257	266
-3	-6	125	121
-3	-5	794	806
-3	-4	1007	1046
-3	-3	155	118
-3	-2	674	711
-3	-1	898	929
-3	0	228	220
-2	-11	259	269
-2	-10	334	318
-2	-9	162	161
-2	-8	586	583
-2	-7	711	731
-2	-6	249	237
-2	-5	728	750
-2	-4	896	941
-2	-3	318	311
-2	-2	991	1021
-2	-1	1409	1432
-2	0	458	446
-1	-11	207	208
-1	-10	344	346
-1	-9	86	81
-1	-8	383	377
-1	-7	613	620
-1	-6	97	106
-1	-5	202	231
-1	-4	793	817
-1	-3	427	423
-1	-2	565	552
-1	-1	598	602
-1	0	293	281
0	-11	227	232
0	-10	111	119
0	-9	276	266
0	-8	159	145
0	-7	397	395
0	-6	315	323
0	-5	215	218
0	-4	555	545
0	-3	528	506
0	-2	57	39
0	-1	188	189
0	0	208	195
1	-11	29	13
1	-10	244	244
1	-9	221	226
1	-8	101	103
1	-7	270	262
1	-6	278	260
1	-5	108	98
1	-4	79	80
1	-3	407	371
1	-2	526	510
1	-1	215	206
1	0	151	147
2	-11	36	31
2	-10	299	292
2	-9	152	142
2	-8	113	114
2	-7	336	351
2	-6	105	103
2	-5	233	221
2	-4	775	769
2	-3	261	252
2	-2	915	895
2	-1	265	267
2	0	296	298
3	-11	92	74
3	-10	283	296
3	-9	419	408
3	-8	251	233
3	-7	395	410
3	-6	519	548
3	-5	225	202
3	-4	410	383
3	-3	1070	1095
3	-2	225	220
3	-1	122	118
3	0	950	948
4	-11	60	60
4	-10	331	331
4	-9	418	416
4	-8	100	111
4	-7	520	553
4	-6	656	687
4	-5	370	375
4	-4	116	119
4	-3	802	833
4	-2	663	677
4	-1	285	270
4	0	959	994
5	-10	242	226
5	-9	298	317
5	-8	223	223
5	-7	202	210

Table 42. Continued

K	L	FOBS	FCAL
**H =	3****		
5	-6	396	414
5	-5	552	596
5	-4	140	147
5	-3	331	369
5	-2	819	888
5	-1	252	252
5	0	618	629
6	-10	35	52
6	-9	203	187
6	-8	112	156
6	-7	264	266
6	-6	85	89
6	-5	366	392
6	-4	63	78
6	-3	42	38
6	-2	681	706
6	-1	412	401
6	0	304	328
7	-9	79	83
7	-8	73	64
7	-7	208	215
7	-6	50	34
7	-5	308	294
7	-4	388	397
7	-3	184	204
7	-2	291	306
7	-1	130	142
7	0	318	332
8	-8	287	299
8	-7	248	256
8	-6	31	30
8	-5	418	432
8	-4	282	285
8	-3	260	264
8	-2	530	533
8	-1	391	385
8	0	90	86
9	-9	127	121
9	-8	357	380
9	-7	295	259
9	-6	245	231
9	-5	596	614
9	-4	362	344
9	-3	68	70
9	-2	723	727
9	-1	508	528
9	0	66	68
10	-8	389	381
10	-7	451	452
10	-6	118	117
10	-5	622	607
10	-4	633	633
10	-3	205	185
10	-2	363	364
10	-1	567	571
10	0	153	147
11	-7	391	376
11	-6	81	61
11	-5	273	284
11	-4	331	331
11	-3	77	82
11	-2	239	222
11	-1	250	243
11	0	274	273
12	-6	32	43
12	-5	53	35
12	-4	123	101
12	-3	151	142
12	-2	107	95
12	-1	57	43
12	0	241	233
13	-4	53	35
13	-3	121	129
13	-2	87	96
13	-1	43	37
13	0	109	108
**H =	4****		
-13	0	128	152
-10	-3	48	51
-10	-1	33	30
-10	0	56	58
-9	-6	116	143
-9	-5	34	29
-9	-4	114	104
-9	-3	164	143
-9	-2	137	132
-9	-1	97	91
-9	0	145	149
-8	-7	284	283
-8	-6	391	377
-8	-5	45	32
-8	-4	46	58
-8	-3	270	293
-8	-2	302	315
-8	-1	31	26
-8	0	439	435
-7	-8	57	53
-7	-7	244	236
-7	-6	252	269
-7	-5	199	215
-7	-4	119	125
-7	-3	541	510
-7	-2	538	537
-7	-1	100	78
-7	0	644	660
-6	-9	277	279
-6	-8	106	114
-6	-7	83	91
-6	-6	311	305
-6	-5	593	555
-6	-4	32	15
-6	-3	356	365
-6	-2	572	581
-6	-1	113	105
-6	0	358	347
-5	-9	171	161
-5	-8	143	150
-5	-7	106	93
-5	-6	121	117
-5	-5	149	150
-5	-4	202	170
-5	-3	342	337
-5	-2	474	466
-5	-1	82	75
-5	0	263	275
-4	-10	78	79
-4	-9	44	46
-4	-8	201	195
-4	-7	167	151
-4	-5	377	378
-4	-4	332	328
-4	-3	250	239
-4	-2	626	618
-4	-1	288	270
-4	0	237	221
-3	-10	171	170
-3	-8	270	259
-3	-7	279	268
-3	-6	172	168
-3	-5	666	660
-3	-4	526	534
-3	-3	47	59
-3	-2	457	469
-3	-1	127	149
-3	0	53	50
-2	-11	322	310
-2	-10	173	167
-2	-9	150	136
-2	-8	501	509
-2	-7	588	572
-2	-5	845	865
-2	-4	636	685
-2	-3	105	103
-2	-2	495	508
-2	-1	636	649
-2	0	405	395
-1	-11	340	324
-1	-10	408	397
-1	-9	150	131
-1	-8	582	582
-1	-7	666	676
-1	-6	62	27
-1	-5	844	858
-1	-4	651	662
-1	-3	262	272
-1	-2	431	424
-1	-1	557	547
-1	0	505	501
0	-11	281	280
0	-10	448	429
0	-9	82	76
0	-8	478	488
0	-7	488	500
0	-6	89	92
0	-5	386	379
0	-4	426	433
0	-3	110	101
0	-2	43	51
0	-1	490	475
0	0	649	629
1	-11	198	188
1	-10	175	184
1	-9	121	128
1	-8	188	193
1	-7	334	329
1	-6	32	26
1	-5	73	69
1	-4	165	173
1	-3	149	151
1	-2	79	63
1	-1	265	262
1	0	654	643
2	-11	91	84
2	-10	156	172
2	-9	139	142
2	-8	39	32
2	-7	191	184
2	-6	181	181
2	-4	261	230
2	-3	186	194
2	-2	283	268
2	-1	79	75
2	0	530	529
3	-11	38	47
3	-10	220	206
3	-9	61	63
3	-8	78	51
3	-7	68	60
3	-6	140	143
3	-5	283	282
3	-4	55	41
3	-3	1181	1171
3	-2	786	778
3	-1	513	509
3	0	828	830
4	-11	102	90
4	-10	285	320
4	-9	270	276
4	-8	128	140
4	-7	349	361
4	-6	600	616
4	-5	795	799
4	-4	311	297
4	-3	1103	1113
4	-2	831	819
4	-1	201	201
4	0	758	791

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**H =	4****			10	-4	378	402	-6	-2	604	617	0	-9	71	72
5	-10	195	197	10	-3	78	75	-6	-1	63	53	0	-8	622	619
5	-9	431	455	10	-2	252	221	-6	0	552	545	0	-7	481	489
5	-8	212	206	10	-1	583	600	-5	-9	329	323	0	-6	50	45
5	-7	408	420	10	0	359	355	-5	-8	347	343	0	-5	555	556
5	-6	683	695	11	-8	355	361	-5	-7	73	33	0	-4	825	820
5	-5	645	655	11	-7	372	360	-5	-6	603	577	0	-3	518	529
5	-4	151	164	11	-6	61	71	-5	-5	503	507	0	-2	430	415
5	-3	1020	1039	11	-5	470	480	-5	-3	499	506	0	-1	469	500
5	-2	838	882	11	-4	532	512	-5	-2	518	525	0	0	572	573
5	-1	86	68	11	-3	362	350	-5	-1	226	209	1	-11	370	374
5	0	940	980	11	-2	174	183	-5	0	387	388	1	-10	393	378
6	-10	146	141	11	-1	560	570	-4	-10	30	25	1	-9	139	134
6	-9	378	407	11	0	435	440	-4	-9	225	225	1	-8	590	591
6	-8	377	354	12	-7	319	331	-4	-8	326	326	1	-7	295	297
6	-7	121	92	12	-6	174	159	-4	-7	113	118	1	-6	248	236
6	-6	558	586	12	-5	191	196	-4	-6	267	279	1	-5	529	510
6	-5	554	576	12	-4	305	316	-4	-5	317	302	1	-4	769	754
6	-4	129	125	12	-3	187	201	-4	-4	140	138	1	-3	538	535
6	-3	865	908	12	-2	33	21	-4	-3	249	254	1	-2	153	126
6	-2	710	736	12	-1	291	296	-4	-2	462	443	1	-1	823	814
6	-1	200	176	12	0	413	414	-4	-1	221	219	1	0	810	813
6	0	549	568	13	-5	50	47	-4	0	120	113	2	-11	171	171
7	-10	35	18	13	-4	178	181	-3	-10	128	128	2	-10	316	307
7	-9	191	175	13	-3	243	219	-3	-8	280	279	2	-9	46	36
7	-8	249	258	13	-2	128	128	-3	-7	117	119	2	-8	289	282
7	-6	313	327	13	-1	225	235	-3	-5	241	240	2	-7	407	417
7	-5	427	417	13	0	204	187	-3	-4	141	118	2	-6	452	445
7	-4	107	103	**H =	5****			-3	-3	59	58	2	-5	305	310
7	-3	263	291	-13	-2	283	289	-3	-2	394	373	2	-4	503	496
7	-2	236	240	-13	-1	37	35	-3	-1	100	97	2	-3	149	187
7	-1	318	300	-13	0	201	200	-3	0	38	51	2	-2	301	293
7	0	182	183	-9	-4	48	67	-2	-10	275	270	2	-1	541	543
8	-10	71	59	-9	-3	73	81	-2	-9	40	43	2	0	293	303
8	-9	100	79	-9	-1	50	43	-2	-8	321	317	3	-11	43	39
8	-8	206	213	-9	0	158	155	-2	-7	99	104	3	-10	90	86
8	-7	123	124	-8	-6	163	163	-2	-6	61	61	3	-9	68	55
8	-6	36	40	-8	-5	136	119	-2	-5	271	273	3	-8	64	76
8	-5	277	288	-8	-4	92	92	-2	-4	330	315	3	-7	92	90
8	-4	30	27	-8	-3	239	229	-2	-3	131	121	3	-6	77	78
8	-3	323	306	-8	-2	101	100	-2	-2	50	55	3	-5	205	181
8	-2	120	115	-8	-1	54	52	-2	-1	237	244	3	-4	120	134
8	-1	68	48	-8	0	210	202	-2	0	30	13	3	-3	248	265
9	-9	65	61	-7	-7	179	173	-1	-11	260	258	3	-2	160	143
9	-8	268	267	-7	-6	274	292	-1	-10	273	258	3	-1	269	284
9	-7	151	156	-7	-5	94	108	-1	-9	117	112	3	0	781	766
9	-6	66	63	-7	-4	149	150	-1	-8	427	434	4	-10	104	97
9	-5	306	300	-7	-3	421	423	-1	-7	456	452	4	-9	65	48
9	-4	125	113	-7	-2	340	332	-1	-6	156	154	4	-8	148	143
9	-3	165	175	-7	-1	132	121	-1	-5	400	404	4	-7	66	59
9	-2	196	198	-7	0	512	519	-1	-4	431	439	4	-6	441	438
9	-1	277	275	-6	-8	155	156	-1	-3	51	48	4	-5	331	354
9	0	84	95	-6	-7	282	276	-1	-2	332	325	4	-4	108	96
10	-8	310	310	-6	-6	562	564	-1	-1	563	558	4	-3	670	688
10	-7	246	259	-6	-5	567	552	-1	0	222	241	4	-2	225	215
10	-6	95	104	-6	-4	70	68	0	-11	471	448	4	-1	149	171
10	-5	395	391	-6	-3	593	585	0	-10	403	397	4	0	587	576

Table 42. Continued

K	L	FOBS	FCAL
H = 5**			
5	-10	140	127
5	-9	226	231
5	-8	344	345
5	-7	39	52
5	-6	651	640
5	-5	436	443
5	-4	462	472
5	-3	634	641
5	-2	598	587
5	-1	373	373
5	0	437	436
6	-11	138	147
6	-10	169	177
6	-9	483	489
6	-8	437	431
6	-7	213	222
6	-6	805	818
6	-5	548	560
6	-4	193	198
6	-3	849	881
6	-2	767	766
6	-1	53	46
6	0	601	608
7	-10	147	147
7	-9	430	456
7	-8	522	522
7	-7	141	135
7	-6	827	852
7	-5	556	578
7	-4	48	27
7	-3	624	622
7	-2	769	793
7	-1	156	152
7	0	464	440
8	-9	299	315
8	-8	383	379
8	-7	88	84
8	-6	535	556
8	-5	362	352
8	-4	173	169
8	-3	245	253
8	-2	280	275
8	-1	52	38
8	0	30	46
9	-9	172	175
9	-8	283	284
9	-6	140	128
9	-5	154	165
9	-4	37	26
9	-3	120	131
9	-2	92	77
9	-1	220	221
9	0	106	117
10	-9	65	88
10	-8	210	[illegible]
10	-6	33	[illegible]

K	L	FOBS	FCAL
10	-5	48	45
10	-4	102	98
10	-3	54	63
10	-2	82	78
10	-1	175	178
10	0	169	165
11	-8	194	183
11	-7	76	76
11	-6	28	26
11	-5	116	107
11	-4	361	357
11	-3	276	271
11	-2	210	219
11	-1	465	450
11	0	342	347
12	-7	305	302
12	-6	239	229
12	-5	84	90
12	-4	422	438
12	-3	268	266
12	-2	171	155
12	-1	473	481
12	0	306	319
13	-5	190	179
13	-4	475	475
13	-3	292	275
13	-2	24	27
13	-1	434	429
13	0	381	369
H = 6**			
-13	-2	250	240
-13	-1	61	42
-8	-4	102	107
-8	-3	212	213
-8	-2	83	79
-8	-1	170	159
-7	-6	209	186
-7	-5	102	97
-7	-4	140	146
-7	-3	358	358
-7	-2	77	89
-7	-1	129	132
-7	0	229	240
-6	-8	146	132
-6	-7	155	141
-6	-6	324	350
-6	-5	291	296
-6	-4	172	160
-6	-3	502	497
-6	-2	332	341
-6	-1	128	132
-6	0	374	372
-5	-9	392	391
-5	-8	224	229
[illegible]	[illegible]	[illegible]	130
[illegible]	[illegible]	[illegible]	666
[illegible]	[illegible]	[illegible]	631

K	L	FOBS	FCAL
-5	-4	121	109
-5	-3	545	557
-5	-2	504	514
-5	-1	39	40
-5	0	304	301
-4	-9	440	444
-4	-8	555	536
-4	-6	606	595
-4	-5	510	527
-4	-4	61	63
-4	-3	364	352
-4	-2	308	304
-4	-1	162	162
-4	0	63	64
-3	-10	79	78
-3	-9	354	344
-3	-8	328	325
-3	-7	33	37
-3	-6	297	304
-3	-5	230	226
-3	-4	30	36
-3	-3	187	184
-3	-2	179	177
-3	-1	184	162
-3	0	56	59
-2	-9	165	159
-2	-8	98	103
-2	-7	49	50
-2	-6	189	179
-2	-5	108	86
-2	-4	67	55
-2	-3	47	42
-2	-2	79	63
-2	-1	197	199
-2	0	99	102
-1	-11	125	123
-1	-10	45	36
-1	-9	120	118
-1	-8	132	135
-1	-7	41	22
-1	-6	28	13
-1	-5	74	45
-1	-4	171	157
-1	-3	29	24
-1	-2	141	147
-1	-1	360	336
-1	0	169	160
0	-11	211	221
0	-10	72	77
0	-9	37	31
0	-8	210	205
0	-7	234	227
0	-6	141	121
0	-5	217	232
0	-4	536	539
0	-3	347	331
0	-2	238	246

K	L	FOBS	FCAL
0	-1	825	835
0	0	483	502
1	-11	319	318
1	-10	221	232
1	-9	63	51
1	-8	330	331
1	-7	482	483
1	-6	138	151
1	-5	279	279
1	-4	968	951
1	-3	604	591
1	-2	307	303
1	-1	933	934
1	0	707	695
2	-11	259	266
2	-10	315	317
2	-9	164	152
2	-8	300	284
2	-7	650	647
2	-6	551	533
2	-5	47	46
2	-4	968	968
2	-3	952	941
2	-2	132	129
2	-1	789	792
2	0	517	542
3	-11	81	83
3	-10	252	252
3	-9	363	353
3	-8	156	155
3	-7	481	482
3	-6	661	677
3	-5	65	54
3	-4	690	681
3	-3	555	546
3	-2	30	30
3	-1	507	514
3	0	196	203
4	-11	49	48
4	-10	156	163
4	-9	326	314
4	-7	279	281
4	-6	217	232
4	-5	34	44
4	-4	198	169
4	-3	286	305
4	-2	97	92
4	-1	358	363
4	0	262	247
5	-11	66	57
5	-10	158	159
5	-9	196	174
5	-8	37	18
5	-7	274	297
5	-6	331	300
5	-5	264	287
5	-4	527	535

Table 42. Continued

K	L	FOBS	FCAL
H = 6**			
5	-3	299	277
5	-2	44	47
5	-1	186	184
5	0	243	255
6	-11	87	71
6	-10	203	184
6	-9	421	427
6	-8	64	68
6	-7	168	168
6	-6	515	518
6	-5	132	108
6	-4	463	471
6	-3	369	359
6	-2	187	210
6	-1	28	23
6	0	280	276
7	-10	270	288
7	-9	549	543
7	-8	190	185
7	-7	186	203
7	-6	540	554
7	-5	336	317
7	-4	230	197
7	-3	634	643
7	-2	674	678
7	-1	259	257
7	0	339	332
8	-10	158	155
8	-9	382	367
8	-8	327	338
8	-7	107	115
8	-6	541	537
8	-5	545	549
8	-4	310	301
8	-3	208	209
8	-2	642	663
8	-1	386	393
8	0	55	43
9	-10	73	71
9	-9	243	250
9	-8	259	273
9	-7	158	136
9	-6	172	162
9	-5	350	358
9	-4	206	199
9	-3	55	72
9	-2	356	375
9	-1	384	376
10	-9	57	57
10	-8	86	80
10	-7	228	248
10	-5	162	145
10	-4	189	201
10	-3	198	179
10	-2	86	80
10	-1	241	238
11	-8	79	86
11	-7	108	97
11	-6	29	26
11	-5	72	81
11	-4	208	215
11	-3	28	25
11	-2	125	130
11	-1	229	232
11	0	52	51
12	-7	209	198
12	-6	64	62
12	-5	150	160
12	-4	320	315
12	-3	151	161
12	-2	381	402
12	-1	328	302
12	0	138	147
13	-6	108	90
13	-5	215	218
13	-4	443	461
13	-3	181	171
13	-2	281	287
13	-1	420	416
13	0	219	226
H = 7**			
-7	-4	182	191
-7	-3	180	183
-6	-6	136	134
-6	-5	68	73
-6	-4	146	147
-6	-3	119	128
-6	-2	65	61
-6	-1	56	51
-6	0	117	131
-5	-8	30	37
-5	-7	191	188
-5	-6	293	298
-5	-5	160	151
-5	-4	83	89
-5	-3	340	338
-5	-2	332	346
-5	-1	30	42
-5	0	155	146
-4	-9	396	401
-4	-8	245	236
-4	-7	63	67
-4	-6	496	487
-4	-5	365	366
-4	-3	323	317
-4	-2	430	423
-4	-1	229	226
-4	0	244	239
-3	-9	389	384
-3	-8	379	361
-3	-7	150	133
-3	-6	340	341
-3	-5	437	440
-3	-4	38	42
-3	-3	141	141
-3	-2	420	426
-3	-1	268	273
-3	0	118	119
-2	-10	30	23
-2	-9	299	282
-2	-8	219	228
-2	-6	163	161
-2	-5	293	291
-2	-4	276	278
-2	-3	73	63
-2	-2	323	316
-2	-1	330	325
-1	-9	191	184
-1	-8	99	106
-1	-7	140	138
-1	-6	55	43
-1	-5	157	142
-1	-4	253	251
-1	-3	36	24
-1	-2	237	241
-1	-1	207	201
-1	0	80	80
0	-11	117	115
0	-9	99	104
0	-8	73	70
0	-7	233	233
0	-6	99	103
0	-5	162	160
0	-4	144	150
0	-3	234	235
0	-2	363	363
0	-1	318	315
0	0	29	24
1	-11	211	218
1	-10	125	129
1	-9	68	66
1	-8	217	224
1	-7	348	356
1	-6	90	90
1	-5	323	308
1	-4	641	643
1	-3	318	310
1	-2	438	438
1	-1	648	650
1	0	343	337
2	-11	296	297
2	-10	293	303
2	-9	67	78
2	-8	226	232
2	-7	578	556
2	-6	297	307
2	-5	455	450
2	-4	841	833
2	-3	361	354
2	-2	283	291
2	-1	788	788
2	0	517	529
3	-11	254	240
3	-10	347	351
3	-9	133	122
3	-8	261	270
3	-7	758	749
3	-6	532	522
3	-5	338	333
3	-4	926	919
3	-3	678	685
3	-2	182	182
3	-1	469	462
3	0	320	319
4	-11	103	99
4	-10	335	348
4	-9	413	423
4	-8	29	27
4	-7	496	478
4	-6	312	318
4	-5	223	215
4	-4	443	470
4	-3	282	282
4	-2	299	299
4	-1	202	197
4	0	350	355
5	-10	115	120
5	-9	228	212
5	-8	120	132
5	-7	498	511
5	-6	126	125
5	-5	69	54
5	-4	198	201
5	-3	207	200
5	-2	96	81
5	-1	76	76
5	0	131	115
6	-10	131	137
6	-9	242	242
6	-8	71	79
6	-7	166	151
6	-6	295	303
6	-5	67	46
6	-3	106	106
6	-2	105	91
6	-1	89	102
6	0	170	168
7	-10	216	229
7	-9	353	343
7	-8	142	136
7	-7	195	203
7	-6	301	294
7	-5	202	200
7	-4	91	102
7	-3	221	185
7	-2	415	404
7	-1	291	295

Table 42. Continued

K	L	FOBS	FCAL
**H =	7****		
7	0	357	372
8	-10	204	229
8	-9	461	444
8	-8	202	190
8	-7	116	105
8	-6	328	327
8	-5	536	540
8	-4	125	116
8	-3	328	316
8	-2	745	771
8	-1	434	460
8	0	277	271
9	-10	101	102
9	-9	374	374
9	-8	312	315
9	-7	42	6
9	-6	260	271
9	-5	506	493
9	-4	418	448
9	-3	410	418
9	-2	629	617
9	-1	449	454
9	0	191	190
10	-9	160	165
10	-8	228	231
10	-7	154	151
10	-6	82	77
10	-5	380	374
10	-4	245	241
10	-3	80	81
10	-2	444	451
10	-1	241	265
10	0	228	239
11	-8	84	90
11	-7	189	199
11	-6	32	42
11	-5	246	258
11	-4	131	116
11	-3	42	61
11	-2	270	290
11	-1	62	61
11	0	195	199
12	-7	112	118
12	-5	203	195
12	-4	135	135
12	-3	102	104
12	-2	165	156
12	-1	124	121
12	0	73	78
13	-6	116	106
13	-5	195	197
13	-4	323	334
13	-3	24	12
13	-2	170	164
13	-1	141	160
13	0	45	48

K	L	FOBS	FCAL
**H =	8****		
-5	-6	40	31
-5	-4	33	30
-5	-3	35	38
-5	-2	41	48
-5	-1	78	79
-5	0	95	97
-4	-7	36	49
-4	-6	108	111
-4	-5	145	140
-4	-4	63	43
-4	-3	239	240
-4	-2	298	294
-4	-1	84	92
-4	0	89	95
-3	-9	256	268
-3	-8	281	268
-3	-7	82	80
-3	-6	335	335
-3	-5	381	375
-3	-4	160	155
-3	-3	333	337
-3	-2	534	537
-3	-1	227	234
-3	0	176	174
-2	-9	346	337
-2	-8	311	307
-2	-6	329	323
-2	-5	532	538
-2	-4	252	249
-2	-3	263	256
-2	-2	530	527
-2	-1	463	453
-2	0	299	308
-1	-9	186	190
-1	-8	244	241
-1	-7	148	145
-1	-6	213	222
-1	-5	590	589
-1	-4	357	350
-1	-3	184	188
-1	-2	523	542
-1	-1	449	459
-1	0	125	123
0	-10	50	57
0	-9	65	65
0	-8	212	222
0	-7	286	283
0	-6	95	93
0	-5	359	352
0	-4	210	224
0	-3	105	100
0	-2	189	180
0	-1	74	78
0	0	92	110
1	-10	159	156
1	-9	89	90

K	L	FOBS	FCAL
1	-8	156	151
1	-7	191	189
1	-6	41	38
1	-5	200	210
1	-4	161	156
1	-3	83	91
1	-2	212	217
1	-1	214	222
1	0	60	67
2	-11	78	88
2	-10	301	300
2	-9	93	101
2	-8	259	259
2	-7	365	381
2	-6	122	103
2	-5	225	218
2	-4	277	276
2	-3	72	78
2	-2	218	223
2	-1	353	324
2	0	113	109
3	-11	285	291
3	-10	385	371
3	-9	70	69
3	-8	371	363
3	-7	641	627
3	-6	182	155
3	-5	410	408
3	-4	543	533
3	-3	435	403
3	-1	543	536
3	0	437	425
4	-11	340	350
4	-10	546	539
4	-9	242	242
4	-8	290	302
4	-7	594	571
4	-6	493	501
4	-5	402	405
4	-4	572	546
4	-3	614	602
4	-2	48	51
4	-1	437	431
4	0	590	579
5	-11	148	148
5	-10	492	491
5	-9	249	233
5	-8	183	168
5	-7	548	559
5	-6	293	275
5	-5	72	66
5	-4	403	403
5	-3	499	506
5	-2	240	234
5	-1	199	174
5	0	476	476
6	-11	36	38

K	L	FOBS	FCAL
6	-10	201	190
6	-9	131	146
6	-8	138	156
6	-7	216	220
6	-6	74	59
6	-5	243	278
6	-4	133	142
6	-3	348	341
6	-2	226	226
6	-1	99	91
6	0	220	220
7	-10	60	53
7	-9	80	94
7	-8	77	78
7	-7	30	25
7	-6	181	210
7	-5	121	93
7	-4	203	220
7	-3	221	225
7	-2	113	123
7	-1	32	45
7	0	122	102
8	-10	89	87
8	-9	93	88
8	-8	181	188
8	-7	42	30
8	-6	152	141
8	-5	174	159
8	-4	134	146
8	-3	147	164
8	-2	209	205
8	-1	40	24
8	0	270	282
9	-9	220	218
9	-8	261	257
9	-7	39	38
9	-6	286	283
9	-5	550	564
9	-4	120	109
9	-3	338	333
9	-2	547	547
9	-1	318	317
9	0	188	192
10	-9	334	354
10	-8	394	387
10	-7	181	174
10	-6	228	224
10	-5	576	579
10	-4	201	196
10	-3	400	413
10	-2	420	420
10	-1	244	254
10	0	182	156
11	-8	360	356
11	-7	181	183
11	-6	253	269
11	-5	456	457

Table 42. Continued

K	L	FOBS	FCAL
**H =		8****	
11	-4	286	297
11	-3	245	252
11	-2	403	386
11	-1	298	298
11	0	26	16
12	-7	122	121
12	-6	153	148
12	-5	287	292
12	-4	111	107
12	-3	78	74
12	-2	245	247
12	-1	143	150
13	-5	186	184
13	-4	76	76
13	-2	58	55
13	-1	101	111
**H =		9****	
-4	-6	40	39
-4	-5	60	53
-4	-3	88	93
-4	-2	94	98
-3	-7	32	25
-3	-6	108	108
-3	-5	183	189
-3	-4	55	48
-3	-3	234	233
-3	-2	238	245
-3	-1	38	26
-3	0	177	177
-2	-8	313	315
-2	-7	50	64
-2	-6	238	242
-2	-5	367	367
-2	-4	206	196
-2	-3	307	306
-2	-2	464	463
-2	-1	88	69
-2	0	86	95
-1	-9	280	277
-1	-8	435	437
-1	-7	92	94
-1	-6	320	329
-1	-5	526	530
-1	-4	387	377
-1	-3	317	324
-1	-2	625	632
-1	-1	432	449
-1	0	120	118
0	-9	188	186
0	-8	476	475
0	-7	262	266
0	-6	208	208
0	-5	608	608
0	-4	439	421
0	-3	127	106
0	-2	458	452

K	L	FOBS	FCAL
0	-1	233	220
0	0	96	90
1	-10	148	149
1	-9	96	103
1	-8	289	263
1	-7	297	296
1	-6	191	200
1	-5	402	387
1	-4	246	233
1	-3	190	191
1	-2	174	173
1	-1	46	53
1	0	76	81
2	-10	167	157
2	-9	30	32
2	-8	268	271
2	-7	60	60
2	-6	48	48
2	-5	231	226
2	-4	137	141
2	-3	239	230
2	-2	118	101
2	-1	80	78
2	0	93	75
3	-10	227	238
3	-9	62	63
3	-8	337	337
3	-7	138	130
3	-6	56	63
3	-5	225	228
3	-4	186	170
3	-3	75	56
3	-2	59	62
3	-1	184	190
3	0	208	211
4	-10	289	282
4	-8	291	293
4	-7	406	412
4	-6	100	75
4	-5	137	127
4	-4	370	365
4	-3	359	374
4	-2	95	93
4	-1	337	327
4	0	464	455
5	-10	460	467
5	-9	241	242
5	-8	85	76
5	-7	508	503
5	-6	466	457
5	-5	30	40
5	-4	318	322
5	-3	466	458
5	-2	344	342
5	-1	309	329
5	0	665	667
6	-10	316	307

K	L	FOBS	FCAL
6	-9	227	223
6	-8	52	56
6	-7	220	217
6	-6	433	444
6	-5	102	91
6	-4	214	211
6	-3	527	530
6	-2	536	542
6	-1	171	166
6	0	495	490
7	-10	153	173
7	-9	147	153
7	-8	97	90
7	-6	331	333
7	-5	334	340
7	-4	71	77
7	-3	396	400
7	-2	345	334
7	-1	75	67
7	0	288	288
8	-10	81	75
8	-9	71	71
8	-8	202	211
8	-6	135	126
8	-5	198	214
8	-4	46	46
8	-3	222	201
8	-2	100	97
8	-1	315	323
8	0	184	161
9	-9	104	109
9	-8	156	151
9	-7	85	82
9	-6	326	325
9	-5	114	100
9	-3	359	363
9	-2	245	253
9	-1	123	135
9	0	198	190
10	-9	284	279
10	-8	343	339
10	-7	44	32
10	-6	391	398
10	-5	342	343
10	-3	371	373
10	-2	329	322
10	-1	43	18
10	0	258	251
11	-8	407	408
11	-7	92	91
11	-6	356	348
11	-5	493	505
11	-4	77	55
11	-3	247	235
11	-2	337	346
11	-1	176	174
11	0	33	23

K	L	FOBS	FCAL
12	-7	126	134
12	-6	203	212
12	-5	311	313
12	-4	217	228
12	-3	113	105
12	-2	237	248
12	-1	236	232
13	-4	148	168
13	-3	36	26
**H =		10****	
-2	-6	275	262
-2	-5	221	222
-2	-4	109	106
-2	-3	203	213
-2	-2	107	119
-1	-8	267	267
-1	-7	71	75
-1	-6	351	351
-1	-5	301	303
-1	-4	57	44
-1	-3	258	255
-1	-2	241	248
-1	-1	147	140
0	-8	396	396
0	-7	63	66
0	-6	325	321
0	-5	364	360
0	-4	121	119
0	-3	153	171
0	-2	494	495
0	-1	297	303
0	0	31	30
1	-9	210	214
1	-8	477	493
1	-7	169	157
1	-6	252	246
1	-5	371	383
1	-4	336	336
1	-3	72	66
1	-2	266	255
1	-1	218	216
1	0	126	118
2	-9	55	61
2	-8	253	243
2	-7	191	185
2	-6	187	185
2	-5	110	123
2	-4	156	141
2	-3	106	98
2	-2	113	121
2	-1	269	262
2	0	151	150
3	-10	116	114
3	-9	74	91
3	-8	123	121
3	-7	130	141
3	-5	40	37

Table 42. Continued

K	L	FOBS	FCAL
H = 10**			
3	-4	215	208
3	-3	215	200
3	-2	28	22
3	-1	190	189
3	0	163	173
4	-10	101	101
4	-8	162	154
4	-7	75	71
4	-6	166	171
4	-5	46	47
4	-4	302	291
4	-3	272	260
4	-2	45	21
4	-1	240	236
4	0	201	183
5	-10	247	250
5	-9	131	123
5	-8	162	161
5	-7	310	302
5	-6	331	333
5	-5	149	130
5	-4	417	398
5	-3	408	420
5	-2	120	125
5	-1	327	323
5	0	415	430
6	-10	304	292
6	-9	288	286
6	-7	464	472
6	-6	360	342
6	-5	114	123
6	-4	491	486
6	-3	462	461
6	-2	79	92
6	-1	342	327
6	0	434	435
7	-9	321	335
7	-7	236	230
7	-6	454	455
7	-5	100	92
7	-4	333	329
7	-3	432	419
7	-2	176	190
7	-1	205	214
7	0	307	317
8	-9	187	172
8	-8	131	144
8	-7	84	80
8	-6	361	377
8	-5	126	113

K	L	FOBS	FCAL
8	-4	266	253
8	-3	237	247
8	-2	63	71
8	-1	110	92
8	0	152	157
9	-9	142	156
9	-8	111	116
9	-7	83	105
9	-6	190	181
9	-5	115	109
9	-4	174	177
9	-3	93	106
9	-2	51	51
9	0	45	54
10	-8	79	69
10	-7	115	120
10	-6	236	230
10	-5	100	111
10	-4	83	76
10	-3	176	170
10	-2	203	216
10	-1	122	112
10	0	95	92
11	-7	29	12
11	-6	305	291
11	-5	319	313
11	-4	123	121
11	-3	55	61
11	-2	250	262
11	-1	124	124
12	-5	321	324
12	-4	160	172
12	-3	63	55
12	-2	326	328
H = 11**			
0	-6	202	199
0	-5	247	237
0	-4	57	53
0	-3	122	131
1	-7	122	119
1	-6	218	225
1	-5	435	437
1	-4	280	286
1	-3	29	16
1	-2	376	375
2	-8	349	358
2	-7	209	211
2	-6	83	81
2	-5	340	318
2	-4	332	335

K	L	FOBS	FCAL
2	-2	259	258
2	-1	396	401
3	-8	224	243
3	-7	162	146
3	-6	32	37
3	-5	167	175
3	-4	205	220
3	-3	191	196
3	-2	160	162
3	-1	294	295
3	0	123	135
4	-8	73	71
4	-7	152	160
4	-6	93	104
4	-5	75	67
4	-4	146	143
4	-3	205	205
4	-2	75	71
4	-1	160	167
4	0	28	19
5	-9	76	77
5	-8	82	82
5	-7	159	161
5	-6	170	160
5	-4	178	191
5	-3	169	163
5	-2	62	54
5	-1	164	165
5	0	34	25
6	-9	169	161
6	-8	45	50
6	-7	321	305
6	-6	338	341
6	-5	53	14
6	-4	335	342
6	-3	233	223
6	-2	89	89
6	-1	235	234
6	0	228	234
7	-9	358	359
7	-8	59	68
7	-7	456	444
7	-6	366	370
7	-5	48	56
7	-4	372	366
7	-3	434	428
7	-2	46	36
7	-1	201	199
7	0	303	298
8	-8	35	23

K	L	FOBS	FCAL
8	-7	444	438
8	-6	412	403
8	-5	56	50
8	-4	313	313
8	-3	423	413
8	-2	164	158
8	-1	148	149
9	-8	119	129
9	-7	253	259
9	-6	303	307
9	-5	90	98
9	-4	153	154
9	-3	187	175
9	-2	97	100
9	-1	47	43
10	-7	132	115
10	-6	80	89
10	-5	41	44
10	-4	100	94
10	-3	137	141
10	-2	84	76
11	-5	103	115
11	-4	126	127
H = 12**			
3	-6	81	78
3	-5	328	325
3	-4	343	344
4	-7	228	231
4	-6	48	46
4	-5	231	220
4	-4	317	321
4	-3	76	75
5	-7	141	145
5	-6	31	25
5	-5	171	174
5	-4	175	170
5	-3	53	61
6	-7	150	157
6	-6	58	50
6	-5	128	118
6	-4	145	135
7	-7	232	228
7	-6	159	153
7	-5	114	112
7	-4	250	262
7	-3	112	116
8	-6	299	300
8	-4	215	212
8	-3	289	296
9	-5	178	180

Table 43. 10*(Fobs vs. Fcal) For [Rh2Cl2(mu-SO2)(DPM)2].

K	L	FOBS	FCAL
H = -20**			
0	2	432	404
0	4	904	926
0	6	1016	1023
0	8	756	806
0	10	504	502
1	1	216	210
1	6	152	122
1	7	122	129
1	8	231	246
1	9	385	333
1	10	278	281
1	11	327	321
2	1	510	491
2	3	290	273
2	6	271	243
2	7	144	155
2	8	326	314
2	9	325	309
2	10	203	160
3	2	222	200
3	7	240	209
3	9	152	115
4	4	402	420
4	5	310	313
4	6	337	322
4	7	231	249
H = -19**			
0	0	135	106
0	2	282	263
0	6	304	297
0	8	525	489
0	10	333	319
0	12	262	258
1	0	168	166
1	1	447	483
1	2	509	483
1	4	964	986
1	6	985	964
1	7	184	171
1	8	776	779
1	9	276	241
1	10	410	415
1	11	363	370
1	12	137	92
1	13	481	501
2	1	300	284
2	8	250	246
2	9	277	325
2	10	406	408
2	11	578	585
2	12	240	238
2	13	676	673
3	0	298	272
3	1	375	398
3	2	327	299
3	3	148	139
3	5	138	153
3	9	416	413
3	11	459	466
3	12	234	226
4	0	305	310
4	4	118	89
4	7	205	183
4	11	310	305
5	0	415	406
5	1	245	255
5	2	365	354
5	3	210	156
5	4	361	358
5	6	469	480
5	7	140	160
5	8	377	411
5	10	196	228
6	6	121	93
6	7	101	29
H = -18**			
0	0	566	544
0	2	1242	1215
0	4	1908	1931
0	6	1519	1543
0	8	1118	1073
0	10	531	616
0	12	213	230
1	0	214	207
1	2	193	200
1	5	179	131
1	6	282	242
1	7	242	252
1	8	341	320
1	9	336	323
1	10	271	280
1	11	359	370
1	13	459	446
1	14	286	273
1	15	543	541
2	1	405	424
2	2	157	148
2	3	158	120
2	4	387	386
2	5	167	197
2	6	480	498
2	7	504	513
2	8	323	320
2	9	636	673
2	11	623	622
2	12	144	154
2	13	701	687
2	15	340	353
3	0	221	235
3	5	138	188
3	9	321	331
3	11	613	628
3	12	146	101
3	13	646	633
3	14	148	136
4	0	262	319
4	2	138	125
4	4	148	176
4	6	288	327
4	7	219	222
4	8	286	284
4	9	278	313
4	11	363	351
4	13	240	268
5	0	163	147
5	1	142	128
5	2	180	197
5	4	233	179
5	6	195	163
5	9	147	182
5	11	127	124
5	13	263	251
6	0	330	342
6	2	393	417
6	4	419	438
6	6	455	456
6	7	121	94
6	8	413	430
6	9	297	263
6	10	342	352
6	11	218	206
7	7	113	97
H = -17**			
0	0	385	401
0	2	305	285
0	12	191	203
0	14	409	386
0	16	650	661
1	0	587	623
1	1	272	276
1	2	1288	1328
1	4	1408	1423
1	5	373	323
1	6	1169	1175
1	7	261	238
1	8	891	872
1	9	458	457
1	10	315	283
1	11	578	560
1	13	549	531
1	15	184	202
2	1	242	193
2	4	184	169
2	5	184	190
2	7	214	263
2	9	488	474
2	11	579	576
2	12	367	387
2	13	813	864
2	14	374	357
2	15	770	788
2	16	221	229
3	5	390	435
3	7	827	827
3	8	264	268
3	9	811	878
3	10	304	306
3	11	686	675
3	12	238	210
3	13	463	480
3	15	275	254
3	16	204	190
4	2	202	216
4	5	206	220
4	8	323	280
4	9	423	429
4	10	330	368
4	11	480	455
4	12	176	200
4	13	482	512
4	14	138	98
4	15	468	436
5	0	273	321
5	1	136	143
5	2	387	411
5	3	327	341
5	4	513	505
5	5	314	343
5	6	635	656
5	7	290	318
5	8	413	394
5	9	236	219
5	11	265	275
5	12	250	180
5	13	251	239
5	14	163	187
6	0	211	200
6	2	173	210
6	4	265	257
6	6	182	162
7	0	315	317
7	1	113	56
7	2	357	358
7	4	398	404
7	5	289	341
7	6	437	423
7	7	429	412
7	8	452	454
7	9	606	576
7	10	343	328
7	11	571	603
8	7	246	215
8	9	189	168
8	10	216	220
H = -16**			
0	0	1314	1278
0	2	1794	1836

Table 43. Continued

K	L	FOBS	FCAL
H = -16**			
0	4	1422	1423
0	6	991	966
0	8	663	607
0	10	207	224
0	14	302	260
0	16	156	120
1	0	484	510
1	1	201	177
1	5	285	287
1	6	203	178
1	8	298	258
1	10	214	158
1	11	357	318
1	12	369	404
1	13	534	535
1	14	412	448
1	15	501	475
1	16	617	564
1	17	186	180
1	18	474	511
2	0	246	213
2	2	460	481
2	3	255	237
2	4	463	452
2	5	679	724
2	6	446	398
2	7	623	654
2	9	796	788
2	11	722	769
2	13	456	436
2	15	172	120
2	16	152	119
3	3	256	272
3	5	292	221
3	7	288	271
3	8	344	333
3	9	789	784
3	10	767	777
3	11	839	838
3	12	562	575
3	13	782	757
3	14	207	191
3	15	591	648
3	17	536	476
4	1	242	284
4	2	443	391
4	3	509	495
4	4	604	606
4	5	846	820
4	6	639	653
4	7	1028	983
4	8	326	398
4	9	711	731
4	10	227	217
4	11	569	537
4	13	343	385
4	14	173	184
4	15	238	222
4	17	179	178
5	0	330	336
5	2	555	473
5	4	244	286
5	8	329	357
5	10	148	154
5	12	203	251
5	13	356	363
5	14	512	542
5	15	168	180
5	16	683	733
6	0	836	838
6	2	918	899
6	3	186	203
6	4	858	874
6	6	606	575
6	8	209	226
6	9	185	195
6	12	421	422
6	14	437	423
7	0	196	232
7	5	221	241
7	7	142	144
7	8	148	127
7	9	285	298
7	10	241	266
7	11	325	262
7	13	225	198
7	14	360	373
8	1	160	186
8	3	266	251
8	4	283	266
8	5	410	410
8	6	465	439
8	7	664	646
8	8	375	381
8	9	772	762
8	10	141	155
8	11	619	645
9	1	159	155
9	3	159	80
9	6	196	189
9	7	272	257
9	8	279	266
9	9	374	381
9	10	248	210
H = -15**			
0	0	862	835
0	2	202	164
0	6	360	382
0	8	524	547
0	12	531	478
0	14	525	621
0	16	632	634
0	18	463	472
1	0	1061	1046
1	2	950	955
1	3	242	211
1	4	715	742
1	6	649	686
1	7	281	274
1	8	223	273
1	9	555	491
1	11	435	398
1	12	308	301
1	14	288	354
1	15	223	166
1	16	434	410
1	18	366	351
2	0	209	124
2	3	304	346
2	4	180	185
2	9	375	323
2	10	673	669
2	11	687	667
2	12	536	565
2	13	675	637
2	14	315	368
2	15	382	397
2	16	431	390
2	18	574	553
3	0	178	216
3	1	181	126
3	3	476	469
3	4	247	229
3	5	1028	1011
3	6	268	199
3	7	1141	1109
3	8	458	408
3	9	861	815
3	11	482	500
3	13	442	470
3	14	232	149
3	15	279	342
3	16	175	191
3	18	182	165
4	0	307	315
4	1	246	226
4	2	282	288
4	3	358	329
4	5	186	211
4	6	506	509
4	7	307	255
4	8	461	434
4	9	656	677
4	10	296	297
4	11	581	628
4	12	258	198
4	13	655	567
4	14	524	485
4	15	425	411
4	16	455	436
4	17	205	185
4	18	530	505
5	0	942	935
5	1	697	747
5	2	1081	1160
5	3	861	831
5	4	1213	1241
5	5	945	965
5	6	676	642
5	7	538	555
5	9	388	410
5	10	217	232
5	11	420	353
5	12	237	185
5	13	159	160
5	16	170	152
5	17	139	118
6	0	630	635
6	2	382	407
6	4	218	204
6	5	188	190
6	7	312	312
6	8	213	258
6	9	422	471
6	11	162	203
6	12	528	538
6	14	930	926
6	16	981	947
7	0	872	853
7	2	853	877
7	3	361	327
7	4	608	575
7	5	603	581
7	6	501	557
7	7	774	815
7	8	211	208
7	9	736	735
7	11	513	438
7	12	433	419
7	13	201	230
7	14	237	279
8	1	165	175
8	4	273	280
8	5	424	408
8	6	350	349
8	7	423	470
8	8	302	281
8	9	661	625
8	10	244	235
8	11	573	586
8	13	455	478
8	14	128	151
9	0	473	479
9	1	287	301
9	2	222	178
9	5	221	189
9	7	484	490

Table 43: Continued

K	L	FOBS	FCAL
H = -15**			
9	9	592	660
9	11	389	407
9	12	151	139
10	0	163	157
10	7	283	265
10	9	409	421
H = -14**			
0	0	546	678
0	2	429	357
0	6	253	195
0	10	283	316
0	12	918	910
0	14	681	817
0	16	558	579
0	18	388	401
1	0	225	234
1	8	198	222
1	9	268	241
1	10	332	406
1	12	444	314
1	14	597	562
1	16	541	605
1	17	168	152
1	18	521	511
2	1	285	280
2	2	307	311
2	3	658	732
2	4	598	603
2	5	630	634
2	6	506	537
2	7	563	537
2	8	201	205
2	9	678	700
2	11	552	535
2	12	192	202
2	14	590	632
2	15	217	203
2	16	571	574
2	18	263	192
3	3	337	358
3	7	616	622
3	8	221	314
3	9	885	848
3	10	425	342
3	11	609	621
3	13	486	455
3	15	388	379
3	18	201	194
3	19	468	484
4	0	714	740
4	1	517	503
4	2	1063	1043
4	3	851	869
4	4	996	1013
4	5	1186	1228
4	6	268	231
4	7	1111	1071
4	9	869	920
4	11	478	511
4	13	467	406
5	0	691	691
5	2	408	421
5	3	214	187
5	6	501	546
5	7	396	402
5	10	542	485
5	11	229	269
5	12	858	820
5	13	514	460
5	14	1050	1029
5	15	200	208
5	16	1005	1032
5	18	935	903
6	0	1575	1569
6	1	474	477
6	2	1509	1519
6	4	1085	1037
6	6	340	330
6	7	502	481
6	8	329	270
6	9	365	376
6	10	518	511
6	11	238	206
6	12	514	491
6	13	381	299
6	14	244	235
7	0	471	391
7	5	267	288
7	7	494	474
7	9	781	745
7	10	189	45
7	11	494	492
7	12	631	610
7	13	342	318
7	14	845	806
7	15	243	243
7	16	630	641
8	0	268	211
8	1	339	412
8	2	289	355
8	3	676	683
8	5	708	700
8	7	1007	1069
8	9	1153	1137
8	11	664	636
8	13	230	221
9	3	216	144
9	4	332	337
9	5	405	436
9	6	357	349
9	7	626	622
9	9	755	771
9	10	144	119
9	11	506	487
9	13	369	362
10	0	588	616
10	1	133	85
10	2	420	417
10	4	138	123
10	5	274	278
10	7	363	381
10	9	300	296
10	11	238	280
11	0	140	136
11	2	127	103
11	7	201	189
11	8	120	110
H = -13**			
0	4	288	348
0	12	508	545
0	14	927	851
0	16	512	556
0	18	466	475
0	20	255	275
1	0	260	238
1	1	588	571
1	2	411	397
1	3	525	547
1	4	509	554
1	5	323	329
1	6	385	414
1	7	673	646
1	8	188	154
1	9	502	538
1	10	475	464
1	12	1185	1126
1	13	315	291
1	14	1015	1018
1	15	215	276
1	16	388	405
1	19	211	154
1	20	197	230
2	2	230	318
2	4	322	308
2	6	365	348
2	7	249	191
2	11	360	355
2	12	284	288
2	14	652	553
2	16	544	601
2	17	287	284
2	18	390	448
2	19	549	555
2	20	149	181
3	0	465	436
3	1	598	616
3	2	235	249
3	3	1267	1204
3	4	413	379
3	5	1633	1622
3	6	498	413
3	7	1224	1262
3	8	396	404
3	9	895	873
3	11	616	640
3	13	612	580
3	14	437	421
3	15	326	259
3	18	176	112
4	0	404	448
4	1	252	200
4	2	233	250
4	3	191	129
4	5	229	268
4	7	460	445
4	8	333	346
4	9	758	710
4	10	364	441
4	11	635	715
4	12	638	698
4	13	436	552
4	14	750	725
4	15	534	499
4	16	675	626
4	18	488	483
4	19	378	381
5	0	1364	1394
5	1	418	471
5	2	1727	1624
5	3	594	633
5	4	853	898
5	5	569	528
5	7	558	557
5	8	441	458
5	10	289	251
5	14	414	362
5	16	249	266
6	0	569	650
6	5	294	281
6	7	706	743
6	9	305	329
6	10	515	509
6	12	904	894
6	14	1070	983
6	16	956	930
6	18	726	718
7	0	938	893
7	1	543	540
7	2	756	764
7	3	532	494
7	4	590	488
7	5	991	939
7	7	1233	1220
7	9	941	906
7	10	440	498
7	11	656	661
7	12	405	356

K	L	FOBS	FCAL
H = -13**			
7	13	453	400
7	14	186	198
8	0	155	13
8	1	198	237
8	2	200	196
8	4	196	65
8	5	282	308
8	7	693	631
8	9	805	800
8	10	391	382
8	11	544	522
8	12	497	400
8	13	211	228
8	14	410	385
9	0	376	330
9	1	353	435
9	2	231	202
9	3	549	565
9	5	659	734
9	6	247	166
9	7	971	941
9	9	954	897
9	10	246	252
9	11	694	698
9	12	260	240
9	13	255	255
10	0	183	193
10	1	147	145
10	5	260	274
10	7	411	436
10	9	400	363
10	12	326	319
11	0	481	487
11	2	569	573
11	3	181	134
11	4	201	182
11	6	154	181
11	7	176	183
11	8	180	208
11	10	248	232
12	3	158	136
12	4	147	173
12	5	119	133
H = -12**			
0	2	282	187
0	6	232	135
0	8	652	701
0	10	1072	1173
0	12	1362	1348
0	14	950	861
0	18	223	188
0	20	384	334
1	5	221	264
1	6	264	205
1	9	364	350
1	10	554	539
1	11	253	261
1	12	845	916
1	14	1221	1142
1	15	416	397
1	16	894	858
1	18	458	427
1	19	413	386
2	0	760	750
2	1	1192	1168
2	2	955	981
2	3	1170	1158
2	4	1251	1286
2	5	1429	1369
2	6	764	748
2	7	1263	1253
2	8	451	414
2	9	818	867
2	12	704	679
2	13	523	401
2	14	700	676
2	18	368	371
2	19	202	205
2	20	425	409
3	1	256	226
3	2	181	148
3	3	241	183
3	4	488	524
3	5	588	552
3	6	660	638
3	7	593	640
3	8	353	286
3	9	484	458
3	10	515	423
3	11	716	651
3	12	321	345
3	13	422	500
3	17	438	459
3	19	774	755
4	0	1095	1009
4	1	562	516
4	2	784	778
4	3	1350	1298
4	5	1470	1401
4	6	578	569
4	7	1361	1364
4	8	671	705
4	9	1056	931
4	10	381	435
4	14	275	219
4	16	240	216
4	18	181	152
4	20	169	123
5	0	597	634
5	5	243	221
5	6	392	396
5	8	482	507
5	9	432	337
5	10	689	643
5	11	717	732
5	12	766	683
5	13	387	435
5	14	931	967
5	15	502	497
5	16	1149	1105
5	18	725	698
6	0	1297	1255
6	1	341	275
6	2	1000	954
6	4	433	383
6	5	389	464
6	7	233	269
6	8	590	533
6	9	616	560
6	10	688	639
6	11	751	746
6	12	300	255
6	14	420	366
7	1	430	412
7	3	271	223
7	4	193	88
7	5	243	193
7	7	503	562
7	9	461	393
7	10	577	551
7	11	475	483
7	12	644	734
7	13	241	275
7	14	791	810
7	16	494	507
8	0	233	256
8	1	1047	999
8	3	907	892
8	5	1133	1030
8	6	338	345
8	7	1370	1259
8	8	227	196
8	9	1167	1207
8	11	794	727
8	12	277	213
8	13	260	249
8	14	213	219
8	16	203	218
9	0	318	317
9	2	389	350
9	4	299	250
9	5	395	371
9	7	594	596
9	8	521	567
9	9	472	432
9	10	209	220
9	11	282	253
9	13	169	153
9	14	232	193
9	15	369	393
10	0	599	624
10	1	569	519
10	2	521	509
10	3	733	704
10	5	670	644
10	7	720	706
10	8	421	356
10	9	480	472
10	10	544	565
10	11	413	380
10	12	386	377
10	13	153	131
10	14	268	262
11	0	390	358
11	1	335	293
11	2	186	193
11	3	227	154
11	6	176	192
11	7	235	213
11	8	207	228
11	10	382	396
11	11	164	146
12	0	343	355
12	2	355	347
12	3	135	183
12	5	186	219
12	6	219	236
12	7	133	102
12	8	431	432
H = -11**			
0	4	540	550
0	6	878	949
0	8	315	357
0	10	1788	1796
0	12	1970	2019
0	14	1513	1575
0	16	739	737
0	18	622	555
1	0	949	929
1	1	1047	1071
1	2	859	874
1	3	804	861
1	4	366	408
1	5	1084	1129
1	6	392	426
1	7	958	1011
1	8	560	509
1	9	256	208
1	10	597	625
1	11	291	311
1	12	557	589
1	13	278	241
1	14	296	279
1	17	251	189
1	18	314	313
1	19	225	241
1	20	336	336

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = -11**				5	3	424	489	9	3	1258	1176	1	15	578	521
1	21	322	313	5	5	627	559	9	4	457	418	1	16	578	567
2	0	512	471	5	6	546	541	9	5	1333	1277	1	17	461	479
2	2	268	204	5	7	684	656	9	6	387	345	1	18	306	280
2	4	566	593	5	8	284	362	9	7	1092	1061	1	19	596	622
2	7	445	380	5	9	253	286	9	9	841	842	1	21	662	656
2	8	268	279	5	10	483	437	9	10	341	351	2	0	1695	1717
2	9	638	642	5	11	648	577	9	11	490	448	2	1	1776	1793
2	10	538	544	5	12	461	475	9	12	188	62	2	2	1169	1133
2	12	688	733	5	13	467	412	9	14	171	169	2	3	2189	2188
2	13	251	201	5	14	544	612	9	16	219	219	2	5	2074	2010
2	14	848	817	5	16	258	246	10	0	312	299	2	6	197	94
2	15	522	467	5	17	303	252	10	1	427	395	2	7	2015	1907
2	16	588	501	6	0	335	216	10	2	379	383	2	9	397	332
2	17	743	731	6	1	482	380	10	4	302	254	2	11	217	64
2	19	1040	991	6	5	351	348	10	5	241	239	2	17	340	267
2	20	207	224	6	6	326	266	10	7	336	299	2	19	249	331
2	21	871	869	6	9	259	185	10	10	500	518	2	21	513	451
3	0	532	514	6	10	525	543	10	12	630	645	3	0	608	578
3	1	1615	1671	6	12	570	594	10	13	303	278	3	1	260	306
3	2	583	546	6	14	676	688	10	14	519	513	3	2	545	488
3	3	2179	2256	6	15	331	262	11	0	790	721	3	3	326	340
3	4	564	617	6	16	880	815	11	1	208	181	3	4	695	755
3	5	2113	2116	6	17	254	215	11	2	533	508	3	5	603	676
3	6	590	619	6	18	617	635	11	3	170	209	3	6	250	280
3	7	1552	1513	6	19	155	144	11	6	682	600	3	7	317	324
3	8	866	909	7	0	494	482	11	8	764	791	3	10	255	106
3	9	836	809	7	1	486	536	11	10	663	663	3	15	557	553
3	10	326	280	7	3	384	351	11	12	538	511	3	16	277	298
3	11	333	363	7	4	272	41	12	0	367	376	3	17	1118	1068
3	13	397	253	7	5	489	463	12	5	151	166	3	18	498	466
3	18	333	324	7	6	356	399	12	8	222	217	3	19	920	901
3	19	320	306	7	7	648	607	12	9	158	125	3	20	202	220
3	20	188	182	7	8	688	587	12	10	453	451	3	21	626	650
4	0	376	345	7	9	817	812	13	1	472	432	4	0	986	954
4	1	282	289	7	10	665	673	13	2	226	226	4	1	1510	1475
4	2	306	284	7	11	404	483	13	3	684	623	4	2	284	173
4	3	364	364	7	12	324	371	13	5	472	461	4	3	1620	1586
4	4	742	725	7	14	325	217	**H = -10****				4	4	402	389
4	5	308	298	7	16	305	267	0	0	1158	1129	4	5	1329	1351
4	6	786	770	7	17	227	173	0	2	603	603	4	6	899	901
4	7	587	579	7	18	158	112	0	6	1159	1055	4	7	828	863
4	8	736	732	8	1	552	538	0	8	812	871	4	8	980	967
4	9	566	587	8	3	218	213	0	10	892	915	4	9	395	397
4	10	723	667	8	6	487	502	0	16	401	338	4	10	786	786
4	11	916	762	8	7	510	556	0	20	235	254	4	12	739	713
4	12	444	517	8	8	428	379	1	0	370	322	4	13	245	232
4	13	599	618	8	9	518	489	1	1	249	261	4	14	517	463
4	14	807	767	8	10	529	549	1	2	282	255	4	15	297	215
4	15	216	258	8	12	300	359	1	3	373	356	4	17	265	291
4	16	713	752	8	13	248	270	1	4	656	599	4	19	318	345
4	17	400	377	8	14	321	301	1	7	832	830	5	4	210	245
4	18	381	427	8	15	379	376	1	8	931	995	5	6	534	575
4	19	393	451	8	16	265	279	1	9	805	839	5	7	311	314
5	0	1224	1233	8	17	343	345	1	10	2054	2037	5	8	461	409
5	1	201	59	9	1	1113	1053	1	12	2218	2238	5	9	348	340
5	2	873	900	9	2	478	393	1	14	1334	1377	5	11	458	371

Table 43. Continued

K	L	FOBS	FCAL
H = -10**			
5	12	408	427
5	13	265	287
5	14	766	686
5	16	627	609
5	18	193	225
6	0	395	330
6	1	209	157
6	3	381	265
6	6	290	327
6	8	461	525
6	9	328	272
6	10	461	423
6	11	512	462
6	12	248	267
6	14	302	339
6	16	285	234
7	1	762	750
7	2	336	286
7	3	362	376
7	5	356	333
7	7	441	475
7	9	286	283
7	10	704	686
7	11	199	139
7	12	892	864
7	13	430	346
7	14	493	477
7	15	405	452
7	16	446	473
7	17	406	426
7	18	413	431
8	1	563	628
8	2	216	135
8	3	566	556
8	4	355	349
8	5	813	871
8	6	444	465
8	7	631	572
8	8	658	616
8	9	376	384
8	10	457	395
8	12	344	392
8	14	354	315
8	16	279	292
8	17	302	305
8	18	147	79
9	1	270	313
9	2	289	306
9	6	443	437
9	7	269	250
9	9	252	261
9	12	221	196
9	13	511	522
9	15	678	678
10	0	604	623
10	1	1056	1042

K	L	FOBS	FCAL
10	2	459	512
10	3	989	1024
10	4	262	280
10	5	763	778
10	6	389	463
10	7	444	477
10	8	873	904
10	9	390	404
10	10	588	578
10	11	191	189
10	12	188	221
10	13	167	128
10	15	219	195
11	0	241	271
11	1	347	345
11	2	249	255
11	4	283	237
11	6	415	394
11	7	189	187
11	8	513	488
11	10	701	655
11	12	772	795
12	0	623	604
12	1	407	376
12	2	195	153
12	3	551	568
12	4	418	398
12	5	581	598
12	6	696	708
12	7	436	487
12	8	711	721
12	9	212	211
12	10	589	541
13	1	296	305
13	3	160	130
13	4	160	168
13	5	348	392
13	7	358	290
H = -9**			
0	2	458	521
0	4	815	789
0	6	425	435
0	8	1702	1664
0	10	2762	2895
0	12	2635	2591
0	14	1595	1565
0	16	745	759
0	18	413	361
1	0	581	587
1	1	1700	1631
1	2	226	283
1	3	1165	1315
1	4	866	953
1	5	1572	1633
1	6	1367	1328
1	7	1031	1054
1	8	1050	1071

K	L	FOBS	FCAL
1	10	744	705
1	11	246	218
1	12	549	461
1	13	279	281
1	14	341	347
1	16	574	527
1	21	398	422
2	1	493	551
2	2	233	235
2	3	1065	1008
2	5	1112	1074
2	6	809	793
2	7	775	772
2	8	905	881
2	10	912	857
2	11	259	303
2	12	1102	1085
2	13	341	350
2	14	370	332
2	15	744	718
2	17	911	966
2	18	352	382
2	19	1046	1006
2	20	198	196
2	21	828	824
3	0	285	265
3	1	2768	2739
3	3	2544	2610
3	4	555	599
3	5	1488	1490
3	6	287	257
3	7	1354	1342
3	8	904	895
3	9	497	558
3	10	483	476
3	12	240	269
3	13	425	548
3	15	640	572
3	17	237	216
3	18	233	207
3	19	281	279
3	20	209	194
3	21	348	312
4	1	195	60
4	2	432	405
4	3	524	450
4	4	449	504
4	5	375	354
4	6	803	717
4	7	209	211
4	9	493	519
4	10	218	249
4	11	267	270
4	12	406	362
4	14	666	702
4	15	635	618
4	16	399	474

K	L	FOBS	FCAL
4	17	769	771
4	18	213	165
4	19	591	591
4	21	514	492
5	0	874	773
5	1	220	285
5	3	547	567
5	4	435	513
5	5	420	450
5	6	733	706
5	8	535	433
5	10	838	944
5	12	1209	1203
5	14	394	346
5	15	218	217
5	17	204	231
5	18	223	186
5	19	201	273
6	1	456	360
6	3	245	125
6	4	216	161
6	6	234	318
6	7	226	238
6	8	373	364
6	9	232	117
6	12	677	663
6	13	172	197
6	14	600	639
6	15	352	358
6	16	508	530
6	17	364	358
6	20	258	230
7	2	195	143
7	5	260	283
7	6	426	437
7	8	758	766
7	10	617	658
7	12	240	266
7	15	237	263
7	16	224	276
7	17	217	279
8	1	443	536
8	2	201	145
8	3	316	238
8	7	438	462
8	8	214	196
8	9	307	349
8	10	562	458
8	12	534	520
8	13	424	392
8	14	313	359
8	15	627	601
8	16	262	268
8	17	758	804
9	0	207	178
9	1	1165	1175
9	3	1149	1211

K	L	FOBS	FCAL
**H =	-9****		
9	5	1051	1019
9	6	467	571
9	7	738	756
9	9	419	375
9	15	190	169
9	17	215	260
10	1	233	221
10	2	248	306
10	4	211	174
10	5	344	405
10	6	369	326
10	7	288	357
10	8	660	645
10	9	264	286
10	10	407	398
10	12	343	367
10	13	293	257
10	14	150	167
10	15	595	620
10	16	181	187
11	0	813	767
11	4	588	630
11	6	908	913
11	7	319	269
11	8	861	839
11	10	639	693
11	12	443	427
11	13	146	88
12	0	175	186
12	2	172	160
12	3	242	185
12	5	238	188
12	6	275	291
12	8	522	511
12	10	641	644
12	12	630	659
13	0	265	244
13	1	943	934
13	3	881	898
13	4	317	339
13	5	580	568
13	6	412	417
13	7	431	453
13	8	490	501
13	9	272	308
**H =	-8****		
0	0	954	997
0	2	188	47
0	4	960	940
0	6	1385	1519
0	8	1370	1391
0	10	655	752
0	12	850	828
0	14	1044	1025
0	16	955	942
0	22	184	138
1	1	454	467
1	2	251	215
1	4	596	555
1	5	382	388
1	6	589	657
1	7	1033	1015
1	8	1158	1193
1	9	686	629
1	10	2008	2067
1	11	337	271
1	12	1872	1901
1	14	903	945
1	15	550	491
1	16	582	603
1	17	612	642
1	19	650	711
1	21	579	555
1	22	236	263
2	0	535	476
2	1	1916	1915
2	2	1351	1285
2	3	2102	2101
2	4	1607	1623
2	5	2075	2061
2	6	887	907
2	7	916	983
2	8	644	632
2	9	218	127
2	10	866	825
2	11	362	446
2	12	632	666
2	13	224	203
2	14	517	481
2	15	307	293
2	16	311	333
2	17	240	144
2	18	410	406
2	19	272	293
2	20	265	281
2	21	520	504
3	0	599	626
3	2	537	536
3	3	335	287
3	5	260	245
3	6	449	386
3	7	511	452
3	9	563	557
3	10	172	28
3	11	634	642
3	13	718	661
3	14	408	397
3	15	1140	1122
3	16	425	456
3	17	949	1001
3	18	431	420
3	19	944	917
3	21	708	724
4	0	742	865
4	1	1612	1724
4	2	246	245
4	3	1409	1394
4	4	716	763
4	5	1112	1068
4	6	933	936
4	7	215	214
4	8	1318	1396
4	10	1308	1334
4	11	496	427
4	12	636	657
4	13	790	819
4	14	337	275
4	16	390	402
4	17	319	345
4	18	231	221
4	19	301	306
4	21	191	218
5	1	306	326
5	3	417	393
5	4	425	342
5	5	544	516
5	6	232	296
5	8	298	311
5	9	499	512
5	10	839	699
5	11	589	609
5	12	954	971
5	13	521	582
5	14	524	539
5	16	212	79
5	17	201	251
5	18	162	227
5	19	450	424
5	20	412	403
6	0	237	117
6	3	253	126
6	4	571	597
6	5	620	676
6	6	920	868
6	7	272	202
6	8	1038	991
6	10	1032	1056
6	11	341	250
6	12	883	822
6	15	187	105
6	19	166	99
6	20	149	168
7	0	218	248
7	3	326	286
7	4	233	151
7	5	473	445
7	7	721	777
7	8	563	582
7	9	277	373
7	10	905	997
7	11	216	185
7	12	936	902
7	13	534	583
7	14	456	489
7	15	741	781
7	16	315	327
7	17	841	799
7	19	391	436
8	1	438	423
8	3	587	595
8	4	323	300
8	5	543	541
8	6	227	80
8	7	186	170
8	8	521	604
8	10	473	460
8	12	286	304
8	13	213	113
8	16	300	294
8	17	228	213
8	18	264	288
9	1	240	205
9	5	441	491
9	6	366	292
9	7	398	393
9	8	420	339
9	9	340	320
9	13	496	503
9	14	242	303
9	15	631	626
9	17	814	819
10	1	1042	1026
10	2	196	243
10	3	846	800
10	4	712	713
10	5	753	700
10	6	966	935
10	7	559	520
10	8	699	743
10	9	259	339
10	10	610	581
10	12	298	295
10	13	148	185
10	15	207	181
11	1	220	83
11	2	256	213
11	3	269	258
11	4	416	455
11	5	451	420
11	6	617	606
11	7	260	248
11	8	506	522
11	9	506	509
11	10	510	536
11	11	281	266
11	12	618	645
11	14	496	514

K	L	FOBS	FCAL
H = -8**			
12	0	419	444
12	1	600	634
12	2	188	172
12	3	489	453
12	4	514	544
12	5	448	400
12	6	744	707
12	7	394	395
12	8	552	562
12	10	421	463
12	12	284	300
13	0	216	231
13	2	212	159
13	3	191	222
13	5	157	195
13	8	383	404
13	9	190	147
13	10	310	319
14	1	757	761
14	3	751	692
14	4	173	158
14	5	545	559
H = -7**			
0	0	202	242
0	2	255	269
0	4	724	728
0	6	679	664
0	8	1041	1108
0	10	1784	1711
0	12	1323	1407
0	14	1239	1286
0	16	999	951
0	20	565	584
0	22	644	670
1	0	822	878
1	1	1203	1227
1	2	2015	2043
1	3	1816	1748
1	4	2283	2330
1	5	1829	1793
1	6	1423	1448
1	7	570	568
1	8	1501	1473
1	10	887	916
1	12	894	919
1	14	1169	1138
1	16	293	318
1	19	197	237
1	21	257	289
2	0	762	713
2	1	390	306
2	2	760	718
2	3	460	469
2	4	1212	1182
2	5	1157	1191
2	6	228	270
2	7	164	102
2	8	320	318
2	10	446	478
2	11	476	420
2	12	546	465
2	13	545	606
2	15	908	919
2	16	312	302
2	17	918	912
2	18	309	339
2	19	920	905
2	20	284	290
2	21	506	488
2	22	379	353
3	0	1523	1434
3	1	2022	2063
3	2	1086	1034
3	3	1622	1603
3	4	650	613
3	5	1391	1417
3	7	344	442
3	8	361	336
3	10	320	228
3	11	1225	1218
3	13	1138	1058
3	14	342	311
3	15	232	308
3	16	593	587
3	17	298	234
3	18	222	301
3	19	520	486
3	21	351	418
4	1	283	230
4	3	279	186
4	5	373	373
4	7	929	850
4	8	543	453
4	9	920	955
4	10	760	792
4	11	983	1034
4	12	1012	1016
4	13	1456	1428
4	14	224	351
4	15	1275	1238
4	17	852	869
4	19	831	798
4	21	594	596
5	1	332	253
5	2	983	1141
5	3	725	744
5	4	1269	1259
5	5	431	460
5	6	1438	1450
5	7	323	256
5	8	1845	1911
5	9	453	511
5	10	1237	1234
5	11	377	414
5	12	477	530
5	13	257	218
5	14	196	236
5	16	426	482
5	19	244	257
5	20	323	345
5	21	198	250
6	2	185	82
6	4	282	246
6	5	201	80
6	6	413	455
6	8	1369	1377
6	9	535	484
6	10	1563	1563
6	12	1299	1326
6	13	521	460
6	14	701	698
6	15	523	524
6	17	283	301
6	18	339	322
6	20	642	599
7	0	218	201
7	1	260	245
7	3	325	278
7	4	742	590
7	5	220	245
7	6	1120	1173
7	8	1086	1137
7	9	216	248
7	10	489	521
7	13	277	255
7	18	175	163
7	19	145	70
8	2	234	215
8	5	657	717
8	7	465	455
8	8	399	318
8	10	323	326
8	11	377	378
8	12	413	420
8	13	682	745
8	14	339	360
8	15	1081	1056
8	17	1238	1200
8	18	145	66
9	0	535	549
9	1	1205	1184
9	2	559	579
9	3	1214	1180
9	4	751	729
9	5	849	868
9	6	652	595
9	7	372	419
9	8	281	380
9	10	210	193
9	11	376	332
9	14	354	321
9	16	346	399
10	0	172	159
10	2	322	386
10	4	362	372
10	5	400	376
10	6	625	600
10	7	469	425
10	8	591	601
10	9	451	469
10	10	254	269
10	13	221	249
10	15	480	524
11	1	318	385
11	2	441	468
11	3	388	421
11	4	781	749
11	5	306	362
11	6	746	728
11	7	276	245
11	8	836	761
11	10	801	790
11	12	340	377
12	0	206	131
12	4	499	503
12	6	535	510
12	7	202	181
12	8	401	389
12	9	236	263
12	10	553	570
12	12	582	609
12	13	161	161
13	0	180	182
13	1	688	709
13	3	396	425
13	4	365	371
13	5	398	423
13	6	427	454
13	7	334	363
13	8	305	305
13	9	211	205
13	10	279	254
14	1	172	168
14	6	180	185
H = -6**			
0	0	1380	1372
0	2	566	618
0	4	1959	1960
0	6	1395	1354
0	8	944	935
0	10	1188	1073
0	12	655	746
0	14	637	595
0	22	181	179
1	1	190	294
1	2	1165	1140
1	3	197	155

Table 43. Continued

K	L	FOBS	FCAL
H = -6**			
1	4	317	350
1	5	1492	1444
1	8	1042	1169
1	9	321	316
1	10	1005	1021
1	11	667	685
1	12	667	743
1	13	211	236
1	14	751	790
1	15	272	315
1	17	806	801
1	18	543	585
1	19	307	347
1	20	837	806
1	22	747	776
2	0	2556	2480
2	1	2194	2181
2	2	1922	1981
2	3	2030	2064
2	4	1907	1954
2	5	1369	1355
2	6	1060	1008
2	7	500	416
2	8	787	827
2	9	370	344
2	10	567	562
2	11	751	800
2	12	257	248
2	13	406	414
2	14	316	310
2	16	222	223
2	18	275	225
2	19	496	437
2	21	271	283
3	0	605	606
3	1	553	484
3	2	587	575
3	3	384	361
3	4	304	251
3	5	260	366
3	6	566	537
3	7	282	348
3	8	890	905
3	9	766	728
3	10	477	505
3	11	1144	1153
3	13	1313	1351
3	14	178	48
3	15	1267	1217
3	17	1078	1050
3	18	212	244
3	19	662	657
3	20	270	270
3	21	413	402
4	0	206	246
4	1	1512	1467
4	2	1440	1323
4	3	1345	1472
4	4	1286	1224
4	5	963	921
4	6	1264	1374
4	7	231	246
4	8	1148	1103
4	9	1138	1171
4	10	832	831
4	11	1233	1210
4	13	642	610
4	14	298	320
4	15	253	157
4	16	251	232
4	17	247	192
4	19	413	406
4	20	218	170
4	21	368	360
5	1	379	460
5	3	182	201
5	4	742	871
5	6	1051	1071
5	7	388	375
5	8	1638	1637
5	9	817	894
5	10	1532	1613
5	11	958	896
5	12	1260	1171
5	13	756	733
5	15	574	612
5	16	446	406
5	17	507	511
5	18	320	325
5	19	558	535
5	20	303	327
5	21	168	211
6	0	319	357
6	1	157	207
6	2	1127	953
6	3	395	359
6	4	2309	2349
6	5	292	330
6	6	2277	2333
6	7	224	188
6	8	1342	1381
6	9	182	26
6	10	718	713
6	12	321	405
6	13	457	438
6	15	308	317
6	18	257	227
6	20	498	513
7	0	265	88
7	2	206	200
7	3	345	386
7	5	491	462
7	6	946	941
7	8	1535	1458
7	9	379	360
7	10	1042	1025
7	11	990	942
7	12	611	614
7	13	1060	1037
7	14	323	305
7	15	1160	1133
7	17	1079	1057
7	18	396	374
7	19	576	586
8	0	263	290
8	1	1295	1342
8	2	237	188
8	3	1626	1673
8	4	394	478
8	5	898	924
8	6	379	316
8	7	202	211
8	9	378	356
8	12	276	298
8	13	181	139
8	14	301	312
8	16	200	211
8	17	200	256
8	19	339	319
9	0	204	93
9	1	477	511
9	2	220	220
9	4	275	334
9	5	464	419
9	6	569	605
9	7	330	385
9	8	331	339
9	11	490	480
9	12	235	148
9	13	694	649
9	15	971	961
9	17	820	818
10	0	266	285
10	1	801	876
10	2	558	574
10	3	640	685
10	4	1040	1055
10	5	396	418
10	6	771	784
10	7	299	250
10	8	478	497
10	10	395	426
10	11	318	250
10	12	420	394
10	15	146	221
10	16	187	220
11	1	431	420
11	2	296	246
11	3	438	395
11	4	398	405
11	5	225	219
11	6	326	317
11	7	232	284
11	8	340	315
11	9	396	395
11	10	438	420
11	12	462	413
11	13	148	199
11	14	163	212
11	15	225	221
12	2	403	368
12	4	466	429
12	6	653	615
12	8	769	744
12	10	569	628
12	11	155	138
12	12	169	175
12	13	148	159
13	2	233	193
13	4	455	418
13	6	441	457
13	8	356	348
13	10	355	351
13	11	147	155
14	1	480	488
14	2	164	183
14	3	381	392
14	4	352	355
14	5	311	308
14	6	283	258
14	8	126	123
H = -5**			
0	0	277	313
0	2	1014	976
0	4	606	648
0	6	1399	1429
0	8	301	320
0	12	555	452
0	14	652	638
0	16	421	330
0	18	1149	1123
0	20	1315	1242
0	22	772	807
1	0	1380	1299
1	1	1512	1464
1	2	2128	2095
1	3	1615	1633
1	4	1683	1681
1	5	413	403
1	6	1166	1270
1	8	204	303
1	10	520	551
1	12	365	459
1	13	206	187
1	15	246	308
1	16	205	168
1	22	196	173

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = -5**				5	3	345	269	8	15	1426	1494	13	11	251	272
2	0	484	486	5	4	2535	2720	8	16	161	120	14	4	146	150
2	1	322	239	5	5	293	193	8	17	1197	1154	14	6	241	271
2	2	702	787	5	6	2442	2381	8	19	588	586	14	8	166	140
2	3	590	581	5	8	1567	1569	9	0	175	64	**H = -4****			
2	4	599	634	5	9	657	636	9	1	1241	1232	0	0	1340	1254
2	5	265	211	5	10	825	852	9	2	298	408	0	2	2176	2138
2	6	1003	986	5	11	340	376	9	3	653	665	0	4	1861	1984
2	7	713	651	5	13	436	443	9	4	583	582	0	6	1278	1206
2	8	322	224	5	14	263	288	9	6	630	517	0	8	216	166
2	9	562	653	5	15	236	165	9	7	358	349	0	10	477	423
2	10	689	732	5	18	278	261	9	8	687	660	0	12	534	414
2	11	801	736	5	19	412	383	9	9	343	332	0	14	562	560
2	12	691	661	5	20	426	421	9	10	509	501	0	16	566	560
2	13	868	869	5	21	267	233	9	12	459	406	0	18	316	254
2	14	307	182	6	0	357	403	9	16	233	257	0	20	659	646
2	15	719	787	6	1	375	439	9	17	146	183	0	22	417	428
2	16	417	411	6	2	138	104	9	18	182	167	1	0	340	324
2	17	937	886	6	3	146	232	10	0	184	100	1	1	934	941
2	18	307	374	6	4	760	697	10	1	183	109	1	2	1938	2056
2	19	263	276	6	5	413	428	10	2	182	102	1	3	561	525
2	20	555	552	6	6	1961	1920	10	4	254	237	1	4	708	672
2	22	627	611	6	8	2138	2176	10	5	176	195	1	6	809	779
3	0	1012	1067	6	10	1638	1683	10	8	339	337	1	7	1484	1531
3	1	2032	2189	6	11	412	393	10	11	414	429	1	8	808	834
3	2	554	607	6	12	1000	998	10	13	587	556	1	9	1230	1209
3	3	1332	1377	6	13	668	675	10	15	482	453	1	10	745	805
3	4	727	785	6	15	512	505	10	17	276	293	1	11	482	542
3	5	384	359	6	16	510	530	11	0	298	335	1	12	668	681
3	6	296	278	6	17	255	295	11	1	385	338	1	13	713	699
3	8	803	766	6	18	523	532	11	2	663	719	1	15	431	460
3	9	1343	1272	6	19	227	264	11	3	267	221	1	16	856	841
3	11	1235	1255	6	20	581	576	11	4	597	628	1	17	325	401
3	13	436	456	7	0	381	375	11	5	433	401	1	18	1008	998
3	17	269	259	7	1	1668	1710	11	6	625	681	1	20	946	975
3	19	451	418	7	2	1831	1934	11	7	248	226	1	21	171	143
3	20	223	170	7	3	1403	1464	11	8	704	728	1	22	642	661
3	21	306	347	7	4	1914	1983	11	10	570	552	2	0	2566	2760
4	1	373	432	7	5	813	769	11	12	173	170	2	1	3118	3252
4	2	253	301	7	6	1398	1395	11	13	262	238	2	2	1003	951
4	4	445	428	7	7	407	391	11	14	186	181	2	3	1191	1186
4	6	136	95	7	8	335	356	11	15	154	185	2	4	136	88
4	7	382	362	7	10	235	206	12	0	188	236	2	5	244	260
4	8	979	964	7	12	389	437	12	2	462	506	2	6	899	922
4	9	645	543	7	14	196	161	12	4	470	467	2	7	556	555
4	10	771	834	7	15	239	330	12	6	399	407	2	8	451	423
4	11	1356	1438	7	17	262	239	12	8	283	314	2	9	794	844
4	13	1723	1767	7	18	308	337	12	10	447	440	2	10	331	293
4	14	396	406	8	2	513	504	12	12	274	253	2	11	928	903
4	15	1123	1131	8	3	579	565	13	1	235	256	2	12	513	537
4	16	273	277	8	4	342	368	13	2	279	293	2	13	330	342
4	17	800	778	8	5	664	637	13	3	150	167	2	14	272	282
4	19	550	577	8	6	362	334	13	4	493	507	2	15	415	428
4	21	372	337	8	7	409	454	13	5	255	291	2	16	233	154
5	0	1734	1759	8	9	747	766	13	6	615	615	2	22	236	196
5	1	1289	1394	8	11	1058	1004	13	8	496	534	3	0	1000	993
5	2	2912	2802	8	13	1192	1209	13	10	320	364	3	1	549	472

K	L	FOBS	FCAL
**H =	-4****		
3	3	376	422
3	5	506	483
3	6	177	234
3	8	470	469
3	9	284	353
3	10	746	806
3	11	1320	1304
3	12	737	738
3	13	1632	1618
3	14	726	669
3	15	1096	1079
3	17	687	698
3	19	331	385
3	20	175	172
3	21	209	159
4	0	2142	2122
4	1	627	560
4	2	1621	1734
4	3	734	634
4	4	1556	1533
4	5	554	589
4	6	726	727
4	7	180	154
4	8	251	269
4	9	1603	1546
4	11	851	882
4	14	315	319
4	16	341	355
4	19	346	344
4	20	245	224
4	21	519	510
5	0	347	348
5	1	1131	1094
5	2	1130	1153
5	3	658	750
5	4	1094	972
5	5	161	63
5	6	1584	1597
5	7	376	346
5	8	1594	1589
5	9	666	678
5	10	1175	1141
5	11	687	730
5	12	348	359
5	13	565	555
5	14	249	268
5	15	497	530
5	16	315	356
5	17	349	372
5	18	289	258
5	20	390	407
6	0	1828	1865
6	1	221	207
6	2	3103	3232
6	3	346	346
6	4	2782	2752

K	L	FOBS	FCAL
6	6	2209	2187
6	7	191	97
6	8	968	1031
6	9	410	393
6	10	822	897
6	12	600	601
6	13	463	472
6	14	326	365
6	15	197	221
6	17	257	228
6	18	230	212
6	19	319	334
6	20	331	356
7	0	568	532
7	1	318	344
7	2	395	423
7	3	160	62
7	4	805	759
7	5	393	356
7	6	1475	1503
7	7	731	746
7	8	1057	1081
7	9	943	897
7	10	426	357
7	11	1005	975
7	13	1213	1123
7	15	1243	1159
7	16	307	383
7	17	846	858
7	18	472	479
7	19	656	645
8	0	526	592
8	1	1627	1673
8	2	769	704
8	3	820	801
8	4	636	627
8	5	168	251
8	7	379	353
8	8	543	597
8	9	493	521
8	10	267	198
8	11	265	273
8	13	232	253
8	16	163	148
8	18	183	141
9	1	284	268
9	2	318	326
9	3	257	238
9	4	338	286
9	6	454	470
9	7	341	243
9	8	317	311
9	9	641	655
9	11	882	898
9	12	326	273
9	13	957	959
9	14	251	245

K	L	FOBS	FCAL
9	15	1038	1039
9	17	680	695
9	18	166	188
10	0	292	330
10	1	236	206
10	2	784	727
10	3	245	245
10	4	999	962
10	5	279	301
10	6	899	884
10	7	356	393
10	8	442	433
10	9	310	335
10	10	263	309
10	11	252	193
10	14	334	306
10	16	343	355
10	17	146	153
11	2	180	228
11	5	232	205
11	7	287	286
11	8	455	490
11	9	377	397
11	10	313	341
11	11	325	335
11	13	300	301
11	14	294	299
12	0	316	353
12	2	480	469
12	4	750	708
12	6	947	912
12	7	220	247
12	8	1009	1003
12	9	321	321
12	10	487	483
12	11	261	236
13	0	275	229
13	2	341	348
13	4	446	427
13	6	452	445
13	8	366	367
13	9	206	180
13	10	184	195
13	11	384	397
14	1	493	498
14	2	269	295
14	3	291	290
14	4	351	368
14	6	310	298
14	7	218	215
14	8	217	212
14	9	266	248
15	1	127	103
15	4	121	153
**H =	-3****		
0	0	186	167
0	2	785	621

K	L	FOBS	FCAL
0	4	2684	2510
0	6	1530	1540
0	8	2081	2041
0	10	1088	1071
0	14	928	997
0	16	1158	1140
0	18	1511	1438
0	20	966	968
0	22	425	394
1	0	1170	1180
1	1	1790	1781
1	2	1499	1390
1	3	378	406
1	4	1100	1194
1	5	1003	1010
1	6	1240	1204
1	7	1060	1002
1	8	588	637
1	9	445	486
1	11	871	862
1	12	280	304
1	13	820	789
1	14	452	392
1	15	472	418
1	18	386	435
1	20	702	661
1	21	220	206
1	22	485	493
2	0	113	95
2	1	859	763
2	2	665	554
2	4	827	782
2	5	941	907
2	6	229	234
2	7	999	916
2	8	1417	1453
2	9	1455	1416
2	10	1870	1761
2	11	1391	1457
2	12	547	550
2	13	1562	1493
2	14	371	299
2	15	1142	1138
2	17	500	500
2	18	202	220
2	20	500	482
2	21	191	166
2	22	246	262
3	0	1304	1406
3	1	1468	1570
3	2	1093	1083
3	3	592	622
3	4	288	261
3	5	167	155
3	6	230	209
3	7	1571	1518
3	8	548	533

Table 43. Continued

K	L	FOBS	FCAL
H = -3**			
3	9	1193	1261
3	10	449	386
3	11	1172	1080
3	12	440	390
3	13	251	205
3	14	354	373
3	15	253	279
3	19	257	251
3	21	280	295
4	0	998	1100
4	1	601	648
4	5	131	82
4	7	152	236
4	8	232	244
4	9	1041	1091
4	10	389	321
4	11	1198	1163
4	12	693	641
4	13	1135	1119
4	14	598	617
4	15	821	866
4	17	558	574
4	18	470	457
4	19	339	324
4	20	395	412
4	21	158	130
5	0	2286	2279
5	1	1892	1952
5	2	2186	2194
5	3	1539	1617
5	4	2103	1982
5	5	945	894
5	6	1627	1671
5	8	1548	1482
5	9	249	267
5	10	446	473
5	11	411	476
5	13	487	515
5	15	229	269
5	17	435	382
5	19	375	396
5	20	275	263
5	21	296	329
6	0	227	266
6	1	802	739
6	2	711	698
6	3	561	521
6	4	1079	1158
6	5	355	349
6	6	1409	1524
6	7	461	482
6	8	969	996
6	10	752	750
6	11	432	451
6	13	251	317
6	14	220	160
6	15	284	340
6	16	586	573
6	17	426	389
6	18	686	713
6	19	384	407
6	20	667	669
7	0	1314	1274
7	1	1038	1067
7	2	1728	1761
7	3	464	406
7	4	1569	1597
7	5	203	233
7	6	821	858
7	7	558	511
7	8	587	568
7	9	575	576
7	10	552	517
7	11	527	506
7	12	434	428
7	13	246	300
7	17	182	137
8	0	328	386
8	2	150	85
8	3	177	154
8	5	377	308
8	7	875	923
8	9	1061	1083
8	10	265	207
8	11	843	887
8	12	177	162
8	13	1333	1345
8	15	1314	1327
8	16	237	267
8	17	839	806
8	18	225	249
8	19	318	314
9	0	295	348
9	1	200	106
9	2	271	201
9	3	680	686
9	4	515	487
9	5	805	825
9	6	617	584
9	7	1062	1093
9	8	652	623
9	9	863	813
9	10	330	337
9	11	494	495
9	13	275	301
9	14	244	253
9	16	327	329
10	1	264	278
10	3	248	202
10	4	264	275
10	5	368	376
10	6	392	358
10	7	397	418
10	8	366	389
10	9	685	649
10	10	377	379
10	11	832	805
10	13	640	684
10	15	440	428
10	16	418	426
10	17	303	352
11	0	906	889
11	2	806	820
11	4	950	937
11	6	948	992
11	7	163	131
11	8	582	608
11	12	208	184
11	14	191	186
12	2	271	292
12	3	188	166
12	4	181	212
12	6	431	398
12	8	506	573
12	11	192	203
12	12	393	418
12	13	179	189
12	14	618	614
13	0	360	372
13	2	562	546
13	4	729	700
13	6	737	751
13	7	355	364
13	8	521	541
13	9	512	528
13	10	332	351
13	11	300	285
14	0	257	232
14	2	138	66
14	6	217	206
14	7	293	305
14	9	376	359
15	0	368	375
15	1	457	481
15	2	314	307
15	3	170	169
15	4	137	107
H = -2**			
0	0	3055	3108
0	2	3644	4151
0	4	3952	4263
0	6	1132	1137
0	8	1305	1194
0	10	246	151
0	12	428	404
0	16	320	250
0	18	1111	1074
0	20	1136	1139
0	22	489	523
1	1	108	57
1	2	136	108
1	3	172	118
1	4	130	126
1	5	2054	2012
1	6	1728	1736
1	7	2171	2240
1	8	1792	1723
1	9	2200	2082
1	10	751	733
1	11	932	913
1	12	311	303
1	13	1348	1295
1	14	965	902
1	15	538	567
1	16	909	951
1	18	931	961
1	20	780	744
1	21	201	147
1	22	305	344
2	0	183	190
2	1	585	427
2	2	1554	1635
2	3	103	61
2	4	935	935
2	5	1573	1545
2	6	732	700
2	7	2696	2574
2	8	165	77
2	9	1427	1375
2	10	624	680
2	11	931	947
2	12	320	343
2	13	348	364
2	16	484	412
2	18	354	351
2	20	338	375
3	0	1420	1359
3	1	1486	1520
3	2	635	621
3	4	701	812
3	5	227	266
3	6	480	464
3	7	1635	1644
3	8	1618	1528
3	9	1952	1891
3	10	1123	1105
3	11	1635	1703
3	12	484	497
3	13	1648	1619
3	14	514	443
3	15	1079	1089
3	16	501	459
3	17	429	511
3	18	403	359
3	20	172	168
3	21	176	158
4	0	586	654

K	L	FOBS	FCAL
H = -2**			
4	1	2353	2468
4	2	132	150
4	3	1006	1000
4	4	675	694
4	6	353	393
4	7	800	809
4	8	306	321
4	9	640	667
4	11	712	665
4	17	369	375
4	19	239	294
4	20	204	254
4	21	310	292
5	0	886	827
5	1	593	572
5	2	242	161
5	3	128	61
5	5	290	338
5	6	1005	931
5	7	598	593
5	8	766	806
5	9	615	586
5	10	306	373
5	11	479	521
5	12	373	307
5	13	288	361
5	14	283	235
5	15	331	349
5	16	504	461
5	18	742	728
5	20	724	704
6	0	1611	1548
6	1	981	951
6	2	2570	2537
6	3	461	358
6	4	2140	2161
6	5	216	253
6	6	959	1016
6	7	505	580
6	8	1323	1310
6	9	313	241
6	10	603	664
6	12	266	230
6	14	193	240
6	15	196	224
6	16	329	330
6	17	466	439
6	20	336	338
7	1	487	512
7	2	202	185
7	3	336	381
7	4	385	372
7	5	218	207
7	7	369	393
7	9	531	526
7	11	572	572
7	13	733	724
7	14	399	403
7	15	725	694
7	16	693	673
7	17	428	404
7	18	710	720
8	0	739	766
8	1	652	656
8	2	442	489
8	3	952	920
8	4	150	98
8	5	1003	957
8	7	761	796
8	9	650	637
8	11	853	860
8	13	447	460
8	16	199	169
8	17	154	127
9	0	401	348
9	4	406	436
9	5	333	380
9	6	512	450
9	7	607	599
9	8	395	474
9	9	676	661
9	11	900	882
9	13	1164	1125
9	15	841	859
9	16	148	181
9	17	439	438
10	0	770	759
10	1	622	599
10	2	1211	1192
10	3	784	778
10	4	1039	968
10	5	830	760
10	6	637	616
10	7	1099	1011
10	8	299	288
10	9	801	825
11	1	328	356
11	3	354	258
11	4	379	364
11	5	207	169
11	6	684	671
11	7	225	226
11	8	591	559
11	9	468	471
11	11	273	213
11	12	669	639
11	13	189	151
11	14	756	769
12	0	929	955
12	2	969	954
12	4	1197	1227
12	6	1038	1020
12	7	302	272
12	8	435	438
12	12	174	166
13	2	253	188
13	3	322	306
13	4	366	327
13	5	303	319
13	6	442	469
13	7	540	534
13	8	209	205
13	9	756	751
13	11	773	776
13	12	163	208
14	0	202	163
14	1	402	422
14	4	135	117
14	5	410	421
14	6	161	147
14	7	430	460
14	8	154	101
14	9	415	427
15	0	265	297
15	2	134	126
15	3	158	158
H = -1**			
0	0	520	363
0	2	1570	1609
0	4	479	561
0	6	933	929
0	8	981	978
0	12	742	697
0	14	1897	1892
0	16	1578	1645
0	18	1002	958
0	20	706	673
1	0	4898	4786
1	1	670	626
1	2	4188	3950
1	3	536	507
1	4	3228	3051
1	5	1586	1570
1	6	1057	1082
1	7	1373	1399
1	8	903	852
1	9	1274	1307
1	11	1161	1196
1	13	256	298
1	14	248	287
1	16	922	876
1	18	821	821
1	20	658	706
2	0	291	270
2	1	82	15
2	3	497	492
2	4	412	376
2	5	2195	2205
2	6	1544	1535
2	7	2438	2453
2	8	1149	1124
2	9	2044	2078
2	10	213	246
2	11	1828	1866
2	12	230	189
2	13	1865	1867
2	15	907	954
2	18	459	365
2	19	318	282
2	20	396	411
3	0	514	534
3	1	2961	2948
3	2	196	181
3	3	537	558
3	4	1025	1066
3	5	1422	1411
3	6	471	431
3	7	2456	2366
3	8	913	839
3	9	954	984
3	12	196	300
3	13	198	252
3	14	414	568
3	15	300	314
3	16	246	231
3	17	231	192
3	20	175	120
4	0	623	678
4	1	249	248
4	3	453	480
4	5	135	123
4	6	654	701
4	7	1285	1313
4	9	1440	1491
4	10	180	169
4	11	1158	1102
4	12	447	460
4	13	480	437
4	14	512	595
4	15	398	398
4	16	685	708
4	18	720	687
4	20	652	634
4	21	274	241
5	0	1365	1376
5	1	1339	1304
5	2	1784	1721
5	3	641	568
5	4	2339	2319
5	5	135	109
5	6	1111	1112
5	7	628	643
5	8	494	488
5	9	694	638
5	11	468	456
5	18	178	206
5	20	335	353

K	L	FOBS	FCAL
H = -1**			
6	0	328	426
6	1	201	273
6	2	312	298
6	4	363	322
6	5	915	892
6	7	568	467
6	9	179	173
6	11	197	218
6	12	401	461
6	14	661	680
6	16	895	862
6	17	277	286
6	18	804	798
6	20	458	495
7	0	2041	2037
7	2	1210	1179
7	3	711	661
7	4	723	764
7	5	735	692
7	6	658	642
7	7	916	894
7	8	635	664
7	9	453	457
7	12	356	372
7	13	178	117
7	14	391	326
7	18	215	219
8	1	354	352
8	5	657	694
8	6	166	180
8	7	343	296
8	9	380	409
8	10	287	379
8	11	749	755
8	13	975	958
8	15	549	595
8	16	351	391
8	18	595	573
9	0	262	309
9	1	400	363
9	2	406	484
9	3	932	1021
9	4	346	322
9	5	949	1023
9	6	214	228
9	7	1080	1157
9	8	420	385
9	9	908	892
9	10	395	400
9	11	382	345
9	15	186	170
10	0	321	321
10	4	721	758
10	6	686	640
10	7	335	393
10	8	257	240
10	9	852	838
10	11	886	881
10	12	311	339
10	13	708	728
10	14	598	596
10	15	490	494
10	16	483	466
11	0	1303	1320
11	1	181	153
11	2	1279	1327
11	3	254	228
11	4	1191	1259
11	5	564	618
11	6	908	860
11	7	491	530
11	8	186	250
12	3	196	199
12	4	405	443
12	5	330	295
12	6	690	708
12	7	366	374
12	8	324	367
12	9	470	444
12	10	424	394
12	11	488	485
12	12	831	839
12	13	333	334
13	0	567	543
13	2	664	641
13	4	629	703
13	5	579	594
13	6	271	270
13	7	643	621
13	9	513	469
13	11	138	119
14	0	158	186
14	2	209	230
14	3	204	197
14	4	291	294
14	5	532	525
14	7	625	628
14	9	752	756
15	0	538	554
15	1	167	198
15	2	490	484
15	3	164	150
15	4	352	343
15	5	315	319
H = 0**			
0	2	4900	6128
0	4	1987	2015
0	6	950	829
0	8	220	177
0	10	361	284
0	14	470	539
0	16	1263	1166
0	18	703	758
0	20	558	517
1	1	321	334
1	2	1281	1268
1	3	127	72
1	4	648	607
1	5	1608	1604
1	6	683	619
1	7	800	817
1	9	812	867
1	10	707	716
1	11	1460	1427
1	12	893	1009
1	13	1072	1082
1	14	1200	1201
1	15	369	332
1	16	897	888
1	17	277	252
1	18	892	932
1	20	677	741
2	0	1549	1466
2	1	856	801
2	2	1618	1517
2	3	3101	2909
2	4	767	794
2	5	1418	1455
2	6	245	247
2	7	1676	1660
2	8	951	933
2	9	1568	1489
2	11	399	451
2	12	713	694
2	14	747	650
2	15	438	423
3	1	179	122
3	2	469	407
3	3	1559	1554
3	4	336	285
3	5	1556	1485
3	7	2421	2362
3	8	272	241
3	9	1853	1901
3	10	552	527
3	11	1732	1750
3	13	929	1028
3	14	432	398
3	15	534	537
3	16	303	316
3	19	296	331
3	21	437	458
4	0	1812	1804
4	1	1457	1458
4	2	291	298
4	3	367	424
4	4	1352	1346
4	5	949	968
4	6	1421	1359
4	7	1375	1375
4	8	278	343
4	9	454	495
4	10	175	86
4	11	315	288
4	12	236	254
4	13	298	327
4	14	298	296
4	15	307	300
4	20	461	445
5	1	565	521
5	2	168	226
5	3	366	333
5	4	284	196
5	5	1015	1054
5	6	579	575
5	7	802	816
5	8	432	407
5	9	466	466
5	10	324	281
5	11	352	401
5	12	744	685
5	13	178	119
5	14	743	692
5	16	705	767
5	17	336	346
5	18	839	843
5	19	220	241
5	20	477	495
6	0	2090	2196
6	1	447	411
6	2	1474	1472
6	3	235	42
6	4	838	795
6	6	740	777
6	7	339	389
6	8	158	161
6	9	310	329
6	10	237	208
6	11	434	436
6	12	679	606
6	14	421	437
6	17	176	121
6	18	260	263
7	1	604	531
7	2	376	409
7	3	345	346
7	4	249	268
7	5	350	331
7	7	193	198
7	9	285	192
7	12	423	388
7	13	180	151
7	14	746	730
7	15	206	117
7	16	806	813
7	17	153	99
7	18	565	564

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 0**				13	2	317	271	2	11	1560	1589	6	0	337	426
7	19	387	377	13	3	295	333	2	12	608	574	6	2	229	341
8	0	528	511	13	4	506	451	2	13	1036	1032	6	3	361	369
8	1	679	613	13	5	717	732	2	14	487	488	6	4	266	301
8	2	581	605	13	6	295	234	2	15	586	570	6	5	720	691
8	3	1293	1331	13	7	806	809	2	16	395	408	6	6	229	160
8	4	237	211	13	9	925	918	2	18	700	694	6	8	233	236
8	5	1138	1182	13	10	243	242	2	19	265	243	6	9	393	332
8	7	619	644	13	11	614	608	2	20	538	523	6	10	762	784
8	8	278	290	14	0	247	216	2	21	338	345	6	11	315	274
8	9	525	568	14	1	233	253	3	0	519	534	6	12	1208	1245
8	10	276	275	14	2	249	268	3	3	701	749	6	13	179	98
8	11	245	273	14	3	595	593	3	4	849	876	6	14	1315	1296
8	15	246	185	14	4	319	333	3	5	1906	1876	6	16	910	877
8	16	190	216	14	5	807	775	3	6	1327	1290	6	18	498	513
8	18	312	306	14	6	239	256	3	7	1103	1147	6	19	182	146
9	1	290	295	14	7	746	697	3	8	1017	915	7	0	2045	2037
9	5	463	468	14	9	364	395	3	9	1028	954	7	1	447	416
9	7	746	756	15	3	157	173	3	10	309	336	7	2	1425	1426
9	8	367	306	15	4	188	212	3	11	170	194	7	3	1259	1301
9	9	942	910	15	5	320	340	3	12	818	754	7	4	548	465
9	10	216	211	**H = 1****				3	13	516	551	7	5	1624	1571
9	11	976	1019	0	0	486	363	3	14	421	358	7	6	253	212
9	12	351	350	0	2	834	753	3	15	462	443	7	7	942	944
9	13	874	876	0	4	927	878	3	16	270	200	7	10	605	559
9	14	263	261	0	10	626	568	4	0	619	678	7	11	430	442
9	15	516	477	0	12	827	897	4	1	242	274	7	12	661	671
10	0	1147	1056	0	14	1398	1384	4	2	619	614	7	13	283	289
10	1	284	193	0	16	1355	1206	4	4	1458	1384	7	16	324	332
10	2	952	997	0	18	842	881	4	5	1184	1137	7	18	433	395
10	3	617	580	0	20	775	811	4	6	2272	2255	7	19	259	251
10	4	425	434	1	0	5446	4786	4	7	1290	1354	8	1	731	828
10	5	1002	979	1	1	1050	969	4	8	1131	1080	8	2	417	419
10	6	548	510	1	2	2298	2254	4	9	1487	1481	8	3	702	664
10	7	989	959	1	3	1101	1054	4	10	553	549	8	4	526	636
10	8	533	536	1	4	1445	1463	4	11	658	708	8	5	663	696
10	9	309	304	1	5	1420	1444	4	12	656	634	8	6	587	582
10	10	197	225	1	6	281	249	4	14	767	772	8	7	293	283
10	16	248	236	1	7	1180	1219	4	16	638	708	8	8	658	653
11	1	425	368	1	8	447	428	4	17	461	468	8	9	651	638
11	2	703	650	1	9	1529	1486	4	18	594	555	8	11	848	893
11	4	1026	932	1	11	408	420	4	19	553	613	8	13	501	496
11	5	253	301	1	14	282	276	4	20	296	249	8	14	328	333
11	6	983	974	1	15	251	233	5	0	1368	1376	8	16	379	341
11	9	233	207	1	16	309	282	5	1	852	878	8	17	338	318
11	10	354	423	1	18	295	232	5	2	1727	1799	8	18	218	222
11	11	252	218	1	20	336	260	5	3	1067	1066	9	0	295	309
11	12	841	791	2	0	302	270	5	4	1066	1025	9	1	201	206
11	14	735	759	2	1	409	370	5	5	344	316	9	2	226	247
12	0	1307	1373	2	2	674	659	5	7	545	561	9	3	702	681
12	2	1237	1260	2	3	2958	2788	5	8	549	564	9	4	411	396
12	4	937	959	2	5	1140	1122	5	9	674	671	9	5	908	891
12	5	197	202	2	6	685	667	5	11	571	601	9	6	200	168
12	6	363	323	2	7	1872	1886	5	12	414	335	9	7	648	636
12	7	188	165	2	8	509	477	5	13	313	368	9	9	400	374
12	9	228	278	2	9	2238	2146	5	18	400	392	9	10	222	188
13	1	252	273	2	10	1062	1004	5	20	428	407	9	13	283	273

Table 43. Continued

K	L	FOBS	FCAL
**H =	1****		
10	0	262	321
10	2	710	729
10	4	394	395
10	5	177	89
10	6	234	274
10	7	823	848
10	8	179	199
10	9	733	786
10	10	343	310
10	11	724	746
10	12	626	658
10	13	651	616
10	14	667	652
10	15	452	428
10	16	377	356
11	0	1331	1320
11	2	1218	1181
11	3	354	298
11	4	748	687
11	5	576	606
11	6	386	392
11	7	383	361
11	8	328	374
12	1	224	187
12	2	364	406
12	4	489	602
12	5	403	471
12	6	296	327
12	7	403	384
12	9	508	501
12	10	478	465
12	11	240	261
12	12	498	500
12	13	205	180
13	0	591	543
13	1	188	215
13	2	402	349
13	3	527	583
13	5	853	855
13	7	803	817
13	9	372	362
13	11	150	127
14	0	215	186
14	1	188	168
14	2	449	454
14	3	340	363
14	4	258	272
14	5	498	514
14	7	577	596
15	0	541	554
15	1	425	461
15	2	545	532
15	3	503	493
15	4	467	510
**H =	2****		
0	0	3073	3108
0	2	3733	3756
0	4	330	315
0	8	940	903
0	10	496	519
0	12	842	904
0	14	468	364
0	16	329	322
0	18	347	324
1	1	144	86
1	3	531	497
1	4	367	373
1	5	329	339
1	6	634	649
1	7	358	330
1	8	1004	934
1	9	613	668
1	10	565	596
1	11	993	1020
1	12	998	1007
1	13	426	486
1	14	1191	1168
1	16	1048	1032
1	18	907	865
1	20	614	576
2	0	166	190
2	1	1610	1609
2	2	159	91
2	3	201	199
2	4	877	860
2	5	1470	1378
2	6	712	725
2	7	986	1061
2	8	563	571
2	9	895	939
2	11	325	440
2	13	386	385
2	16	219	112
2	18	284	215
2	20	186	199
3	0	1416	1359
3	1	893	836
3	2	1355	1384
3	3	1477	1531
3	4	916	995
3	5	2264	2268
3	6	1580	1568
3	7	2452	2448
3	8	837	842
3	9	1911	1937
3	11	966	982
3	13	601	584
3	17	519	568
3	18	206	208
3	19	689	699
4	0	582	654
4	1	1514	1490
4	2	1546	1501
4	3	1195	1238
4	4	636	595
4	5	1433	1489
4	6	769	783
4	7	1332	1289
4	9	630	624
4	11	282	357
4	13	535	524
4	15	338	304
4	18	341	330
4	19	186	165
4	20	277	280
5	0	891	827
5	1	460	501
5	2	320	328
5	3	605	635
5	4	1313	1391
5	5	362	341
5	6	149	134
5	7	313	333
5	8	800	806
5	10	1500	1521
5	12	1443	1451
5	13	433	420
5	14	1525	1398
5	15	486	474
5	16	1058	1038
5	17	322	357
5	18	541	587
5	19	428	401
6	0	1619	1548
6	1	720	705
6	2	1000	1116
6	3	502	500
6	5	918	883
6	6	151	175
6	7	183	236
6	8	639	642
6	9	518	499
6	10	995	987
6	11	396	353
6	12	673	683
6	16	603	559
6	18	493	504
6	19	190	201
7	1	1392	1398
7	3	653	635
7	4	436	436
7	5	582	608
7	6	265	299
7	7	532	557
7	9	226	249
7	10	469	494
7	11	340	342
7	12	923	939
7	13	346	320
7	14	904	908
7	16	546	548
7	17	295	274
7	18	248	242
8	0	778	766
8	1	1305	1346
8	2	788	839
8	3	1341	1347
8	4	970	1018
8	5	1428	1416
8	6	478	481
8	7	1095	1091
8	8	203	210
8	9	383	370
8	13	498	473
8	14	232	212
8	16	361	355
8	17	272	281
9	0	390	348
9	1	507	541
9	3	856	829
9	4	582	517
9	5	760	745
9	6	643	677
9	7	1047	1009
9	8	426	455
9	9	1070	1049
9	10	340	350
9	11	989	1001
9	12	508	496
9	13	482	525
9	14	367	317
9	15	203	181
9	16	191	154
10	0	777	759
10	1	340	279
10	2	245	197
10	3	339	349
10	5	874	878
10	7	485	457
10	8	528	515
10	9	189	171
10	15	168	151
11	2	677	692
11	4	695	690
11	5	177	65
11	6	225	217
11	10	532	510
11	11	247	241
11	12	533	539
11	13	150	184
11	14	576	558
12	0	944	955
12	2	670	707
12	4	359	357
12	5	298	309
12	7	253	238
12	10	137	68

K	L	FOBS	FCAL
**H =	2****		
12	11	248	221
12	12	137	125
13	2	188	222
13	4	146	147
13	5	354	326
13	7	376	398
13	9	260	243
13	10	249	261
14	0	187	163
14	1	659	643
14	2	354	384
14	3	751	693
14	4	225	227
14	5	744	742
14	6	170	189
14	7	649	643
14	8	173	230
15	0	296	297
15	1	126	123
15	2	190	200
15	3	327	326
15	4	133	121
**H =	3****		
0	0	184	167
0	2	2644	2509
0	4	2032	1998
0	6	606	634
0	8	485	456
0	10	233	130
0	12	863	770
0	14	657	727
0	16	856	860
0	18	626	588
0	20	449	464
1	0	1204	1180
1	1	186	130
1	2	1840	1805
1	3	1377	1343
1	4	259	257
1	5	1032	1014
1	6	391	390
1	7	1400	1343
1	8	857	854
1	10	1101	1116
1	11	305	343
1	12	852	857
1	13	390	452
1	14	335	307
1	16	404	385
1	18	504	463
1	20	164	195
2	2	1023	1018
2	3	907	866
2	4	190	226
2	5	959	966
2	6	886	864
2	7	1256	1285
2	8	746	790
2	9	1289	1311
2	10	578	525
2	11	850	837
2	12	388	380
2	14	835	812
2	15	377	407
2	16	921	943
2	17	359	372
2	18	549	545
2	19	464	410
3	0	1319	1406
3	1	2841	2830
3	2	853	899
3	3	1943	1943
3	5	1799	1731
3	6	658	624
3	7	1303	1225
3	8	452	417
3	9	1020	997
3	10	206	133
3	11	711	678
3	12	440	415
3	13	366	403
3	19	276	291
4	0	1010	1100
4	1	539	506
4	2	1532	1490
4	3	411	437
4	4	1493	1390
4	5	1929	1869
4	6	635	629
4	7	1784	1812
4	8	661	646
4	9	1078	1066
4	10	1388	1453
4	11	560	515
4	12	977	1031
4	14	805	819
4	15	539	536
4	16	586	593
4	17	743	751
4	19	803	783
5	0	2298	2279
5	1	1146	1072
5	2	1257	1242
5	3	596	604
5	4	436	397
5	5	636	616
5	6	241	209
5	7	595	665
5	8	333	355
5	9	388	427
5	10	280	211
5	16	557	558
5	18	512	502
6	0	279	266
6	1	795	784
6	3	263	328
6	4	728	758
6	5	968	886
6	6	421	400
6	7	391	347
6	8	1328	1342
6	9	295	228
6	10	1811	1779
6	12	1563	1553
6	13	272	314
6	14	1308	1316
6	16	697	721
6	18	413	404
7	0	1289	1274
7	1	1630	1572
7	2	1045	1004
7	3	1807	1730
7	4	328	288
7	5	1892	1878
7	7	1144	1070
7	8	889	896
7	9	307	369
7	10	514	515
7	13	373	353
7	14	404	402
7	16	485	531
7	17	336	316
7	18	286	318
8	0	352	386
8	1	1192	1204
8	2	348	317
8	3	1197	1229
8	4	613	633
8	5	1042	1107
8	6	457	453
8	7	947	938
8	9	666	680
8	10	220	232
8	11	885	878
8	12	381	376
8	14	230	217
8	15	221	219
8	17	221	218
9	0	318	348
9	1	642	629
9	2	531	426
9	3	1009	1008
9	4	382	382
9	5	1351	1346
9	7	748	720
9	9	265	270
9	10	280	249
10	3	309	343
10	4	239	227
10	5	580	640
10	7	768	775
10	9	552	575
10	10	845	810
10	11	376	368
10	12	854	835
10	13	311	265
10	14	707	718
11	0	896	889
11	1	220	181
11	2	615	598
11	3	577	575
11	4	277	280
11	5	399	362
11	6	227	143
11	11	305	281
11	14	225	212
12	0	204	201
12	3	198	107
12	4	288	284
12	7	227	226
12	8	249	281
12	10	354	353
12	12	416	426
13	0	391	372
13	1	349	368
13	3	598	586
13	5	494	498
13	6	230	229
13	7	288	301
13	9	205	187
13	10	125	127
14	0	256	232
14	3	177	195
14	7	176	201
15	0	385	375
15	1	565	565
15	2	221	209
15	3	504	533
**H =	4****		
0	0	1368	1254
0	2	578	600
0	4	361	312
0	6	293	244
0	8	1256	1282
0	10	1440	1488
0	12	399	353
0	14	310	285
0	16	570	528
0	18	362	363
1	0	337	324
1	1	731	684
1	2	818	718
1	3	198	235
1	4	611	620
1	5	953	880
1	6	687	719
1	9	388	370

Table 43. Continued

K	L	FOBS	FCAL
H = 4**			
1	10	768	703
1	12	588	618
1	13	419	390
1	14	478	491
1	16	721	644
1	18	270	299
1	19	220	201
2	0	2670	2760
2	1	1946	1885
2	2	1935	1974
2	3	1264	1203
2	4	214	253
2	5	1845	1837
2	6	1021	983
2	7	1353	1339
2	8	234	308
2	10	623	616
2	12	568	485
2	15	345	313
2	16	434	479
2	18	435	459
2	19	287	261
3	0	997	993
3	1	310	265
3	2	713	706
3	3	1692	1648
3	4	140	172
3	5	1494	1493
3	6	446	478
3	7	1292	1381
3	8	355	353
3	9	1347	1319
3	10	546	489
3	11	660	638
3	14	375	359
3	15	706	775
3	16	438	388
3	17	1011	1006
3	19	695	718
4	0	2156	2122
4	1	2971	2986
4	2	955	955
4	3	2534	2406
4	4	391	413
4	5	2165	2131
4	7	597	607
4	8	263	147
4	9	369	313
4	10	348	309
4	11	191	105
4	17	239	245
4	19	330	375
5	0	358	348
5	1	462	362
5	2	696	833
5	3	329	436
5	6	985	968
5	7	866	905
5	8	1561	1522
5	9	1043	1025
5	10	1930	1910
5	12	1623	1592
5	14	1311	1329
5	15	617	623
5	16	880	869
5	17	310	360
5	18	249	296
6	0	1856	1865
6	1	706	803
6	2	509	494
6	3	1368	1374
6	4	718	750
6	5	901	946
6	6	891	832
6	7	349	365
6	8	640	626
6	9	207	222
6	10	401	436
6	14	482	486
6	16	565	576
6	17	201	171
6	18	390	380
7	0	546	532
7	1	750	765
7	3	999	1044
7	5	776	828
7	6	174	183
7	7	634	592
7	8	909	890
7	9	470	521
7	10	1106	1109
7	11	476	516
7	12	1023	1026
7	14	523	549
7	15	177	162
7	16	303	307
8	0	541	592
8	1	1839	1802
8	2	539	562
8	3	1994	1978
8	5	1874	1894
8	7	1183	1167
8	8	233	205
8	9	453	429
8	10	202	169
8	11	257	242
8	13	227	154
8	15	272	287
9	1	962	900
9	3	1211	1176
9	5	1059	1043
9	6	250	233
9	7	647	718
9	9	659	630
9	10	476	472
9	11	277	271
9	12	589	589
9	13	150	79
9	14	483	482
9	15	249	280
9	16	218	214
10	0	313	330
10	1	379	384
10	2	219	203
10	3	835	893
10	4	288	299
10	5	886	907
10	6	206	172
10	7	331	303
10	9	195	123
11	3	232	205
11	5	358	319
11	8	511	468
11	10	661	658
11	12	630	683
12	0	343	353
12	2	182	245
12	5	199	111
12	8	177	137
12	11	187	211
13	0	269	229
13	3	138	127
13	8	194	213
14	1	551	601
14	3	515	563
14	4	208	203
14	5	399	363
14	7	323	299
15	1	246	227
H = 5**			
0	0	290	313
0	2	197	135
0	4	320	335
0	8	826	828
0	10	1138	1087
0	12	661	718
0	14	361	318
0	16	290	317
0	18	156	203
1	0	1423	1299
1	1	485	391
1	2	906	869
1	3	803	784
1	4	203	171
1	5	369	372
1	6	998	980
1	7	352	306
1	8	1396	1367
1	9	599	639
1	10	948	908
1	11	652	624
1	13	227	179
1	14	431	416
1	15	254	249
1	16	402	441
1	18	428	390
2	0	492	486
2	1	269	196
2	2	691	688
2	3	552	545
2	4	378	341
2	5	666	683
2	6	767	773
2	7	1006	1005
2	8	850	779
2	9	674	667
2	10	481	444
2	12	523	547
2	13	462	468
2	14	466	505
2	15	843	898
2	16	522	474
2	17	745	768
2	19	502	500
3	0	1035	1067
3	1	3014	2904
3	2	1142	1177
3	3	2735	2680
3	4	309	368
3	5	1304	1333
3	6	209	138
3	7	647	708
3	9	445	399
3	10	641	663
3	11	446	472
3	16	616	556
3	17	283	302
3	18	215	247
3	19	393	376
4	0	126	163
4	1	814	699
4	2	258	222
4	3	1327	1383
4	5	1729	1771
4	6	864	959
4	7	1543	1413
4	8	1404	1448
4	9	978	973
4	10	1080	1068
4	11	[illegible]	643
4	12	[illegible]	764
4	14	[illegible]	577
4	15	[illegible]	677
4	16	438	413
4	17	742	730
5	0	1762	1759
5	1	1516	1570

K	L	FOBS	FCAL
H = 5**			
5	2	610	611
5	3	146	180
5	4	831	841
5	5	461	518
5	6	672	594
5	9	298	293
5	13	276	236
5	16	273	220
6	0	346	403
6	1	292	163
6	2	296	339
6	3	1157	1129
6	4	320	337
6	5	712	756
6	6	691	712
6	8	1418	1421
6	9	425	418
6	10	1458	1450
6	12	1205	1158
6	14	752	754
6	16	597	561
7	0	367	375
7	1	2025	1998
7	3	2063	2095
7	4	300	212
7	5	1354	1335
7	6	672	740
7	7	778	818
7	8	608	657
7	9	415	396
7	12	310	344
7	14	184	182
7	17	276	277
8	1	903	980
8	3	1167	1093
8	4	415	450
8	5	1009	987
8	6	620	635
8	7	504	528
8	8	680	651
8	9	470	461
8	10	388	364
8	12	245	239
8	13	284	282
8	15	304	304
9	1	1612	1589
9	2	212	195
9	3	1537	1517
9	4	629	657
9	5	1504	1508
9	7	877	832
9	8	348	315
9	14	181	188
9	15	216	222
10	1	211	223
10	2	183	226
10	3	580	636
10	5	648	611
10	8	521	500
10	9	223	179
10	10	857	893
10	11	286	258
10	12	837	833
10	13	261	286
10	14	521	542
11	0	345	335
11	1	547	448
11	3	397	404
11	6	241	246
11	8	254	293
11	10	210	173
11	12	154	193
12	0	183	236
12	2	223	171
12	6	161	176
12	7	171	150
12	8	485	495
12	10	506	531
13	1	410	462
13	3	405	412
13	4	176	213
13	5	150	167
13	6	206	208
14	1	145	136
14	3	285	353
14	5	303	334
H = 6**			
0	0	1446	1372
0	4	387	372
0	6	507	608
0	8	1146	1087
0	10	641	628
0	12	492	481
0	14	629	680
0	16	325	412
0	18	205	178
1	1	371	354
1	2	162	49
1	3	339	299
1	4	287	209
1	5	317	306
1	6	1096	1069
1	7	419	428
1	8	1548	1598
1	10	1360	1422
1	11	571	586
1	12	981	947
1	13	504	567
1	14	276	290
1	15	526	488
1	17	392	365
1	19	283	309
2	0	2580	2480
2	1	2182	2199
2	2	1461	1345
2	3	1222	1140
2	5	304	367
2	6	364	362
2	8	582	522
2	9	214	247
2	10	400	393
2	14	370	449
2	15	234	257
2	16	639	614
2	17	222	261
2	18	255	235
3	0	599	606
3	1	1489	1523
3	2	1237	1212
3	3	1508	1562
3	5	1170	1163
3	6	327	336
3	7	676	640
3	9	392	461
3	12	218	152
3	13	518	493
3	15	1098	1081
3	17	921	986
4	0	215	246
4	1	2206	2142
4	3	1985	2026
4	4	835	824
4	5	527	508
4	6	301	391
4	7	251	244
4	11	256	258
4	12	547	510
4	16	165	123
4	17	187	198
4	18	152	127
5	2	403	436
5	4	529	462
5	5	813	876
5	6	963	1003
5	7	1236	1261
5	8	1405	1326
5	9	875	917
5	10	944	960
5	11	549	551
5	12	1263	1217
5	14	919	938
5	15	253	245
5	16	593	542
5	17	250	223
6	0	285	357
6	1	966	914
6	2	594	642
6	3	1021	1018
6	4	307	351
6	5	482	410
6	6	585	654
6	7	354	296
6	8	214	147
6	9	243	208
6	10	335	339
6	11	206	141
6	13	243	244
6	15	246	239
7	2	425	378
7	3	714	783
7	4	208	243
7	5	531	515
7	6	212	212
7	7	438	430
7	8	979	1035
7	9	371	407
7	10	909	898
7	11	222	121
7	12	502	476
7	14	411	374
7	15	170	199
7	16	304	312
8	0	175	290
8	1	1210	1279
8	2	590	577
8	3	1410	1388
8	4	610	524
8	5	1209	1149
8	6	402	416
8	7	794	859
8	8	372	414
8	10	290	260
8	11	218	264
8	14	227	227
9	0	198	93
9	1	853	931
9	3	645	612
9	4	853	820
9	5	402	463
9	6	399	371
9	8	300	301
9	10	383	405
9	11	466	480
9	12	390	358
9	13	480	485
9	14	214	220
10	0	275	285
10	1	1078	1091
10	3	982	996
10	5	212	235
10	6	532	500
10	8	431	447
10	10	180	206
10	13	141	61
11	2	288	207
11	4	346	263
11	6	514	526

K	L	FOBS	FCAL
H = 6**			
11	7	278	290
11	8	831	828
11	9	222	218
11	10	788	753
11	12	712	702
12	1	378	343
12	2	440	431
12	3	318	318
12	4	667	674
12	6	493	432
12	8	181	168
12	10	157	148
13	1	230	187
13	3	411	399
13	5	241	240
13	8	331	328
14	1	641	641
14	3	534	560
H = 7**			
0	0	225	242
0	2	479	553
0	4	1050	1021
0	6	1821	1712
0	8	2362	2471
0	10	2095	2194
0	12	1003	943
0	14	219	264
1	0	921	878
1	1	281	300
1	2	194	182
1	3	364	395
1	4	384	483
1	6	919	896
1	7	481	497
1	8	1050	1040
1	9	254	295
1	10	342	424
1	12	246	257
1	13	336	337
1	14	519	451
1	15	386	361
1	16	406	376
1	17	198	193
2	0	711	713
2	1	707	701
2	2	172	155
2	3	583	650
2	4	1096	1041
2	5	1122	1032
2	6	1043	1066
2	8	882	892
2	10	778	807
2	11	698	681
2	12	454	423
2	13	974	947
2	15	1033	1028
2	17	839	841
3	0	1540	1434
3	1	1985	2029
3	2	847	852
3	3	1819	1856
3	4	711	726
3	5	719	659
3	14	258	243
3	15	179	119
3	16	366	368
3	17	363	363
4	1	436	492
4	2	745	731
4	3	1444	1355
4	4	1162	1176
4	5	905	937
4	6	1003	1026
4	7	650	645
4	8	754	759
4	9	595	591
4	10	469	438
4	11	418	420
4	12	729	665
4	13	410	364
4	14	363	349
4	15	619	649
4	16	156	140
4	17	504	515
5	1	392	428
5	2	655	620
5	3	516	487
5	4	795	693
5	6	402	417
5	7	516	527
5	8	412	417
5	10	817	746
5	11	319	284
5	12	426	439
5	13	274	263
5	15	161	174
5	17	134	60
6	1	422	437
6	3	536	487
6	4	268	265
6	6	411	319
6	7	346	460
6	8	481	459
6	9	237	208
6	10	884	939
6	11	214	183
6	12	901	868
6	14	683	658
6	16	390	381
7	0	265	201
7	1	786	803
7	2	436	522
7	3	634	584
7	5	482	521
7	6	644	671
7	8	462	392
7	13	249	241
8	0	174	121
8	1	265	181
8	2	560	625
8	3	488	605
8	4	552	601
8	6	573	520
8	7	271	286
8	8	443	446
8	10	308	297
8	11	452	446
8	13	400	423
8	15	452	461
9	0	538	549
9	1	1293	1264
9	2	445	395
9	3	1217	1146
9	4	168	66
9	5	733	659
9	6	221	206
9	7	371	343
9	11	164	120
9	12	194	228
10	1	387	365
10	2	168	102
10	3	466	440
10	4	190	228
10	6	608	614
10	7	300	336
10	8	768	765
10	9	530	473
10	10	728	698
10	11	550	505
10	12	481	493
11	0	197	229
11	2	702	725
11	4	861	799
11	6	559	549
11	8	341	348
11	10	250	212
12	3	277	304
12	6	505	508
12	8	628	654
12	9	137	125
13	0	209	182
13	1	702	662
13	2	293	273
13	3	399	381
13	4	302	312
13	6	305	346
13	7	124	44
14	1	353	406
14	2	155	98
14	3	391	388
H = 8**			
0	0	972	997
0	2	1355	1332
0	4	1211	1211
0	6	1621	1565
0	8	824	876
0	10	288	331
0	14	298	245
0	16	180	170
1	2	632	604
1	3	358	384
1	4	1458	1452
1	5	1088	1052
1	6	1796	1905
1	7	430	531
1	8	1964	2032
1	10	1384	1429
1	11	500	506
1	12	486	507
1	13	566	585
1	14	276	283
1	15	527	534
1	17	570	554
2	0	546	476
2	1	1910	1880
2	2	600	515
2	3	1869	1864
2	4	422	357
2	5	618	549
2	6	246	228
2	7	235	177
2	8	603	596
2	9	350	324
2	10	308	259
2	13	223	247
2	15	498	490
2	16	193	162
2	17	432	436
3	0	575	626
3	1	994	986
3	3	662	666
3	4	327	321
3	7	249	125
3	10	224	270
3	11	453	496
3	12	452	448
3	13	1093	1105
3	14	382	382
3	15	922	949
3	16	152	185
3	17	567	589
4	0	757	865
4	1	1323	1332
4	2	727	733
4	3	971	883
4	4	977	941
4	5	353	372

K	L	FOBS	FCAL
H = 8**			
4	6	733	712
4	7	210	66
4	8	662	696
4	10	595	638
4	13	254	266
4	14	167	132
4	15	295	302
4	17	253	270
5	1	185	142
5	2	242	254
5	3	274	311
5	4	485	461
5	5	629	553
5	6	317	337
5	7	542	511
5	8	441	446
5	9	299	176
5	10	777	754
5	12	723	738
5	14	378	354
6	0	205	117
6	1	284	192
6	2	264	268
6	6	461	437
6	8	783	719
6	9	245	179
6	11	297	277
6	13	336	334
6	15	144	123
7	1	335	316
7	3	239	216
7	6	510	560
7	8	846	814
7	10	735	665
7	11	328	260
7	12	357	377
7	13	341	310
7	14	247	277
7	15	221	221
8	1	718	727
8	2	260	271
8	3	390	519
8	4	296	312
8	5	598	630
8	6	527	506
8	8	615	607
8	9	255	245
8	10	465	426
8	11	235	222
8	12	180	142
8	14	147	155
9	2	287	374
9	3	310	347
9	5	263	191
9	6	160	58
9	8	431	395

K	L	FOBS	FCAL
9	9	529	551
9	11	640	639
9	13	652	624
10	0	238	155
10	1	870	868
10	2	667	624
10	3	586	592
10	4	705	737
10	5	244	202
10	6	395	388
10	8	389	340
10	11	254	246
11	2	228	265
11	3	205	212
11	4	559	566
11	5	158	138
11	6	853	845
11	8	867	801
11	10	788	767
12	0	438	444
12	1	570	625
12	2	819	812
12	3	294	272
12	4	654	650
12	6	368	360
12	8	164	138
13	0	237	231
13	1	375	377
13	3	275	282
13	5	161	139
14	1	627	619
H = 9**			
0	2	997	1069
0	4	1552	1603
0	6	2499	2604
0	8	2387	2299
0	10	1405	1414
0	12	532	570
0	14	475	405
1	0	531	587
1	1	1571	1569
1	2	1739	1741
1	3	1023	1026
1	4	1561	1582
1	6	990	1042
1	7	453	430
1	8	602	619
1	10	353	332
1	11	447	447
1	12	258	216
1	13	380	400
1	15	305	292
1	17	351	344
2	1	922	912
2	2	810	900
2	3	383	417
2	4	1224	1211

K	L	FOBS	FCAL
2	5	573	568
2	6	935	889
2	8	628	610
2	9	493	535
2	11	704	695
2	12	192	158
2	13	980	979
2	14	212	205
2	15	770	787
2	16	215	180
3	0	297	265
3	1	1622	1618
3	2	262	218
3	3	1126	1109
3	4	514	514
3	9	218	294
3	11	343	299
3	13	258	251
3	14	178	166
3	15	381	380
4	2	300	253
4	4	447	443
4	5	251	222
4	6	457	573
4	8	442	445
4	9	208	192
4	10	694	683
4	11	611	568
4	12	424	428
4	13	623	647
4	14	168	133
4	15	514	513
4	16	241	210
5	0	851	773
5	1	374	393
5	2	699	797
5	3	367	319
5	4	509	499
5	6	805	722
5	7	292	233
5	8	858	830
5	10	383	381
5	11	260	285
5	13	389	436
5	14	306	286
5	15	220	232
6	1	382	455
6	4	326	268
6	6	436	484
6	8	809	741
6	10	721	677
6	12	421	428
7	4	903	825
7	5	271	270
7	6	687	622
7	14	178	150
8	1	388	297

K	L	FOBS	FCAL
8	2	259	263
8	3	454	432
8	4	407	364
8	5	390	369
8	6	521	506
8	8	430	401
8	9	419	456
8	10	332	252
8	11	658	631
8	12	190	149
8	13	426	455
9	0	226	178
9	1	1247	1209
9	2	309	299
9	3	987	947
9	5	324	313
9	11	154	134
9	12	166	172
10	1	701	654
10	3	572	513
10	4	581	597
10	6	603	589
10	8	590	599
10	9	195	252
10	10	260	277
10	11	460	450
11	0	795	767
11	2	1078	1078
11	4	912	885
11	6	513	414
11	8	240	256
11	9	193	201
12	0	187	186
12	2	212	256
12	4	544	519
12	6	646	648
12	7	215	220
13	0	244	244
13	1	638	601
13	2	346	333
13	3	372	361
13	4	326	325
H = 10**			
0	0	1182	1129
0	2	1387	1399
0	4	1292	1327
0	6	1117	1081
0	8	408	354
0	10	359	336
0	12	532	561
0	14	139	79
1	0	360	322
1	1	480	482
1	2	1130	1164
1	3	916	956
1	4	1244	1277
1	5	652	634

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 10**				5	14	236	237	12	3	234	195	4	12	194	140
1	6	1614	1642	6	0	274	330	12	4	320	327	4	13	735	719
1	8	1046	1022	6	1	206	96	12	6	155	185	5	0	1275	1233
1	9	288	250	6	2	777	762	13	1	270	293	5	2	1144	1067
1	10	393	370	6	3	286	213	13	2	175	186	5	3	261	261
1	11	389	389	6	4	1039	949	**H = 11****				5	4	626	658
1	12	232	215	6	5	366	299	0	2	748	776	5	5	477	453
1	13	416	389	6	6	576	651	0	4	1264	1261	5	6	395	392
1	15	506	490	6	8	273	273	0	6	1659	1613	5	8	271	271
2	0	1707	1717	6	10	282	273	0	8	774	776	5	10	213	229
2	1	1551	1585	6	11	175	161	0	10	301	305	5	11	169	134
2	2	1142	1224	6	12	266	258	0	12	474	461	5	12	415	401
2	3	1208	1263	7	1	695	660	1	0	976	929	5	13	146	141
2	4	513	471	7	3	486	513	1	1	1396	1325	6	0	302	216
2	6	441	407	7	4	783	746	1	2	855	901	6	1	391	346
2	7	226	276	7	6	1161	1168	1	3	580	572	6	2	712	716
2	8	413	395	7	7	216	251	1	4	832	817	6	4	1211	1233
2	10	386	377	7	8	832	791	1	5	184	76	6	6	1329	1335
2	13	269	289	7	9	437	473	1	6	502	491	6	8	871	926
2	15	187	242	7	10	377	393	1	8	442	427	6	9	237	228
2	16	154	152	7	11	544	482	1	10	395	396	6	10	333	321
3	0	609	578	7	12	241	228	1	11	205	230	6	11	250	244
3	2	384	409	7	13	443	461	2	0	498	471	6	13	172	145
3	5	303	384	8	1	950	904	2	1	530	590	7	0	438	482
3	6	380	413	8	2	303	266	2	2	613	547	7	1	468	428
3	7	267	255	8	3	771	681	2	3	222	254	7	2	898	835
3	8	556	542	8	4	589	606	2	4	293	358	7	3	247	265
3	9	443	444	8	6	318	329	2	6	191	99	7	4	771	815
3	10	499	519	8	12	206	164	2	7	299	229	8	1	608	604
3	11	973	981	9	0	184	244	2	9	437	407	8	2	201	100
3	12	338	362	9	1	475	408	2	11	556	578	8	3	319	356
3	13	973	959	9	3	475	490	2	12	249	183	8	6	346	371
3	14	306	333	9	4	314	260	2	13	603	626	8	7	535	544
3	15	642	647	9	5	254	251	2	14	345	356	8	8	298	297
4	0	963	954	9	9	488	424	2	15	685	669	8	9	726	751
4	1	688	705	9	10	197	163	3	0	523	514	8	10	192	202
4	2	791	768	9	11	519	542	3	1	484	420	8	11	695	758
4	3	249	209	10	0	620	623	3	3	453	427	9	0	251	226
4	4	628	611	10	1	728	756	3	4	426	352	9	1	828	793
4	5	330	335	10	2	717	796	3	5	250	237	9	2	221	261
4	6	658	720	10	3	272	247	3	7	444	484	9	3	295	326
4	7	289	333	10	4	628	590	3	9	567	504	9	10	157	109
4	9	357	349	10	5	181	180	3	10	256	242	10	0	265	299
4	12	333	349	10	6	300	284	3	11	192	202	10	1	391	431
4	13	445	450	10	9	222	190	3	13	245	253	10	2	270	323
4	14	369	332	11	0	229	271	4	0	338	345	10	3	213	211
4	15	308	306	11	1	358	431	4	1	337	310	10	4	316	373
5	2	341	328	11	2	527	478	4	2	322	285	10	5	195	200
5	4	573	589	11	3	191	160	4	3	578	568	10	6	278	257
5	5	306	208	11	4	689	635	4	4	508	446	10	8	130	138
5	6	671	721	11	5	251	241	4	5	694	682	11	0	777	721
5	7	344	354	11	6	540	554	4	6	694	637	11	2	640	584
5	8	801	779	11	7	278	299	4	7	508	433	11	4	353	339
5	9	285	300	11	8	542	556	4	8	645	601	11	5	236	242
5	10	605	663	12	0	607	604	4	9	658	657	11	6	251	292
5	12	188	175	12	1	225	258	4	10	311	352	12	0	354	376
5	13	243	270	12	2	562	611	4	11	936	942	12	2	446	460

Table 43. Continued

K	L	FOBS	FCAL
H = 11**			
12	4	306	381
H = 12**			
0	0	267	219
0	2	503	456
0	4	708	735
0	6	590	533
0	8	406	405
0	10	293	246
0	12	156	121
0	14	155	173
1	1	583	581
1	2	422	404
1	3	242	156
1	4	698	738
1	6	530	512
1	7	379	387
1	8	392	426
1	9	248	264
1	11	213	231
1	13	329	334
1	14	353	352
2	0	732	750
2	1	583	540
2	4	221	246
2	5	182	205
2	6	388	341
2	7	407	407
2	8	348	321
3	0	214	233
3	2	193	137
3	3	485	545
3	4	410	402
3	5	290	280
3	6	236	263
3	7	255	262
3	9	663	652
3	11	965	943
3	12	173	147
3	13	715	711
4	0	1048	1009
4	1	266	228
4	2	975	981
4	3	465	491
4	4	363	376
4	5	445	450
4	6	194	136
4	7	427	459
4	8	207	117
4	9	208	214
4	10	338	305
4	12	161	153
4	13	202	198
5	0	624	634
5	2	615	676
5	4	893	917
5	5	269	271
5	6	807	842
5	7	381	388
5	8	677	753
5	9	405	403
5	10	248	208
5	11	309	315
5	12	310	300
6	0	1344	1255
6	2	1073	1058
6	4	957	966
6	6	346	337
6	10	136	75
7	1	248	338
7	2	375	406
7	4	1091	1088
7	5	435	418
7	6	950	975
7	7	757	780
7	8	421	425
7	9	924	911
7	11	801	780
8	1	689	685
8	2	254	284
8	6	155	68
8	7	188	166
8	9	130	31
9	0	366	317
9	1	369	319
9	5	196	154
9	7	442	441
9	9	532	525
10	0	618	624
10	1	317	265
10	2	433	435
10	3	206	191
10	4	258	303
10	6	170	128
11	0	372	358
11	1	231	261
11	2	233	214
11	4	142	168
12	0	346	355
12	2	303	313
H = 13**			
0	2	440	366
0	4	839	825
0	6	668	663
0	8	389	369
0	12	356	301
1	0	279	238
1	2	225	166
1	4	368	410
1	6	485	500
1	8	225	249
1	12	192	228
2	3	205	188
2	4	228	175
2	5	349	316
2	6	432	391
2	7	396	442
2	8	404	432
2	9	541	550
2	10	167	191
2	11	508	512
2	12	185	177
2	13	477	475
3	0	484	436
3	3	486	532
3	4	363	329
3	5	689	655
3	7	729	727
3	9	275	307
3	10	195	206
3	11	167	187
3	12	230	239
4	0	411	448
4	2	239	176
4	3	333	351
4	4	265	245
4	5	270	291
4	6	219	191
4	7	723	662
4	9	807	786
4	11	735	767
4	12	120	116
5	0	1354	1394
5	1	200	200
5	2	977	1004
5	4	886	840
5	5	412	422
5	6	371	411
5	10	158	186
6	0	576	650
6	2	1013	959
6	4	1288	1337
6	6	961	989
6	7	242	244
6	8	493	469
6	9	414	394
6	11	376	359
7	0	887	893
7	1	306	306
7	2	849	916
7	3	236	150
7	4	510	540
7	6	194	191
7	8	208	197
8	1	324	354
8	2	213	116
8	4	147	116
8	5	608	597
8	7	878	909
8	9	782	794
9	0	332	330
9	2	371	391
9	3	171	179
9	4	405	381
9	5	221	220
9	7	121	145
10	4	155	153
10	5	139	143
11	0	475	487
11	2	389	379
11	3	157	195
H = 14**			
0	0	591	678
0	2	681	679
0	4	463	447
0	6	375	398
0	8	275	238
0	12	144	161
1	2	613	606
1	3	280	294
1	4	870	825
1	5	556	562
1	6	628	638
1	7	417	435
1	8	340	324
1	9	384	343
1	10	141	98
1	11	177	189
1	12	401	382
2	2	206	180
2	3	600	630
2	4	446	420
2	5	636	636
2	6	204	226
2	7	281	294
2	10	244	237
3	3	186	210
3	4	183	180
3	5	248	295
3	6	497	485
3	7	701	666
3	8	403	392
3	9	778	787
3	10	269	240
3	11	544	574
4	0	743	740
4	1	190	218
4	2	592	599
4	3	344	304
4	4	321	303
4	5	733	744
4	7	423	415
4	11	234	252
5	0	760	691
5	2	887	789
5	4	689	708
5	5	296	293
5	6	618	571

K	L	FOBS	FCAL
H = 14**			
5	7	318	355
5	8	229	218
5	9	230	266
5	10	176	147
6	0	1502	1569
6	2	1097	1066
6	4	649	646
6	6	310	351
6	8	148	158
7	0	485	391
7	2	713	690
7	3	256	261
7	4	535	548
7	5	557	578
7	7	768	753
8	0	253	211
8	3	368	334
8	4	260	225
8	5	293	347
8	6	176	73
9	2	231	195
9	3	228	237
9	4	307	306
9	5	484	495
9	6	217	229
10	0	598	616
10	2	487	505
10	3	149	144
11	0	123	136
H = 15**			
0	0	879	835
0	2	1215	1193
0	4	934	947
0	6	275	324
0	8	130	87
0	10	372	397
1	0	1083	1046
1	1	315	304
1	2	523	506
1	3	638	598
1	5	238	246
1	9	192	171
2	1	451	394
2	2	423	448
2	3	523	537
2	4	647	693
2	5	883	889
2	6	799	783
2	7	644	598
2	8	321	313
2	9	508	569
3	0	214	216
3	3	535	489
3	4	268	238
3	5	622	679
3	7	214	287
3	8	193	176
4	0	306	315
4	1	258	206
4	2	236	199
4	3	226	173
4	5	333	370
4	7	608	595
4	8	156	139
4	9	597	577
5	0	938	935
5	2	633	623
5	3	219	154
5	4	503	485
5	5	176	248
5	6	261	257
6	0	651	635
6	2	617	668
6	4	420	420
6	6	291	268
6	7	207	218
7	0	852	853
7	2	373	386
7	6	140	141
8	3	321	345
8	4	133	149
8	5	527	560
9	0	486	479
9	1	462	471
9	2	435	437
9	3	427	434
10	0	143	157
10	1	124	182
H = 16**			
0	0	1338	1278
0	2	494	539
1	0	538	510
1	1	598	566
1	2	730	762
1	3	693	705
1	4	663	645
1	5	629	633
1	6	262	273
1	7	317	304
1	8	144	174
1	9	341	349
2	0	244	213
2	1	627	626
2	2	258	234
2	3	599	641
2	4	209	200
2	5	338	342
2	8	116	59
3	1	356	368
3	2	291	275
3	3	413	456
3	4	520	513
3	5	592	598
3	6	498	471
3	7	619	656
3	8	160	174
4	2	207	184
4	3	195	203
4	4	179	142
4	5	348	368
4	7	201	192
4	8	116	83
5	0	327	336
5	1	222	285
5	2	358	366
5	3	311	303
5	4	269	241
5	5	224	240
5	6	201	224
5	7	176	137
6	0	838	838
6	2	480	485
6	4	288	265
6	6	149	158
7	0	209	232
7	2	247	299
7	5	231	222
8	0	151	57
8	1	356	350
8	2	175	165
8	3	260	267
9	0	138	113
9	1	139	106
H = 17**			
0	0	397	401
0	2	505	542
0	4	261	250
0	6	176	172
1	0	579	623
1	1	588	511
1	2	325	318
1	3	417	424
1	5	374	354
1	7	171	201
2	1	616	630
2	2	416	372
2	3	631	653
2	4	475	472
2	5	700	699
2	6	131	193
2	7	644	615
3	1	267	275
3	3	282	306
3	5	298	315
4	1	224	233
4	2	154	171
4	3	393	373
4	4	143	165
4	5	409	416
5	0	290	321
5	1	216	214
5	2	332	323
5	3	286	279
5	4	203	211
5	5	142	143
6	0	217	200
6	1	272	263
6	2	181	141
6	3	352	354
6	4	104	31
7	0	290	317
7	2	151	139
7	3	128	125
H = 18**			
0	0	532	544
0	2	182	146
1	0	221	207
1	1	436	462
1	2	265	241
1	3	488	501
1	5	411	400
2	1	557	598
2	3	571	585
2	4	140	121
2	5	384	388
3	0	261	235
3	1	408	424
3	2	156	138
3	3	582	573
3	5	687	687
4	0	294	319
4	1	343	359
4	2	270	276
4	3	399	391
5	0	187	147
5	1	316	332
5	2	256	240
5	3	344	328
6	0	355	342
H = 19**			
0	0	148	106
1	0	136	166
1	1	410	406
1	2	113	73
1	3	304	315
2	1	589	565
2	3	635	625
3	0	300	272
3	1	530	524
3	2	241	246
4	0	310	310
4	1	314	333
5	0	424	406

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -21**				9	1	368	366	9	1	582	558	-9	0	420	472
1	0	772	794	10	1	542	569	12	1	405	397	-7	0	817	833
3	0	388	381	12	1	405	325	13	1	430	524	-5	0	1235	1273
5	0	637	698	13	1	337	326	-7	2	265	265	-3	0	921	937
7	0	406	304	-4	2	559	572	-6	2	258	209	-1	0	782	838
4	1	288	315	-3	2	331	357	-5	2	430	421	1	0	514	418
5	1	503	491	2	2	286	326	-3	2	536	531	3	0	1003	978
L = -20**				4	2	296	241	-2	2	509	496	5	0	416	459
-2	0	234	197	7	2	451	431	1	2	683	695	7	0	504	593
0	0	258	284	10	2	649	662	2	2	333	297	11	0	471	460
2	0	272	270	12	2	477	452	3	2	699	721	13	0	396	369
4	0	422	409	13	2	409	346	6	2	1020	990	15	0	579	612
-3	1	344	317	-5	3	587	571	7	2	701	693	-10	1	254	173
-1	1	424	438	-3	3	246	183	9	2	461	492	-8	1	398	398
0	1	409	411	-1	3	342	307	14	2	370	337	-6	1	417	394
1	1	338	433	1	3	360	394	-4	3	471	475	-4	1	838	833
2	1	396	385	2	3	490	552	-2	3	319	341	-1	1	346	365
3	1	558	588	5	3	513	496	1	3	325	283	0	1	781	813
4	1	330	312	7	3	329	327	2	3	392	316	1	1	445	429
7	1	573	520	9	3	516	513	3	3	438	454	2	1	723	775
10	1	538	518	10	3	937	845	4	3	559	545	4	1	657	610
0	2	261	220	11	3	631	555	6	3	363	361	6	1	652	540
2	2	265	278	12	3	323	349	7	3	414	437	8	1	667	667
3	2	410	431	-2	4	626	644	8	3	506	478	9	1	660	700
6	2	750	701	-1	4	408	295	9	3	460	441	11	1	458	499
7	2	662	541	0	4	284	302	11	3	872	818	14	1	600	624
8	2	363	384	1	4	527	459	14	3	347	388	15	1	586	66[illegible]
9	2	1033	968	2	4	279	295	-6	4	453	504	-7	2	415	353
0	3	261	245	3	4	990	990	-4	4	250	206	-2	2	284	248
1	3	359	337	4	4	319	247	-3	4	251	188	5	2	496	379
4	3	745	702	5	4	293	371	4	4	553	449	7	2	862	829
7	3	495	453	6	4	762	738	7	4	586	516	8	2	1141	1143
8	3	654	601	9	4	578	613	10	4	819	778	10	2	1119	1165
1	4	330	242	11	4	578	531	12	4	517	501	12	2	340	364
2	4	449	378	-1	5	715	679	13	4	399	393	13	2	397	381
5	4	339	318	2	5	520	442	-4	5	330	351	15	2	461	515
6	4	289	235	4	5	305	296	-3	5	640	589	16	2	1096	1120
L = -19**				7	5	579	619	-1	5	759	755	-9	3	437	458
-5	0	923	956	**L = -18****				2	5	715	745	-8	3	245	266
-3	0	854	918	-8	0	332	329	3	5	624	616	-7	3	341	372
-1	0	464	454	-6	0	316	254	4	5	352	286	-6	3	436	470
1	0	1033	1078	0	0	298	300	5	5	690	757	-3	3	445	390
3	0	574	596	2	0	308	335	7	5	526	518	-2	3	320	120
5	0	934	933	8	0	643	658	11	5	675	675	-1	3	473	458
7	0	404	374	10	0	330	274	-2	6	1010	951	2	3	466	546
9	0	690	692	12	0	685	700	0	6	943	911	5	3	816	676
11	0	408	502	14	0	611	654	1	6	305	280	6	3	606	618
13	0	271	359	-8	1	320	288	3	6	267	200	9	3	903	782
-5	1	593	590	-6	1	606	603	4	6	536	541	11	3	663	670
-4	1	651	692	-4	1	557	629	6	6	621	606	14	3	868	846
-3	1	376	381	-1	1	280	228	8	6	621	597	15	3	608	624
-2	1	252	209	0	1	524	534	9	6	389	337	-8	4	425	416
0	1	648	654	2	1	512	469	2	7	227	277	-7	4	761	793
1	1	340	197	4	1	521	562	3	7	486	456	-5	4	885	927
2	1	548	575	5	1	411	374	4	7	331	283	-2	4	866	890
4	1	585	601	6	1	395	327	5	7	878	892	1	4	761	708
8	1	1206	1100	7	1	446	345	**L = -17****				3	4	835	817

H	K	FOBS	FCAL
L = -17**			
6	4	570	546
8	4	308	286
9	4	388	330
13	4	290	308
-7	5	258	250
-6	5	508	436
-3	5	555	626
-2	5	414	366
-1	5	543	484
0	5	289	271
1	5	405	451
2	5	294	291
3	5	330	396
4	5	304	379
5	5	531	545
6	5	632	598
7	5	371	314
8	5	393	294
9	5	383	271
11	5	408	345
12	5	464	471
-3	6	603	580
[illegible]	6	639	660
2	6	290	311
3	6	276	270
5	6	732	703
6	6	531	469
7	6	752	732
9	6	658	683
10	6	462	467
12	6	301	230
-3	7	396	375
-1	7	562	540
1	7	287	271
4	7	318	315
6	7	580	597
8	7	477	488
L = -16**			
-8	0	503	534
-6	0	697	644
-4	0	934	1000
-2	0	284	256
0	0	1253	1333
2	0	1314	1268
4	0	926	946
8	0	1041	1058
10	0	433	345
12	0	833	963
14	0	306	230
16	0	977	1091
-11	1	303	259
-8	1	716	719
-7	1	446	442
-6	1	698	709
-5	1	313	237
-4	1	665	706
-3	1	629	701
0	1	361	424
1	1	865	921
2	1	344	366
3	1	632	609
5	1	534	427
7	1	705	676
9	1	1023	1093
13	1	491	458
15	1	521	571
16	1	399	421
-11	2	613	596
-10	2	571	536
-7	2	578	544
-5	2	581	683
-4	2	326	321
-3	2	480	472
-2	2	752	799
-1	2	319	382
0	2	300	173
1	2	836	837
3	2	544	596
8	2	703	657
9	2	405	491
11	2	372	432
15	2	658	685
17	2	1083	1131
-9	3	435	413
-8	3	245	288
-6	3	580	581
-5	3	453	473
-4	3	451	481
-3	3	435	360
-2	3	312	312
0	3	706	735
2	3	388	427
3	3	726	636
6	3	546	484
9	3	899	930
10	3	676	618
11	3	900	881
12	3	340	345
14	3	331	319
16	3	451	482
17	3	700	679
-10	4	511	464
-4	4	276	327
-3	4	399	431
-1	4	640	604
2	4	1079	975
3	4	389	323
4	4	1083	1062
5	4	801	722
7	4	842	833
8	4	434	544
9	4	497	391
10	4	851	766
13	4	866	841
14	4	377	367
15	4	680	652
16	4	428	408
-9	5	447	385
-6	5	464	464
-5	5	356	353
-4	5	398	328
-3	5	661	660
-2	5	813	840
-1	5	481	454
0	5	338	145
2	5	523	468
3	5	801	786
4	5	486	409
6	5	570	640
9	5	309	380
11	5	558	568
13	5	315	258
14	5	841	763
15	5	471	449
-7	6	294	341
-4	6	488	439
-2	6	558	583
0	6	514	540
4	6	323	209
7	6	272	305
10	6	376	404
-4	7	355	357
-1	7	525	493
0	7	323	399
1	7	274	289
3	7	526	509
4	7	456	469
5	7	401	447
6	7	348	361
8	7	610	630
12	7	735	758
-2	8	206	93
1	8	551	565
3	8	452	453
5	8	891	926
7	8	675	704
9	8	317	286
L = -15**			
-13	0	817	846
-11	0	620	[illegible]
-9	0	537	583
-7	0	273	211
-5	0	710	699
1	0	593	606
3	0	290	280
7	0	599	530
13	0	724	788
17	0	1026	1111
-12	1	571	571
-9	1	285	189
-8	1	339	312
-7	1	339	281
-5	1	945	973
-4	1	312	226
-3	1	378	359
-2	1	564	491
-1	1	882	861
1	1	677	662
3	1	715	663
4	1	582	544
5	1	859	900
6	1	1053	955
10	1	520	554
11	1	480	449
14	1	340	340
15	1	314	342
16	1	853	880
18	1	647	684
-11	2	245	222
-6	2	450	503
-4	2	698	754
-1	2	728	710
0	2	994	946
2	2	907	905
4	2	1115	1117
5	2	637	643
7	2	1178	1102
8	2	1251	1217
9	2	434	538
10	2	781	800
12	2	503	545
14	2	367	351
15	2	389	341
16	2	297	290
-12	3	480	463
-11	3	278	279
-10	3	488	457
-8	3	294	319
-6	3	356	248
-4	3	272	176
-3	3	633	621
1	3	767	821
2	3	413	343
3	3	372	463
6	3	1200	1155
7	3	598	517
8	3	343	247
10	3	490	515
13	3	411	409
14	3	951	1025
15	3	674	708
16	3	735	796
18	3	525	573
-10	4	827	849
-7	4	572	592
-5	4	404	456
-4	4	438	437

H	K	FOBS	FCAL
L = -15**			
-2	4	489	472
-1	4	302	319
0	4	362	387
1	4	608	525
2	4	414	475
3	4	813	756
5	4	644	676
9	4	467	449
10	4	494	497
11	4	788	773
12	4	292	312
14	4	937	919
15	4	294	361
16	4	517	545
17	4	380	333
-9	5	626	627
-8	5	446	482
-7	5	597	603
-6	5	376	398
-4	5	528	485
-3	5	370	376
-2	5	820	808
0	5	574	565
1	5	978	978
3	5	1269	1266
4	5	1028	1004
6	5	863	838
10	5	440	381
11	5	341	324
12	5	803	771
15	5	643	673
-9	6	380	391
-7	6	476	428
-6	6	426	402
-5	6	457	425
-3	6	1316	1227
-1	6	1254	1282
1	6	373	316
2	6	876	864
3	6	710	750
5	6	898	913
7	6	892	873
8	6	338	382
9	6	523	479
10	6	637	601
11	6	522	438
13	6	725	723
15	6	260	283
-7	7	287	273
-5	7	495	482
-4	7	310	356
-2	7	307	295
-1	7	287	308
0	7	503	573
4	7	853	821
5	7	770	748
6	7	875	840
8	7	415	358
9	7	359	285
12	7	599	609
13	7	839	842
-4	8	468	460
-2	8	482	467
0	8	525	443
2	8	236	260
5	8	249	201
6	8	391	348
0	9	465	472
2	9	245	204
3	9	223	146
4	9	683	665
5	9	522	519
6	9	790	765
7	9	405	506
L = -14**			
-12	0	610	623
-8	0	957	936
-6	0	986	1065
-4	0	1250	1295
0	0	1895	1884
2	0	1163	1209
4	0	1474	1431
6	0	416	482
8	0	725	714
10	0	451	555
12	0	416	482
14	0	326	407
16	0	540	553
18	0	694	627
-14	1	584	597
-12	1	1132	1138
-11	1	839	849
-8	1	441	446
-7	1	563	566
-6	1	329	382
-5	1	409	420
-3	1	832	800
-2	1	446	409
-1	1	984	939
0	1	543	558
1	1	1310	1331
2	1	772	776
3	1	1101	1074
4	1	402	442
5	1	404	307
7	1	1482	1521
8	1	590	659
9	1	630	745
10	1	434	561
12	1	566	568
15	1	503	519
16	1	761	775
17	1	420	448
18	1	572	594
19	1	325	313
-13	2	786	781
-11	2	476	452
-10	2	329	376
-9	2	260	260
-7	2	308	302
-6	2	632	633
-5	2	518	549
-2	2	323	320
-1	2	325	287
0	2	620	614
2	2	372	338
6	2	1527	1468
7	2	1067	1054
8	2	833	857
9	2	1333	1366
10	2	673	734
11	2	538	603
14	2	613	644
15	2	1238	1350
17	2	1379	1441
18	2	506	543
19	2	473	509
-13	3	502	495
-11	3	472	455
-10	3	544	533
-7	3	533	492
-6	3	476	510
-4	3	286	273
-3	3	320	261
-2	3	854	922
-1	3	368	398
0	3	523	495
1	3	838	821
3	3	356	345
4	3	803	731
6	3	1006	1004
8	3	974	922
9	3	1114	1160
10	3	713	759
11	3	726	671
13	3	746	782
15	3	722	753
16	3	876	904
17	3	275	281
18	3	367	378
-11	4	436	468
-9	4	692	697
-8	4	391	317
-6	4	977	980
-3	4	871	848
-2	4	360	197
-1	4	612	680
0	4	381	315
2	4	1316	1283
5	4	1109	1024
7	4	376	361
8	4	453	431
10	4	796	733
11	4	405	343
12	4	387	388
18	4	464	443
-11	5	378	337
-10	5	682	699
-8	5	444	524
-7	5	537	487
-5	5	562	511
-4	5	369	406
-2	5	1368	1325
0	5	631	637
1	5	820	774
3	5	322	264
5	5	774	816
6	5	487	463
9	5	803	793
10	5	320	303
13	5	951	931
14	5	606	527
17	5	265	215
-10	6	606	568
-8	6	420	388
-3	6	288	311
-1	6	535	557
4	6	813	738
6	6	589	617
11	6	411	464
12	6	673	663
14	6	846	815
16	6	544	499
-8	7	606	565
-6	7	291	185
-4	7	629	656
-2	7	746	731
0	7	477	481
7	7	489	443
8	7	702	646
11	7	592	545
13	7	847	814
-7	8	488	469
-6	8	262	176
-5	8	385	377
-3	8	345	366
-1	8	581	628
1	8	460	473
3	8	760	763
5	8	712	708
7	8	460	491
11	8	613	605
-4	9	393	382
0	9	709	696
2	9	253	193
4	9	464	494
5	9	407	402

H	K	FOBS	FCAL
L = -14**			
6	9	243	251
7	9	475	491
10	9	218	259
4	10	385	371
L = -13**			
-15	0	472	479
-13	0	781	823
-5	0	730	772
-3	0	394	321
-1	0	1161	1190
1	0	1641	1593
3	0	1289	1272
5	0	685	607
7	0	765	789
9	0	748	732
11	0	1119	1238
13	0	977	1071
15	0	976	1038
17	0	807	799
-15	1	230	215
-14	1	234	214
-13	1	839	786
-11	1	416	428
-9	1	466	436
-7	1	953	963
-6	1	374	349
-5	1	1651	1640
-4	1	444	427
-3	1	476	456
-2	1	596	606
-1	1	793	837
0	1	1244	1333
2	1	888	922
3	1	351	477
4	1	511	483
5	1	775	703
6	1	375	223
8	1	1242	1385
10	1	413	504
12	1	489	477
16	1	1236	1252
17	1	425	390
19	1	477	478
20	1	304	295
-14	2	701	710
-12	2	810	786
-11	2	740	730
-9	2	421	436
-8	2	487	480
-7	2	414	394
-6	2	797	800
-4	2	1187	1220
-3	2	948	976
-2	2	373	446
-1	2	709	726
0	2	1043	1143
2	2	404	516
3	2	321	328
4	2	388	367
5	2	906	810
8	2	492	479
9	2	526	554
11	2	782	862
14	2	301	257
16	2	871	961
17	2	350	310
18	2	993	991
19	2	376	369
20	2	290	270
-13	3	516	528
-12	3	398	407
-11	3	561	602
-10	3	682	653
-7	3	745	759
-5	3	343	339
-4	3	427	490
-3	3	711	802
-2	3	798	863
-1	3	294	243
1	3	528	518
2	3	561	542
3	3	365	331
4	3	400	383
5	3	409	390
6	3	869	791
7	3	948	901
8	3	694	716
9	3	438	427
10	3	1057	1086
11	3	707	711
12	3	567	601
13	3	635	618
14	3	443	471
16	3	382	394
17	3	874	887
18	3	818	832
19	3	293	256
-14	4	240	232
-12	4	333	370
-11	4	337	313
-8	4	364	324
-6	4	451	401
-5	4	482	501
-2	4	400	449
1	4	688	658
2	4	548	578
3	4	1862	1854
4	4	364	385
5	4	1032	989
6	4	762	725
9	4	1246	1171
10	4	498	511
11	4	1238	1220
12	4	584	588
14	4	1210	1241
15	4	315	268
17	4	281	274
18	4	588	559
19	4	300	371
-11	5	245	187
-10	5	258	294
-9	5	316	298
-8	5	650	611
-7	5	501	551
-5	5	555	586
-4	5	906	959
-3	5	587	621
-2	5	460	505
-1	5	774	715
1	5	866	860
2	5	627	600
3	5	1056	1015
4	5	754	725
5	5	884	918
7	5	711	647
10	5	1114	1069
12	5	376	303
14	5	306	372
15	5	783	757
16	5	300	333
17	5	276	185
18	5	327	363
-11	6	728	708
-10	6	430	384
-9	6	870	865
-6	6	662	612
-5	6	741	768
-4	6	420	298
-3	6	1469	1427
-1	6	1427	1378
1	6	500	473
2	6	1076	1006
3	6	794	760
5	6	331	405
7	6	387	438
10	6	310	375
12	6	318	299
15	6	375	290
16	6	305	261
-10	7	290	322
-9	7	708	691
-8	7	588	586
-4	7	452	475
-3	7	393	418
-2	7	762	718
0	7	714	722
1	7	573	572
4	7	495	590
5	7	794	772
6	7	472	544
7	7	390	444
8	7	386	339
11	7	517	546
13	7	923	911
14	7	341	368
15	7	388	393
-8	8	438	441
-6	8	312	291
-3	8	257	203
4	8	884	898
6	8	829	804
7	8	254	229
8	8	483	409
9	8	313	274
10	8	597	640
12	8	1639	1619
14	8	838	851
-5	9	268	280
-4	9	421	356
-2	9	445	426
0	9	553	567
1	9	569	602
2	9	275	259
4	9	592	584
5	9	736	714
6	9	273	228
7	9	358	314
8	9	354	326
9	9	476	541
11	9	622	672
-3	10	693	700
-1	10	666	642
1	10	476	474
2	10	557	531
3	10	541	552
4	10	207	163
6	10	234	119
L = -12**			
-16	0	310	281
-14	0	696	734
-12	0	1080	1063
-10	0	669	666
-8	0	1069	1062
-6	0	865	884
-4	0	1553	1545
-2	0	613	534
0	0	857	809
4	0	628	666
6	0	618	642
10	0	805	817
12	0	409	431
14	0	694	701
16	0	434	461
18	0	868	927
20	0	286	293
-15	1	272	256
-14	1	229	290

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -12**				7	3	416	355	18	5	425	409	0	9	480	516
-13	1	486	465	8	3	1617	1581	-8	6	300	339	2	9	235	251
-12	1	397	438	10	3	466	489	-5	6	678	683	3	9	372	396
-11	1	484	541	12	3	462	426	-4	6	955	928	5	9	885	951
-9	1	331	309	13	3	958	1030	-2	6	1305	1308	6	9	723	725
-6	1	799	859	14	3	870	893	0	6	819	832	7	9	837	907
-5	1	779	776	15	3	1190	1173	1	6	344	417	8	9	349	363
-3	1	291	315	16	3	465	547	4	6	1449	1390	11	9	687	692
-2	1	576	579	19	3	384	409	5	6	1007	1001	12	9	580	550
-1	1	1149	1165	20	3	410	401	6	6	1553	1484	13	9	546	500
0	1	1196	1210	-15	4	504	529	8	6	643	654	-5	10	616	636
2	1	1481	1430	-14	4	963	953	9	6	686	655	-4	10	738	748
3	1	600	611	-12	4	474	500	11	6	528	544	-2	10	887	890
4	1	744	715	-11	4	926	887	12	6	817	802	-1	10	310	297
6	1	462	439	-9	4	645	701	13	6	888	798	0	10	768	749
7	1	1059	1192	-8	4	611	612	14	6	538	522	1	10	438	454
8	1	734	771	-7	4	461	411	16	6	318	290	3	10	209	148
9	1	455	499	-6	4	977	1029	17	6	273	240	4	10	887	911
10	1	309	401	-3	4	1051	991	-12	7	706	666	5	10	410	353
12	1	600	627	-1	4	323	340	-11	7	563	525	6	10	901	917
13	1	312	329	0	4	309	311	-10	7	938	927	8	10	768	789
16	1	689	758	2	4	513	485	-9	7	515	530	9	10	205	204
17	1	1061	1134	3	4	365	354	-8	7	623	621	10	10	216	197
18	1	330	290	4	4	755	720	-6	7	543	586	2	11	573	576
-14	2	357	360	5	4	424	493	-4	7	836	787	3	11	493	519
-12	2	365	342	6	4	638	579	-2	7	581	540	**L = -11****			
-9	2	554	553	7	4	387	382	-1	7	732	727	-13	0	375	373
-7	2	286	341	9	4	318	50	0	7	491	470	-7	0	1475	1381
-6	2	725	732	11	4	548	528	2	7	743	711	-5	0	2052	2051
-3	2	330	309	12	4	516	576	3	7	542	611	-3	0	427	451
-2	2	835	817	13	4	374	403	5	7	1069	1037	-1	0	1871	1957
-1	2	438	368	14	4	593	619	6	7	352	327	1	0	2016	2105
0	2	384	348	15	4	846	836	7	7	758	784	3	0	1257	1295
1	2	858	875	16	4	407	406	9	7	422	345	5	0	448	525
3	2	880	915	19	4	748	737	11	7	833	803	7	0	1910	1903
6	2	1675	1735	-13	5	338	274	12	7	742	758	9	0	1063	1146
7	2	1561	1572	-12	5	231	196	13	7	753	715	11	0	725	731
8	2	289	221	-10	5	1011	998	14	7	627	603	13	0	561	535
9	2	1484	1574	-8	5	538	501	15	7	480	428	15	0	1030	1014
10	2	525	558	-7	5	1050	1056	-9	8	952	931	19	0	565	582
11	2	585	637	-6	5	355	361	-7	8	446	388	21	0	585	550
14	2	868	890	-4	5	283	263	-5	8	602	600	-15	1	557	534
15	2	852	902	-3	5	1468	1456	-3	8	426	443	-13	1	1137	1090
16	2	289	292	-2	5	650	668	-1	8	834	951	-11	1	334	285
17	2	473	511	-1	5	741	697	3	8	618	625	-10	1	782	821
-15	3	593	585	0	5	481	469	4	8	393	386	-9	1	617	603
-13	3	873	898	1	5	510	538	9	8	486	478	-8	1	924	958
-12	3	503	536	2	5	1211	1128	11	8	662	679	-7	1	1158	1168
-10	3	642	655	3	5	845	740	13	8	1396	1353	-6	1	693	636
-5	3	385	352	4	5	336	395	14	8	271	266	-5	1	1010	1068
-4	3	283	311	5	5	1475	1466	15	8	348	334	-4	1	1215	1185
-2	3	869	921	6	5	426	422	-8	9	779	757	-3	1	385	338
0	3	558	548	7	5	511	413	-7	9	233	245	-2	1	223	69
1	3	484	504	10	5	1102	933	-6	9	366	366	0	1	1585	1672
2	3	578	495	11	5	508	447	-4	9	554	576	1	1	599	652
4	3	859	805	13	5	765	723	-3	9	341	387	2	1	860	878
6	3	535	544	16	5	326	385	-1	9	379	427	3	1	356	303

Table 44. Continued

H	K	FOBS	FCAL
L = -11**			
4	1	844	776
5	1	843	833
6	1	1277	1334
7	1	836	935
8	1	2294	2451
9	1	639	671
10	1	376	399
11	1	556	580
12	1	458	475
14	1	354	344
15	1	516	530
16	1	471	544
17	1	799	814
18	1	327	417
19	1	589	573
20	1	375	368
21	1	250	214
-16	2	603	598
-14	2	925	934
-13	2	355	348
-12	2	1051	1050
-11	2	951	966
-8	2	707	743
-6	2	835	838
-4	2	897	908
-3	2	1112	1161
-1	2	336	331
0	2	415	471
1	2	398	435
3	2	559	541
5	2	560	524
6	2	641	602
7	2	989	1047
8	2	1272	1324
10	2	1231	1314
11	2	878	898
13	2	397	374
14	2	1116	1157
15	2	284	259
16	2	1683	1692
17	2	667	687
18	2	1016	1046
19	2	393	347
20	2	351	350
-16	3	358	286
-15	3	827	837
-14	3	918	899
-13	3	509	516
-12	3	264	117
-11	3	291	316
-10	3	881	863
-9	3	689	711
-7	3	813	801
-6	3	463	427
-5	3	727	807
-3	3	256	241
-2	3	466	568
-1	3	417	444
2	3	1068	1074
4	3	612	601
5	3	1423	1447
6	3	466	406
8	3	445	446
9	3	1248	1333
10	3	1498	1499
11	3	748	794
12	3	817	836
13	3	495	487
14	3	428	425
15	3	694	765
17	3	1111	1132
18	3	536	521
20	3	394	395
-15	4	235	211
-13	4	403	372
-10	4	305	367
-9	4	957	930
-8	4	662	685
-7	4	883	860
-6	4	299	245
-5	4	631	649
-4	4	815	820
-2	4	1294	1363
-1	4	412	400
1	4	1624	1584
2	4	462	425
3	4	1408	1323
4	4	947	957
6	4	1190	1141
8	4	512	403
9	4	1053	1075
11	4	710	736
13	4	382	378
14	4	933	935
16	4	453	434
17	4	369	387
20	4	539	536
-15	5	443	474
-14	5	226	227
-12	5	526	538
-10	5	411	468
-9	5	630	568
-8	5	258	197
-7	5	443	459
-6	5	293	359
-5	5	786	767
-4	5	526	563
-3	5	1782	1809
-1	5	1437	1381
0	5	847	831
2	5	919	848
3	5	329	182
4	5	463	479
5	5	922	917
6	5	331	375
7	5	1267	1207
8	5	318	138
10	5	918	899
11	5	670	596
14	5	620	601
15	5	357	370
19	5	327	291
-14	6	355	362
-13	6	302	318
-12	6	349	273
-11	6	706	724
-10	6	419	468
-9	6	698	717
-8	6	612	630
-7	6	340	285
-6	6	809	748
-5	6	292	333
-4	6	623	647
-2	6	470	469
2	6	532	562
4	6	281	203
5	6	842	853
6	6	766	725
7	6	628	630
9	6	313	239
12	6	388	361
13	6	994	925
15	6	748	718
16	6	273	214
18	6	717	695
-13	7	205	206
-11	7	349	379
-8	7	354	301
-7	7	570	555
-5	7	467	463
-3	7	819	821
0	7	540	531
1	7	348	336
2	7	397	429
3	7	379	465
4	7	499	501
5	7	489	511
6	7	519	444
10	7	348	354
11	7	784	777
12	7	622	616
13	7	265	233
14	7	763	734
-11	8	372	374
-10	8	656	645
-5	8	267	146
-4	8	448	450
-3	8	274	302
-2	8	746	646
0	8	1041	1002
1	8	504	470
2	8	312	275
4	8	1283	1270
6	8	603	615
8	8	784	781
10	8	448	492
12	8	1027	1013
-8	9	462	449
-7	9	240	200
-5	9	377	336
-3	9	401	489
-1	9	594	618
0	9	344	321
1	9	557	536
3	9	612	640
6	9	488	452
9	9	455	521
10	9	332	370
11	9	878	885
12	9	880	903
14	9	591	580
-7	10	241	195
-6	10	384	327
-5	10	457	429
-4	10	214	191
-2	10	312	278
5	10	552	546
6	10	596	553
7	10	380	372
9	10	294	321
11	10	263	276
-3	11	615	620
-2	11	238	209
-1	11	952	945
0	11	683	721
2	11	616	601
3	11	463	480
5	11	426	403
6	11	208	234
7	11	554	590
L = -10**			
-14	0	819	835
-12	0	1227	1256
-10	0	1114	1041
-8	0	270	325
-6	0	661	634
-4	0	738	762
0	0	1477	1422
2	0	2417	2494
6	0	485	366
8	0	1081	1119
10	0	1530	1596
12	0	889	916
16	0	1028	1114
18	0	441	494
20	0	268	280
-17	1	269	268

Table 44. Continued

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -10**				19	2	252	293	16	4	489	464	-10	7	866	81
-16	1	324	278	21	2	239	166	18	4	428	507	-9	7	574	49
-14	1	430	392	-17	3	258	260	19	4	626	597	-8	7	399	39
-13	1	513	496	-15	3	231	272	-16	5	231	227	-6	7	954	90
-12	1	339	268	-14	3	260	279	-15	5	488	471	-5	7	333	33
-11	1	611	664	-13	3	527	527	-14	5	307	323	-3	7	330	35
-9	1	600	567	-12	3	1057	1085	-13	5	262	295	-1	7	623	61
-8	1	751	765	-11	3	780	790	-12	5	267	251	0	7	377	31
-7	1	876	935	-9	3	410	380	-10	5	668	669	2	7	421	42
-6	1	2162	2222	-8	3	774	762	-8	5	468	445	3	7	1046	95
-5	1	221	200	-4	3	771	776	-7	5	955	1020	4	7	762	71
-4	1	1070	1144	-3	3	702	698	-6	5	1084	1077	5	7	1399	137
-3	1	226	292	-1	3	379	349	-5	5	1303	1303	6	7	660	69
-2	1	830	802	0	3	1151	1193	-4	5	675	752	7	7	667	67
-1	1	664	689	1	3	423	437	-3	5	1682	1682	8	7	320	33
0	1	472	516	2	3	393	416	-1	5	456	373	9	7	307	26
1	1	1189	1206	3	3	601	503	2	5	1720	1705	11	7	713	71
2	1	373	422	5	3	767	733	3	5	1772	1725	12	7	1506	144
4	1	1393	1325	6	3	533	609	4	5	1228	1227	14	7	630	56
5	1	451	513	7	3	1030	1058	5	5	1048	1009	16	7	248	14
6	1	379	334	8	3	540	466	6	5	696	658	17	7	663	65
7	1	644	671	9	3	813	850	9	5	613	536	-9	8	806	76
8	1	282	195	10	3	465	498	10	5	633	614	-5	8	551	54
9	1	1647	1663	11	3	1361	1420	11	5	537	591	-3	8	353	33
10	1	454	447	12	3	861	907	14	5	890	845	-1	8	441	41
12	1	452	535	13	3	785	810	15	5	301	232	0	8	398	36
15	1	852	880	14	3	755	781	16	5	304	345	3	8	286	27
17	1	1080	1105	15	3	1166	1268	17	5	455	465	5	8	1352	137
18	1	502	497	16	3	590	583	18	5	546	512	7	8	760	80
21	1	244	270	17	3	385	430	-13	6	380	351	11	8	1703	167
-16	2	383	396	18	3	766	827	-12	6	431	435	13	8	1650	161
-15	2	666	669	19	3	874	895	-11	6	312	253	14	8	308	27
-14	2	309	298	-16	4	589	566	-10	6	713	765	15	8	280	27
-13	2	1216	1202	-15	4	496	491	-9	6	510	495	-10	9	534	56
-12	2	589	544	-14	4	525	471	-8	6	805	784	-9	9	418	44
-11	2	670	694	-11	4	958	989	-7	6	397	395	-8	9	718	74
-10	2	798	825	-10	4	440	465	-5	6	400	425	-6	9	580	56
-9	2	757	730	-8	4	581	619	-4	6	1757	1718	-5	9	355	42
-8	2	489	398	-6	4	421	347	-3	6	274	161	-3	9	464	51
-7	2	912	938	-5	4	299	232	-2	6	1942	1928	-2	9	346	29
-5	2	1363	1355	-4	4	524	520	0	6	856	811	-1	9	706	72
-3	2	572	565	-3	4	598	593	1	6	850	828	1	9	308	365
-2	2	871	840	-2	4	514	547	2	6	567	611	2	9	580	54
-1	2	992	965	-1	4	416	436	3	6	394	409	3	9	781	73
0	2	369	391	2	4	351	406	4	6	1234	1175	4	9	630	612
1	2	856	856	3	4	1350	1286	5	6	1030	996	5	9	899	88
3	2	1569	1388	4	4	1381	1365	6	6	876	875	6	9	958	924
4	2	355	292	5	4	307	279	7	6	512	506	7	9	771	76
6	2	1237	1300	7	4	389	310	8	6	730	720	8	9	588	571
7	2	1352	1427	8	4	898	858	9	6	805	760	11	9	332	311
8	2	710	741	9	4	330	343	10	6	317	368	12	9	955	970
10	2	265	261	10	4	1518	1556	13	6	593	638	14	9	425	408
13	2	333	335	11	4	888	881	15	6	285	306	-8	10	301	297
14	2	795	874	12	4	474	522	16	6	304	240	-7	10	366	421
16	2	427	420	13	4	971	1041	19	6	468	468	-6	10	649	652
17	2	676	683	14	4	706	765	-12	7	556	530	-5	10	656	640
18	2	435	470	15	4	787	890	-11	7	750	759	-4	10	933	950

Table 44. Continued

H	K	FOBS	FCAL
L = -10**			
-2	10	996	1029
-1	10	279	263
0	10	674	744
1	10	692	752
2	10	328	270
3	10	222	299
4	10	723	763
6	10	607	571
8	10	367	367
9	10	540	570
10	10	458	425
-5	11	504	514
-4	11	260	201
-3	11	555	543
-2	11	258	245
-1	11	320	304
0	11	316	330
1	11	203	184
2	11	839	841
3	11	703	672
4	11	348	366
5	11	429	436
6	11	504	546
L = -9**			
-15	0	797	784
-13	0	830	806
-9	0	777	789
-7	0	1888	1910
-5	0	2505	2495
-3	0	796	738
-1	0	3000	3030
1	0	1458	1424
3	0	1155	1123
5	0	809	834
7	0	1493	1583
9	0	737	756
11	0	364	303
15	0	627	680
17	0	1328	1279
19	0	808	773
21	0	498	505
-16	1	421	414
-14	1	267	254
-13	1	953	975
-12	1	468	431
-11	1	541	519
-9	1	571	579
-8	1	529	523
-7	1	398	349
-6	1	227	283
-4	1	740	798
-2	1	1325	1321
-1	1	648	667
0	1	1349	1312
1	1	2196	2143
2	1	349	322
3	1	763	715
4	1	802	770
5	1	722	707
6	1	1618	1679
7	1	674	696
8	1	1123	1140
9	1	844	793
10	1	417	469
11	1	1273	1282
12	1	471	418
14	1	416	385
15	1	759	842
16	1	787	804
17	1	683	722
18	1	965	968
19	1	333	301
20	1	294	275
22	1	274	321
-17	2	396	371
-15	2	244	249
-14	2	460	436
-12	2	481	439
-11	2	616	618
-10	2	413	411
-9	2	558	586
-8	2	285	229
-7	2	537	532
-6	2	506	475
-5	2	689	717
-4	2	326	307
-3	2	994	1013
-2	2	660	633
-1	2	938	929
0	2	736	755
2	2	895	929
5	2	933	904
6	2	1167	1138
7	2	1678	1736
8	2	1942	2067
9	2	274	258
10	2	1135	1223
11	2	618	595
13	2	758	740
14	2	1292	1287
15	2	473	470
16	2	1386	1440
17	2	526	545
18	2	458	443
21	2	262	333
-17	3	836	830
-16	3	379	342
-15	3	570	605
-14	3	1358	1355
-11	3	566	590
-10	3	439	460
-9	3	446	409
-6	3	1144	1129
-3	3	1161	1196
1	3	785	775
2	3	1498	1384
3	3	532	499
5	3	1380	1296
6	3	740	715
7	3	1111	1128
9	3	1774	1843
10	3	485	534
12	3	627	601
13	3	400	424
14	3	1282	1311
15	3	998	1023
16	3	770	783
17	3	582	515
19	3	486	436
21	3	395	411
-16	4	466	459
-15	4	573	567
-13	4	522	513
-12	4	456	475
-11	4	318	284
-10	4	650	677
-9	4	916	965
-8	4	903	896
-7	4	1639	1699
-6	4	386	413
-5	4	470	429
-4	4	1085	1093
-3	4	312	276
-2	4	1297	1336
0	4	498	518
1	4	1942	1884
2	4	526	399
3	4	531	525
4	4	663	645
6	4	1238	1166
7	4	295	259
8	4	853	908
9	4	611	545
10	4	771	756
11	4	359	410
12	4	348	412
15	4	1144	1097
16	4	555	563
18	4	586	553
20	4	1020	1014
-15	5	414	420
-14	5	335	302
-13	5	289	214
-12	5	303	258
-11	5	784	768
-10	5	408	384
-9	5	970	1003
-8	5	981	939
-6	5	541	543
-4	5	813	815
-3	5	1626	1601
-2	5	586	635
-1	5	1397	1379
0	5	1180	1173
1	5	615	598
3	5	1183	1119
4	5	2373	2380
5	5	491	473
6	5	359	378
7	5	625	656
9	5	488	502
11	5	858	855
12	5	1106	1168
14	5	347	407
15	5	301	391
19	5	527	545
20	5	678	668
-16	6	351	372
-15	6	224	219
-12	6	465	430
-11	6	308	299
-8	6	379	375
-5	6	767	778
-4	6	848	861
-3	6	1610	1541
-2	6	487	460
-1	6	1438	1410
0	6	288	297
2	6	529	453
3	6	1589	1554
5	6	1924	1861
6	6	972	878
7	6	945	887
9	6	361	364
11	6	574	541
13	6	1315	1256
15	6	517	456
18	6	655	638
19	6	407	409
-13	7	613	586
-12	7	261	271
-11	7	1079	1053
-10	7	303	341
-9	7	905	891
-7	7	725	682
-5	7	904	915
-4	7	476	496
-3	7	769	771
-2	7	542	520
-1	7	350	304
1	7	271	248
3	7	671	735
4	7	483	518
5	7	418	391
6	7	1221	1170
8	7	391	348
10	7	938	860

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
**L =	-9****			13	10	543	578	8	1	1294	1281	-1	3	353	364
12	7	1165	1159	-6	11	524	507	9	1	1394	1418	0	3	968	946
13	7	579	539	-3	11	605	584	10	1	661	757	2	3	472	188
14	7	592	616	-2	11	589	623	12	1	324	319	3	3	1634	1630
16	7	358	386	-1	11	1036	1024	15	1	968	976	4	3	874	882
-13	8	229	121	0	11	766	819	16	1	411	381	5	3	326	341
-12	8	951	975	1	11	371	363	18	1	1106	1060	6	3	907	905
-11	8	244	182	4	11	722	729	21	1	619	642	7	3	340	358
-10	8	1281	1224	6	11	440	416	22	1	834	818	8	3	902	899
-8	8	795	840	7	11	379	410	-19	2	426	433	9	3	1280	1329
-6	8	377	263	9	11	235	248	-18	2	415	424	10	3	1006	1081
-4	8	607	549	10	11	232	172	-17	2	311	275	11	3	1454	1598
-2	8	527	516	1	12	803	835	-16	2	372	354	12	3	648	673
0	8	854	837	4	12	296	274	-15	2	1135	1121	13	3	476	442
2	8	808	843	**L =	-8****			-13	2	1579	1598	16	3	1356	1408
4	8	329	363	-18	0	337	297	-12	2	853	896	17	3	328	317
5	8	268	192	-14	0	359	371	-11	2	652	729	18	3	531	498
8	8	625	662	-12	0	748	775	-10	2	596	609	19	3	905	940
12	8	593	529	-10	0	359	319	-9	2	819	836	20	3	466	434
14	8	1130	1109	-8	0	1763	1794	-7	2	939	941	21	3	334	311
16	8	589	543	-6	0	1804	1852	-6	2	380	378	-16	4	474	440
-11	9	585	598	-4	0	1027	1005	-5	2	1336	1348	-15	4	247	198
-9	9	881	845	-2	0	969	914	-4	2	930	942	-12	4	329	314
-8	9	410	390	0	0	4496	4672	-2	2	256	271	-11	4	578	558
-6	9	295	278	2	0	3699	3741	0	2	884	905	-10	4	994	988
-5	9	746	742	4	0	967	978	1	2	643	537	-9	4	1187	1230
-4	9	512	496	6	0	1718	1663	2	2	1199	1163	-8	4	357	401
-3	9	468	458	8	0	1396	1491	3	2	541	543	-6	4	531	586
-2	9	336	377	10	0	845	792	4	2	581	546	-5	4	456	457
-1	9	826	789	12	0	1058	1124	8	2	1590	1636	-4	4	438	437
3	9	926	951	14	0	441	453	9	2	1421	1493	-3	4	418	393
4	9	1043	1010	16	0	1118	1123	10	2	994	1064	-2	4	1054	1040
5	9	961	916	18	0	567	561	11	2	557	513	-1	4	1231	1251
6	9	1059	987	20	0	343	350	12	2	648	662	0	4	758	752
8	9	405	378	-17	1	252	182	13	2	698	719	1	4	418	400
9	9	371	326	-16	1	480	543	15	2	1398	1419	2	4	1913	1826
10	9	633	597	-14	1	1139	1171	16	2	441	421	3	4	1611	1568
12	9	1014	1013	-12	1	732	754	17	2	1599	1614	4	4	1532	1514
13	9	801	783	-11	1	939	951	18	2	1057	1007	5	4	1490	1406
14	9	594	576	-10	1	290	274	19	2	289	393	6	4	510	516
15	9	483	419	-9	1	311	291	21	2	434	484	7	4	271	317
-9	10	347	296	-8	1	1086	1111	22	2	265	250	8	4	1456	1446
-8	10	385	379	-7	1	1379	1436	-17	3	785	758	9	4	764	779
-7	10	206	172	-6	1	2201	2200	-16	3	846	825	10	4	1624	1693
-6	10	342	362	-5	1	795	795	-15	3	447	448	11	4	775	756
-4	10	423	420	-4	1	1473	1474	-14	3	633	647	13	4	1079	1116
-3	10	755	744	-3	1	997	955	-12	3	722	717	14	4	396	334
-2	10	517	465	-2	1	440	480	-11	3	820	858	15	4	352	363
-1	10	614	623	-1	1	1621	1595	-10	3	730	747	17	4	595	605
1	10	279	252	0	1	301	373	-9	3	561	611	18	4	640	563
2	10	408	374	1	1	1443	1497	-8	3	1636	1614	19	4	444	380
3	10	675	691	2	1	566	530	-7	3	798	789	20	4	246	235
5	10	1141	1144	3	1	1101	1051	-6	3	484	438	21	4	313	240
6	10	797	814	4	1	1106	1193	-5	3	742	710	-17	5	240	194
7	10	1071	1072	5	1	474	407	-4	3	353	414	-16	5	480	470
11	10	576	607	6	1	306	258	-3	3	1383	1382	-15	5	444	484
12	10	236	179	7	1	1879	1960	-2	3	539	567	-14	5	532	542

H	K	FOBS	FCAL
L = -8**			
-13	5	642	668
-11	5	302	302
-6	5	1009	1069
-5	5	1235	1316
-4	5	715	727
-3	5	759	829
-2	5	1737	1745
1	5	694	678
2	5	674	684
3	5	369	416
4	5	709	631
6	5	1511	1537
7	5	294	344
9	5	632	667
10	5	340	293
12	5	483	540
13	5	750	746
14	5	958	966
17	5	506	437
19	5	507	464
-16	6	350	361
-15	6	405	395
-12	6	996	961
-11	6	666	686
-10	6	1242	1276
-9	6	349	268
-8	6	517	487
-7	6	712	706
-6	6	534	524
-4	6	1206	1218
-3	6	341	394
-2	6	706	680
-1	6	572	663
0	6	378	373
1	6	1083	1058
3	6	538	581
6	6	565	574
7	6	784	760
8	6	355	343
9	6	663	628
11	6	345	325
12	6	602	582
14	6	770	767
15	6	713	660
19	6	561	522
-11	7	456	501
-9	7	568	546
-6	7	304	285
-4	7	1053	1067
-1	7	829	845
0	7	475	448
2	7	260	159
3	7	872	835
4	7	1627	1581
6	7	323	323
8	7	439	442

H	K	FOBS	FCAL
12	7	1490	1416
13	7	1098	1000
17	7	599	583
18	7	534	489
-14	8	216	160
-12	8	390	412
-11	8	818	767
-7	8	271	297
-4	8	362	377
-3	8	1025	1053
0	8	581	586
3	8	411	403
4	8	369	359
5	8	1349	1299
7	8	796	767
11	8	1672	1616
13	8	809	770
-12	9	231	205
-11	9	491	511
-9	9	496	502
-8	9	253	297
-6	9	362	374
-5	9	374	311
-4	9	705	697
-2	9	715	725
-1	9	735	727
1	9	253	181
3	9	322	319
4	9	666	660
6	9	534	590
8	9	455	412
10	9	335	353
11	9	440	355
12	9	819	796
13	9	984	927
14	9	335	323
-10	10	806	831
-8	10	479	497
-7	10	461	479
-6	10	616	595
-5	10	278	219
-4	10	620	648
-2	10	259	280
0	10	564	573
1	10	676	630
2	10	409	442
6	10	548	551
7	10	485	462
8	10	225	109
9	10	546	541
10	10	268	297
12	10	414	439
-6	11	466	512
-5	11	833	855
-4	11	503	491
-2	11	1082	1059
-1	11	410	429

H	K	FOBS	FCAL
1	11	599	584
2	11	696	690
3	11	567	565
4	11	351	340
5	11	225	164
6	11	825	871
7	11	281	310
9	11	253	228
10	11	400	428
11	11	214	236
-3	12	478	456
-2	12	534	565
-1	12	677	688
0	12	781	783
1	12	515	528
2	12	880	910
3	12	448	490
4	12	321	308
5	12	366	363
L = -7**			
-17	0	583	557
-15	0	787	734
-13	0	1190	1123
-11	0	367	341
-9	0	1048	1021
-5	0	1558	1584
-3	0	307	274
-1	0	1729	1664
1	0	2298	2403
3	0	372	329
5	0	591	604
7	0	353	285
9	0	1956	2022
11	0	363	319
17	0	1403	1457
19	0	412	410
21	0	264	350
-16	1	421	413
-15	1	605	566
-13	1	542	558
-12	1	626	598
-10	1	671	737
-9	1	218	208
-8	1	246	261
-7	1	1704	1690
-6	1	693	681
-5	1	889	944
-4	1	244	264
-3	1	777	763
-2	1	1367	1386
-1	1	1148	1111
0	1	341	386
1	1	2702	2659
2	1	915	917
3	1	1563	1547
4	1	728	751
5	1	787	763

H	K	FOBS	FCAL
6	1	554	599
7	1	431	469
8	1	903	912
9	1	309	254
10	1	1400	1384
11	1	856	898
12	1	332	332
13	1	519	495
15	1	670	711
16	1	1507	1465
18	1	711	733
22	1	251	182
-19	2	255	223
-17	2	757	753
-16	2	497	522
-15	2	520	492
-14	2	778	774
-13	2	319	323
-12	2	722	740
-10	2	568	575
-9	2	959	991
-8	2	1064	1113
-7	2	850	882
-6	2	1293	1351
-5	2	1393	1383
-4	2	905	885
-3	2	365	300
-1	2	284	277
0	2	1388	1392
1	2	708	688
2	2	1658	1492
5	2	1387	1503
6	2	632	741
7	2	1336	1329
8	2	1535	1570
9	2	290	329
10	2	347	344
11	2	340	315
12	2	661	706
13	2	674	684
14	2	482	467
18	2	500	546
19	2	685	686
20	2	304	306
21	2	538	519
22	2	311	302
-19	3	627	624
-18	3	431	438
-17	3	427	398
-14	3	1400	1426
-13	3	854	842
-12	3	561	552
-11	3	752	726
-10	3	467	471
-9	3	869	872
-7	3	500	448
-6	3	716	770

Table 44. Continued

H	K	FOBS	FCAL
L = -7**			
-4	3	491	463
-3	3	731	763
-1	3	1161	1167
1	3	1524	1460
2	3	397	381
3	3	435	363
4	3	413	254
6	3	922	946
7	3	1308	1338
8	3	655	652
9	3	844	859
10	3	1010	1049
11	3	1244	1310
12	3	326	335
13	3	626	655
14	3	1724	1784
15	3	632	586
16	3	640	593
17	3	528	449
18	3	793	804
19	3	711	696
22	3	692	716
-18	4	620	660
-17	4	311	323
-16	4	605	646
-15	4	727	732
-13	4	321	302
-12	4	1094	1084
-10	4	657	674
-7	4	1226	1235
-6	4	699	785
-4	4	1078	1073
-2	4	914	842
-1	4	490	468
0	4	584	620
1	4	474	435
2	4	1395	1368
3	4	1338	1313
4	4	302	290
5	4	273	331
7	4	1473	1485
8	4	308	384
9	4	766	806
10	4	1745	1737
11	4	1421	1458
12	4	1219	1262
13	4	327	281
14	4	449	438
15	4	1099	1090
16	4	484	468
17	4	585	538
18	4	754	723
20	4	1033	1022
21	4	523	510
-16	5	398	372
-11	5	1106	1100
-10	5	335	412
-9	5	854	848
-8	5	1251	1278
-7	5	478	414
-5	5	679	703
-4	5	1848	1916
-3	5	572	564
-2	5	615	573
-1	5	303	321
0	5	944	892
1	5	1165	1074
2	5	999	902
3	5	1652	1621
4	5	2718	2677
5	5	485	505
7	5	321	274
8	5	471	459
9	5	878	850
10	5	640	576
11	5	852	844
12	5	945	933
13	5	342	263
15	5	1041	1077
16	5	320	336
19	5	498	488
-17	6	227	258
-16	6	478	460
-14	6	287	290
-13	6	405	371
-12	6	416	456
-11	6	848	860
-10	6	398	374
-9	6	534	552
-8	6	326	339
-7	6	333	271
-6	6	791	787
-5	6	1390	1358
-4	6	911	873
-3	6	2689	2636
-2	6	623	642
-1	6	1465	1427
0	6	674	675
2	6	673	698
3	6	1803	1804
5	6	1727	1695
6	6	576	585
7	6	509	493
8	6	477	454
10	6	516	456
11	6	301	321
12	6	861	824
13	6	573	544
14	6	440	364
16	6	302	291
20	6	788	709
-15	7	481	464
-13	7	833	768
-12	7	887	881
-11	7	787	779
-10	7	976	956
-9	7	1119	1163
-7	7	303	286
-5	7	1116	1130
-4	7	714	667
-3	7	316	267
-2	7	1385	1346
0	7	333	311
2	7	946	976
3	7	354	290
4	7	1123	1102
5	7	1398	1355
6	7	1488	1442
8	7	370	313
10	7	936	898
11	7	1004	963
12	7	408	321
13	7	1501	1480
16	7	353	364
18	7	360	288
19	7	888	834
-15	8	276	270
-13	8	264	258
-12	8	781	752
-10	8	887	886
-8	8	805	774
-6	8	794	830
-5	8	432	423
-3	8	301	274
-2	8	355	413
-1	8	356	341
0	8	390	410
2	8	758	775
4	8	812	822
6	8	1076	1045
8	8	551	552
10	8	678	626
12	8	2124	2070
13	8	324	261
14	8	1246	1201
16	8	435	384
-13	9	638	588
-12	9	809	832
-11	9	663	617
-10	9	580	581
-9	9	944	928
-5	9	696	737
-4	9	741	775
-2	9	763	724
-1	9	650	632
0	9	515	519
1	9	341	369
2	9	328	346
4	9	919	936
5	9	1425	1435
6	9	1021	1035
8	9	536	556
10	9	687	635
11	9	698	676
12	9	413	433
13	9	1152	1121
16	9	589	554
-11	10	830	798
-8	10	222	225
-7	10	278	226
-6	10	842	832
-5	10	686	683
-4	10	520	509
-3	10	1414	1471
-2	10	588	620
-1	10	1139	1126
0	10	811	822
2	10	747	780
3	10	904	930
5	10	1106	1071
6	10	378	382
7	10	751	779
9	10	274	167
10	10	546	543
11	10	617	612
-9	11	538	491
-8	11	582	595
-5	11	560	553
-4	11	786	774
-2	11	579	548
-1	11	491	476
1	11	573	613
2	11	633	646
3	11	847	850
4	11	913	931
5	11	421	395
9	11	493	480
10	11	390	408
11	11	221	204
-5	12	210	206
-3	12	234	216
-1	12	340	328
2	12	376	396
3	12	626	671
7	12	627	658
L = -6**			
-20	0	259	219
-18	0	368	335
-16	0	1004	1054
-12	0	230	188
-8	0	2131	2223
-6	0	2838	2837
-4	0	823	853
-2	0	1278	1250
0	0	3427	3542
2	0	1566	1590
4	0	999	1021

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -6**				1	2	2242	2186	-11	4	656	604	19	5	628	609
6	0	1860	1851	2	2	1528	1476	-10	4	1151	1114	20	5	351	358
8	0	1382	1251	3	2	626	596	-9	4	1628	1605	21	5	468	490
12	0	732	781	4	2	260	145	-8	4	1048	1062	-16	6	438	434
14	0	571	586	5	2	991	965	-7	4	327	328	-15	6	506	532
16	0	513	504	6	2	1288	1336	-6	4	1824	1805	-12	6	522	533
18	0	895	913	7	2	1362	1406	-5	4	1119	1197	-11	6	567	581
20	0	523	552	8	2	1866	1880	-4	4	248	235	-10	6	436	457
22	0	372	368	9	2	2349	2418	-3	4	1256	1321	-7	6	706	712
-19	1	302	275	10	2	1496	1481	-2	4	841	778	-5	6	1006	1002
-17	1	259	212	11	2	579	616	-1	4	1216	1184	-4	6	727	539
-16	1	342	264	12	2	829	859	0	4	672	687	-3	6	606	542
-15	1	616	601	13	2	792	838	2	4	1523	1532	-2	6	1437	1453
-14	1	1441	1409	14	2	866	846	3	4	962	915	-1	6	1010	970
-12	1	901	923	15	2	2000	2025	4	4	444	377	0	6	297	311
-11	1	838	842	17	2	1298	1297	5	4	1625	1636	1	6	629	606
-10	1	552	539	18	2	568	597	6	4	430	441	2	6	943	947
-9	1	883	881	21	2	601	520	7	4	672	701	3	6	1149	1086
-8	1	336	318	-19	3	310	261	8	4	318	374	4	6	1947	1892
-7	1	1666	1599	-18	3	592	541	9	4	528	483	5	6	688	680
-6	1	798	820	-17	3	603	620	10	4	506	533	6	6	1195	1178
-5	1	1034	1034	-16	3	1099	1097	11	4	445	494	7	6	1152	1067
-4	1	878	886	-15	3	1303	1309	12	4	559	515	9	6	427	383
-3	1	657	670	-14	3	251	257	13	4	667	682	12	6	1105	1108
-1	1	2206	2229	-13	3	723	742	14	4	359	380	14	6	1065	1012
0	1	2301	2299	-11	3	829	842	15	4	728	725	15	6	456	467
1	1	1845	1786	-10	3	802	805	16	4	539	522	17	6	293	291
2	1	1392	1320	-8	3	1061	1061	19	4	1198	1174	19	6	340	306
3	1	720	713	-7	3	1384	1407	21	4	446	441	20	6	830	791
4	1	485	549	-5	3	1236	1218	-17	5	347	348	-17	7	617	613
6	1	414	448	-3	3	1161	1191	-16	5	287	341	-16	7	393	375
7	1	2501	2552	-2	3	712	713	-14	5	449	491	-12	7	852	871
8	1	1449	1473	-1	3	503	521	-13	5	972	963	-11	7	275	245
10	1	1905	1940	1	3	901	903	-10	5	918	935	-10	7	518	496
12	1	325	331	2	3	555	532	-9	5	701	680	-9	7	556	579
14	1	473	465	3	3	1280	1283	-8	5	440	400	-8	7	1175	1173
16	1	270	287	4	3	828	783	-7	5	678	698	-7	7	452	468
17	1	1334	1313	5	3	1329	1319	-5	5	280	302	-6	7	708	766
18	1	1032	980	6	3	698	606	-4	5	1129	1168	-4	7	1973	1916
21	1	628	606	7	3	256	234	-3	5	453	466	-3	7	1078	1086
22	1	796	801	8	3	1646	1691	-2	5	2759	2778	-2	7	494	460
-19	2	251	234	9	3	770	814	-1	5	1700	1667	-1	7	259	218
-18	2	366	358	10	3	629	607	0	5	555	565	0	7	724	705
-17	2	353	370	11	3	1776	1800	1	5	512	507	2	7	283	299
-16	2	357	376	12	3	243	161	2	5	270	318	4	7	940	931
-15	2	1089	1108	13	3	434	415	3	5	1061	1098	5	7	1246	1186
-13	2	1014	1027	14	3	916	918	4	5	774	756	6	7	393	446
-12	2	900	946	15	3	684	704	5	5	1192	1153	7	7	498	495
-11	2	291	228	16	3	1318	1380	6	5	1335	1302	8	7	498	455
-9	2	279	211	18	3	595	567	9	5	531	603	9	7	684	630
-8	2	347	367	19	3	557	560	10	5	568	625	11	7	656	585
-6	2	1719	1753	20	3	719	712	11	5	848	820	13	7	1424	1334
-5	2	473	495	21	3	595	629	12	5	317	262	14	7	614	615
-4	2	1171	1142	22	3	273	253	13	5	903	915	15	7	528	557
-3	2	547	549	-17	4	875	876	14	5	307	228	17	7	513	434
-1	2	932	909	-14	4	918	889	17	5	288	185	19	7	265	219
0	2	1752	1766	-13	4	387	388	18	5	378	409	-15	8	771	734

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -6**				7	10	728	734	-6	1	583	598	16	2	1315	1357
-14	8	293	322	9	10	248	262	-5	1	1852	1831	18	2	1023	1041
-13	8	571	591	10	10	388	333	-4	1	203	128	19	2	1179	1140
-12	8	368	349	11	10	321	305	-3	1	270	279	20	2	524	541
-11	8	1518	1489	12	10	714	741	-2	1	772	804	21	2	478	435
-9	8	845	826	13	10	228	270	-1	1	463	440	22	2	958	914
-7	8	472	469	14	10	711	693	0	1	3106	3088	-20	3	224	235
-6	8	306	255	-7	11	733	776	1	1	674	707	-19	3	663	679
-5	8	1101	1142	-5	11	477	462	2	1	1681	1606	-18	3	934	953
-3	8	803	786	-4	11	378	405	3	1	1588	1605	-17	3	442	400
-1	8	372	350	-3	11	690	668	4	1	239	285	-16	3	351	353
2	8	269	280	-2	11	1381	1377	5	1	797	805	-15	3	780	766
3	8	864	825	-1	11	901	907	6	1	653	641	-14	3	411	399
5	8	481	477	0	11	393	402	7	1	938	922	-13	3	1230	1277
6	8	268	220	1	11	464	458	8	1	3240	3339	-12	3	274	237
7	8	590	540	5	11	734	730	9	1	1628	1692	-11	3	345	310
11	8	492	474	6	11	960	912	10	1	205	244	-10	3	999	1027
13	8	785	830	7	11	385	385	11	1	728	747	-9	3	1975	2066
17	8	759	715	8	11	477	475	12	1	263	213	-8	3	836	818
-14	9	304	250	11	11	363	343	13	1	470	474	-7	3	376	405
-13	9	215	147	12	11	458	412	14	1	254	112	-6	3	1032	953
-12	9	1063	1090	-6	12	577	613	16	1	1183	1171	-5	3	501	458
-10	9	594	600	-3	12	813	800	17	1	783	846	-4	3	478	410
-9	9	352	368	-2	12	277	288	20	1	332	279	-3	3	880	857
-8	9	246	233	-1	12	491	494	21	1	686	689	-2	3	531	526
-6	9	528	517	0	12	801	775	22	1	307	334	-1	3	1678	1684
-5	9	388	402	1	12	493	512	-20	2	554	566	1	3	269	269
-4	9	949	922	2	12	496	498	-17	2	1047	1057	2	3	1031	999
-3	9	483	520	3	12	291	334	-16	2	1458	1464	3	3	595	547
-2	9	570	605	5	12	317	312	-15	2	476	453	4	3	1135	1108
0	9	511	510	6	12	205	188	-14	2	1618	1636	5	3	293	280
2	9	333	339	8	12	362	401	-13	2	612	584	6	3	1742	1765
4	9	286	338	**L = -5****				-12	2	1020	1006	7	3	1139	1131
5	9	943	909	-13	0	913	895	-11	2	807	809	8	3	917	901
6	9	487	496	-11	0	1323	1312	-9	2	804	785	9	3	1065	1080
7	9	341	259	-9	0	192	173	-8	2	1752	1734	10	3	1992	2079
8	9	469	491	-7	0	1743	1780	-7	2	1092	1057	11	3	1649	1692
9	9	366	379	-5	0	596	617	-6	2	1667	1638	12	3	400	372
10	9	320	296	-3	0	1151	1147	-5	2	1137	1099	14	3	1338	1335
11	9	1258	1225	-1	0	2298	2237	-4	2	934	939	15	3	660	611
12	9	265	295	1	0	4940	5252	-3	2	1156	1155	16	3	274	267
13	9	1089	1053	7	0	2728	2656	-2	2	742	715	17	3	809	763
14	9	923	892	9	0	2916	2941	0	2	266	339	18	3	1035	1021
-11	10	244	205	15	0	645	610	2	2	256	174	19	3	347	332
-10	10	537	537	17	0	1235	1126	3	2	768	761	20	3	559	531
-9	10	318	323	21	0	358	326	4	2	331	316	-19	4	333	360
-8	10	346	356	-20	1	711	704	5	2	1611	1656	-17	4	304	277
-7	10	364	364	-19	1	446	411	6	2	512	511	-16	4	260	270
-6	10	274	211	-18	1	462	491	7	2	1443	1414	-15	4	470	517
-5	10	574	582	-17	1	453	400	8	2	913	939	-14	4	489	529
-4	10	728	734	-15	1	1203	1241	9	2	208	111	-13	4	433	462
-2	10	514	541	-14	1	335	286	10	2	588	611	-12	4	930	946
-1	10	566	586	-13	1	561	530	11	2	1691	1750	-11	4	297	286
2	10	349	359	-10	1	1432	1385	12	2	528	544	-10	4	484	492
4	10	1134	1202	-9	1	701	676	13	2	373	326	-8	4	794	834
5	10	681	727	-8	1	1866	1836	14	2	686	672	-6	4	715	698
6	10	1596	1544	-7	1	2637	2680	15	2	454	414	-5	4	996	1029

Table 44. Continued

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -5**				-16	6	315	329	-8	8	273	247	13	10	843	822
-3	4	932	994	-14	6	646	649	-7	8	444	378	14	10	366	326
-2	4	1206	1183	-13	6	1043	1088	-6	8	450	427	-10	11	214	239
-1	4	1074	1098	-12	6	336	348	-5	8	533	534	-7	11	350	370
0	4	633	657	-11	6	989	1047	-4	8	805	773	-6	11	429	411
1	4	729	692	-9	6	640	673	-2	8	303	363	-5	11	888	918
2	4	2021	1996	-6	6	797	820	1	8	327	357	-4	11	781	804
3	4	2737	2778	-5	6	1524	1546	2	8	539	515	-3	11	646	705
4	4	1018	988	-4	6	599	603	4	8	1778	1787	0	11	588	627
5	4	481	395	-3	6	2293	2267	6	8	1099	1081	1	11	642	629
6	4	623	591	-1	6	888	884	8	8	621	583	2	11	1140	1166
7	4	1871	1919	0	6	746	697	9	8	532	515	3	11	643	615
9	4	1986	1966	1	6	343	64	10	8	934	905	4	11	454	392
10	4	1538	1563	2	6	603	583	12	8	1925	1889	5	11	875	963
11	4	1673	1742	3	6	1290	1281	13	8	414	393	6	11	518	485
12	4	1141	1102	4	6	931	946	14	8	765	761	7	11	699	703
13	4	319	314	5	6	462	425	16	8	409	369	9	11	458	446
15	4	479	474	6	6	1387	1372	18	8	752	758	10	11	319	360
17	4	341	301	8	6	540	450	-13	9	383	404	-6	12	261	266
18	4	393	450	9	6	581	600	-12	9	894	895	-5	12	473	477
20	4	363	373	10	6	288	257	-11	9	219	194	-3	12	366	329
-19	5	585	617	12	6	1031	1025	-10	9	641	609	-2	12	698	735
-16	5	620	625	13	6	541	563	-9	9	544	557	-1	12	834	866
-15	5	273	323	14	6	923	897	-4	9	311	259	1	12	548	588
-14	5	443	482	15	6	416	349	-3	9	813	828	2	12	743	758
-13	5	391	413	16	6	432	396	-2	9	865	937	3	12	950	993
-12	5	386	420	19	6	565	571	-1	9	293	272	4	12	373	345
-11	5	773	790	20	6	716	675	1	9	555	565	6	12	362	336
-8	5	1182	1232	-17	7	400	446	2	9	511	506	7	12	555	573
[illegible]	5	688	694	-13	7	410	433	3	9	323	200	8	12	528	521
-6	5	949	970	-12	7	736	737	5	9	1298	1319	9	12	621	628
-5	5	823	910	-10	7	958	917	6	9	508	492	**L = -4****			
-4	5	1817	1851	-9	7	485	478	7	9	309	226	-20	0	247	303
-3	5	1359	1319	-4	7	346	310	11	9	605	583	-16	0	1269	1290
2	5	960	946	-3	7	958	926	12	9	637	541	-14	0	565	580
-1	5	755	719	-2	7	1220	1263	13	9	686	651	-10	0	683	679
0	5	248	136	-1	7	315	256	15	9	350	314	-8	0	1906	1860
1	5	1521	1508	1	7	595	588	16	9	619	545	-6	0	1781	1820
2	5	722	741	2	7	866	832	-13	10	513	516	-4	0	939	919
3	5	1558	1576	3	7	1611	1575	-12	10	277	213	-2	0	1762	1717
4	5	806	846	4	7	603	519	-11	10	1264	1322	0	0	2306	2162
5	5	1589	1506	5	7	1669	1648	-9	10	489	467	4	0	1770	1730
6	5	991	946	6	7	944	966	-8	10	230	193	6	0	338	284
7	5	1070	1054	8	7	491	447	-7	10	471	530	8	0	1321	1322
8	5	643	673	9	7	454	458	-6	10	795	798	10	0	1927	1918
9	5	1038	989	10	7	346	332	-5	10	546	462	12	0	327	323
10	5	584	553	11	7	1325	1250	-4	10	413	322	14	0	1101	1057
11	5	324	301	12	7	735	731	-3	10	1253	1251	16	0	1207	1173
14	5	796	766	13	7	1133	1090	-1	10	1018	1084	18	0	1401	1393
15	5	978	945	14	7	639	626	0	10	520	506	20	0	937	889
16	5	459	451	16	7	783	710	1	10	311	266	-21	1	442	425
17	5	411	413	18	7	625	641	2	10	491	527	-19	1	260	247
18	5	306	243	19	7	846	756	3	10	643	641	-17	1	943	926
20	5	866	832	-16	8	308	288	6	10	264	259	-16	1	550	516
21	5	343	353	-14	8	527	538	9	10	259	300	-15	1	550	570
-18	6	508	506	-13	8	408	349	10	10	341	296	-14	1	685	676
-17	6	264	301	-12	8	553	547	12	10	432	441	-13	1	323	296

Table 44. Continued

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCA
L = -4**				-16	3	332	301	1	4	517	572	-3	6	687	67
-9	1	881	925	-15	3	1667	1692	2	4	578	592	-2	6	1683	167
-8	1	1763	1780	-14	3	747	759	3	4	732	719	-1	6	758	80
-6	1	1412	1369	-13	3	744	743	4	4	1057	976	0	6	917	88
-5	1	1097	1094	-12	3	775	780	5	4	718	662	1	6	435	43
-3	1	414	388	-11	3	247	203	6	4	920	899	2	6	1679	166
-1	1	1795	1773	-10	3	223	135	7	4	543	576	3	6	842	89
0	1	3340	3345	-9	3	397	437	8	4	929	841	4	6	2979	298
1	1	1774	1714	-8	3	712	727	9	4	846	870	5	6	1183	115
2	1	2662	2710	-7	3	1734	1748	10	4	1366	1355	6	6	1110	110
3	1	878	861	-6	3	1040	1045	11	4	1525	1535	7	6	891	88
4	1	1762	1742	-5	3	1046	1077	12	4	1135	1125	8	6	385	37
5	1	802	758	-4	3	1126	1126	14	4	1303	1342	10	6	379	37
6	1	727	675	-3	3	618	616	15	4	949	977	12	6	1091	103
8	1	690	702	-2	3	252	315	16	4	593	610	13	6	516	45
9	1	1981	1960	-1	3	1578	1665	17	4	462	457	17	6	301	34
10	1	1726	1731	0	3	1417	1351	19	4	1672	1681	-18	7	451	44
11	1	339	296	1	3	1764	1672	21	4	508	491	-17	7	346	27
14	1	429	424	2	3	664	548	-18	5	510	533	-16	7	733	75
15	1	286	361	3	3	1184	1154	-16	5	296	283	-15	7	335	35
17	1	1972	1920	4	3	1387	1370	-13	5	571	583	-14	7	451	47
21	1	351	387	5	3	315	281	-12	5	602	622	-13	7	789	782
22	1	504	429	6	3	1225	1201	-10	5	1822	1838	-12	7	1254	1249
-21	2	533	556	7	3	1325	1343	-9	5	1586	1588	-11	7	812	865
-20	2	593	590	8	3	1350	1403	-7	5	662	636	-10	7	873	893
-18	2	282	321	9	3	794	742	-6	5	629	679	-8	7	987	1059
-15	2	281	253	10	3	448	504	-5	5	1505	1548	-7	7	494	484
-14	2	691	702	11	3	281	308	-3	5	1579	1565	-6	7	1173	1145
-12	2	652	670	12	3	645	610	-2	5	1491	1512	-5	7	1075	1086
-11	2	508	572	13	3	1385	1418	-1	5	1492	1467	-4	7	1748	1788
-10	2	1336	1273	14	3	1252	1233	1	5	395	367	-3	7	1702	1710
-9	2	563	574	15	3	1329	1283	2	5	1153	1108	-2	7	269	309
-8	2	197	116	16	3	816	835	3	5	2519	2575	-1	7	353	319
-7	2	1861	1892	17	3	380	331	4	5	899	856	0	7	475	439
-6	2	2494	2524	18	3	1455	1376	5	5	447	443	1	7	240	229
-5	2	1226	1154	19	3	481	444	6	5	500	448	3	7	890	913
-4	2	303	271	20	3	400	480	7	5	309	231	4	7	268	283
-2	2	1048	1039	21	3	580	559	10	5	1136	1138	5	7	2240	2217
0	2	1356	1346	22	3	260	211	11	5	1483	1478	6	7	1256	1219
1	2	1353	1302	-20	4	383	363	12	5	436	433	7	7	633	627
2	2	1194	1152	-19	4	762	773	15	5	561	599	8	7	400	450
4	2	704	702	-17	4	1025	1029	16	5	329	280	9	7	744	647
5	2	754	737	-16	4	669	667	18	5	836	799	10	7	814	797
6	2	1712	1717	-14	4	1073	1119	20	5	559	538	11	7	843	818
7	2	1313	1338	-13	4	440	447	21	5	263	173	12	7	1389	1375
8	2	760	768	-11	4	994	977	-18	6	250	262	13	7	607	645
9	2	1647	1692	-10	4	835	866	-17	6	285	234	14	7	635	622
11	2	264	254	-9	4	1351	1352	-16	6	282	221	15	7	513	451
12	2	691	687	-8	4	1722	1726	-15	6	296	310	16	7	311	300
13	2	738	796	-7	4	993	996	-13	6	559	591	18	7	349	316
14	2	1000	984	-6	4	990	991	-12	6	294	223	19	7	345	329
15	2	789	799	-5	4	399	398	-11	6	686	625	-16	8	273	240
16	2	411	401	-4	4	772	762	-10	6	397	338	-15	8	544	579
18	2	323	339	-3	4	1018	1036	-9	6	323	388	-14	8	388	426
19	2	311	368	-2	4	547	554	-6	6	720	706	-13	8	916	946
22	2	315	306	-1	4	605	596	-5	6	2310	2418	-11	8	1297	1294
-18	3	887	892	0	4	538	546	-4	6	2627	2684	-9	8	882	806

H	K	FOBS	FCAL
L = -4**			
-6	8	263	194
-5	8	898	890
-2	8	305	354
-1	8	429	400
0	8	342	298
1	8	526	558
2	8	561	613
5	8	952	903
6	8	295	282
7	8	502	523
9	8	445	493
11	8	840	833
12	8	576	567
13	8	2130	2053
15	8	309	302
17	8	1222	1153
-14	9	203	225
-13	9	605	622
-12	9	1185	1144
-11	9	569	613
-10	9	1060	1069
-8	9	364	353
-6	9	777	823
-5	9	613	536
-4	9	296	311
-3	9	826	792
0	9	621	658
2	9	530	532
3	9	465	486
4	9	1030	1024
5	9	1149	1111
6	9	642	678
7	9	688	673
9	9	535	479
11	9	674	660
12	9	1497	1439
13	9	501	535
14	9	978	914
15	9	307	291
16	9	655	612
-13	10	232	248
-12	10	706	707
-5	10	1278	1371
-4	10	2150	2201
-3	10	296	273
-2	10	1305	1247
-1	10	732	667
1	10	700	637
2	10	501	527
3	10	351	268
4	10	1809	1822
5	10	819	815
6	10	1688	1691
7	10	426	437
8	10	352	413
10	10	481	534
12	10	423	395
13	10	219	142
14	10	216	187
-11	11	259	224
-10	11	845	888
-9	11	200	220
-7	11	646	672
-6	11	409	406
-3	11	1028	1068
-2	11	1215	1227
-1	11	532	541
0	11	517	568
2	11	761	735
3	11	1024	1103
4	11	478	413
5	11	609	622
6	11	732	728
8	11	334	390
10	11	341	371
11	11	530	553
12	11	593	571
-8	12	601	575
-6	12	358	413
-3	12	311	346
0	12	274	313
2	12	232	199
3	12	273	262
6	12	525	520
9	12	394	389
-2	13	278	254
-1	13	268	250
0	13	438	448
1	13	483	479
2	13	180	173
L = -3**			
-21	0	353	349
-19	0	276	227
-17	0	647	638
-13	0	658	643
-11	0	802	830
-9	0	1867	1856
-7	0	4353	4506
-5	0	413	389
-3	0	606	639
-1	0	3109	3166
1	0	4366	4912
3	0	236	165
7	0	2372	2353
9	0	910	825
11	0	686	550
13	0	701	641
15	0	365	399
17	0	692	724
19	0	326	273
21	0	417	390
-19	1	278	277
-18	1	355	317
-16	1	575	571
-15	1	1401	1398
-13	1	828	782
-12	1	445	444
-11	1	348	328
-10	1	429	408
-9	1	218	225
-8	1	2146	2248
-7	1	1417	1402
-6	1	1571	1550
-5	1	661	646
-4	1	1714	1677
-3	1	963	943
-2	1	759	729
-1	1	1997	1990
0	1	3056	3098
1	1	1394	1373
2	1	1268	1256
3	1	1277	1287
4	1	857	818
5	1	809	747
6	1	1896	1855
7	1	1441	1491
8	1	2471	2456
9	1	1933	1950
10	1	370	297
11	1	1172	1149
12	1	275	309
13	1	491	465
14	1	534	500
15	1	406	425
16	1	279	255
17	1	1581	1552
20	1	708	717
21	1	610	609
22	1	556	531
-21	2	225	223
-20	2	766	778
-19	2	493	458
-17	2	801	828
-16	2	1546	1581
-15	2	290	281
-14	2	1407	1507
-13	2	521	518
-12	2	435	448
-11	2	486	528
-10	2	574	585
-8	2	498	467
-7	2	273	233
-6	2	722	722
-5	2	307	285
-4	2	481	464
-3	2	450	426
-2	2	1161	1160
-1	2	2624	2606
0	2	1031	987
1	2	1737	1672
2	2	796	724
3	2	724	736
5	2	353	367
6	2	418	376
7	2	2630	2699
8	2	2940	2992
10	2	862	913
11	2	1643	1705
12	2	1642	1623
13	2	291	301
14	2	1632	1587
15	2	595	554
16	2	2503	2450
17	2	774	800
18	2	1092	1105
19	2	751	780
20	2	382	292
21	2	312	312
22	2	736	734
-21	3	742	785
-18	3	808	773
-17	3	980	1015
-16	3	731	767
-15	3	503	472
-14	3	440	463
-13	3	952	916
-11	3	508	508
-10	3	1293	1254
-9	3	1736	1781
-8	3	1288	1308
-7	3	358	320
-6	3	644	697
-5	3	578	588
-4	3	688	721
-1	3	1654	1689
0	3	921	868
1	3	1831	1838
2	3	2897	2924
4	3	406	462
5	3	475	466
6	3	481	431
7	3	481	477
8	3	414	426
9	3	2078	2105
10	3	2275	2330
11	3	734	744
12	3	455	428
13	3	750	712
15	3	1879	1825
16	3	519	522
17	3	479	495
18	3	1354	1268
19	3	476	472
20	3	453	479
21	3	272	247
22	3	678	619
-18	4	751	750

Table 44. Continued

H	K	FOBS	FCAL
L = -3**			
-15	4	546	508
-14	4	606	583
-13	4	859	840
-11	4	1300	1322
-10	4	1375	1420
-9	4	1408	1443
-8	4	1605	1607
-7	4	1804	1754
-6	4	1060	1041
-5	4	769	775
-4	4	615	593
-3	4	1843	1865
-2	4	2769	2831
-1	4	1672	1629
0	4	759	703
1	4	2204	2152
2	4	2712	2707
3	4	2001	1962
4	4	1239	1174
6	4	529	569
7	4	451	430
9	4	942	911
10	4	448	396
11	4	250	209
12	4	385	404
15	4	389	386
16	4	509	460
17	4	338	284
18	4	724	679
19	4	255	154
20	4	402	422
-20	5	229	286
-18	5	558	575
-16	5	847	863
-15	5	458	439
-14	5	1103	1116
-13	5	257	160
-12	5	341	337
-10	5	483	517
-9	5	821	822
-8	5	735	707
-7	5	867	895
-6	5	923	989
-5	5	1103	1078
-3	5	1408	1487
-2	5	1779	1717
-1	5	1237	1253
0	5	776	756
1	5	691	697
3	5	645	621
4	5	899	856
5	5	1837	1726
6	5	1088	1100
7	5	1479	1457
8	5	561	548
9	5	313	298
10	5	627	617
11	5	1252	1265
12	5	346	399
14	5	305	245
15	5	684	620
16	5	590	562
18	5	534	469
19	5	406	431
20	5	969	908
-19	6	388	408
-18	6	296	316
-17	6	518	519
-14	6	439	415
-13	6	1062	1044
-12	6	420	443
-11	6	588	597
-9	6	418	434
-8	6	613	636
-5	6	466	438
-4	6	450	451
-2	6	820	894
-1	6	305	264
0	6	1253	1210
1	6	446	439
2	6	304	303
3	6	851	831
5	6	2023	2005
6	6	1850	1826
7	6	762	750
8	6	599	568
10	6	308	278
11	6	916	925
12	6	369	363
13	6	1198	1154
14	6	1174	1178
15	6	298	352
19	6	650	646
20	6	413	373
-18	7	833	849
-13	7	372	424
-12	7	545	559
-11	7	908	893
-10	7	414	413
-8	7	359	296
-7	7	259	240
-6	7	482	522
-5	7	1817	1913
-4	7	782	785
-3	7	1202	1204
-2	7	830	838
-1	7	352	432
2	7	289	280
3	7	1583	1545
4	7	739	700
5	7	745	693
6	7	726	685
7	7	634	621
8	7	551	589
9	7	663	639
11	7	539	498
12	7	1016	978
13	7	267	39
14	7	800	752
15	7	387	360
16	7	742	692
18	7	418	430
19	7	256	256
-17	8	227	232
-16	8	635	674
-14	8	243	272
-12	8	1773	1818
-11	8	330	279
-10	8	828	888
-9	8	426	379
-8	8	357	284
-7	8	528	565
-5	8	618	643
-4	8	1523	1541
-2	8	245	238
4	8	1664	1558
6	8	687	636
7	8	273	205
10	8	402	395
12	8	512	541
16	8	448	444
-15	9	823	817
-13	9	495	508
-12	9	624	621
-11	9	993	1029
-10	9	451	428
-6	9	396	403
-5	9	758	837
-4	9	644	704
-3	9	959	1008
1	9	330	324
2	9	350	351
3	9	442	361
4	9	574	630
5	9	564	576
6	9	602	613
10	9	436	401
11	9	335	305
12	9	1291	1265
13	9	311	234
14	9	415	441
16	9	453	449
-14	10	308	294
-13	10	462	488
-11	10	888	914
-10	10	224	242
-9	10	512	530
-8	10	325	340
-7	10	325	267
-6	10	366	378
-3	10	363	418
-2	10	572	648
-1	10	397	300
2	10	308	351
3	10	698	676
5	10	1467	1408
6	10	1150	1216
11	10	617	587
12	10	373	343
13	10	1160	1170
14	10	423	424
-11	11	300	282
-10	11	208	272
-7	11	491	511
-6	11	951	1039
-5	11	537	596
-3	11	1288	1398
-2	11	856	869
-1	11	571	589
0	11	884	943
1	11	490	447
2	11	659	652
4	11	458	370
5	11	1149	1114
6	11	861	898
7	11	978	965
9	11	389	417
11	11	422	416
12	11	345	322
-8	12	568	530
-7	12	435	465
-6	12	268	292
-5	12	726	743
-4	12	304	296
-3	12	471	520
-2	12	940	1016
-1	12	776	841
1	12	513	540
2	12	626	625
3	12	783	807
4	12	419	406
6	12	235	194
7	12	539	563
8	12	429	435
9	12	301	245
10	12	258	262
-2	13	321	352
-1	13	312	321
1	13	345	362
2	13	446	455
3	13	542	560
4	13	220	272
L = -2**			
-22	0	282	343
-20	0	336	312
-16	0	685	677
-14	0	648	610

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -2**				-13	2	755	761	11	3	982	939	-2	5	470	463
-12	0	746	681	-11	2	815	792	12	3	769	706	-1	5	459	443
-10	0	871	875	-10	2	1791	1850	13	3	1382	1372	0	5	572	529
-8	0	234	192	-9	2	1976	1985	15	3	1406	1338	1	5	1041	960
-6	0	892	865	-8	2	477	473	16	3	366	425	2	5	2454	2465
-4	0	907	870	-7	2	2060	2142	17	3	894	945	3	5	3071	3086
-2	0	870	792	-6	2	2193	2243	18	3	1156	1120	4	5	1717	1682
0	0	4956	5833	-5	2	231	280	19	3	977	942	5	5	577	512
2	0	2674	2703	-4	2	299	214	21	3	284	264	6	5	557	552
4	0	1843	1809	-3	2	925	915	22	3	428	413	7	5	950	937
6	0	1074	1066	-2	2	218	216	-21	4	489	495	8	5	259	199
8	0	4531	4592	-1	2	2636	2637	-20	4	349	374	9	5	348	297
10	0	2764	2633	0	2	485	443	-19	4	771	791	10	5	1055	1058
12	0	398	459	1	2	2932	2948	-17	4	637	673	11	5	1252	1269
14	0	912	890	2	2	264	194	-16	4	628	589	14	5	966	925
16	0	969	965	3	2	461	480	-14	4	650	700	15	5	1057	971
18	0	734	736	4	2	996	976	-13	4	398	387	16	5	431	418
20	0	331	326	5	2	714	643	-11	4	650	631	18	5	347	289
-21	1	818	855	6	2	206	231	-10	4	394	365	19	5	394	388
-20	1	484	478	7	2	244	215	-7	4	761	808	21	5	438	447
-18	1	409	411	10	2	641	573	-6	4	910	878	-19	6	719	727
-17	1	974	1025	12	2	402	363	-5	4	352	316	-18	6	227	222
-16	1	1320	1289	15	2	846	834	-2	4	1505	1442	-14	6	380	381
-15	1	319	294	17	2	1062	1045	-1	4	1871	1843	-13	6	1017	1093
-12	1	345	362	18	2	785	802	1	4	1535	1513	-12	6	965	985
-11	1	456	395	21	2	849	842	2	4	1517	1445	-11	6	379	455
-10	1	570	571	22	2	319	321	3	4	2566	2506	-10	6	856	889
-8	1	3564	3652	-21	3	297	320	4	4	2038	1993	-9	6	446	475
-7	1	1631	1660	-20	3	455	482	5	4	289	275	-8	6	640	667
-6	1	2115	2115	-19	3	537	568	6	4	1965	1989	-7	6	381	372
-5	1	680	643	-18	3	606	584	7	4	976	984	-6	6	663	704
-4	1	938	903	-17	3	581	556	8	4	858	930	-5	6	1927	1961
-3	1	1361	1293	-16	3	653	640	9	4	1939	1982	-4	6	2558	2625
-2	1	753	715	-15	3	1391	1394	10	4	1391	1398	-2	6	1607	1696
-1	1	1551	1538	-14	3	1302	1311	11	4	1797	1788	-1	6	731	712
0	1	2041	2043	-13	3	446	474	12	4	682	691	1	6	385	330
1	1	2347	2409	-12	3	921	962	14	4	1439	1405	2	6	1185	1205
2	1	1210	1228	-11	3	884	854	15	4	753	783	3	6	253	267
3	1	315	261	-10	3	779	817	16	4	444	449	4	6	1403	1423
4	1	1818	1724	-9	3	2034	2056	17	4	510	485	5	6	559	502
5	1	1603	1516	-8	3	1281	1301	19	4	1051	1079	8	6	443	451
6	1	2201	2150	-7	3	1517	1493	21	4	245	253	11	6	512	525
7	1	1648	1576	-6	3	644	607	-20	5	504	564	13	6	324	295
8	1	1113	1092	-4	3	1668	1667	-19	5	492	497	14	6	627	618
9	1	1856	1834	-3	3	844	831	-18	5	653	641	16	6	317	273
11	1	562	597	-2	3	2183	2260	-17	5	292	311	18	6	473	506
15	1	906	911	-1	3	2207	2236	-14	5	377	370	19	6	775	731
16	1	821	808	0	3	831	813	-13	5	385	364	20	6	773	740
17	1	818	846	1	3	578	584	-12	5	531	552	-16	7	549	604
18	1	628	579	2	3	349	366	-11	5	458	420	-14	7	472	484
19	1	297	217	4	3	596	630	-10	5	1236	1213	-13	7	968	989
-20	2	500	497	5	3	1068	1039	-9	5	1190	1247	-12	7	607	651
-19	2	690	686	6	3	1177	1167	-7	5	356	364	-11	7	1398	1424
-18	2	1271	1248	7	3	1576	1518	-6	5	1564	1608	-10	7	281	185
-17	2	1032	1027	8	3	293	287	-5	5	1854	1926	-9	7	318	283
-15	2	1832	1870	9	3	1601	1617	-4	5	452	500	-8	7	583	568
-14	2	1172	1176	10	3	2169	2178	-3	5	1152	1168	-6	7	846	861

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -2**				-3	9	827	826	-1	12	520	496	-1	1	2423	2473
-5	7	311	339	0	9	318	369	1	12	357	385	0	1	1619	1667
-3	7	1553	1543	3	9	409	421	2	12	802	806	1	1	2626	2805
-2	7	615	584	4	9	1978	2001	3	12	721	781	2	1	177	153
0	7	411	418	5	9	975	1036	4	12	406	398	3	1	585	591
1	7	656	621	6	9	608	615	5	12	343	366	4	1	1283	1275
2	7	261	216	7	9	274	326	6	12	949	1000	5	1	816	781
3	7	572	544	12	9	1567	1539	8	12	426	442	6	1	3298	3259
4	7	1626	1680	14	9	474	416	9	12	613	625	7	1	889	873
5	7	1394	1436	15	9	460	423	10	12	704	711	8	1	301	280
6	7	907	845	16	9	900	886	-4	13	303	367	9	1	1570	1548
7	7	428	358	-14	10	226	206	-3	13	523	506	10	1	550	549
9	7	985	953	-13	10	643	650	-2	13	552	572	12	1	670	649
10	7	757	665	-12	10	1187	1205	-1	13	293	286	15	1	382	320
12	7	1469	1450	-11	10	270	200	0	13	259	330	16	1	1127	1138
13	7	379	239	-10	10	494	439	1	13	206	182	17	1	1136	1076
15	7	556	531	-7	10	577	611	2	13	313	302	18	1	904	821
16	7	285	327	-6	10	679	735	3	13	326	342	20	1	753	715
17	7	367	365	-5	10	1075	1073	5	13	327	360	21	1	569	538
18	7	599	534	-4	10	1916	1985	**L = -1****				22	1	373	389
19	7	819	721	-2	10	1014	1035	-19	0	503	520	-22	2	608	655
-17	8	656	672	-1	10	393	403	-17	0	1523	1536	-20	2	361	336
-16	8	216	182	1	10	773	831	-15	0	510	545	-19	2	370	367
-13	8	538	528	2	10	579	630	-13	0	279	333	-16	2	662	642
-11	8	420	381	3	10	344	363	-11	0	1871	1840	-14	2	433	514
-9	8	416	358	4	10	722	703	-9	0	2477	2411	-13	2	346	317
-7	8	492	586	5	10	737	751	-7	0	3459	3579	-12	2	333	288
-6	8	389	432	6	10	662	707	-5	0	876	848	-11	2	402	356
-5	8	253	311	10	10	232	243	-3	0	839	791	-9	2	1184	1136
-4	8	284	301	12	10	373	329	-1	0	2434	2460	-8	2	1991	1947
-3	8	623	597	15	10	374	326	1	0	2003	1995	-7	2	2238	2267
-1	8	755	819	-12	11	292	304	5	0	275	240	-6	2	501	476
0	8	274	259	-11	11	484	481	7	0	732	723	-5	2	649	644
1	8	427	386	-10	11	645	662	9	0	1200	1162	-4	2	246	230
2	8	359	315	-9	11	263	260	11	0	1269	1213	-3	2	1408	1381
3	8	852	815	-6	11	809	758	13	0	323	278	-2	2	237	254
4	8	425	450	-5	11	774	815	15	0	608	554	-1	2	819	834
5	8	2318	2266	-4	11	409	356	17	0	2433	2359	0	2	309	319
6	8	612	659	-3	11	547	547	19	0	427	383	2	2	638	606
7	8	353	306	-2	11	612	606	-21	1	320	283	3	2	345	351
8	8	354	358	0	11	295	284	-20	1	427	385	4	2	1566	1503
11	8	1719	1686	1	11	699	691	-18	1	269	267	6	2	1008	965
12	8	450	398	2	11	1221	1254	-17	1	272	270	7	2	2888	2931
13	8	2315	2153	3	11	1063	1078	-16	1	1058	1094	8	2	2607	2636
15	8	503	510	4	11	975	991	-15	1	658	658	9	2	945	962
16	8	247	256	5	11	263	218	-13	1	624	598	11	2	935	948
17	8	812	786	6	11	246	186	-12	1	820	831	12	2	1748	1718
-15	9	318	304	7	11	534	540	-11	1	433	386	13	2	255	255
-14	9	461	478	9	11	297	280	-10	1	1012	1001	14	2	1300	1318
-13	9	866	880	10	11	382	365	-9	1	1037	1051	15	2	608	601
-12	9	311	344	11	11	333	325	-8	1	1367	1427	16	2	1296	1282
-11	9	1126	1164	12	11	337	307	-7	1	800	768	17	2	401	418
-10	9	850	923	13	11	353	358	-6	1	610	601	18	2	611	526
-9	9	280	291	-7	12	197	217	-5	1	2223	2123	19	2	475	394
-6	9	474	514	-6	12	272	286	-4	1	731	662	20	2	382	372
-5	9	651	704	-3	12	276	241	-3	1	235	183	21	2	320	286
-4	9	507	508	-2	12	492	497	-2	1	1246	1238	-21	3	438	468

H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL	H	K	FOBS	FCAL
L = -1**				1	4	693	704	-6	6	1585	1641	-4	8	1389	1418
-20	3	283	327	2	4	725	717	-5	6	1077	1129	-2	8	260	277
-19	3	646	674	3	4	1076	1046	-4	6	503	537	-1	8	765	790
-18	3	354	317	4	4	419	391	-3	6	2937	3077	0	8	302	303
-17	3	1190	1265	6	4	446	486	-2	6	916	925	7	8	313	293
-16	3	680	722	8	4	342	301	-1	6	626	639	8	8	408	345
-15	3	259	268	9	4	491	448	1	6	993	1020	11	8	353	314
-14	3	1444	1451	10	4	1350	1338	2	6	1493	1572	12	8	1725	1678
-11	3	908	925	11	4	994	957	3	6	3016	3005	14	8	611	580
-9	3	616	668	12	4	231	124	4	6	877	766	16	8	1132	1075
-8	3	865	896	13	4	509	468	5	6	2690	2602	17	8	250	220
-7	3	1271	1295	15	4	982	1001	6	6	1769	1735	18	8	863	844
-6	3	1923	1929	18	4	1628	1595	7	6	947	912	-16	9	297	340
-5	3	1224	1230	20	4	566	523	8	6	990	979	-15	9	686	742
-4	3	1445	1466	21	4	311	322	11	6	1216	1183	-14	9	447	462
-3	3	276	267	-19	5	528	526	13	6	1178	1152	-13	9	1202	1317
-2	3	380	410	-18	5	249	304	14	6	1051	1018	-12	9	354	345
-1	3	642	619	-16	5	444	488	17	6	278	243	-11	9	1236	1271
0	3	1054	1026	-15	5	868	870	-19	7	609	641	-7	9	292	286
1	3	1817	1758	-14	5	1150	1190	-18	7	525	568	-6	9	666	735
2	3	3857	3929	-12	5	352	278	-17	7	723	700	-5	9	1052	1097
3	3	1398	1361	-11	5	1108	1105	-15	7	385	341	-4	9	1226	1311
4	3	635	612	-10	5	1168	1224	-14	7	335	313	-3	9	721	718
5	3	374	360	-9	5	1153	1178	-13	7	1428	1505	-2	9	305	366
6	3	1356	1414	-8	5	310	263	-12	7	436	447	2	9	331	260
7	3	1912	1872	-6	5	468	468	-11	7	998	1061	4	9	1411	1341
8	3	717	710	-5	5	361	401	-10	7	410	433	5	9	615	547
9	3	864	859	-4	5	1137	1143	-9	7	1024	1065	6	9	751	698
10	3	1810	1772	-3	5	2026	2099	-8	7	623	639	9	9	283	200
12	3	639	574	-2	5	2343	2447	-6	7	399	347	10	9	568	578
13	3	1209	1164	-1	5	1726	1700	-5	7	1965	2008	11	9	525	473
14	3	1664	1625	0	5	256	244	-4	7	1715	1831	12	9	1251	1247
15	3	1398	1381	1	5	1032	983	-3	7	470	465	13	9	945	903
16	3	1321	1285	2	5	1748	1723	-1	7	423	404	14	9	648	625
17	3	360	392	3	5	1864	1801	1	7	563	507	-12	10	228	218
18	3	689	632	4	5	719	674	3	7	1104	1123	-10	10	413	429
19	3	994	946	5	5	602	565	4	7	2005	1980	-6	10	517	481
20	3	422	424	6	5	812	785	5	7	1360	1396	-5	10	1098	1180
22	3	623	575	7	5	366	412	6	7	1035	976	-4	10	369	319
-21	4	641	638	8	5	363	411	8	7	824	765	-3	10	1173	1205
-20	4	385	385	9	5	756	750	9	7	1028	987	-2	10	951	954
-18	4	1254	1326	10	5	1465	1476	10	7	618	561	0	10	472	466
-15	4	1130	1149	11	5	1224	1207	11	7	502	446	2	10	850	862
-14	4	698	703	12	5	508	459	12	7	1362	1331	3	10	1498	1494
-13	4	971	1008	14	5	493	401	13	7	1134	1138	5	10	1803	1790
-11	4	1888	1932	15	5	432	388	14	7	558	578	6	10	1329	1358
-10	4	2320	2340	18	5	244	169	17	7	450	457	11	10	654	683
-9	4	1414	1420	19	5	930	883	19	7	382	311	13	10	894	888
-8	4	736	744	20	5	333	326	-16	8	1023	1046	14	10	229	240
-7	4	1119	1138	21	5	232	251	-15	8	245	264	-12	11	295	309
-6	4	1032	1102	-19	6	240	259	-14	8	440	463	-11	11	752	770
-5	4	496	519	-17	6	422	410	-12	8	2440	2604	-10	11	496	528
-4	4	268	275	-14	6	476	517	-11	8	502	441	-8	11	454	491
-3	4	1853	1943	-12	6	431	449	-10	8	829	945	-6	11	500	492
-2	4	1329	1345	-11	6	288	289	-8	8	557	685	-4	11	670	689
-1	4	1382	1340	-9	6	231	187	-7	8	508	555	-3	11	1436	1409
0	4	758	761	-8	6	735	728	-5	8	300	244	-2	11	837	834

Table 44. Continued

H	K	FOBS	FCAL
L = -1**			
-1	11	871	883
0	11	390	407
2	11	248	213
3	11	783	778
4	11	1124	1161
5	11	774	770
6	11	237	268
7	11	506	528
8	11	278	251
10	11	484	467
11	11	838	835
12	11	599	553
-9	12	468	487
-8	12	387	425
-7	12	441	518
-5	12	638	658
-3	12	411	438
-2	12	523	525
-1	12	416	383
5	12	251	224
8	12	215	219
10	12	348	278
0	13	189	189
1	13	274	268
2	13	339	368
3	13	346	326
4	13	204	215
5	13	226	209
L = 0**			
-22	0	318	383
-18	0	490	459
-16	0	628	623
-14	0	633	607
-12	0	297	286
-10	0	1314	1282
-8	0	3276	3398
-6	0	838	820
-4	0	1348	1307
-2	0	2461	2457
-22	1	430	390
-21	1	643	668
-20	1	382	401
-18	1	588	623
-17	1	373	338
-16	1	1866	1907
-15	1	244	134
-12	1	370	368
-11	1	1479	1469
-10	1	470	443
-9	1	650	660
-8	1	2502	2507
-7	1	1488	1492
-6	1	2861	2809
-5	1	1140	1075
-4	1	1177	1149
-3	1	727	751
-1	1	2670	2849
-22	2	281	289
-21	2	815	820
-19	2	385	425
-18	2	1395	1421
-17	2	1520	1512
-16	2	269	281
-15	2	1970	2049
-14	2	984	982
-13	2	1145	1203
-12	2	645	617
-11	2	727	780
-10	2	1019	1088
-9	2	1237	1258
-8	2	873	852
-7	2	1057	1089
-6	2	1204	1216
-5	2	330	264
-4	2	251	283
-2	2	228	223
0	2	200	142
-22	3	583	652
-20	3	387	457
-19	3	837	818
-17	3	1009	1009
-16	3	995	1004
-15	3	519	540
-14	3	1456	1474
-13	3	488	501
-11	3	1102	1121
-10	3	1801	1832
-9	3	1860	1933
-8	3	655	640
-7	3	504	508
-5	3	466	448
-4	3	247	252
-3	3	1830	1832
-2	3	2192	2205
-1	3	1371	1303
-18	4	263	142
-15	4	351	353
-14	4	379	460
-12	4	343	303
-11	4	1033	1056
-10	4	1226	1296
-9	4	1750	1842
-8	4	898	880
-7	4	248	270
-6	4	1419	1546
-5	4	353	400
-4	4	1644	1655
-3	4	725	713
-2	4	2308	2333
-1	4	3044	3114
0	4	833	744
-20	5	343	342
-19	5	522	514
-17	5	583	588
-16	5	329	340
-15	5	669	618
-14	5	1177	1179
-13	5	263	316
-9	5	612	598
-7	5	1087	1131
-6	5	1281	1408
-5	5	1294	1400
-3	5	1699	1716
-2	5	2104	2166
-1	5	559	507
-20	6	794	845
-19	6	906	951
-18	6	326	424
-17	6	329	316
-15	6	546	581
-14	6	794	801
-13	6	1082	1116
-12	6	1090	1110
-10	6	709	756
-9	6	340	423
-8	6	419	373
-6	6	1019	1104
-5	6	574	617
-4	6	1211	1234
-3	6	231	287
-2	6	339	375
-1	6	251	203
0	6	340	361
-19	7	528	548
-18	7	488	522
-17	7	372	412
-14	7	417	398
-13	7	929	973
-12	7	902	930
-11	7	766	745
-4	7	1699	1791
-3	7	678	706
-2	7	693	727
-18	8	296	337
-13	8	867	877
-11	8	1085	1096
-7	8	558	560
-5	8	1541	1578
-3	8	1016	1070
-2	8	593	587
-1	8	748	701
-16	9	501	601
-15	9	296	307
-13	9	645	653
-12	9	521	541
-11	9	852	837
-7	9	313	288
-4	9	1252	1296
-3	9	517	618
-15	10	381	333
-14	10	316	334
-13	10	265	271
-12	10	954	952
-10	10	341	372
-8	10	286	349
-7	10	478	500
-6	10	384	413
-4	10	826	884
-2	10	297	411
-7	11	499	510
-6	11	775	846
-5	11	849	879
-4	11	996	1051
-2	11	658	666
-1	11	596	598
-9	12	608	596
-8	12	284	298
-7	12	249	237
-6	12	894	925
-5	12	202	173
-3	12	663	680
-2	12	941	989
-1	12	589	600
0	12	282	315
-5	13	345	355
-3	13	605	611
-2	13	540	550
-1	13	189	223

Table 45. 10*(Fobs vs. Fcal) For [Rh2Cl2(CO)(C2S4)(DPM)2].

K	L	FOBS	FCAL
**H =		0****	
0	2	9929	8960
0	4	1412	580
0	6	1254	929
0	8	676	601
0	10	1173	1237
0	12	833	896
0	14	1256	1166
0	16	2025	1819
0	18	1534	1527
0	20	632	679
8	0	999	1079
8	1	439	476
8	4	362	235
8	6	357	238
9	-1	1208	1215
9	1	606	677
9	5	467	446
10	0	1185	1158
10	2	817	818
10	5	430	492
10	7	525	628
10	8	461	558
10	9	488	560
10	10	397	476
11	-1	1970	1946
11	1	1172	1162
11	3	999	995
11	5	955	1031
11	8	964	945
12	1	848	810
12	4	562	484
12	5	559	686
12	6	1008	1126
12	7	1700	1826
12	8	808	979
12	9	1307	1340
13	-1	1482	1557
13	1	707	749
13	2	479	594
13	5	693	693
13	6	461	615
13	8	723	873
13	10	747	800
13	12	415	529
13	13	452	537
14	0	1325	1381
14	1	853	795
14	2	512	610
14	3	600	568
14	5	427	625
14	6	554	534
14	8	599	588
14	9	750	802
14	11	653	766
14	13	424	490
15	-1	606	218
15	0	605	576
15	1	397	286
15	2	556	681
15	3	614	617
15	5	498	523
15	6	479	530
15	8	1178	1336
15	10	682	818
16	0	1048	1011
16	1	754	836
16	2	523	519
16	7	509	568
16	8	856	819
17	-1	2811	2957
17	1	1173	1432
17	2	487	522
17	3	616	775
17	4	385	410
17	6	1266	1438
17	8	1603	1682
17	9	535	571
17	12	539	681
17	13	650	662
18	0	2420	2790
18	2	1512	1907
18	4	714	864
18	8	477	308
18	13	623	526
18	14	1198	1254
18	16	754	572
19	-1	4064	4227
19	0	620	704
19	1	468	620
19	3	1132	1192
19	4	510	479
19	5	778	940
19	6	1064	1024
19	7	1396	1250
19	8	995	916
19	10	1336	1219
19	12	981	953
19	13	829	824
19	15	949	822
19	16	690	702
19	17	603	566
20	0	2576	2669
20	1	1485	1326
20	3	1702	1811
20	4	592	611
20	5	1024	1127
20	7	3831	3730
20	9	3894	4015
20	11	1720	1676
20	12	601	428
20	13	646	673
20	14	982	1059
20	15	742	836
20	16	651	735
21	-1	2267	1844
21	0	1447	1662
21	1	2013	1961
21	2	1578	1629
21	3	956	1035
21	5	422	590
21	6	584	541
21	7	1633	1574
21	9	1077	957
21	10	1263	1288
21	11	452	396
21	12	1743	1711
21	14	711	853
21	16	1034	932
21	18	776	727
22	0	5685	5922
22	2	747	1043
22	5	1256	1304
22	6	553	694
22	7	1867	1799
22	8	388	280
22	9	3042	2882
22	10	424	373
22	11	469	545
22	16	742	670
22	17	590	478
22	18	475	587
23	-1	4059	4089
23	0	1771	2014
23	1	1526	1805
23	2	398	449
23	3	1108	1342
23	4	1346	1515
23	5	1931	1815
23	7	1214	1360
23	9	1937	1866
23	10	555	540
24	0	4748	5254
24	1	1352	959
24	2	1761	996
24	3	690	701
24	4	496	528
24	5	822	908
24	7	341	271
24	8	911	713
24	9	882	884
24	10	748	794
24	11	910	951
24	12	446	325
24	13	488	501
24	14	638	558
24	16	1010	919
24	18	550	416
25	-1	442	952
25	0	595	1036
25	1	1299	1329
25	2	1297	1413
25	6	387	303
25	7	718	693
25	8	903	803
25	9	1202	1133
25	10	395	282
25	11	443	194
25	12	466	434
25	13	471	283
25	17	738	733
26	0	769	275
26	1	2728	3213
26	2	769	891
26	3	690	1144
26	4	663	563
26	5	1257	1421
26	7	2548	2312
26	9	778	985
26	11	458	413
26	13	486	426
26	16	743	634
26	17	541	506
27	-1	4544	4476
27	0	392	894
27	1	1951	1984
27	2	1287	1382
27	3	260	542
27	4	289	868
27	5	1621	1531
27	6	2590	2347
27	8	3395	3177
27	9	737	660
27	10	2290	2358
27	11	620	571
27	13	796	808
27	15	642	471
28	1	970	1185
28	2	926	551
28	3	1002	1177
28	4	1679	1538
28	5	1131	1192
28	6	911	1040
28	7	842	528
28	8	2390	2175
28	9	551	410
28	10	1001	893
28	11	780	771
28	12	626	620
28	13	1086	1016
28	14	1406	1314
28	15	508	368
**H =		1****	
0	0	933	1876
0	2	226	146
0	4	1987	1946
0	6	5994	5318
0	8	7370	7001

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 1**				17	-1	600	927	22	6	2546	2609	26	11	463	213
0	10	3815	3776	17	4	402	611	22	7	496	332	26	12	899	852
0	12	1221	1283	17	5	666	700	22	8	3625	3766	26	13	518	357
0	16	876	841	17	7	1200	1236	22	10	1223	1333	26	14	515	469
0	18	493	688	17	14	624	632	22	11	530	555	26	18	451	443
7	0	927	971	18	-1	1365	1411	22	13	559	498	27	0	4949	5715
8	-1	404	390	18	0	482	583	22	15	991	889	27	2	1424	1435
8	3	515	437	18	3	725	776	22	16	591	463	27	3	1874	1867
8	5	377	412	18	4	968	1127	22	17	1025	1019	27	4	1647	1268
8	6	518	580	18	6	2452	2853	22	18	471	423	27	5	2258	2140
9	3	363	382	18	8	2286	2496	23	-1	3766	4491	27	7	2286	2216
9	5	677	753	18	9	563	522	23	0	516	800	27	8	1140	1066
9	7	683	791	18	15	707	689	23	1	1778	1888	27	9	1200	1157
10	-1	822	936	19	-1	924	1076	23	2	1467	1394	27	13	474	274
10	4	605	625	19	0	1615	1618	23	3	802	728	27	14	1214	1065
10	6	1155	1254	19	1	1391	1273	23	7	635	546	27	15	634	594
10	7	577	557	19	2	497	616	23	9	1315	1293	27	16	1565	1584
10	8	886	960	19	3	675	698	23	10	587	537	27	17	446	489
11	5	619	564	19	4	664	731	23	11	447	522	27	18	900	979
11	6	421	447	19	5	2646	2830	23	15	950	904	28	-1	215	458
11	7	1047	1102	19	6	1361	1513	23	16	557	383	28	0	2546	2851
11	9	1058	1184	19	7	2881	3046	23	17	606	488	28	1	1539	1304
11	11	750	849	19	8	839	852	24	-1	1442	1558	28	2	1362	1685
12	-1	2129	2058	19	9	593	673	24	0	1095	1230	28	3	1814	1966
12	0	656	501	19	11	997	1012	24	1	351	241	28	4	618	664
12	1	1221	1167	19	13	677	740	24	2	941	1487	28	6	2150	1974
12	4	727	742	19	15	559	701	24	4	849	844	28	7	905	747
12	7	408	371	20	-1	5604	6417	24	5	1205	1263	28	8	934	817
12	9	608	623	20	0	793	1101	24	6	1991	1940	28	9	539	498
12	10	766	784	20	1	3672	4240	24	7	473	505	28	10	2065	2097
12	12	781	829	20	3	1452	1612	24	8	2324	2454	28	11	820	737
13	0	588	641	20	5	778	848	24	9	525	416	28	12	1123	1091
13	1	1031	1123	20	6	1825	1558	24	10	421	379	28	13	955	931
13	2	641	666	20	7	606	749	24	11	545	444	28	14	561	605
13	3	564	655	20	8	487	548	25	-1	1332	1870	28	15	591	535
13	4	503	503	20	13	875	701	25	0	346	918	28	16	1036	987
13	5	703	711	20	15	711	717	25	1	1067	963	28	18	474	477
13	6	587	513	20	17	847	792	25	2	1832	1857	28	19	512	568
13	7	1330	1358	21	0	943	946	25	3	1207	1518	**H = 2****			
13	9	767	896	21	2	1995	2374	25	4	691	561	0	0	9509	9265
13	10	390	367	21	3	1409	1644	25	5	823	748	0	2	1623	1590
14	-1	693	813	21	4	435	661	25	7	1611	1638	0	4	3058	2457
14	0	604	622	21	5	2115	2195	25	9	923	993	0	8	987	970
14	5	865	1005	21	6	1634	1652	25	11	438	445	0	12	877	658
14	6	483	569	21	7	1248	1248	25	12	536	577	0	14	1709	1617
14	7	880	793	21	8	457	400	25	14	775	668	0	16	1882	1903
14	8	700	773	21	9	771	936	25	15	971	1006	0	18	1368	1611
14	9	504	398	21	11	741	730	25	16	522	641	7	2	381	315
15	0	1057	1193	21	12	757	727	26	-1	1343	1513	8	-2	832	905
15	1	395	482	21	13	535	560	26	0	608	991	8	-1	561	441
16	-1	1165	1266	21	14	971	939	26	1	847	516	9	-2	610	535
16	0	515	451	21	15	558	658	26	2	798	771	9	-1	719	721
16	4	616	601	22	-1	5309	5923	26	3	2578	1903	9	6	357	386
16	6	487	537	22	1	1539	2034	26	4	856	784	10	-2	1531	1557
16	7	473	691	22	2	749	1091	26	5	1727	1914	10	0	664	630
16	13	687	784	22	3	383	67	26	6	1572	1564	10	3	451	343
16	15	739	715	22	4	655	551	26	9	666	541	10	5	1012	1087

Table 45. Continued

K	L	FOBS	FCAL
H = 2**			
10	7	677	791
10	8	438	349
11	-2	724	765
11	-1	927	876
11	1	512	529
11	3	829	851
11	4	611	669
11	5	651	644
11	6	924	1073
11	8	387	523
11	9	373	174
12	-2	1048	937
12	4	529	594
12	5	1341	1423
12	7	1511	1793
12	9	523	692
12	10	471	336
13	-1	416	441
13	0	443	368
13	1	533	418
13	3	428	528
13	4	823	863
13	6	1291	1428
13	8	619	840
13	10	637	716
13	11	501	531
14	-2	1090	1201
14	3	505	725
14	5	682	597
14	7	530	632
14	9	521	451
14	10	476	446
14	12	422	495
14	13	487	561
15	-2	778	953
15	-1	467	407
15	0	714	873
15	5	424	426
15	6	1577	1807
15	8	1058	1159
15	14	522	499
16	-2	1536	1751
16	-1	1093	1106
16	0	1507	1681
16	3	485	475
16	5	1114	1225
16	7	756	777
16	13	458	407
17	1	736	745
17	4	888	969
17	6	2070	2303
17	8	713	856
17	13	517	500
18	-2	2311	2850
18	-1	638	850
18	0	828	1003
18	2	1025	1072
18	3	695	672
18	5	859	860
18	6	813	899
18	8	940	987
18	9	772	935
18	12	1163	1188
18	14	938	941
18	16	583	565
19	-2	559	418
19	-1	1169	1261
19	1	845	973
19	3	903	1020
19	4	680	734
19	5	1063	1174
19	6	940	1117
19	8	1189	1246
19	10	970	938
19	11	853	838
19	13	1291	1327
19	14	576	648
19	15	939	1057
20	-2	2575	2964
20	-1	568	856
20	0	825	1201
20	1	2016	2413
20	3	2278	2562
20	4	855	750
20	5	4312	4933
20	6	559	740
20	7	4408	4841
20	9	1804	1881
20	10	720	654
20	12	689	808
20	14	606	495
20	15	822	993
20	16	675	455
21	-2	3139	3290
21	-1	2229	2744
21	0	1425	1351
21	1	440	668
21	2	594	792
21	4	748	742
21	5	1113	1108
21	6	710	796
21	7	1054	1169
21	8	995	1009
21	10	1392	1489
21	12	876	995
21	14	995	1106
21	16	760	560
22	-2	3170	3539
22	-1	1594	1859
22	0	846	919
22	2	1432	1572
22	3	1449	1465
22	5	2115	2131
22	7	2802	2930
22	9	762	801
22	14	1063	991
22	16	905	938
23	-2	468	304
23	-1	2716	2611
23	0	763	656
23	1	2333	2721
23	2	636	516
23	4	924	979
23	6	963	1034
23	8	706	683
23	9	779	764
23	13	773	767
24	-2	1443	1486
24	-1	700	802
24	0	1844	1645
24	2	561	187
24	4	396	440
24	5	519	515
24	7	673	684
24	8	476	367
24	9	1047	1046
24	14	580	629
24	16	571	533
25	-2	1174	1251
25	-1	790	1113
25	0	1250	1903
25	1	1350	1138
25	3	961	1121
25	4	1015	1035
25	5	661	600
25	6	1595	1735
25	7	608	470
25	14	672	742
25	15	1092	1119
25	17	619	687
26	-2	722	1030
26	-1	669	997
26	0	831	909
26	1	3761	3638
26	3	1776	1356
26	5	3315	3457
26	6	462	588
26	7	2080	2096
26	8	373	280
26	9	425	282
26	11	547	501
26	12	488	338
26	14	633	549
26	15	633	590
26	16	441	458
26	18	439	447
27	-2	207	531
27	-1	1809	2001
27	0	291	138
27	4	3972	4029
27	5	374	344
27	6	5017	5062
27	7	884	1010
27	8	2194	2032
27	11	1224	1270
27	13	999	1064
27	15	680	670
28	-2	341	331
28	-1	2478	2370
28	0	1081	1057
28	1	397	493
28	2	2512	3105
28	3	573	521
28	4	2845	2664
28	5	2353	2323
28	6	1246	1201
28	7	534	462
28	9	1155	1131
28	10	850	699
28	11	927	916
28	12	1043	1005
28	13	954	1045
28	14	606	544
28	15	573	462
28	18	852	1101
H = 3**			
0	-2	619	704
0	0	2023	2165
0	2	6723	6163
0	4	7582	7479
0	6	9146	8846
0	8	4937	4818
0	10	362	344
0	12	686	762
0	14	1037	969
0	16	839	972
7	-2	919	944
8	4	436	548
9	-3	463	503
9	-1	456	471
9	3	503	590
9	5	899	1005
10	-3	547	593
10	2	651	613
10	4	1165	1174
10	6	964	994
10	8	426	469
11	-2	620	675
11	-1	965	898
11	1	623	597
11	3	645	627
11	4	421	392
11	5	499	390
11	7	1065	1067
11	9	962	1079
12	-3	1781	1799
12	-1	942	916

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 3**				19	4	491	430	23	9	729	630	27	10	572	673
12	1	469	420	19	5	2148	2592	23	13	792	743	27	12	1343	1394
12	4	626	500	19	7	817	825	23	15	492	518	27	14	1737	1589
12	5	398	359	19	9	510	499	24	-3	882	843	27	16	890	955
12	7	546	458	19	13	587	495	24	-2	2483	2527	28	-3	208	66
12	8	447	548	20	-3	5521	5875	24	-1	1310	1419	28	-2	2677	2219
12	10	627	616	20	-1	3003	3167	24	0	528	590	28	-1	826	1013
13	-3	503	536	20	0	463	406	24	1	752	799	28	0	1049	1142
13	-2	1103	1132	20	1	940	1014	24	2	504	414	28	1	3017	3033
13	2	472	640	20	2	682	822	24	3	681	686	28	2	464	529
13	3	538	542	20	4	1561	1842	24	4	2424	2851	28	3	4071	3886
13	4	675	637	20	5	1438	1484	24	5	712	838	28	5	333	303
13	5	1269	1384	20	6	1044	1119	24	6	2474	2596	28	6	1273	1241
13	6	744	698	20	7	713	933	24	7	588	576	28	7	491	531
13	7	585	701	20	8	492	641	24	8	538	431	28	8	1674	1665
14	-3	1781	2002	20	11	950	1050	24	12	666	704	28	10	1198	1242
14	-2	737	716	20	13	1789	1837	24	13	615	520	28	11	1292	1259
14	-1	951	1085	20	15	1277	1316	24	15	585	650	28	13	1658	1628
14	4	520	516	21	-3	1078	1135	25	-3	1617	1648	28	15	467	471
14	6	932	1084	21	-1	1028	746	25	-1	863	1123	28	16	740	726
15	-2	777	913	21	0	2074	2496	25	1	653	939	28	17	426	397
15	0	758	705	21	2	1802	1944	25	3	1788	1917	**H = 4****			
15	2	625	689	21	3	1486	1555	25	4	768	800	0	-2	7144	6652
15	3	539	493	21	4	882	1075	25	5	1890	2065	0	0	2525	2079
15	5	519	564	21	5	2232	2531	25	6	1035	779	0	2	4694	4670
15	7	545	580	21	6	501	409	25	7	1053	911	0	6	1302	1270
16	-3	722	788	21	7	1114	1291	25	8	530	564	0	8	434	507
16	2	502	434	21	8	558	736	25	9	508	433	0	10	1604	1817
16	4	805	840	21	10	854	916	25	10	557	425	0	12	2446	2345
16	6	921	1063	21	12	1244	1321	25	12	825	812	0	14	1906	1771
16	7	691	763	21	15	610	631	25	14	1145	1113	0	16	1229	1309
16	8	452	380	21	16	549	544	26	-3	2392	2582	0	18	573	832
16	13	614	779	22	-3	1665	1787	26	-2	1052	1139	7	-3	346	121
17	-3	808	716	22	-2	1090	1048	26	-1	860	594	8	-4	670	681
17	-2	551	731	22	-1	830	718	26	0	610	622	8	-3	675	670
17	1	363	460	22	0	724	794	26	1	369	394	8	-1	486	378
17	2	1069	1087	22	1	948	921	26	3	430	580	8	0	432	317
17	3	838	915	22	2	525	615	26	4	1433	1464	9	-3	856	931
17	4	910	959	22	4	1679	1953	26	5	833	694	9	3	375	341
17	5	1220	1196	22	6	3406	3525	26	6	1336	1424	10	-4	1755	1831
17	7	612	641	22	7	795	628	26	7	1029	1004	10	-2	571	532
17	10	538	677	22	8	1642	1723	26	9	790	710	10	2	456	359
17	12	884	919	22	9	577	410	26	11	1075	1082	10	3	858	914
17	14	468	603	22	11	768	722	26	12	613	632	10	5	693	762
18	-2	522	521	22	13	1119	1074	26	13	816	768	10	6	371	423
18	1	376	375	22	14	676	662	26	15	548	492	11	-4	616	658
18	2	1127	1360	22	15	1107	1204	26	17	547	542	11	-3	1203	1316
18	3	682	791	22	16	638	718	27	-3	1197	1300	11	-2	664	608
18	4	2365	2833	22	17	574	613	27	-2	3080	3223	11	-1	486	532
18	6	2216	2667	23	-2	446	389	27	-1	334	331	11	0	447	269
18	7	517	667	23	-1	2144	2393	27	0	2020	1661	11	1	843	817
18	8	817	850	23	0	652	399	27	2	1113	1029	11	2	404	435
19	-3	489	658	23	3	774	981	27	3	2281	2434	11	3	916	1068
19	-2	1572	1722	23	4	948	1029	27	4	2541	2755	11	4	789	865
19	-1	990	1095	23	5	519	523	27	5	4096	4395	11	6	404	424
19	0	895	986	23	7	512	495	27	6	1528	1456	12	-4	1289	1296
19	3	1366	1539	23	8	700	632	27	7	1901	2057	12	-2	697	760

K	L	FOBS	FCAL
H = 4**			
12	-1	550	545
12	1	1001	1030
12	3	1225	1380
12	5	1326	1482
12	7	699	802
12	8	391	378
12	9	410	406
13	-4	459	361
13	-3	1044	1052
13	-2	426	424
13	3	526	613
13	4	830	855
13	5	580	478
13	6	753	787
13	8	886	882
13	10	448	565
13	11	462	500
14	-4	1099	1115
14	-3	469	627
14	-1	444	388
14	3	685	917
14	5	1116	1236
14	6	455	400
14	7	970	1043
14	8	649	747
14	12	629	712
15	0	504	392
15	2	400	437
15	4	836	959
15	6	1157	1256
15	9	451	430
15	10	458	454
15	12	511	489
16	-4	1040	1069
16	-3	992	949
16	0	478	543
16	2	400	131
16	3	944	895
16	5	884	1013
17	-3	1016	1031
17	1	438	467
17	2	526	634
17	3	649	788
17	4	1647	1777
17	6	526	411
17	8	669	616
17	11	446	536
18	-4	2890	3320
18	-3	1120	1277
18	-2	1820	2005
18	-1	811	973
18	0	537	737
18	1	515	538
18	3	1404	1556
18	4	693	785
18	5	943	972
18	6	612	782
18	7	532	721
18	9	688	788
18	12	838	960
18	14	658	735
19	-4	1313	1244
19	-3	1771	1925
19	-2	921	952
19	-1	1038	1194
19	0	741	795
19	1	1279	1287
19	2	628	553
19	3	595	674
19	4	1381	1616
19	6	1536	1963
19	8	792	919
19	9	1105	1278
19	11	1635	1765
19	13	1018	1150
20	-4	935	1153
20	-1	1207	1164
20	0	782	836
20	1	2225	2356
20	2	816	855
20	3	3428	3901
20	5	3681	4262
20	7	1964	2434
20	8	728	644
20	10	654	690
20	11	630	434
20	12	788	640
20	13	868	997
20	15	614	892
21	-4	1483	1400
21	-3	3421	3560
21	-2	1255	1171
21	-1	1774	1616
21	0	753	752
21	3	476	514
21	5	600	658
21	6	1361	1621
21	7	571	571
21	8	1338	1576
21	11	837	953
21	13	715	863
22	-4	1863	1778
22	-3	608	611
22	-2	1528	1478
22	-1	1247	1227
22	0	1827	1883
22	1	740	732
22	2	1662	1839
22	3	1649	1965
22	4	975	1133
22	5	1939	2371
22	7	859	975
22	9	544	426
22	11	732	732
22	12	1035	1144
22	14	1041	1169
22	16	504	703
23	-4	1588	1447
23	-3	398	482
23	-1	572	685
23	0	793	1097
23	1	1525	1590
23	2	574	358
23	3	1148	1262
23	4	935	1095
23	7	1359	1376
23	8	480	451
23	9	737	592
23	11	612	677
23	13	568	552
24	-4	992	1059
24	-3	850	686
24	-2	3065	3262
24	2	743	829
24	4	845	805
24	5	666	472
24	10	593	768
24	12	784	715
24	13	530	484
24	14	816	793
25	-4	1586	1555
25	-3	589	589
25	-2	330	294
25	-1	858	800
25	1	1036	878
25	3	802	845
25	5	884	913
25	6	1095	1009
25	8	498	499
25	15	529	511
26	-4	549	675
26	-2	341	368
26	-1	2223	2239
26	0	317	312
26	1	1939	2221
26	2	721	643
26	3	1349	1467
26	4	937	1055
26	5	1239	1107
26	7	791	1158
26	14	573	587
27	-4	1106	1343
27	-3	1338	1263
27	-1	1700	1674
27	0	947	555
27	1	2208	2168
27	2	1808	2033
27	4	6095	6555
27	6	2922	2967
27	9	641	665
27	11	872	779
27	12	888	876
27	13	591	500
27	14	593	577
27	15	572	618
27	16	450	517
28	-4	771	650
28	-3	1034	782
28	-1	1623	1732
28	0	1326	1204
28	1	943	968
28	2	2675	2844
28	4	688	831
28	6	466	443
28	7	680	764
28	9	1233	1513
28	10	1285	1313
28	11	544	650
28	12	1220	1060
28	16	696	720
H = 5**			
0	-4	1143	1194
0	-2	1047	809
0	0	2316	2134
0	2	7171	7236
0	4	10109	9656
0	6	4297	4461
0	10	733	742
0	12	1391	1509
0	14	1268	1532
7	-4	952	921
8	1	506	432
8	2	503	595
9	-5	443	385
9	-4	482	546
9	-3	667	705
9	-2	479	476
9	1	623	676
9	2	367	231
9	3	899	956
9	5	563	528
10	-5	949	966
10	-2	390	447
10	-1	516	476
10	0	923	989
10	1	635	723
10	2	1382	1555
10	4	1208	1329
10	5	361	269
11	-4	846	831
11	-3	724	711
11	-1	995	998
11	1	707	699
11	3	509	482
11	5	501	530
11	7	588	705
12	-5	1900	1977

Table 45. Continued

K	L	FOBS	FCAL
**H =	5****		
12	-4	1054	955
12	-3	882	916
12	2	607	541
12	4	671	724
12	5	702	741
12	6	415	513
13	-5	767	746
13	-4	1302	1300
13	-3	662	601
13	-2	738	750
13	0	410	381
13	2	647	697
13	3	782	784
13	5	653	743
14	-5	1571	1593
14	-4	936	942
14	-3	1470	1470
14	-2	621	608
14	-1	667	689
14	2	636	632
14	4	703	712
14	5	482	330
14	6	713	870
15	-5	617	666
15	-4	1323	1350
15	0	906	937
15	2	938	1011
15	5	533	530
15	6	496	536
15	7	743	933
15	12	541	529
16	-5	1168	1360
16	-4	787	850
16	-1	506	526
16	1	628	778
16	2	745	983
16	3	524	603
16	4	1213	1475
16	6	688	806
16	7	575	572
16	13	413	415
17	-5	1740	1453
17	-4	1133	1220
17	0	1186	1155
17	2	911	945
17	3	885	1016
17	5	709	767
17	10	725	891
17	12	718	916
18	-2	415	493
18	-1	376	255
18	0	770	775
18	1	435	460
18	2	1073	1379
18	4	1800	2164
18	5	833	1068
18	6	832	954
19	-5	432	356
19	-4	1258	1179
19	-3	521	497
19	-2	1310	1425
19	0	576	653
19	1	984	1192
19	2	536	593
19	3	1427	1627
19	7	1069	1372
19	9	727	872
19	12	702	758
19	14	545	739
20	-5	3976	4059
20	-4	962	815
20	-3	1815	1802
20	-2	820	877
20	-1	1583	1666
20	0	493	530
20	1	538	585
20	2	1117	1501
20	4	1866	2108
20	7	550	562
20	8	704	863
20	9	827	909
20	11	1264	1421
20	13	1273	1383
20	15	625	762
21	-5	1608	1769
21	-4	752	602
21	-3	1001	1051
21	-2	1065	1173
21	-1	390	509
21	0	1173	1261
21	2	549	1069
21	3	2118	2343
21	5	2146	2556
21	6	954	1092
21	7	486	513
21	10	847	847
22	-5	1785	1770
22	-4	611	668
22	-2	527	521
22	0	556	555
22	1	372	375
22	2	1113	1137
22	4	2487	2864
22	6	1354	1510
22	7	693	774
22	8	608	517
22	9	1213	1432
22	11	1081	1154
22	12	741	640
22	13	1010	1004
22	14	695	810
23	-5	730	731
23	-4	616	723
23	-2	831	887
23	-1	359	346
23	1	506	525
23	2	461	533
23	3	698	727
23	4	483	484
23	5	683	811
23	6	775	807
23	7	782	811
24	-5	759	678
24	-4	567	564
24	-2	584	645
24	0	1222	1292
24	1	655	701
24	2	429	510
24	3	600	704
24	4	2707	2803
24	6	637	770
24	9	497	411
25	-5	1179	1162
25	-4	1787	1910
25	-3	306	158
25	-2	1751	1843
25	-1	1195	1256
25	0	387	371
25	2	1128	1198
25	3	1326	1412
25	5	1492	1549
25	7	751	706
25	15	492	302
26	-5	1113	1367
26	-3	1361	1276
26	-2	1695	1652
26	-1	2437	2442
26	0	1305	1257
26	1	632	628
26	3	927	985
26	4	1031	1137
26	7	536	403
26	9	929	1133
26	11	914	905
27	-5	1026	958
27	-4	4406	4065
27	-3	3373	3277
27	-1	1689	1765
27	0	1825	1721
27	2	968	864
27	3	2325	2413
27	4	1092	1192
27	5	1790	1989
27	6	548	840
27	8	719	764
27	10	1240	1349
27	12	1143	995
27	14	676	674
28	-5	658	621
28	-4	1000	880
28	-3	822	602
28	-2	3128	2957
28	-1	1110	1000
28	0	908	651
28	1	3857	3626
28	2	2360	2230
28	3	2327	2522
28	4	1310	1443
28	6	2033	2453
28	8	1808	2003
28	9	991	989
28	11	1165	1204
28	14	463	515
**H =	6****		
0	-4	6563	6195
0	-2	1008	978
0	0	806	548
0	2	2278	2324
0	6	1251	1179
0	8	2097	2215
0	10	3040	3093
0	12	2114	1996
0	14	915	931
8	-6	553	573
8	-5	628	598
8	-3	699	721
8	-2	474	342
8	0	341	378
8	1	421	451
9	-5	844	848
9	-2	439	471
9	0	471	467
9	3	420	487
10	-6	1103	1162
10	-4	577	575
10	0	557	553
10	1	460	540
10	3	617	791
10	4	441	580
11	-5	759	842
11	1	495	515
11	2	777	775
12	-4	468	492
12	-1	736	768
12	0	756	908
12	1	1556	1746
12	3	1545	1652
12	4	478	137
12	5	531	532
12	7	408	339
13	-6	542	468
13	-5	744	838
13	-4	633	606
13	1	501	607
13	2	508	571
13	4	962	1046
13	5	412	512

Table 45. Continued

K	L	FOBS	FCAL
**H =		6****	
13	6	635	715
13	7	421	601
13	8	771	1005
14	-6	617	708
14	-5	705	770
14	-4	817	815
14	0	483	550
14	1	463	561
14	3	838	944
14	5	1045	1205
14	6	499	466
14	7	444	413
15	-6	1032	1066
15	-5	646	641
15	-4	656	706
15	2	1098	1288
15	4	1079	1176
16	-5	1164	1228
16	-3	579	563
16	3	985	963
16	4	433	443
17	-5	1335	1470
17	-2	393	409
17	-1	969	940
17	0	563	755
17	2	1233	1372
17	4	644	740
17	6	604	667
17	8	567	750
17	10	479	638
18	-6	3289	3424
18	-5	938	966
18	-4	1435	1481
18	-3	541	379
18	-1	583	543
18	0	1137	1106
18	1	486	533
18	3	866	827
18	4	526	526
18	7	503	584
18	12	437	526
19	-6	1299	1355
19	-5	2501	2567
19	-4	1069	1016
19	-2	1259	1403
19	-1	1556	1627
19	0	1389	1420
19	1	1714	2037
19	2	1204	1334
19	3	464	610
19	4	1079	1346
19	5	582	588
19	6	805	1056
19	7	703	769
19	9	1358	1570
19	11	840	1137
19	12	551	661
20	-6	2102	2058
20	-5	2406	2380
20	-3	1529	1462
20	-2	874	784
20	-1	2123	2186
20	0	783	862
20	1	2834	2994
20	3	4065	4623
20	5	1855	2300
20	7	746	973
20	8	822	953
20	10	731	926
21	-6	1319	1193
21	-5	1010	892
21	-4	1256	1286
21	-3	2404	2502
21	-2	497	519
21	-1	1138	1129
21	0	519	439
21	3	572	469
21	4	1251	1653
21	5	715	806
21	6	1908	2376
21	11	676	645
21	12	537	734
22	-6	3203	3151
22	-5	493	601
22	-4	1861	2012
22	-2	1216	1241
22	0	1085	1126
22	1	1205	1353
22	2	649	720
22	3	2583	2757
22	4	1251	1191
22	5	913	1155
22	7	625	734
22	10	564	526
22	12	941	988
22	14	574	731
23	-6	1555	1570
23	-5	855	876
23	-3	907	970
23	-2	507	561
23	-1	1191	1065
23	0	439	464
23	1	1045	1095
23	2	918	935
23	15	556	731
24	-6	3060	3231
24	-5	397	383
24	-4	1149	1136
24	-3	993	990
24	-2	505	557
24	-1	327	513
24	0	941	946
24	3	638	699
24	4	499	361
24	5	532	601
24	6	738	814
24	12	1009	1036
24	14	642	557
25	-6	1790	1726
25	-5	1525	1573
25	-4	805	718
25	-3	411	549
25	-2	321	265
25	0	1676	1821
25	1	945	1018
25	3	421	316
25	4	1253	1235
25	10	570	518
26	-6	617	523
26	-5	668	501
26	-4	934	1012
26	-3	2275	2210
26	-2	550	651
26	0	769	831
26	1	433	510
26	2	1146	1233
26	3	1528	1430
26	4	386	419
26	7	804	1130
27	-6	1311	1222
27	-5	820	767
27	-4	679	594
27	-3	2965	2890
27	-2	714	650
27	-1	2260	2204
27	0	401	376
27	1	1276	1288
27	2	3918	3986
27	3	826	1117
27	4	4030	4486
27	5	888	903
27	7	829	801
27	9	867	913
27	10	517	530
27	11	709	658
27	12	507	630
27	13	769	902
27	14	449	613
28	-6	928	882
28	-4	355	18
28	-3	1021	1174
28	-2	971	1047
28	0	1219	1094
28	1	1185	1187
28	2	1165	1483
28	3	708	842
28	4	671	753
28	5	888	1027
28	7	1548	1516
28	14	1145	1297
28	15	649	685
28	16	559	724
**H =		7****	
0	-6	1726	1749
0	-4	1920	1716
0	-2	1704	1512
0	0	1823	1998
0	2	8176	8340
0	4	4645	4942
0	6	960	1194
0	10	449	222
0	12	640	725
0	14	500	624
0	16	593	499
9	-6	497	656
9	-5	472	417
9	-4	531	395
9	-1	461	534
9	1	828	904
9	3	438	349
10	-7	596	604
10	-3	548	480
10	-2	716	808
10	-1	730	821
10	0	1385	1516
10	2	1231	1376
10	4	348	335
10	5	414	516
11	-6	676	759
11	-5	836	760
11	-3	1252	1160
11	-2	440	342
11	-1	992	1042
11	1	1173	1278
11	3	543	658
12	-7	1834	1777
12	-6	768	617
12	-5	1355	1366
12	-4	725	641
12	-2	490	518
12	2	406	305
12	3	450	334
13	-6	889	783
13	-5	1130	1106
13	-4	594	580
13	-3	457	416
13	-2	458	508
13	0	603	579
13	1	1029	1173
13	3	625	661
13	7	384	353
14	-7	895	718
14	-6	611	651
14	-5	627	526
14	-4	799	902
14	-1	1047	1100
14	0	554	595

K	L	FOBS	FCAL
**H =		7****	
14	1	1006	1006
14	2	564	578
14	7	380	224
14	9	576	680
15	-6	1694	1734
15	-4	561	624
15	0	478	609
15	1	450	359
15	2	574	548
16	-7	1127	1177
16	-5	475	599
16	-2	493	438
16	-1	880	956
16	0	461	391
16	2	639	727
16	4	675	770
17	-7	1017	1030
17	-6	1405	1540
17	-5	1426	1413
17	-2	616	557
17	0	661	719
17	1	481	652
17	3	581	643
17	10	779	942
17	12	424	591
18	-7	1094	1116
18	-6	1648	1464
18	-4	771	696
18	-2	579	667
18	0	2392	2518
18	2	2438	2681
18	3	664	697
18	4	675	806
19	-7	421	299
19	-6	933	911
19	-5	626	619
19	-2	481	479
19	-1	722	881
19	0	1156	1251
19	1	1933	2026
19	3	553	570
19	5	1180	1350
19	7	888	1121
19	9	706	769
19	10	503	761
19	12	481	578
20	-7	3642	3618
20	-6	912	953
20	-5	2012	2092
20	-4	1112	1159
20	0	1016	941
20	2	1654	1669
20	5	1016	1197
20	6	749	867
20	7	631	807
20	9	585	788
20	11	1214	1538
20	13	528	806
21	-7	922	806
21	-6	372	267
21	-5	1632	1632
21	-4	399	334
21	-3	1221	1307
21	-1	874	926
21	0	668	1079
21	1	1156	1211
21	3	1703	1783
21	5	1047	1158
21	14	784	997
22	-7	3135	3174
22	-6	564	575
22	-5	1661	1780
22	-4	1542	1585
22	-3	533	422
22	-1	676	807
22	0	1496	1678
22	1	829	995
22	2	2876	3073
22	3	436	555
22	4	1493	1669
22	5	695	633
22	6	523	731
22	7	561	586
22	8	580	601
22	9	952	1177
22	11	1282	1332
23	-7	2159	2106
23	-5	1083	1080
23	-4	331	343
23	-3	444	437
23	-2	746	719
23	0	394	257
23	2	1005	1039
23	3	1647	1941
23	4	789	989
23	5	1640	1702
24	-7	1150	1123
24	-6	752	632
24	-5	509	485
24	-4	1768	1725
24	-3	766	642
24	-1	744	681
24	1	958	1125
24	2	2686	2726
24	3	1013	1122
24	4	1584	1913
24	5	541	566
25	-7	2718	2436
25	-6	1759	1665
25	-5	1366	1322
25	-2	473	354
25	-1	852	732
25	0	1821	2008
25	1	1314	1321
25	2	966	934
25	3	1183	1265
26	-7	2568	2448
26	-6	810	819
26	-5	465	473
26	-4	838	941
26	-3	1150	956
26	-2	553	576
26	-1	2521	2690
26	0	370	205
26	1	1873	1969
26	2	447	437
26	3	715	1121
26	5	769	864
26	15	455	526
27	-7	599	710
27	-6	4807	4308
27	-5	2396	2274
27	-4	1559	1491
27	-3	443	310
27	-2	611	537
27	-1	415	495
27	0	1315	1466
27	1	948	966
27	2	812	780
27	3	1369	1308
27	4	535	771
27	8	948	973
27	10	1230	1231
27	12	877	962
28	-6	3672	3469
28	-5	649	591
28	-4	362	134
28	-3	832	758
28	-2	1406	1256
28	-1	339	284
28	0	1386	1312
28	1	1468	1515
28	2	485	228
28	3	415	351
28	4	1978	2076
28	5	413	277
28	6	2318	2667
28	8	1241	1302
28	10	587	730
28	13	563	745
28	14	481	508
28	15	529	549
**H =		8****	
0	-6	7710	7249
0	-4	2512	2526
0	-2	1662	1805
0	0	494	321
0	2	598	665
0	4	2043	2151
0	6	1749	1764
0	8	1507	1592
0	10	2850	2946
0	12	1886	1977
8	-7	575	528
8	-5	695	646
8	-2	507	606
9	-7	942	900
9	-5	405	443
9	-2	514	616
9	0	587	699
9	1	381	425
10	-8	772	754
10	-6	399	540
10	-1	463	470
10	0	389	316
10	1	435	580
11	-8	934	718
11	-2	416	388
11	0	873	880
11	2	374	410
11	3	492	463
11	4	509	625
11	5	443	271
12	-4	418	306
12	-2	636	780
12	-1	1216	1288
12	0	414	676
12	1	1598	1740
12	2	454	317
12	3	875	919
12	6	405	288
13	-6	523	548
13	-4	589	649
13	-2	977	932
13	0	1082	1146
13	2	726	809
13	4	526	643
13	5	551	543
13	6	442	470
13	8	383	424
14	-8	797	719
14	-7	820	726
14	-6	919	880
14	-5	465	333
14	-4	588	728
14	-3	462	478
14	1	641	707
14	2	633	650
14	3	872	902
14	5	496	641
14	9	423	590
15	-8	857	786
15	-6	1233	1323
15	0	1606	1755
15	1	444	145
15	2	1405	1584
15	4	489	629

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 8**				21	-2	491	533	26	-1	2106	2015	11	-3	1038	1105
16	-8	882	929	21	0	1086	1019	26	0	1114	1181	11	-1	933	1123
16	-7	1469	1451	21	2	449	533	26	1	1666	1641	11	1	702	923
16	-5	577	410	21	4	1859	2196	26	3	402	82	11	2	459	577
16	-1	576	804	21	6	689	1040	26	7	919	1157	11	3	445	590
16	1	774	849	21	8	667	864	26	9	838	973	12	-9	1115	1078
16	2	656	684	21	9	567	649	27	-8	385	295	12	-8	433	438
16	3	437	393	22	-8	3081	2769	27	-7	1048	911	12	-7	1151	1003
16	5	665	826	22	-7	1276	1303	27	-6	680	464	12	-5	590	499
17	-7	724	703	22	-6	1559	1440	27	-4	742	801	12	-1	405	484
17	-6	610	430	22	-5	957	1074	27	-3	625	628	13	-9	777	707
17	-3	914	842	22	-4	491	475	27	-2	2234	2392	13	-8	800	797
17	-2	601	765	22	-3	514	480	27	-1	2360	2433	13	-7	642	642
17	-1	1385	1573	22	-1	1416	1355	27	0	3523	3300	13	-5	756	778
17	0	1145	1297	22	1	2114	2141	27	2	3011	3195	13	-3	442	430
17	2	792	1026	22	2	815	985	27	3	806	940	13	-2	732	737
17	5	495	451	22	3	920	1083	27	4	850	998	13	-1	1303	1400
17	8	577	699	22	7	730	1053	27	5	786	968	13	1	733	899
18	-8	2786	2798	22	9	548	546	27	6	445	398	14	-9	1301	1326
18	-7	1275	1141	22	10	977	1172	27	7	505	546	14	-8	533	498
18	-6	1566	1549	22	12	630	898	27	8	502	230	14	-7	676	673
18	-5	574	567	23	-8	1183	1051	27	9	922	992	14	-6	738	612
18	-2	1055	1029	23	-7	639	554	27	11	803	900	14	-5	434	430
18	2	883	977	23	-6	694	688	28	-7	1845	1868	14	-2	721	814
18	6	609	652	23	-5	370	146	28	-6	876	644	14	0	633	848
18	8	684	879	23	-2	351	246	28	-5	1002	998	15	-8	947	1013
18	10	717	874	23	0	1131	1130	28	-3	856	1112	15	-6	1235	1170
19	-8	745	859	23	2	803	910	28	-2	642	911	15	8	485	616
19	-7	1514	1306	23	3	817	769	28	-1	1209	1122	16	-9	1415	1338
19	-5	500	557	23	13	755	776	28	0	316	283	16	-7	810	882
19	-3	1558	1562	24	-8	2455	2199	28	2	949	1052	16	-6	486	377
19	-2	1431	1548	24	-7	441	541	28	3	1858	1956	16	-5	658	772
19	-1	2408	2640	24	-6	1236	1174	28	5	1759	1971	16	-3	582	300
19	0	783	893	24	-2	1033	996	28	7	1131	1325	16	0	631	443
19	1	536	632	24	0	666	665	28	9	941	775	16	1	1011	1092
19	2	933	1076	24	1	453	639	28	12	1198	1598	16	2	502	335
19	4	800	873	24	2	628	645	28	13	560	674	16	7	691	774
19	9	787	938	24	3	446	479	28	14	979	1317	16	9	509	631
19	10	560	806	24	4	700	713	**H = 9****				17	-8	778	747
20	-8	2477	2395	24	6	883	904	0	-8	1291	1296	17	-7	1742	1758
20	-7	1666	1616	24	10	997	1052	0	-6	3780	3756	17	-5	775	858
20	-6	1385	1434	25	-7	1942	1746	0	-4	2641	2773	17	-4	613	639
20	-5	2343	2360	25	-6	353	131	0	-2	2638	2629	17	-2	853	983
20	-4	408	383	25	-5	673	561	0	0	5532	5284	17	-1	697	823
20	-3	2083	2216	25	-4	373	331	0	2	4771	5209	17	1	566	638
20	-2	420	415	25	-3	845	761	0	4	1853	2212	17	4	457	512
20	-1	4226	4394	25	-2	737	669	0	8	478	525	17	6	497	594
20	1	4146	4502	25	0	1611	1518	0	14	593	593	17	8	523	519
20	3	1469	1809	25	1	717	879	9	-1	784	813	18	-9	1696	1460
20	6	617	811	25	2	871	1009	10	-9	493	472	18	-8	502	456
20	8	874	938	25	3	1008	1133	10	-7	415	550	18	-7	677	519
20	10	510	675	25	6	748	952	10	-3	403	384	18	-6	450	636
21	-8	1997	1978	25	9	630	630	10	-2	795	894	18	-4	1258	1406
21	-7	1365	1374	26	-8	833	735	10	0	1031	1190	18	-2	2634	2726
21	-6	1721	1770	26	-7	993	873	11	-8	744	670	18	-1	561	706
21	-5	558	409	26	-5	942	883	11	-7	801	807	18	0	2752	3008
21	-4	443	282	26	-3	1790	1920	11	-5	1148	1179	18	1	870	1023

Table 45. Continued

K	L	FOBS	FCAL
H = 9**			
18	2	832	869
18	3	475	645
19	-8	657	586
19	-7	428	413
19	-6	422	467
19	-1	1973	2082
19	0	567	458
19	1	808	953
19	3	502	601
19	5	1075	1252
19	7	985	1147
19	10	439	731
20	-9	3178	2898
20	-7	1446	1556
20	-3	563	566
20	-2	1021	1082
20	-1	479	458
20	0	680	693
20	3	958	989
20	4	654	646
20	5	1383	1584
20	7	1117	1363
20	9	1313	1827
21	-9	856	930
21	-8	552	508
21	-7	401	237
21	-6	1307	1305
21	-4	1030	1205
21	-3	1123	1211
21	-2	511	670
21	-1	2023	2076
21	0	1014	1127
21	1	1643	1818
21	3	1380	1521
21	5	669	723
21	8	856	736
21	12	720	989
22	-9	2777	2538
22	-7	1885	1809
22	-6	1584	1647
22	-5	900	932
22	-4	1517	1616
22	-3	561	711
22	-2	1800	1687
22	0	2954	3170
22	1	626	482
22	2	1872	2057
22	3	858	916
22	4	965	996
22	5	641	758
22	7	773	774
22	8	608	301
22	9	1463	1782
23	-9	1712	1518
23	-8	1113	1014
23	-7	1568	1487
23	-6	436	481
23	-5	1268	904
23	-3	952	1008
23	-1	1063	1031
23	0	624	601
23	2	545	540
23	3	1160	1324
23	4	497	693
23	5	696	889
23	7	830	1042
23	17	721	589
24	-9	1352	1188
24	-8	703	556
24	-7	462	416
24	-6	1431	1391
24	-4	1854	2021
24	-3	368	438
24	-2	1225	1170
24	-1	439	360
24	0	1695	1816
24	1	835	853
24	2	1402	1491
24	4	689	738
24	17	1113	973
24	18	522	365
25	-9	2233	2058
25	-8	1335	1296
25	-7	1897	1906
25	-6	1383	1425
25	-4	395	380
25	-3	847	844
25	-2	495	448
25	-1	1513	1587
25	2	900	884
25	3	514	453
25	7	642	646
25	8	714	902
25	18	373	359
26	-9	1043	698
26	-6	394	320
26	-5	1018	858
26	-4	492	477
26	-3	2266	2240
26	-1	593	516
26	0	488	604
26	3	465	467
27	-9	764	662
27	-8	5501	5011
27	-7	1685	1534
27	-6	2647	2646
27	-5	2056	2022
27	-4	1124	1095
27	-2	487	468
27	-1	2730	2871
27	0	1614	1673
27	1	368	486
27	4	400	438
27	5	863	935
27	6	806	928
27	7	549	678
27	8	1801	2044
27	10	1216	1430
27	13	467	344
28	-9	600	493
28	-8	1941	2026
28	-7	398	279
28	-6	1917	1744
28	-5	1190	1233
28	-3	975	1102
28	-2	2495	1990
28	-1	399	385
28	0	1266	1148
28	2	795	679
28	3	835	869
28	4	1157	1405
28	6	1507	1794
28	7	720	792
28	8	941	1052
28	13	625	771
28	17	1305	963
H = 10**			
0	-8	5057	4686
0	-6	3241	3136
0	-5	496	0
0	-4	548	548
0	-2	715	687
0	0	571	685
0	2	1552	1448
0	4	1775	2155
0	6	1888	1922
0	8	2893	2867
0	10	2336	2599
9	-7	617	596
9	-4	591	529
10	-10	630	612
11	-10	783	721
11	-8	526	504
11	-3	554	683
11	-2	816	991
11	0	508	674
11	1	534	520
11	3	622	704
12	-10	443	428
12	-7	461	472
12	-6	558	604
12	-5	533	502
12	-3	805	775
12	-1	1163	1307
12	1	1040	1073
12	3	383	259
13	-9	831	901
13	-8	613	609
13	-6	754	685
13	-4	818	781
13	-2	680	753
13	0	855	875
13	2	550	595
13	3	417	388
14	-10	1034	896
14	-9	574	597
14	-8	935	840
14	-6	619	621
14	-3	665	652
14	-2	537	474
14	-1	1146	1130
14	0	690	786
14	1	690	738
14	5	401	368
15	-10	659	507
15	-8	1254	1134
15	-6	607	592
15	-5	517	555
15	-2	872	899
15	0	1373	1564
15	2	955	1063
15	3	449	289
16	-10	479	353
16	-9	1284	1235
16	-8	594	609
16	-7	1024	1049
16	-3	766	790
16	-1	598	848
16	5	683	763
17	-9	576	475
17	-7	763	820
17	-3	504	536
17	-2	1316	1437
17	-1	611	636
17	0	518	691
18	-10	2574	2369
18	-9	925	940
18	-8	2153	2055
18	-7	648	679
18	-6	1029	1023
18	-3	706	815
18	-1	548	392
18	0	727	822
18	6	1116	1447
18	8	1103	1373
19	-10	1540	1478
19	-9	843	876
19	-6	420	201
19	-5	883	897
19	-3	1489	1564
19	-2	741	792
19	0	793	976
19	1	451	451
19	2	995	1210
19	3	672	720
19	4	525	551
19	5	726	882

K	L	FOBS	FCAL
H = 10**			
19	7	707	922
20	-10	1298	1323
20	-9	841	899
20	-8	1381	1506
20	-7	1857	1947
20	-5	1945	2032
20	-3	3233	3356
20	-1	2505	2960
20	0	1011	1123
20	1	2073	2405
20	6	845	981
20	8	457	601
20	9	537	697
20	16	371	130
21	-10	1588	1576
21	-9	2028	1838
21	-8	1733	1726
21	-7	483	458
21	-6	961	914
21	-5	773	876
21	-4	850	703
21	-3	1110	1229
21	-2	790	718
21	2	589	729
21	4	824	971
21	6	714	923
21	9	580	845
21	17	480	470
22	-10	2292	2134
22	-9	1197	1102
22	-8	1745	1664
22	-7	1254	1287
22	-6	1491	1498
22	-5	581	606
22	-4	951	910
22	-3	1741	1618
22	-2	683	690
22	-1	1731	1869
22	1	433	507
22	2	541	531
22	4	681	718
22	5	832	868
22	8	1231	1492
22	10	766	1019
22	17	690	567
23	-10	518	490
23	-8	799	753
23	-7	378	313
23	-6	795	739
23	-2	1011	1000
23	-1	524	661
23	0	800	859
23	1	420	548
23	5	554	560
23	7	697	774
23	10	537	643

K	L	FOBS	FCAL
23	11	533	755
23	16	758	666
23	17	760	624
24	-10	1737	1495
24	-9	1400	1275
24	-8	1884	1740
24	-7	459	300
24	-6	989	879
24	-5	510	428
24	-2	1096	993
24	1	526	438
24	2	1392	1501
24	6	611	648
24	7	576	719
24	8	1178	1207
24	10	689	703
24	16	445	306
24	19	1233	920
25	-10	1215	1050
25	-9	1756	1628
25	-8	653	618
25	-7	1035	1094
25	-6	438	237
25	-2	1149	1178
25	-1	1416	1485
25	0	793	1035
25	1	1510	1641
25	4	649	664
25	6	720	841
25	7	657	809
25	9	602	705
25	16	540	336
25	18	561	476
25	19	384	340
26	-7	738	730
26	-5	665	607
26	-3	828	813
26	-2	392	322
26	0	713	770
26	2	520	606
26	5	495	299
26	10	480	251
26	16	1281	1046
26	17	412	314
26	18	626	493
27	-10	387	331
27	-9	1201	1168
27	-8	370	304
27	-7	920	899
27	-6	1108	1098
27	-4	3080	2938
27	-3	1287	1300
27	-2	4495	4645
27	-1	473	443
27	0	2331	2331
27	1	580	592
27	2	731	543

K	L	FOBS	FCAL
27	3	486	499
27	5	610	757
27	7	1055	1225
27	8	662	780
27	9	743	953
27	19	402	287
28	-10	357	297
28	-9	1635	1599
28	-8	920	1068
28	-7	2262	2168
28	-6	1294	1313
28	-4	1106	1245
28	-3	1624	1520
28	-2	570	318
28	0	1320	1554
28	3	951	1109
28	4	722	699
28	5	1638	1774
28	6	861	677
28	7	604	778
28	10	928	1266
28	12	1135	1499
28	19	408	323
H = 11**			
0	-10	1313	1176
0	-8	2568	2442
0	-6	1940	2023
0	-4	3792	3908
0	-2	4830	4725
0	0	3957	4131
0	2	1233	1326
0	8	582	570
0	12	454	475
10	-4	679	769
10	-2	911	1007
11	-10	691	789
11	-9	475	447
11	-8	698	715
11	-7	890	911
11	-5	735	766
12	-11	1173	1060
12	-10	1018	960
12	-6	510	547
12	-3	411	452
12	-2	433	346
13	-8	451	481
13	-4	571	636
13	-3	698	741
13	-1	816	924
13	0	437	520
13	4	378	369
14	-11	1319	1101
14	-10	453	488
14	-2	676	765
14	0	656	768
15	-10	861	948
15	-6	718	545

K	L	FOBS	FCAL
15	-2	568	491
15	0	691	818
15	1	404	268
15	2	584	557
15	6	594	746
16	-11	661	669
16	-9	880	858
16	-7	540	675
16	-4	585	508
16	-3	482	509
16	-2	956	914
16	-1	1030	1101
16	1	695	621
16	5	629	712
16	7	551	642
17	-11	756	642
17	-10	1131	957
17	-9	754	688
17	-6	649	676
17	-4	1018	979
17	-1	520	587
17	3	503	612
17	4	699	946
17	6	467	801
17	7	474	436
17	16	992	880
18	-9	710	813
18	-6	1278	1319
18	-4	1103	1217
18	-2	1905	2182
18	-1	898	1056
18	0	1403	1588
18	1	554	680
18	6	457	439
18	16	478	366
19	-9	491	334
19	-4	561	632
19	-3	983	960
19	-2	509	590
19	-1	784	794
19	3	902	917
19	5	779	855
19	8	477	724
19	16	551	453
20	-11	3002	2683
20	-10	475	287
20	-9	2394	2227
20	-8	465	381
20	-7	966	1053
20	-6	464	356
20	-4	1270	1307
20	-2	1125	1341
20	-1	710	834
20	1	985	1016
20	2	793	871
20	3	1255	1323
20	5	1418	1760

Table 45. Continued

K	L	FOBS	FCAL
H = 11**			
20	7	1252	1780
20	9	794	1242
21	-11	1565	1435
21	-10	447	533
21	-9	1044	986
21	-8	1310	1276
21	-7	549	524
21	-6	571	532
21	-5	394	196
21	-4	811	851
21	-3	1926	1927
21	-2	942	997
21	-1	1677	1850
21	0	681	612
21	1	930	1028
21	3	476	481
21	4	693	781
21	6	818	750
21	8	519	390
21	10	837	1101
21	15	986	742
21	16	1053	879
21	18	493	377
22	-11	1374	1198
22	-10	478	359
22	-9	1296	1241
22	-8	625	621
22	-6	1128	1062
22	-5	537	561
22	-4	1877	1710
22	-3	385	238
22	-2	1810	1825
22	0	1905	2073
22	1	724	875
22	2	850	812
22	3	924	998
22	5	663	706
22	6	698	758
22	7	1053	1222
22	9	496	776
22	17	668	568
22	18	653	448
22	19	1089	930
23	-10	1606	1531
23	-9	1249	1095
23	-8	1373	1252
23	-7	891	885
23	-3	450	529
23	0	866	813
23	3	456	538
23	15	875	721
23	16	578	526
23	17	967	771
23	18	697	511
23	19	612	506
24	-11	1252	1082
24	-10	1039	872
24	-9	596	429
24	-6	545	484
24	-5	1546	1407
24	-4	1568	1534
24	-3	1248	1185
24	-2	1484	1521
24	0	1296	1316
24	2	571	564
24	15	1374	1171
24	16	731	630
24	17	579	502
25	-11	1711	1655
25	-10	883	910
25	-9	2327	2141
25	-8	1018	974
25	-7	966	834
25	-5	765	674
25	-4	500	475
25	-3	1274	1376
25	-1	619	728
25	6	640	680
25	7	508	617
25	8	503	558
25	15	395	317
25	18	548	364
25	19	893	649
26	-10	1197	1018
26	-9	1690	1653
26	-8	689	636
26	-7	471	467
26	-3	445	523
26	0	439	436
26	1	578	928
26	3	625	703
26	5	751	842
26	6	461	678
26	11	539	694
26	17	390	408
26	18	722	501
26	19	382	235
26	20	880	716
27	-11	2240	2129
27	-10	3594	3443
27	-9	1336	1320
27	-8	2258	2293
27	-7	692	627
27	-6	433	253
27	-5	510	549
27	-3	808	983
27	-2	1936	2074
27	-1	1580	1824
27	1	451	431
27	2	1239	1135
27	3	883	872
27	4	1013	1072
27	5	658	780
27	6	1517	1784
27	8	1277	1687
27	15	381	207
27	16	470	264
27	17	704	547
27	18	767	590
28	-10	1441	1454
28	-9	725	656
28	-8	2200	2144
28	-6	632	765
28	-5	1623	1681
28	-3	416	292
28	-1	528	471
28	2	530	551
28	3	732	737
28	4	732	705
28	5	752	775
28	11	569	959
28	15	1967	1449
28	17	864	663
H = 12**			
0	-10	2408	2205
0	-8	1757	1675
0	-4	341	101
0	-2	758	689
0	2	2266	2308
0	4	2216	2341
0	6	1841	2224
0	8	1717	2124
10	-6	778	724
11	-12	462	287
11	-11	511	511
11	-10	724	708
11	-8	438	398
11	-5	531	515
11	-4	610	678
11	-2	411	399
12	-9	701	638
12	-7	591	570
12	-5	890	898
12	-3	1023	1225
12	-1	814	855
13	-11	862	813
13	-10	664	557
13	-9	682	737
13	-8	733	713
13	-2	607	641
13	0	655	869
13	2	466	550
14	-12	930	901
14	-11	1169	1111
14	-10	915	763
14	-9	1000	960
14	-8	445	383
14	-5	506	572
14	-3	878	859
14	-2	512	534
14	-1	474	462
14	0	514	653
15	-12	762	804
15	-10	639	585
15	-7	515	558
15	-5	643	565
15	-4	598	528
15	-2	1296	1379
15	0	731	878
15	15	623	542
16	-11	912	895
16	-9	1224	1013
16	-7	513	453
16	-5	535	538
16	-3	639	748
16	-1	520	479
16	4	401	329
16	16	426	291
17	-9	605	607
17	-4	643	768
17	-3	1044	1040
17	-2	495	580
17	-1	577	681
18	-12	2189	1834
18	-11	619	601
18	-10	1346	1398
18	-9	793	758
18	-8	899	973
18	-5	1122	1158
18	-3	1272	1243
18	2	673	788
18	4	867	1086
18	6	914	1135
19	-12	815	665
19	-11	1264	1139
19	-10	1537	1391
19	-9	821	693
19	-8	503	504
19	-7	859	805
19	-5	1175	1222
19	-4	605	607
19	-2	506	475
19	1	575	655
19	3	939	1197
19	5	781	984
19	15	1738	1345
19	17	972	676
19	18	570	388
20	-12	1044	991
20	-11	697	657
20	-10	566	454
20	-9	1038	1086
20	-8	630	600
20	-7	1262	1284
20	-6	502	622
20	-5	1396	1488
20	-4	423	233

K	L	FOBS	FCAL
H = 12**			
20	-3	2139	2273
20	-2	648	621
20	-1	2081	2277
20	0	572	698
20	1	754	938
20	2	555	452
20	5	449	475
20	7	521	578
20	18	618	473
21	-12	836	737
21	-11	1034	719
21	-10	1983	1801
21	-9	1278	1179
21	-8	629	459
21	-3	499	654
21	5	613	775
21	7	918	1168
21	15	700	550
21	16	477	441
21	17	553	312
21	18	487	355
22	-12	2468	2091
22	-10	1412	1255
22	-9	480	425
22	-8	794	788
22	-6	1489	1491
22	-5	1237	1279
22	-4	844	976
22	-3	2056	2308
22	-1	812	766
22	0	728	911
22	2	1222	1231
22	3	756	756
22	4	710	711
22	6	886	1106
22	8	1018	1338
22	14	736	615
22	19	814	656
23	-12	474	385
23	-10	988	816
23	-9	471	469
23	-8	680	533
23	-7	416	391
23	-6	389	336
23	-5	712	754
23	-4	445	541
23	-2	784	856
23	-1	921	891
23	3	654	566
23	5	621	591
23	8	493	681
23	9	523	657
23	14	725	701
23	15	689	689
23	16	711	607
23	18	573	444
24	-12	1598	1401
24	-11	1535	1463
24	-10	1647	1538
24	-9	997	934
24	-8	848	816
24	0	903	1013
24	2	1129	1075
24	5	463	445
24	6	1215	1330
24	7	572	753
24	8	855	1090
24	15	539	355
24	19	1585	1226
24	20	424	312
25	-12	737	718
25	-11	1308	1186
25	-10	686	576
25	-9	1259	1132
25	-8	589	580
25	-7	697	588
25	-3	1516	1522
25	-2	1245	1291
25	-1	1378	1622
25	1	705	841
25	2	541	624
25	5	481	622
25	7	601	558
25	16	666	571
25	17	1183	972
25	18	702	567
25	19	564	493
26	-12	404	445
26	-11	840	806
26	-10	451	430
26	-9	1386	1153
26	-7	1058	982
26	-6	432	351
26	-5	1145	949
26	-4	449	453
26	-3	711	765
26	-2	615	581
26	-1	386	225
26	0	827	896
26	1	473	548
26	2	911	1019
26	14	2815	2221
26	15	507	240
26	16	1438	1234
26	19	525	291
26	20	612	546
27	-11	578	445
27	-9	550	626
27	-8	525	536
27	-6	1967	1926
27	-5	997	1056
27	-4	3639	3897
27	-3	1316	1579
27	-2	3395	3673
27	0	1385	1437
27	1	814	836
27	2	518	497
27	4	577	628
27	6	933	1056
27	7	560	616
27	14	623	474
27	16	602	396
27	17	736	646
27	18	1183	928
27	19	658	505
27	20	1267	950
28	-12	1231	1018
28	-11	468	381
28	-10	1751	1735
28	-9	642	715
28	-8	994	1032
28	-7	801	840
28	-6	1432	1316
28	-5	653	632
28	-4	1408	1354
28	-3	551	546
28	-2	1291	1351
28	-1	469	408
28	0	979	1111
28	2	761	767
28	3	673	800
28	4	1273	1366
28	5	840	920
28	7	621	545
28	8	614	721
28	10	828	1122
28	17	869	729
28	19	858	653
H = 13**			
0	-12	1130	996
0	-10	1083	1016
0	-8	1396	1460
0	-6	1082	1144
0	-4	4448	4843
0	-2	4057	4267
0	0	1413	1518
0	2	463	335
0	6	451	526
11	-9	545	605
11	-7	542	591
12	-13	899	736
12	-12	826	829
12	-11	596	550
12	-10	760	731
12	-5	389	502
13	-8	571	551
13	-6	582	602
13	-5	490	533
13	-3	573	573
13	-2	407	386
13	0	532	506
14	-13	616	438
14	-12	641	442
14	-11	460	310
14	-8	453	204
14	-7	549	688
14	-4	504	568
14	-3	493	560
14	-2	543	514
14	-1	709	771
14	0	577	723
14	14	561	524
15	-12	788	641
15	-2	642	654
15	0	641	766
15	3	497	518
15	13	531	342
15	14	620	516
16	-11	995	1057
16	-6	475	483
16	-4	815	708
16	-3	1185	1179
16	-1	625	722
16	5	437	547
16	14	1026	920
16	16	514	316
17	-13	793	747
17	-12	764	748
17	-11	508	451
17	-9	598	608
17	-7	1005	878
17	-6	866	905
17	-3	582	594
17	0	487	543
17	4	680	891
17	14	1482	1192
17	16	561	446
17	17	626	451
18	-9	628	458
18	-8	755	784
18	-6	1218	1200
18	-4	1782	1857
18	-3	620	706
18	-2	1264	1343
18	4	451	483
18	6	505	679
18	13	608	394
18	17	743	573
19	-11	559	464
19	-5	514	503
19	-3	469	306
19	1	753	820
19	3	681	741
19	4	676	834
19	13	648	618
19	14	965	795
20	-13	2284	1825

K	L	FOBS	FCAL
H = 13**			
20	-12	473	382
20	-11	766	573
20	-10	541	548
20	-9	516	518
20	-8	736	662
20	-6	800	874
20	-4	1831	1892
20	-2	771	975
20	-1	825	937
20	0	536	522
20	1	986	1087
20	2	531	622
20	3	854	1121
20	5	1043	1416
20	7	848	1027
20	17	435	472
20	18	543	447
20	19	436	457
21	-13	1399	1195
21	-12	465	348
21	-11	2354	2085
21	-10	1341	1267
21	-9	1400	1305
21	-6	1407	1489
21	-5	588	660
21	-3	1014	1070
21	-2	1171	1250
21	-1	554	530
21	13	1203	1107
21	14	1553	1276
21	15	627	514
21	16	1120	938
21	17	572	556
21	19	793	606
22	-13	1555	1358
22	-11	905	951
22	-8	710	745
22	-7	776	801
22	-6	1623	1670
22	-5	1390	1481
22	-4	1753	1882
22	-2	1403	1463
22	-1	464	274
22	0	581	745
22	1	617	691
22	2	533	479
22	3	619	749
22	5	631	820
22	13	491	363
22	17	986	817
22	18	778	599
22	20	768	627
23	-13	1149	1117
23	-12	873	705
23	-11	1500	1290
23	-10	1176	1030
23	-9	528	348
23	-8	714	643
23	-7	1283	1206
23	-5	621	566
23	-4	504	544
23	-2	1087	1130
23	0	623	539
23	1	480	459
23	4	468	432
23	5	440	255
23	9	465	241
23	14	981	881
23	16	766	563
23	19	590	414
23	20	586	527
24	-13	1023	840
24	-12	566	506
24	-11	875	815
24	-9	1013	919
24	-8	733	771
24	-7	1026	1061
24	-5	1011	1123
24	-4	1665	1609
24	-3	789	948
24	-2	1480	1527
24	0	667	816
24	13	1663	1339
24	14	519	489
24	15	1063	881
24	16	631	493
24	17	698	488
24	19	406	272
25	-13	1686	1520
25	-12	537	540
25	-11	1969	1926
25	-10	450	461
25	-9	1180	1192
25	-7	558	529
25	-6	949	976
25	-5	963	1111
25	-4	762	676
25	-3	1460	1498
25	4	610	556
25	5	609	810
25	13	1005	858
25	15	1366	1126
25	16	527	415
25	17	447	465
25	19	711	628
26	-13	611	471
26	-11	479	377
26	-10	1028	963
26	-9	1159	1008
26	-8	359	400
26	-7	812	875
26	-5	1440	1511
26	-3	693	687
26	-2	430	404
26	1	520	707
26	5	530	486
26	6	650	679
26	8	513	771
26	14	657	564
26	15	448	544
26	17	953	651
26	18	815	633
26	19	889	690
26	20	884	577
27	-13	1156	1021
27	-12	1990	1803
27	-11	1326	1255
27	-10	1386	1303
27	-8	1003	1017
27	-7	387	353
27	-6	394	394
27	-3	1237	1215
27	-2	805	904
27	-1	584	699
27	0	904	851
27	2	701	754
27	4	1141	1323
27	6	1334	1382
27	8	535	675
27	13	526	683
27	16	600	460
27	18	725	496
27	20	415	272
28	-12	1456	1386
28	-11	495	380
28	-10	1806	1688
28	-9	1101	1062
28	-8	1063	930
28	-7	940	980
28	-6	679	556
28	-5	831	719
28	-1	401	405
28	0	644	702
28	1	436	606
28	3	686	699
28	4	623	459
28	7	543	524
28	9	500	643
28	13	3068	2456
28	15	1875	1571
28	17	886	679
28	19	1086	870
28	21	1159	908
H = 14**			
0	-12	1638	1229
0	-10	1214	1133
0	-8	388	250
0	-6	2478	2528
0	-4	442	165
0	0	793	813
0	2	768	1023
0	4	1588	1960
0	6	1635	2028
12	-11	437	454
12	-9	423	446
12	-7	732	831
12	-5	928	1004
12	-3	442	538
12	12	764	606
13	-12	503	456
13	-10	766	734
13	-8	676	634
13	-6	478	481
13	-1	427	526
13	13	842	632
14	-14	882	735
14	-13	1000	800
14	-12	962	806
14	-11	793	723
14	-10	569	512
14	-9	780	640
14	-5	639	609
14	-4	628	579
14	-3	511	606
14	-2	422	471
14	12	671	587
14	13	610	449
14	15	579	487
15	-14	1116	906
15	-12	795	742
15	-7	612	586
15	-6	724	771
15	-4	1153	1186
15	-2	456	588
15	13	606	567
16	-14	953	681
16	-13	1156	1055
16	-11	794	752
16	-8	595	603
16	-7	450	517
16	-5	837	895
16	12	1066	858
16	13	753	649
16	16	647	525
17	-14	445	182
17	-7	553	719
17	-6	521	568
17	-4	633	614
17	-3	518	558
17	2	625	661
17	4	419	413
17	14	448	229
17	17	451	385
17	18	587	544
18	-14	986	1010
18	-13	670	603
18	-12	725	698

K	L	FOBS	FCAL
H = 14**			
18	-11	570	636
18	-8	794	664
18	-5	636	692
18	-4	630	676
18	0	498	694
18	2	519	666
18	4	687	936
18	13	760	677
18	14	571	451
18	17	438	393
18	18	488	391
19	-13	816	637
19	-12	884	895
19	-11	558	597
19	-10	1155	1083
19	-9	553	426
19	-8	919	866
19	-7	1559	1513
19	-6	603	664
19	-3	471	447
19	3	656	808
19	13	1135	944
19	14	428	400
19	15	728	577
19	16	450	347
19	17	628	580
19	18	1050	810
19	19	731	424
20	-14	1130	1005
20	-13	949	718
20	-12	899	748
20	-11	1088	876
20	-10	552	464
20	-9	1227	1063
20	-8	444	319
20	-7	2034	1989
20	-5	2263	2174
20	-3	1247	1215
20	2	428	552
20	16	917	715
20	18	972	739
21	-14	1201	976
21	-12	1559	1218
21	-11	475	410
21	-9	758	672
21	-6	633	406
21	1	567	709
21	2	551	683
21	3	958	1112
21	5	585	800
21	13	932	784
21	19	847	609
21	20	466	358
22	-14	1625	1359
22	-13	838	693
22	-12	442	218
22	-9	598	519
22	-6	941	972
22	-5	1832	1861
22	-4	936	819
22	-3	1336	1443
22	-2	528	681
22	0	578	671
22	2	502	625
22	3	502	612
22	4	758	904
22	6	801	1027
22	12	874	686
22	13	544	492
22	14	801	769
22	15	438	228
22	17	456	369
23	-11	502	391
23	-7	1513	1574
23	-6	648	648
23	-5	506	505
23	-4	1043	1087
23	-3	1105	1134
23	-2	441	330
23	-1	621	696
23	6	561	532
23	12	987	814
23	13	1153	991
23	14	1087	861
23	18	569	459
23	19	440	236
24	-14	938	813
24	-11	494	481
24	-9	424	360
24	-8	1035	982
24	-6	1075	985
24	-5	648	750
24	-2	1050	1121
24	4	1160	1216
24	6	861	1108
24	7	448	465
24	14	443	235
24	15	573	354
24	17	1261	1142
24	19	1308	1043
24	20	598	518
25	-13	1000	915
25	-9	443	544
25	-7	565	671
25	-6	502	523
25	-5	1221	1202
25	-4	954	894
25	-3	1559	1700
25	-1	670	652
25	8	468	528
25	15	1533	1322
25	16	627	647
25	17	1277	965
25	20	406	164
26	-13	671	625
26	-11	503	474
26	-9	913	986
26	-8	473	501
26	-6	871	924
26	-5	1211	961
26	-2	779	905
26	0	501	581
26	1	438	549
26	2	505	569
26	7	405	29
26	12	3112	2695
26	14	1806	1567
26	15	585	383
26	20	667	557
27	-10	488	330
27	-9	579	630
27	-8	734	859
27	-7	1186	1240
27	-6	2569	2676
27	-5	1045	1374
27	-4	3241	3400
27	-3	757	905
27	-2	1287	1458
27	4	596	653
27	5	508	550
27	6	420	601
27	14	560	421
27	15	582	600
27	16	518	508
27	17	853	707
27	18	1063	950
27	19	429	333
28	-13	879	880
28	-12	712	692
28	-11	447	385
28	-8	900	1052
28	-6	956	1086
28	-4	973	993
28	-3	906	997
28	-2	1482	1812
28	-1	516	539
28	3	696	534
28	6	564	691
28	7	500	478
28	13	1101	947
28	19	918	540
28	21	851	680
H = 15**			
0	-14	1346	1219
0	-12	2109	1837
0	-10	890	777
0	-8	1121	1169
0	-6	2616	2559
0	-4	2733	2665
0	-2	1440	1586
0	2	470	460
12	11	762	689
13	-8	462	472
13	-7	792	853
13	-5	598	631
14	-14	416	303
14	-12	613	479
14	-9	490	523
14	-8	745	746
14	-6	619	612
14	-3	559	589
14	-1	459	456
14	12	708	479
14	15	632	521
15	-15	466	306
15	-8	729	760
15	-2	471	663
15	11	494	411
15	15	831	759
16	-15	921	813
16	-13	1009	944
16	-11	812	743
16	-9	611	560
16	-5	1165	1249
16	-4	663	670
16	-3	975	1010
16	11	491	419
16	12	940	803
16	13	835	688
16	14	602	510
17	-15	408	386
17	-13	531	586
17	-11	433	285
17	-9	463	507
17	-8	568	654
17	-6	462	492
17	-2	446	471
17	3	411	421
17	11	672	654
17	12	1590	1349
17	15	542	340
17	17	765	598
18	-15	1082	911
18	-11	416	391
18	-8	1478	1529
18	-7	488	538
18	-6	1943	2012
18	-4	854	1054
18	11	775	571
18	14	456	438
18	15	633	546
18	16	637	503
18	17	540	383
19	-8	597	468
19	-7	712	725
19	-1	518	630
19	1	667	813

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 15**				22	-4	1006	1014	25	3	570	791	28	15	779	662
19	3	418	495	22	-3	491	392	25	4	486	685	28	19	1000	838
19	11	940	857	22	-2	653	747	25	5	639	907	28	21	667	449
19	12	496	469	22	0	491	322	25	11	492	539	**H = 16****			
19	13	634	388	22	3	744	776	25	13	1091	901	0	-14	1119	801
19	15	606	416	22	11	492	508	25	15	501	401	0	-12	638	641
19	16	515	353	22	13	1087	949	25	16	639	536	0	-8	1155	1145
19	17	442	314	22	15	1670	1309	25	17	725	560	0	-4	954	1060
19	19	485	338	22	16	485	365	25	19	419	254	0	-2	977	1327
20	-15	978	853	22	17	2102	1642	26	-14	465	252	0	0	898	1037
20	-11	671	524	22	18	818	746	26	-10	424	459	0	2	1944	2073
20	-10	776	798	22	19	409	432	26	-9	1247	1230	0	4	1350	1738
20	-9	515	434	22	20	410	356	26	-7	806	909	0	6	445	548
20	-6	824	869	23	-15	1415	1203	26	-3	528	628	10	10	956	924
20	-4	635	733	23	-14	528	541	26	3	465	311	11	10	593	314
20	-3	748	799	23	-13	1868	1519	26	12	709	708	11	11	1115	1071
20	-1	854	1056	23	-12	783	673	26	15	667	542	12	10	663	621
20	0	476	565	23	-11	1037	921	26	16	850	774	12	12	691	681
20	1	568	952	23	-5	455	400	26	17	1455	1148	12	14	821	725
20	3	873	1054	23	-4	1163	1215	26	18	1323	1007	13	11	643	550
20	5	621	858	23	-3	653	664	26	19	934	750	13	13	479	491
20	11	865	624	23	-2	1170	1310	26	20	1383	1091	13	14	650	572
20	12	793	701	23	1	642	705	26	21	480	389	13	15	642	659
20	13	597	468	23	2	599	579	27	-15	673	653	14	-12	552	503
20	14	461	264	23	5	428	456	27	-14	1345	1113	14	-11	394	293
20	15	930	747	23	11	607	551	27	-13	1217	1063	14	-7	608	598
20	16	954	815	23	12	926	779	27	-12	431	486	14	-6	479	432
20	17	1025	879	23	18	795	728	27	-11	392	293	14	-5	620	630
20	18	580	542	23	19	512	494	27	-9	448	282	14	10	769	659
20	19	669	569	23	20	762	633	27	-8	469	296	14	16	454	420
21	-13	1156	1108	24	-14	1006	885	27	-5	450	416	15	-14	1103	952
21	-12	887	715	24	-13	612	485	27	-2	634	799	15	-12	480	392
21	-11	1059	982	24	-12	788	652	27	0	736	1026	15	-11	518	461
21	-9	824	872	24	-11	703	771	27	4	1133	1247	15	-9	779	680
21	-8	1563	1602	24	-9	550	607	27	7	427	443	15	-8	837	741
21	-7	836	830	24	-8	964	998	27	14	648	504	15	-6	595	644
21	-5	896	900	24	-7	738	778	27	15	593	482	15	10	483	335
21	-4	1006	1079	24	-6	1008	947	27	16	1085	758	15	11	774	696
21	-3	548	543	24	-5	1645	1724	27	17	443	314	15	15	947	778
21	-2	511	615	24	-4	878	909	27	18	1127	890	16	-15	628	471
21	2	594	576	24	-3	731	691	27	21	494	358	16	-14	483	335
21	12	2323	2039	24	-2	1003	1133	28	-15	427	308	16	-13	733	666
21	13	488	392	24	11	1958	1770	28	-14	1009	838	16	-9	617	586
21	14	1186	1090	24	12	497	446	28	-13	493	410	16	-7	679	666
21	16	537	457	24	15	441	351	28	-12	973	878	16	10	1242	1116
21	17	568	514	24	16	806	616	28	-9	474	529	16	11	489	380
21	19	597	501	24	17	992	747	28	-8	943	841	16	12	458	42
22	-15	1363	1098	25	-15	873	812	28	-7	502	475	16	14	441	380
22	-14	990	845	25	-13	1483	1333	28	-6	834	588	16	15	551	422
22	-13	745	674	25	-11	705	636	28	-5	582	660	17	-16	425	380
22	-12	1212	1105	25	-8	1393	1428	28	0	1226	1524	17	-15	529	488
22	-10	1218	1142	25	-7	937	902	28	2	1032	1010	17	-9	574	658
22	-9	637	588	25	-6	773	794	28	4	480	500	17	-8	762	822
22	-8	1946	1886	25	-5	1191	1248	28	5	521	646	17	0	442	565
22	-7	671	735	25	-3	593	587	28	7	458	716	17	10	533	561
22	-6	2012	1959	25	1	458	339	28	11	2368	2001	17	14	829	768
22	-5	575	447	25	2	604	692	28	13	2486	2112	17	15	628	480

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 16**				21	3	504	638	25	-15	1174	1098	28	-1	1011	1015
17	16	1416	1199	21	10	517	464	25	-13	902	945	28	1	670	723
17	17	709	525	21	11	614	445	25	-9	515	466	28	6	442	698
17	18	811	651	21	17	582	453	25	-8	836	829	28	13	486	387
18	-16	999	863	21	18	807	654	25	-7	1256	1292	28	17	803	639
18	-15	546	501	21	19	830	729	25	-5	1170	1379	28	19	2089	1460
18	-14	796	758	21	20	745	536	25	-3	642	580	28	21	1014	762
18	-13	553	520	22	-16	1043	848	25	-2	630	687	**H = 17****			
18	-12	693	706	22	-15	1011	896	25	0	711	696	0	-16	1402	1155
18	-10	575	460	22	-9	606	527	25	1	492	541	0	-14	1593	1364
18	-6	419	448	22	-8	587	551	25	10	763	698	0	-12	1358	1135
18	-5	454	507	22	-7	667	603	25	13	694	699	0	-10	1924	1768
18	-3	560	501	22	-6	508	661	25	15	1017	896	0	-8	2014	1947
18	0	541	768	22	-2	482	589	26	-16	428	23	0	-6	1207	1201
18	2	848	1085	22	-1	625	625	26	-11	475	470	0	-4	699	567
18	10	1007	945	22	0	724	735	26	-9	704	522	0	0	512	677
18	11	930	877	22	1	484	573	26	-8	622	550	10	9	457	474
18	12	944	829	22	2	696	745	26	-7	472	491	10	11	914	865
18	14	675	468	22	4	509	633	26	-6	776	807	11	9	630	692
18	15	928	813	22	10	611	535	26	-5	460	578	11	11	772	721
18	17	520	513	22	11	708	733	26	-4	804	885	11	12	607	598
18	18	490	437	22	12	836	763	26	-3	449	308	12	9	1154	1063
19	-13	548	617	22	13	532	557	26	1	891	1121	12	11	451	351
19	-12	571	496	22	14	506	323	26	10	2735	2487	13	9	538	501
19	-10	551	490	22	15	1195	917	26	11	674	699	13	10	804	763
19	-9	901	880	22	17	856	737	26	12	1453	1378	13	14	465	149
19	-8	654	728	23	-13	943	763	26	15	773	636	14	11	475	206
19	-6	490	521	23	-11	541	519	26	17	496	363	15	-10	413	541
19	11	1998	1677	23	-9	951	1050	26	18	453	423	15	-8	425	586
19	13	538	524	23	-8	823	836	26	20	492	446	15	-6	573	550
19	15	516	461	23	-6	948	884	27	-16	430	348	15	9	500	493
19	16	730	676	23	-5	998	1161	27	-12	921	855	15	11	533	355
19	17	789	693	23	-4	936	1010	27	-10	1462	1431	15	13	513	526
19	18	878	772	23	-3	558	475	27	-9	769	786	15	15	1471	1288
19	19	1017	749	23	4	514	647	27	-8	2296	2229	15	17	874	719
20	-16	909	836	23	10	962	825	27	-7	931	965	16	-13	819	893
20	-15	683	582	23	11	1014	906	27	-6	1426	1510	16	-7	742	728
20	-14	803	864	23	12	475	463	27	-5	939	846	16	-5	796	875
20	-13	846	801	23	15	474	394	27	-4	793	891	16	10	559	505
20	-11	832	810	23	16	831	686	27	1	614	712	16	11	709	486
20	-9	2114	2011	23	18	760	561	27	2	470	566	16	13	618	518
20	-7	2115	2112	24	-16	825	608	27	13	713	594	16	14	957	827
20	-6	465	355	24	-10	613	638	27	14	1221	895	16	16	450	372
20	-5	938	1045	24	-9	624	419	27	15	1465	1262	16	17	704	516
20	-1	417	312	24	-4	631	713	27	16	1637	1434	17	-15	545	394
20	0	448	593	24	2	971	986	27	17	1432	1143	17	-13	433	373
20	2	608	708	24	4	537	699	27	20	596	517	17	-12	469	405
20	11	923	780	24	11	633	540	28	-15	960	858	17	-10	737	690
20	14	1421	1091	24	12	422	321	28	-14	731	695	17	-1	428	400
20	16	1477	1244	24	13	515	367	28	-13	762	752	17	10	2154	2023
20	18	991	821	24	14	608	515	28	-10	947	955	17	12	548	405
21	-14	682	649	24	15	741	666	28	-9	819	724	17	17	592	460
21	-12	552	542	24	17	1387	1109	28	-8	662	619	18	-17	656	588
21	-8	843	620	24	18	432	291	28	-5	850	958	18	-16	440	556
21	-2	504	664	24	19	976	780	28	-4	1084	1304	18	-15	890	752
21	0	856	936	24	20	781	607	28	-3	428	564	18	-10	991	1092
21	1	505	649	24	21	531	468	28	-2	950	1146	18	-8	1230	1244

K	L	FOBS	FCAL
H = 17**			
18	-7	550	676
18	-6	887	1053
18	-5	411	545
18	-2	582	636
18	10	1185	989
18	12	666	621
18	14	574	422
19	-12	491	378
19	-9	453	413
19	-4	552	491
19	-1	636	742
19	10	572	520
19	11	884	760
19	12	704	517
19	14	554	393
19	15	930	838
19	16	488	298
19	17	823	517
19	19	770	603
20	-17	957	807
20	-15	750	652
20	-11	597	588
20	-10	397	352
20	-8	591	574
20	-5	651	606
20	-3	555	660
20	-2	436	489
20	-1	933	1077
20	1	759	1000
20	9	1819	1567
20	10	459	437
20	11	794	712
20	13	764	701
20	14	1773	1509
20	15	1296	1019
20	16	1144	1006
20	17	826	752
20	19	438	433
20	20	670	451
21	-17	566	491
21	-16	462	301
21	-14	567	593
21	-11	509	359
21	-10	660	735
21	-9	780	822
21	-7	877	954
21	-5	563	546
21	10	2725	2316
21	12	1015	896
21	13	796	566
21	14	459	475
21	15	1014	892
21	16	622	600
21	17	633	485
21	18	625	588
21	19	500	300
22	-17	808	724
22	-15	873	723
22	-14	878	770
22	-12	1394	1244
22	-11	610	566
22	-10	1571	1464
22	-8	1165	1100
22	-6	781	714
22	-5	542	566
22	-1	657	546
22	1	679	794
22	10	605	468
22	11	470	428
22	12	870	751
22	13	1644	1461
22	14	580	576
22	15	2449	1997
22	16	551	468
22	17	1296	1127
22	18	776	632
23	-16	837	726
23	-15	718	684
23	-14	787	753
23	-13	803	873
23	-9	576	521
23	-6	688	584
23	-4	732	777
23	-2	424	504
23	-1	761	924
23	2	443	445
23	9	1604	1387
23	10	754	682
23	11	1366	1185
23	13	621	588
23	15	611	450
23	16	1327	1080
23	18	899	761
23	19	603	444
23	21	604	491
24	-17	528	440
24	-16	833	748
24	-13	714	603
24	-11	622	589
24	-10	1318	1329
24	-9	723	716
24	-8	734	775
24	-7	673	731
24	-5	443	452
24	0	613	769
24	9	1737	1522
24	10	794	665
24	11	742	668
24	13	597	554
24	14	1276	1035
24	15	1119	965
24	16	841	723
25	-17	453	343
25	-15	712	599
25	-14	838	719
25	-13	664	640
25	-11	648	555
25	-9	1124	1025
25	-8	452	601
25	-7	667	597
25	-6	562	640
25	-5	520	619
25	1	416	521
25	3	616	799
25	13	1101	716
25	15	1300	964
25	17	441	289
25	20	605	423
25	21	1069	904
26	-15	602	468
26	-13	525	315
26	-11	748	668
26	-9	525	586
26	-3	492	402
26	0	490	721
26	1	468	312
26	12	389	314
26	14	1616	1500
26	15	1302	1116
26	16	1491	1227
26	17	1265	1073
26	18	1417	1071
26	20	1233	1028
27	-17	1258	1053
27	-16	1417	1183
27	-15	1058	835
27	-14	1129	1028
27	-8	679	638
27	-5	571	532
27	-4	832	944
27	-3	533	653
27	-2	1081	1198
27	-1	876	1027
27	0	1282	1565
27	2	886	1245
27	9	502	419
27	10	375	338
27	11	438	450
27	12	1076	876
27	13	658	488
27	14	1096	927
27	15	1823	1564
27	16	1041	772
27	17	749	616
27	18	612	573
27	21	897	779
28	-15	747	723
28	-14	535	588
28	-12	621	618
28	-11	509	275
28	-10	533	411
28	-2	1285	1305
28	0	615	747
28	9	3136	2756
28	11	1615	1645
28	13	984	860
28	15	1311	973
28	17	950	765
28	19	747	632
28	21	497	219
H = 18**			
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0	-14	892	738
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0	2	1031	1400
0	4	581	723
9	8	414	435
9	10	565	653
10	8	1020	1005
10	12	424	405
11	8	635	586
11	9	1062	1031
11	11	451	268
11	13	503	381
12	8	734	649
12	9	586	479
12	10	1183	1094
12	12	934	890
12	13	539	631
12	14	718	686
13	9	749	674
13	11	594	420
13	13	684	583
13	14	1013	950
13	15	746	642
14	8	873	798
14	9	481	380
14	10	605	615
14	14	562	425
14	16	885	704
15	9	1169	1051
15	11	621	487
15	13	814	817
15	15	578	460
16	-9	474	611
16	-8	424	396
16	-7	420	561
16	8	710	642
16	13	783	772
16	18	421	308
17	-10	453	505
17	-9	552	557
17	9	823	821
17	12	1009	915

K	L	FOBS	FCAL
H = 18**			
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17	14	1362	1090
17	15	1226	1046
17	16	1026	771
17	17	587	593
17	18	929	769
18	-15	494	429
18	-14	657	643
18	-4	407	392
18	8	858	741
18	9	1023	961
18	12	608	602
18	13	2273	1922
18	14	963	745
18	15	1525	1340
18	16	713	647
18	18	632	497
19	-15	472	350
19	9	3963	3532
19	11	1400	1245
19	12	1181	864
19	13	808	623
19	14	801	761
19	15	820	707
19	16	587	529
19	17	711	542
19	18	691	556
19	19	467	415
20	-17	460	433
20	-16	900	758
20	-15	610	547
20	-14	552	573
20	-13	597	508
20	-12	422	274
20	-11	911	894
20	-9	1270	1326
20	-7	873	933
20	-5	417	434
20	-4	427	335
20	8	427	199
20	9	909	879
20	12	950	808
20	14	1617	1186
20	16	1489	1210
20	17	434	364
20	18	623	609
20	19	797	593
21	-14	905	785
21	-11	573	605
21	-9	578	659
21	-7	510	613
21	-6	538	496
21	-5	481	498
21	-2	727	905
21	8	1785	1496
21	9	1259	1184
21	10	608	411
21	11	563	425
21	12	651	718
21	14	900	957
21	15	1327	1158
21	16	1388	1120
21	17	660	662
21	18	818	696
21	20	680	560
22	-18	1058	826
22	-17	566	451
22	-16	821	637
22	-15	448	360
22	-11	645	660
22	-9	776	784
22	-6	682	719
22	-4	1045	1166
22	-2	918	1040
22	0	485	657
22	8	1208	1051
22	9	1400	1283
22	11	1086	1123
22	13	638	574
22	16	468	145
22	19	551	468
23	-17	767	581
23	-15	918	875
23	-14	760	666
23	-10	665	610
23	-8	435	495
23	-7	416	448
23	-6	631	687
23	-5	479	491
23	9	961	827
23	10	498	489
23	11	596	599
23	12	1403	1162
23	14	1455	1255
24	-18	714	596
24	-17	541	371
24	-16	683	499
24	-13	477	417
24	-12	467	466
24	-11	530	538
24	-9	437	392
24	-8	506	457
24	-6	501	523
24	-5	564	591
24	-4	729	791
24	-3	437	527
24	-2	830	904
24	-1	551	675
24	0	744	923
24	1	463	558
24	2	518	478
24	8	1120	905
24	9	542	507
24	10	1157	884
24	11	779	707
24	13	1718	1446
24	15	958	746
24	17	1092	816
24	19	801	766
25	-18	963	828
25	-17	1713	1429
25	-16	703	650
25	-15	1502	1269
25	-9	903	994
25	-7	958	1162
25	-5	652	910
25	-2	436	607
25	1	463	521
25	8	989	845
25	10	1390	1286
25	11	986	928
25	13	605	547
25	16	562	417
26	-15	1100	1083
26	-13	744	734
26	-11	480	363
26	-9	465	328
26	-7	484	356
26	-6	845	825
26	-4	703	862
26	-3	497	621
26	-1	582	702
26	8	5358	4869
26	9	1357	1279
26	10	2223	2012
26	19	582	414
27	-18	464	531
27	-16	512	362
27	-12	1593	1482
27	-10	1893	1900
27	-9	575	605
27	-8	1243	1305
27	-7	784	806
27	-6	625	648
27	8	912	845
27	9	578	503
27	11	551	530
27	12	2066	1796
27	13	815	698
27	14	2103	1839
27	15	1264	1028
27	16	706	517
27	17	960	798
27	20	704	492
28	-18	531	510
28	-16	1211	1036
28	-15	537	531
28	-14	620	631
28	-13	578	545
28	-12	619	495
28	-10	680	660
28	-6	532	611
28	-2	524	350
28	-1	536	656
28	9	2621	2383
28	13	1957	1728
28	15	1294	866
28	17	1449	1056
28	19	1329	1041
H = 19**			
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0	-8	1822	1809
0	-6	670	658
8	7	860	838
9	8	540	548
9	9	596	626
10	7	968	920
10	8	469	401
10	9	1040	1027
10	11	981	1004
10	12	748	727
11	7	646	688
11	9	1050	1033
11	10	528	433
11	13	612	563
12	7	1125	1190
12	8	692	660
12	9	1056	998
13	8	873	716
13	9	609	420
13	11	500	319
14	8	729	681
14	9	529	484
14	10	575	485
14	11	1083	941
14	12	455	432
14	13	648	444
14	14	512	496
14	16	470	484
15	7	549	645
15	9	509	613
15	12	490	459
15	13	1144	1078
15	15	554	496
15	16	466	337
15	17	484	415
16	7	526	543
16	8	806	873
16	13	512	380
16	14	1079	984
16	16	540	363
17	7	529	497
17	8	3057	2852
17	10	1338	1278
17	11	486	364

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
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17	12	734	610	22	-11	431	384	25	20	430	179	0	0	1138	1335
18	-12	791	789	22	-10	852	889	25	21	962	794	8	6	433	465
18	-10	747	794	22	-8	475	550	26	-19	465	264	9	8	509	399
18	-9	400	441	22	-4	532	622	26	-18	422	266	10	6	1064	1127
18	-8	775	801	22	-2	473	608	26	-17	1168	909	10	9	380	145
18	7	1608	1528	22	7	578	490	26	-15	586	415	10	12	386	268
18	8	1302	1209	22	10	1026	876	26	-11	631	699	11	7	983	945
18	9	847	776	22	12	1176	1057	26	-3	535	532	11	11	465	511
18	11	1023	885	22	13	704	557	26	-2	428	383	11	13	648	651
18	12	455	456	22	14	707	660	26	0	475	618	12	6	789	695
18	18	464	252	22	15	2166	1762	26	7	1131	1055	12	8	844	837
19	-14	459	321	22	16	693	633	26	8	399	310	12	10	837	836
19	-6	501	606	22	17	525	529	26	11	1091	881	12	11	574	636
19	7	511	285	22	18	641	546	26	12	2573	2345	12	12	727	762
19	8	1254	1331	23	-18	796	650	26	13	1495	1292	12	13	433	321
19	9	465	347	23	-17	515	596	26	14	1733	1381	12	15	874	775
19	10	663	593	23	-16	1064	874	26	15	1496	1242	13	7	821	729
19	13	693	509	23	-15	820	722	26	16	1626	1322	13	10	477	419
19	15	1293	917	23	-14	459	430	26	18	1361	1171	13	12	624	626
19	17	1597	1284	23	-13	443	377	27	-19	528	412	13	13	926	818
19	19	773	581	23	-1	390	415	27	-18	1291	926	13	14	520	559
20	-15	392	257	23	8	1967	1799	27	-17	708	677	13	15	602	571
20	-12	491	446	23	9	1248	1121	27	-16	1288	1010	13	16	696	499
20	-10	781	913	23	11	1402	1327	27	-15	401	391	14	6	984	990
20	-9	535	443	23	12	469	443	27	-14	418	459	14	7	654	634
20	-7	534	738	23	13	1043	857	27	-6	383	395	14	9	781	800
20	-5	809	870	23	14	485	555	27	-4	628	722	14	10	799	786
20	-3	1007	1091	23	15	653	635	27	-3	687	842	14	12	506	358
20	7	1655	1515	23	20	551	329	27	-2	773	969	14	14	502	345
20	8	475	[illegible]	23	21	427	370	27	0	862	1110	14	16	605	494
20	9	1091	[illegible]	24	-18	375	333	27	9	983	955	15	6	468	462
20	10	1043	[illegible]	24	-17	830	685	27	10	1558	1459	15	7	833	856
20	11	607	[illegible]	24	-15	660	648	27	12	595	628	15	13	849	863
20	12	1586	[illegible]	24	-13	735	724	27	13	910	864	15	15	481	505
20	13	1293	[illegible]	24	-12	575	606	27	14	930	771	16	6	908	964
20	14	1275	[illegible]	24	-11	493	657	27	15	1047	759	16	7	1153	1029
20	15	1239	[illegible]	24	-10	948	1000	27	16	1835	1569	16	8	584	387
20	16	532	[illegible]	24	-8	403	372	27	19	620	603	16	10	826	742
20	20	941	[illegible]	24	7	2729	2336	27	20	962	737	16	11	641	598
21	-17	713	[illegible]	24	8	639	739	27	21	547	536	17	7	1527	1566
21	-16	832	[illegible]	24	9	861	778	28	-16	622	499	17	10	682	706
21	-15	412	[illegible]	24	11	1056	1003	28	-15	658	689	17	11	774	755
21	-14	501	385	24	12	486	480	28	-14	1062	855	17	12	966	782
21	7	2075	1978	24	13	412	336	28	-12	657	528	17	13	1116	956
21	8	3212	3077	24	14	452	334	28	7	7532	6978	17	14	1516	1261
21	9	1643	1474	24	15	1236	1023	28	9	3270	2948	17	15	570	524
21	10	1546	1333	24	21	745	632	28	11	1843	1430	17	16	1408	1183
21	11	1111	1028	25	-17	548	511	28	13	1747	1519	17	18	575	521
21	12	747	578	25	-15	593	511	28	15	1685	1394	18	6	593	408
21	13	1598	1322	25	-11	1050	1091	28	17	1163	995	18	7	1948	1838
21	14	550	387	25	-10	407	248	28	21	855	653	18	8	502	341
21	15	909	658	25	-9	817	859	**H = 20****				18	9	994	896
21	17	692	464	25	-7	426	523	0	-16	697	458	18	10	488	487
21	18	509	424	25	7	405	251	0	-10	641	670	18	11	1793	1728
22	-17	667	503	25	9	1952	1820	0	-6	620	670	18	12	1231	1086
22	-14	662	590	25	11	1146	791	0	-4	603	588	18	13	1837	1572

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
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18	15	857	701	23	-9	639	711	26	6	7316	6708	10	9	962	923
18	16	498	463	23	-7	502	597	26	7	759	798	10	10	568	690
18	19	537	559	23	6	399	438	26	8	3280	2954	10	12	579	643
19	7	3455	3426	23	7	851	742	26	10	1104	863	11	8	440	263
19	8	531	458	23	8	1653	1543	26	11	923	860	11	10	683	530
19	9	2246	2049	23	9	879	772	26	12	617	627	11	11	601	529
19	10	747	657	23	10	506	314	26	17	744	634	11	12	737	729
19	11	1768	1665	23	11	553	362	26	19	549	429	11	13	605	660
19	12	1412	1200	23	12	1574	1365	26	20	815	797	11	14	545	613
19	13	1334	1187	23	13	1341	1125	26	21	528	555	12	5	1018	1091
19	14	1071	824	23	14	618	471	27	-15	495	350	12	7	566	600
19	15	567	363	23	16	1115	971	27	-14	384	430	12	8	503	505
19	16	483	375	24	-14	487	418	27	-12	1464	1476	12	14	482	606
20	-13	739	690	24	-13	441	490	27	-11	516	482	12	15	424	300
20	-11	1040	1053	24	-12	620	637	27	-10	1505	1455	13	7	515	352
20	-9	615	647	24	-10	422	418	27	-9	453	594	13	9	665	538
20	-8	395	338	24	-9	476	479	27	-8	638	830	13	10	461	288
20	-7	404	373	24	-7	439	461	27	6	424	430	13	11	746	587
20	7	830	718	24	-6	423	478	27	7	336	200	14	6	1520	1438
20	10	1078	945	24	-4	521	560	27	8	1888	1530	14	9	790	737
20	11	771	684	24	6	1920	1898	27	9	1426	1407	14	10	560	291
20	12	1140	950	24	7	377	250	27	11	745	671	14	11	1079	1051
20	13	511	456	24	8	619	503	27	12	1477	1287	14	12	564	456
20	14	1658	1468	24	10	1002	828	27	13	682	572	14	14	1038	960
20	16	525	506	24	11	1548	1331	27	14	1175	856	15	5	469	618
20	17	486	512	24	12	888	928	27	15	1048	978	15	6	1379	1251
20	19	701	663	24	13	1362	1135	27	16	554	457	15	8	819	656
20	20	880	766	24	15	1191	941	27	17	539	446	15	10	542	511
21	-5	378	266	24	17	833	713	27	19	586	408	15	11	841	876
21	6	428	196	24	20	1064	849	27	20	503	349	15	13	1207	1055
21	7	2318	2153	24	21	479	232	28	-18	738	567	15	14	500	413
21	8	404	196	25	-17	1215	1116	28	-16	1107	914	15	15	588	608
21	10	544	497	25	-15	890	859	28	-15	451	434	16	5	662	746
21	12	1074	851	25	-12	367	298	28	-14	366	78	16	6	1006	894
21	13	713	610	25	-9	773	854	28	-12	877	801	16	8	845	868
21	14	1794	1493	25	-7	617	679	28	-8	495	551	16	9	899	813
21	15	1001	847	25	-4	444	491	28	-3	549	522	16	10	502	424
21	16	2039	1818	25	-2	469	528	28	7	4227	3913	16	11	777	761
21	17	628	531	25	6	366	205	28	9	2070	1816	16	12	988	848
21	18	693	647	25	7	1394	1315	28	11	3531	2927	16	14	911	810
21	19	457	313	25	8	1084	1081	28	13	2732	2162	17	5	1079	1066
21	20	480	463	25	9	1142	1022	28	15	2193	1719	17	6	2416	2485
22	-12	411	381	25	10	714	650	28	17	1656	1330	17	8	863	869
22	-11	1187	1114	25	11	1142	837	28	21	495	459	17	9	449	514
22	-9	655	768	25	13	661	526	**H =	21****			17	10	499	462
22	-6	615	748	25	18	630	673	0	-12	1362	1246	17	11	685	667
22	-4	572	727	25	19	545	376	0	-10	1552	1461	17	13	522	397
22	6	1236	1261	25	21	750	616	0	-8	795	792	17	17	641	544
22	7	818	755	26	-18	400	210	7	5	620	559	17	18	480	404
22	8	723	632	26	-17	642	578	7	6	391	331	18	5	2357	2504
22	9	1463	1457	26	-16	620	556	8	5	1009	918	18	7	946	825
22	10	419	288	26	-15	920	852	9	5	457	431	18	9	1235	1113
22	12	727	605	26	-14	651	570	9	6	1125	1087	18	11	545	546
22	19	851	845	26	-11	694	560	9	7	465	343	18	15	566	385
23	-15	487	386	26	-9	402	371	10	5	1262	1279	18	19	901	795

K	L	FOBS	FCAL
H = 21**			
19	5	2071	1984
19	6	2082	2194
19	7	780	622
19	8	563	592
19	9	682	632
19	10	754	592
19	11	1058	856
19	13	1991	1579
19	15	2229	1936
19	17	1006	897
19	18	436	400
19	19	470	444
20	5	1668	1478
20	6	882	900
20	7	477	417
20	8	797	812
20	10	848	933
20	11	1279	1212
20	12	1153	1048
20	13	1743	1467
20	14	629	365
20	15	621	400
20	18	553	646
20	20	692	627
21	5	1656	1615
21	6	3610	3310
21	7	2091	2101
21	8	1292	1229
21	9	515	409
21	11	1733	1560
21	13	2223	1892
21	15	1547	1202
21	16	844	694
21	20	495	401
22	-12	996	1000
22	-10	397	415
22	5	877	847
22	6	404	407
22	7	2362	2363
22	8	996	902
22	9	556	505
22	10	1084	879
22	12	1407	1167
22	13	1164	1133
22	14	935	797
22	18	435	388
22	19	933	724
23	-11	408	344
23	-10	526	469
23	-9	388	278
23	-8	435	535
23	5	394	305
23	6	2481	2303
23	7	521	421
23	8	584	460
23	9	825	732
23	10	722	414
23	11	615	568
23	13	958	975
23	14	557	451
23	15	1066	997
23	16	725	702
23	19	431	465
23	20	523	478
24	-15	681	661
24	-13	703	683
24	-12	821	763
24	-11	429	459
24	5	2132	2207
24	6	1162	908
24	7	377	328
24	8	537	345
24	11	768	553
24	12	608	605
24	13	1297	1158
24	14	565	632
24	15	507	448
24	19	454	457
24	21	556	448
25	-14	664	678
25	-13	836	873
25	-11	1046	1127
25	-9	699	832
25	5	1237	1087
25	6	1107	988
25	7	2700	2436
25	8	404	265
25	9	1178	992
25	10	668	566
25	11	1003	943
25	12	394	274
25	13	1188	1009
25	14	770	687
25	16	624	480
26	-10	361	277
26	-9	688	620
26	-7	396	463
26	5	1588	1542
26	6	1961	1558
26	7	714	611
26	8	408	386
26	10	2293	2056
26	11	2008	1759
26	12	2784	2374
26	13	1843	1608
26	14	2603	2252
26	15	1330	1176
26	16	1506	1298
27	-16	538	408
27	-6	377	456
27	-4	666	802
27	6	416	444
27	7	1632	1473
27	8	2485	2295
27	9	806	675
27	10	1809	1590
27	11	994	874
27	12	2161	2087
27	13	1039	832
27	14	1367	1260
27	16	631	394
27	17	827	673
27	18	744	706
27	19	477	459
27	20	1481	1182
28	-16	508	480
28	-9	493	639
28	-4	514	481
28	5	9095	8563
28	7	6243	5464
28	9	2443	2320
28	11	803	765
28	13	2194	1925
28	15	2327	2098
28	17	643	572
28	19	642	522
28	21	549	419
H = 22**			
0	-12	362	281
0	-8	427	475
7	5	373	427
8	4	489	572
8	5	552	503
8	9	750	773
9	6	482	464
10	4	808	1075
10	8	526	447
10	9	521	520
11	5	1353	1435
11	7	717	633
11	11	551	522
12	4	924	991
12	5	594	677
12	6	618	669
12	11	733	676
12	12	661	686
12	13	693	538
12	15	661	651
13	5	1495	1597
13	6	443	507
13	7	575	624
13	8	544	489
13	10	893	813
13	11	806	764
13	12	855	833
13	13	520	590
14	4	1307	1317
14	7	507	467
14	10	632	688
14	12	469	403
14	14	578	521
15	4	573	358
15	5	447	297
15	7	634	725
15	11	670	594
15	15	489	359
16	4	1621	1703
16	5	1905	1937
16	7	517	435
16	8	900	910
16	9	645	632
16	10	621	452
17	4	512	296
17	5	771	745
17	8	568	504
17	9	645	649
17	10	1702	1662
17	11	809	674
17	12	2116	2049
17	13	600	417
17	14	1378	1267
18	4	1561	1603
18	5	1933	1804
18	6	1391	1427
18	7	1044	855
18	8	931	742
18	9	717	704
18	10	788	819
18	11	1280	1235
18	12	1072	1115
18	13	773	727
18	14	729	630
19	4	630	545
19	5	2930	2834
19	7	1815	1771
19	9	1506	1454
19	10	1537	1328
19	11	1418	1328
19	12	1456	1240
19	13	1355	1252
19	14	703	615
19	15	1175	1105
19	19	483	373
20	4	684	413
20	5	1331	1440
20	6	1245	1157
20	8	1525	1388
20	9	1043	866
20	10	1972	2056
20	11	1013	946
20	12	1514	1423
20	13	509	454
20	18	978	790
20	19	691	681
21	4	1359	1327
21	5	1958	1730
21	6	418	269

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**H =	22****			26	5	1823	1603	11	8	803	723	19	11	2671	2430
21	7	1320	1215	26	6	3546	3016	11	9	737	771	19	13	2297	2107
21	9	785	696	26	7	328	108	11	10	768	763	19	15	980	899
21	10	999	824	26	8	1093	1001	11	11	534	646	19	16	663	583
21	12	2279	2076	26	9	1594	1484	11	13	693	814	19	18	776	592
21	13	946	1000	26	10	542	421	12	3	1431	1457	20	3	2866	2932
21	14	2488	2162	26	11	1612	1333	12	8	468	500	20	5	2452	2453
21	15	597	701	26	13	1267	953	12	10	636	504	20	6	1600	1428
21	16	1026	983	26	14	1050	958	12	12	435	421	20	7	531	639
21	19	503	438	26	17	961	808	12	14	527	632	20	8	607	626
22	4	692	649	26	18	487	480	13	3	863	914	20	9	942	980
22	5	585	447	26	19	693	603	13	4	551	637	20	10	1945	1716
22	6	692	646	26	20	757	500	13	6	533	509	20	11	917	893
22	7	822	965	26	21	467	481	13	8	466	262	20	13	1001	924
22	10	1359	1059	27	-12	1008	938	13	11	929	832	20	14	961	803
22	11	427	341	27	-10	830	732	13	13	870	739	20	16	948	967
22	12	704	650	27	5	1136	1113	13	15	432	453	20	17	517	596
22	15	637	618	27	6	1425	1333	14	12	607	668	20	18	972	933
22	17	931	985	27	7	1979	1897	15	3	695	753	21	3	909	1114
22	18	552	506	27	8	516	462	15	4	1544	1576	21	4	2460	2402
22	19	671	666	27	9	1199	1120	15	5	653	674	21	6	1849	1789
23	4	419	549	27	10	1773	1550	15	6	891	837	21	7	673	571
23	5	884	776	27	11	969	900	15	9	1173	1120	21	8	657	429
23	6	1369	1402	27	12	1817	1525	15	11	1157	1114	21	9	790	776
23	7	632	618	27	16	675	619	15	13	589	599	21	10	1036	953
23	8	631	539	27	17	1051	916	16	3	555	447	21	11	2068	1912
23	9	1087	971	27	19	837	756	16	4	661	453	21	12	524	499
23	10	541	686	27	21	501	449	16	5	667	649	21	13	1294	1281
23	11	640	679	28	-10	683	685	16	9	1168	1066	21	14	666	432
23	12	2552	2358	28	5	1123	1170	16	10	940	792	21	18	526	452
23	13	898	853	28	7	1511	1476	16	11	1206	966	22	3	566	462
23	14	762	669	28	9	953	890	16	12	601	583	22	4	965	913
24	4	374	361	28	11	4339	3794	17	3	534	638	22	5	2997	2829
24	5	586	568	28	13	4422	3794	17	4	2023	2138	22	6	1071	1114
24	6	1781	1915	28	15	2159	1894	17	5	428	337	22	7	1101	902
24	7	595	425	28	17	747	622	17	7	512	466	22	8	835	676
24	9	394	371	28	21	426	417	17	9	955	844	22	9	1398	1327
24	10	975	736	**H =	23****			17	11	920	974	22	10	1298	1314
24	11	1352	1193	6	4	619	483	17	12	532	500	22	11	1418	1167
24	13	1630	1479	7	4	441	497	17	13	735	776	22	12	1195	1091
24	14	759	735	7	5	351	393	17	14	556	455	22	13	616	524
24	15	593	663	8	3	1313	1365	17	15	701	586	22	14	575	499
24	16	631	481	8	4	391	272	17	17	933	874	22	15	1315	1181
25	4	940	753	8	7	376	438	18	3	1050	1258	22	16	506	148
25	5	337	236	9	4	1838	1787	18	5	439	368	22	19	531	565
25	6	398	346	9	6	540	519	18	7	1004	968	23	3	1389	1274
25	8	931	907	9	11	575	592	18	10	472	285	23	6	1048	1015
25	9	855	799	10	3	1018	1101	18	11	522	524	23	8	1130	1083
25	10	355	207	10	5	1041	1010	18	12	790	665	23	9	934	763
25	11	903	949	10	7	1085	944	18	14	643	544	23	10	1081	913
25	12	577	498	10	8	656	643	18	17	953	863	23	11	392	270
25	15	841	839	10	9	664	606	18	18	765	726	23	12	1525	1341
25	16	1133	1043	10	10	789	857	19	3	1270	1276	23	13	448	595
25	18	435	413	10	12	432	525	19	4	1533	1645	23	14	1377	1097
25	19	528	406	11	3	530	454	19	8	562	446	23	15	568	565
25	21	482	356	11	4	815	904	19	9	2342	2120	23	18	708	686
26	4	4679	4245	11	6	462	443	19	10	683	546	24	4	359	356

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
**H =	23****			28	17	1474	1115	16	4	847	801	21	10	1625	1607
24	5	449	453	28	19	472	293	16	6	621	568	21	11	864	975
24	7	525	478	**H =	24****			16	9	751	754	21	12	1523	1492
24	8	1251	1188	6	2	1516	1438	16	12	582	535	21	14	1036	862
24	9	1475	1435	6	4	821	706	17	2	990	1128	21	15	817	583
24	10	961	926	8	3	453	435	17	4	901	703	21	17	861	814
24	11	1417	1260	8	4	539	525	17	5	547	430	22	2	434	444
24	12	784	699	8	5	437	526	17	6	485	306	22	3	1261	1410
24	15	498	168	8	7	498	480	17	7	1115	1112	22	4	690	611
24	19	664	472	8	9	646	732	17	8	2032	2087	22	5	874	935
25	3	2713	2609	9	3	618	622	17	9	655	543	22	6	503	349
25	4	1053	1073	9	4	811	901	17	10	2012	1886	22	10	639	578
25	7	1730	1558	9	5	387	460	17	12	1179	1113	22	11	717	716
25	8	906	829	9	7	401	427	18	2	2406	2403	22	13	1015	956
25	9	1486	1325	9	8	717	731	18	3	457	335	22	15	1106	1092
25	10	686	623	9	10	657	634	18	4	2531	2522	22	17	696	655
25	11	1164	802	10	2	963	1103	18	6	1812	1754	22	18	477	584
25	12	709	692	10	7	400	336	18	7	1586	1534	22	19	578	370
25	13	522	540	10	11	586	438	18	8	506	454	23	2	498	439
25	14	1023	911	11	3	1736	1864	18	9	1733	1743	23	3	782	1001
25	15	1219	1191	11	5	561	681	18	10	582	435	23	4	463	500
25	19	435	342	11	11	481	519	18	12	736	843	23	5	601	726
26	3	1671	1635	11	12	716	710	18	13	898	949	23	7	1040	957
26	4	304	200	11	13	472	494	18	15	618	745	23	8	563	611
26	6	315	113	12	2	1390	1427	19	2	1017	754	23	9	825	774
26	7	1119	1007	12	3	724	755	19	3	6982	7122	23	10	1598	1596
26	8	1411	1229	12	4	869	875	19	5	2515	2380	23	12	605	498
26	10	3580	3156	12	8	422	294	19	6	497	449	23	13	853	939
26	11	1932	1889	12	9	865	808	19	7	1025	888	23	15	725	731
26	12	3722	3272	12	10	415	469	19	8	1097	1148	23	16	804	799
26	13	1790	1736	12	11	847	792	19	9	1070	1154	23	20	531	488
26	14	1463	1379	12	12	475	394	19	10	1349	1338	24	2	1467	1500
26	15	481	409	12	13	562	511	19	11	1619	1653	24	3	3147	3327
26	19	626	513	13	3	1081	1108	19	12	851	826	24	4	2561	2542
27	3	1383	1350	13	4	746	703	19	13	1418	1193	24	5	789	787
27	4	1436	1041	13	7	478	595	19	17	770	603	24	6	1746	1716
27	5	1269	1182	13	10	1005	995	20	2	758	598	24	7	534	556
27	6	1807	1542	13	11	638	617	20	3	1092	1017	24	9	569	642
27	7	409	208	13	12	540	555	20	4	1615	1493	24	10	551	525
27	8	3224	3006	14	2	1405	1612	20	5	669	669	24	11	1156	1053
27	9	948	867	14	4	593	643	20	6	1131	1077	24	13	695	598
27	10	2582	2353	14	6	606	756	20	7	756	666	24	14	877	700
27	11	880	741	14	8	1067	1133	20	8	2741	2466	24	18	516	373
27	12	827	620	14	9	572	413	20	9	507	404	25	3	1365	1073
27	15	1444	1239	14	10	1122	1155	20	10	2070	1791	25	4	291	120
27	16	506	452	14	12	541	684	20	11	1890	1797	25	5	758	456
27	17	959	964	14	15	713	742	20	12	631	564	25	7	1407	1260
27	18	1231	995	14	16	464	337	20	13	854	837	25	9	480	522
27	20	882	783	15	2	706	809	20	14	566	528	25	10	386	388
28	3	1828	2009	15	3	724	637	20	16	1045	835	25	11	443	487
28	5	4123	4057	15	4	593	528	20	18	956	975	25	13	1188	1001
28	7	2318	2158	15	7	735	809	20	19	691	648	25	14	615	532
28	8	339	0	15	9	802	765	21	2	1772	1646	25	16	1052	944
28	9	1638	1458	15	10	544	646	21	3	2323	2382	25	17	1185	963
28	11	2636	2534	15	11	779	651	21	4	1653	1802	26	2	5913	6197
28	13	2455	2367	15	12	1111	954	21	8	748	829	26	3	1069	1111
28	15	813	767	16	2	1917	1894	21	9	1401	1388	26	4	1056	1010

K	L	FOBS	FCAL
H = 24**			
26	5	1230	1035
26	6	498	574
26	7	1757	1535
26	9	2899	2574
26	11	1207	1197
26	12	494	555
26	13	722	725
26	14	472	541
26	15	525	369
26	16	1461	1283
26	18	816	809
26	19	842	897
27	2	1211	1241
27	3	778	839
27	4	310	161
27	5	446	356
27	6	968	830
27	7	1409	1299
27	8	1978	1786
27	9	2292	1959
27	11	1381	1215
27	12	1549	1304
27	14	2177	2122
27	16	962	939
27	17	1435	1303
27	18	766	712
27	19	617	648
27	20	955	961
28	3	1392	826
28	5	1086	660
28	7	617	573
28	9	4879	4426
28	11	4354	4077
28	13	2829	2628
28	15	851	802
28	19	978	1083
H = 25**			
6	4	441	465
7	2	613	752
7	3	443	456
7	6	464	425
8	1	1436	1426
8	2	457	499
8	3	542	575
8	5	684	692
8	6	441	604
9	2	1553	1552
9	4	624	702
9	7	523	614
9	9	482	581
10	1	1214	1211
10	2	480	388
10	3	960	1007
10	5	1294	1331
10	6	512	440
10	7	991	1002

K	L	FOBS	FCAL
10	8	855	792
10	9	506	374
10	10	490	436
11	1	546	614
11	2	521	425
11	3	994	1114
11	4	827	851
11	6	996	931
11	7	936	1097
11	8	728	651
11	9	1407	1503
11	10	749	787
11	11	563	689
12	1	1797	2027
12	2	769	791
12	3	969	931
12	4	420	516
12	5	609	624
12	8	798	738
12	10	434	292
12	12	570	589
12	14	541	590
13	1	526	440
13	2	1156	1180
13	3	623	550
13	5	557	478
13	6	830	825
13	8	663	616
13	9	844	891
13	10	702	715
13	11	1286	1348
13	13	923	996
14	2	1267	1381
14	4	614	553
14	6	863	762
14	9	482	556
15	1	954	951
15	2	949	897
15	3	901	1137
15	7	886	986
15	9	641	633
15	12	688	731
16	1	910	982
16	3	630	477
16	5	711	754
16	6	503	563
16	7	687	790
16	8	1483	1499
16	9	1276	1130
16	10	666	506
16	11	718	603
16	14	824	920
16	15	564	554
17	2	2697	2811
17	3	805	933
17	4	1310	1281
17	11	930	870

K	L	FOBS	FCAL
17	15	847	828
17	16	584	514
17	17	534	502
18	1	2804	2866
18	2	393	390
18	3	564	567
18	5	565	535
18	6	527	591
18	10	1179	1100
18	11	533	321
18	12	1284	1254
18	14	628	582
18	15	1247	1089
18	17	901	897
18	18	508	491
19	1	1425	1630
19	2	608	451
19	4	1156	1210
19	5	1177	1143
19	6	706	732
19	7	1136	1174
19	9	2885	2744
19	10	725	583
19	11	2710	2434
19	13	1309	1262
19	14	668	623
19	16	1196	1094
19	18	494	388
20	1	3755	3765
20	2	613	586
20	3	2730	2518
20	4	1877	1856
20	5	1157	1181
20	6	1177	1235
20	8	1161	1261
20	11	783	837
20	12	1446	1344
20	13	935	924
20	14	1791	1721
20	16	988	953
20	18	500	596
21	1	580	363
21	2	5228	5302
21	4	1619	1287
21	5	1472	1360
21	6	388	414
21	7	347	447
21	8	913	1009
21	9	1840	1770
21	10	1016	896
21	11	1699	1602
21	16	524	595
21	19	587	601
22	1	929	1020
22	2	1205	1251
22	3	1884	1559
22	4	890	993

K	L	FOBS	FCAL
22	6	599	599
22	9	2659	2589
22	10	717	764
22	11	903	876
22	12	722	679
22	13	623	638
22	15	658	536
22	17	562	398
23	1	1738	1956
23	2	2666	2194
23	3	1468	1678
23	4	887	879
23	8	1112	1057
23	9	388	440
23	10	691	512
23	11	969	778
23	12	1212	1211
23	13	541	490
23	16	1110	1014
23	18	652	549
24	1	488	464
24	3	388	72
24	4	439	87
24	5	758	762
24	6	1044	1017
24	8	531	497
24	9	1344	1361
24	10	402	181
24	11	441	407
24	17	831	760
25	1	360	762
25	3	2371	2414
25	4	842	799
25	5	358	66
25	7	1406	1340
25	8	563	539
25	9	574	568
25	10	917	790
25	11	883	859
25	12	691	544
25	13	1622	1573
25	14	609	562
25	15	1251	1207
26	1	2566	2467
26	2	426	348
26	3	3952	3331
26	4	1233	871
26	5	568	507
26	6	987	821
26	7	747	829
26	8	2684	2573
26	9	795	699
26	10	3625	3216
26	12	2070	1999
26	18	473	455
26	20	551	524
27	1	1256	1512

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 25**				12	4	750	810	18	11	732	710	23	6	858	1089
27	3	246	133	12	7	499	521	18	13	1385	1374	23	10	1670	1535
27	4	1365	1562	12	9	936	967	19	0	1068	892	23	12	454	328
27	6	1177	1061	12	11	740	689	19	1	6481	6708	23	13	569	564
27	8	2053	1741	13	2	649	786	19	3	3163	3084	23	14	862	915
27	10	1639	1605	13	5	639	629	19	5	1259	1282	23	15	493	492
27	11	466	398	13	7	950	949	19	6	916	916	23	18	640	625
27	13	1171	1186	13	9	766	832	19	7	1258	1195	24	0	748	998
27	14	438	322	13	10	987	1044	19	8	1277	1166	24	1	708	720
27	15	1544	1448	14	0	2988	3211	19	10	969	1063	24	2	621	672
27	16	1078	1039	14	1	804	874	19	14	506	452	24	3	1001	1346
27	18	1013	981	14	2	1097	1248	19	15	790	600	24	6	718	659
28	1	15199	15285	14	3	480	516	20	0	3090	3240	24	9	548	396
28	3	7875	6641	14	4	620	457	20	3	403	327	24	10	999	851
28	5	364	168	14	6	689	720	20	4	1393	1357	24	11	712	748
28	7	2186	2138	14	8	827	789	20	6	837	753	24	14	688	540
28	9	1917	1821	14	10	498	634	20	7	1014	1072	24	17	683	585
28	11	2074	2009	14	13	866	955	20	8	2223	2271	25	1	581	209
28	13	459	435	14	14	602	560	20	9	1728	1743	25	2	867	837
28	15	1855	1701	15	0	662	648	20	10	1629	1730	25	3	1832	1394
28	17	1360	1304	15	1	1741	1931	20	11	1520	1485	25	4	706	708
H = 26**				15	7	651	736	20	15	616	335	25	6	898	822
6	0	1310	1324	15	8	610	562	20	16	816	852	25	7	678	665
6	2	899	867	15	9	1078	1072	20	17	587	475	25	9	1214	1090
6	3	331	214	15	10	820	863	21	0	1708	2188	25	11	619	678
7	1	505	436	15	11	525	419	21	1	6314	6133	25	12	426	471
7	7	542	371	15	15	667	785	21	2	1393	1355	25	14	870	826
8	2	581	655	16	0	1165	1487	21	3	805	693	25	15	756	749
8	6	382	473	16	1	1171	1346	21	4	667	542	25	17	487	349
8	7	728	786	16	2	628	902	21	5	438	241	25	18	434	576
8	9	737	762	16	3	751	628	21	7	786	672	26	0	8586	8069
9	0	605	584	16	4	844	708	21	8	2155	2041	26	1	410	471
9	1	1189	1264	16	7	620	595	21	9	880	856	26	2	5995	5337
9	2	574	675	16	12	630	637	21	10	1849	1851	26	3	245	143
9	5	393	273	16	16	708	613	21	11	651	583	26	4	1796	1330
9	6	934	1008	17	1	703	633	21	12	962	929	26	5	791	832
9	8	1211	1245	17	2	1060	1300	21	13	903	984	26	6	763	675
9	10	665	756	17	3	391	376	21	15	1303	1306	26	7	808	810
10	0	746	821	17	4	495	594	21	17	782	787	26	9	698	612
10	5	711	655	17	5	647	656	22	0	3883	3763	26	10	356	212
10	7	519	553	17	6	708	1342	22	2	756	699	26	11	954	867
10	9	763	868	17	7	772	751	22	3	1774	2159	26	14	1298	1194
10	11	559	565	17	8	1702	1672	22	4	1319	1183	26	15	655	712
11	1	2016	2178	17	10	1527	1355	22	5	693	417	26	16	1271	1174
11	2	635	689	17	11	515	372	22	6	819	822	26	17	712	815
11	3	783	890	17	15	732	648	22	7	773	623	26	18	712	588
11	4	488	527	18	0	1533	1396	22	9	614	720	26	19	637	713
11	5	443	423	18	1	1209	1317	22	11	981	937	27	0	478	1142
11	6	456	506	18	2	1455	1449	22	13	695	781	27	1	380	59
11	9	562	616	18	3	995	1036	22	16	608	628	27	2	1605	1831
11	10	539	488	18	4	1695	1633	22	17	760	655	27	3	1339	1357
11	11	618	599	18	5	1557	1534	22	19	508	396	27	4	671	430
11	12	914	892	18	6	870	891	23	0	1175	1136	27	6	620	804
12	0	1114	1149	18	7	2700	2664	23	1	2010	1540	27	7	788	788
12	1	985	1065	18	8	946	1103	23	2	1716	1040	27	8	703	615
12	2	1135	1228	18	9	1555	1470	23	4	1732	1706	27	9	2361	2286
12	3	935	908	18	10	1042	1003	23	5	1278	1135	27	10	823	911

Table 45. Continued

K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL	K	L	FOBS	FCAL
H = 26**				27	16	845	916	28	5	2518	2450	28	13	635	609
27	11	757	715	27	17	679	556	28	7	4335	4099	28	15	564	585
27	12	2356	2335	27	18	981	1047	28	9	5307	4754	28	17	1100	1271
27	14	1485	1504	28	1	848	423	28	11	3386	3302	28	19	1055	1157
27	15	1105	989	28	3	433	1146								