

Supporting Information

The Effect of Auxiliary Ligand on Mechanism and Reactivity: DFT Study on H₂ Activation by Lewis Acid-Transition Metal Complex (Tris(phosphino)borane)Fe(L)

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1. The comparison of absolute energies of different catalysts using different functionals.

Table S1. The comparison of absolute energies of different catalysts using different functionals

Catalyst	Apical Ligand	Spin State	M06L				B3LYP				B3LYP*(15% exact exchange)			
			H/(Hartree)		G/(Hartree)		H/(Hartree)		G/(Hartree)		H/(Hartree)		G/(Hartree)	
			gas	solution	gas	solution	gas	solution	gas	solution	gas	solution	gas	solution
1	N ₂	singlet	-2213.918171	-2214.773829	-2214.012574	-2214.868232	-2214.011435	-2214.896796	-2214.107643	-2214.993003	-2213.416325	-2203.325646	-2213.509916	-2203.419237
		triplet	-2213.896728	-2214.758767	-2214.000212	-2214.862251	-2214.022342	-2214.913627	-2214.125235	-2215.016521	-2213.403026	-2203.335395	-2213.502559	-2203.434928
3	CN ^t Bu	singlet	-2354.926184	-2355.828264	-2355.033284	-2355.935364	-2355.047674	-2355.975021	-2355.159079	-2356.086425	-2354.331236	-2343.283275	-2354.435483	-2343.387522
		triplet	-2354.899597	-2355.809974	-2355.012806	-2355.923183	-2355.054259	-2355.98992	-2355.173009	-2356.108669	-2354.317254	-2343.291387	-2354.427574	-2343.401707
5	CO	singlet	-2217.742259	-2218.603311	-2217.837571	-2218.698623	-2217.836712	-2218.72731	-2217.932209	-2218.822807	-2217.238821	-2207.145497	-2217.331291	-2207.237967
		triplet	-2217.714052	-2218.578113	-2217.813748	-2218.677809	-2217.829959	-2218.724206	-2217.93184	-2218.826087	-2217.221584	-2207.13971	-2217.319187	-2207.237313

- H and G designate the thermal enthalpy and the Gibbs free energy, separately.

Several functionals that are often used when describing relative energies in transition metal complexes were examined so as to decide the most appropriate functional for our calculation. The absolute energies of catalysts **1**, **3** and **5** gained by using M06L, B3LYP and B3LYP* (15% exact exchange) functionals are listed in Table S1, where the lower energy of the two spin states are in bold type. According to these results, we choose B3LYP* (15% exact exchange) as the functional for our calculation for its better prediction of spin states.

2. The absolute energies of all optimized structures.

Table S2. The absolute energies of all optimized structures

Species	Ec	Uc	Hc	Gc	E	U	H	G	Solvation Energy	H in Solution	G in Solution
H ₂	0.009707	0.012068	0.013012	-0.001813	-1.155507	-1.153147	-1.152203	-1.167028	-1.146643	-1.133631	-1.148456
N ₂	0.005312	0.007673	0.008617	-0.01316	-109.505336	-109.502975	-109.502031	-109.523808	-108.900328	-108.891711	-108.913488
CN ^t Bu	0.12635	0.133444	0.134388	0.096435	-250.403843	-250.396749	-250.395805	-250.433758	-248.967548	-248.83316	-248.871113
CO	0.004779	0.00714	0.008084	-0.014382	-113.289198	-113.286837	-113.285893	-113.308359	-112.680747	-112.672663	-112.695129
^s 1	0.471631	0.504749	0.505693	0.412102	-2213.450387	-2213.417269	-2213.416325	-2213.509916	-2203.831339	-2203.325646	-2203.419237
^t 1	0.46928	0.503775	0.504719	0.405186	-2213.438465	-2213.40397	-2213.403026	-2213.502559	-2203.840114	-2203.335395	-2203.434928
^s 2	0.489651	0.522922	0.523866	0.430052	-2214.625167	-2214.591896	-2214.590952	-2214.684766	-2205.017351	-2204.493485	-2204.587299
^t 2	0.486443	0.519523	0.520467	0.425859	-2214.582285	-2214.549205	-2214.54826	-2214.642869	-2204.98465	-2204.464183	-2204.558791

^s 3	0.592025	0.630523	0.631467	0.52722	-2354.370678	-2354.33218	-2354.331236	-2354.435483	-2343.914742	-2343.283275	-2343.387522
^t 3	0.589799	0.629756	0.630701	0.520381	-2354.358155	-2354.318198	-2354.317254	-2354.427574	-2343.922088	-2343.291387	-2343.401707
^s 4	0.610272	0.649026	0.64997	0.544854	-2355.549458	-2355.510703	-2355.509759	-2355.614875	-2345.105024	-2344.455054	-2344.56017
^t 4	0.60751	0.64753	0.648474	0.538238	-2355.503008	-2355.462988	-2355.462044	-2355.572279	-2345.070216	-2344.421742	-2344.531978
^s 5	0.472181	0.504913	0.505857	0.413387	-2217.272498	-2217.239765	-2217.238821	-2217.331291	-2207.651354	-2207.145497	-2207.237967
^t 5	0.470259	0.504132	0.505076	0.407473	-2217.256401	-2217.222528	-2217.221584	-2217.319187	-2207.644786	-2207.13971	-2207.237313
^s 6	0.490099	0.523059	0.524004	0.430935	-2218.44896	-2218.416	-2218.415055	-2218.508124	-2208.837369	-2208.313365	-2208.406434
^t 6	0.487054	0.521328	0.522272	0.423794	-2218.398229	-2218.363955	-2218.363011	-2218.461489	-2208.796239	-2208.273967	-2208.372445
^s IM1-A	0.462735	0.493469	0.494414	0.406224	-2103.903701	-2103.872967	-2103.872022	-2103.960212	-2094.890969	-2094.396555	-2094.484745
^t IM1-A	0.461679	0.49328	0.494224	0.401914	-2103.914591	-2103.882989	-2103.882045	-2103.974355	-2094.919679	-2094.425455	-2094.517765
^s IM2-A	0.477997	0.509155	0.510099	0.42177	-2105.07785	-2105.046692	-2105.045748	-2105.134078	-2096.066285	-2095.556186	-2095.644515

^t IM2 –A	0.475683	0.508527	0.509471	0.415199	–2105.070914	–2105.03807	–2105.037125	–2105.131398	–2096.074992	–2095.565521	–2095.659793
^s TS1 –A	0.47617	0.507113	0.508057	0.42006	–2105.078305	–2105.047362	–2105.046418	–2105.134415	–2096.064988	–2095.556931	–2095.644928
^t TS1 –A	0.472942	0.505261	0.506206	0.412648	–2105.058716	–2105.026397	–2105.025453	–2105.11901	–2096.06326	–2095.557054	–2095.650612
^s IM3 –A	0.478475	0.509441	0.510385	0.422348	–2105.078992	–2105.048027	–2105.047083	–2105.135119	–2096.068556	–2095.558171	–2095.646208
^t IM3 –A	0.474922	0.507247	0.508191	0.415094	–2105.057299	–2105.024974	–2105.02403	–2105.117127	–2096.065302	–2095.557111	–2095.650208
^s TS2 –A	0.477038	0.507732	0.508676	0.421002	–2105.048904	–2105.018211	–2105.017266	–2105.10494	–2096.039764	–2095.531088	–2095.618762
^t TS2 –A	0.474958	0.506349	0.507293	0.416647	–2105.047843	–2105.016452	–2105.015508	–2105.106154	–2096.054199	–2095.546906	–2095.637552
^s IM4 –A	0.479618	0.510967	0.511911	0.422241	–2105.073472	–2105.042123	–2105.041178	–2105.130849	–2096.075916	–2095.564005	–2095.653675
^t IM4 –A	0.478421	0.510238	0.511183	0.418981	–2105.084486	–2105.052669	–2105.051725	–2105.143926	–2096.095703	–2095.58452	–2095.676722
^s TS –A	0.478177	0.509105	0.510049	0.421576	–2105.061617	–2105.030689	–2105.029745	–2105.118218	–2096.063142	–2095.553093	–2095.641566
^s IM5 –A	0.480466	0.511431	0.512375	0.423984	–2105.068488	–2105.037523	–2105.036579	–2105.12497	–2096.073027	–2095.560652	–2095.649043

^s IM2'-A	0.478535	0.509836	0.51078	0.42187	-2105.05481	-2105.023509	-2105.022565	-2105.111475	-2096.05004	-2095.53926	-2095.62817
^s TS1'-A	0.476441	0.507509	0.508453	0.419937	-2105.055074	-2105.024006	-2105.023062	-2105.111578	-2096.050155	-2095.541702	-2095.630218
^t TS-1B	0.481959	0.516966	0.517910	0.417078	-2214.550654	-2214.515647	-2214.514703	-2214.615535	-2204.950907	-2204.432997	-2204.533829
^t TS-3B	0.602911	0.643177	0.644121	0.533322	-2355.469786	-2355.429520	-2355.428576	-2355.539375	-2345.027136	-2344.383015	-2344.493814
^t TS-5B^a	0.483309	0.517515	0.518460	0.420363	-2218.384540	-2218.350333	-2218.349389	-2218.447485	-2208.7450678	-2208.226608	-2208.324705
^s IM1-C	0.485095	0.519461	0.520405	0.424047	-2214.544929	-2214.510563	-2214.509619	-2214.605978	-2204.929405	-2204.409	-2204.505358
^s IM2-C	0.486491	0.520483	0.521427	0.425683	-2214.554149	-2214.520157	-2214.519213	-2214.614957	-2204.941535	-2204.420108	-2204.515852
^s IM3-C	0.487612	0.521632	0.522577	0.425606	-2214.576241	-2214.542221	-2214.541277	-2214.638247	-2204.971123	-2204.448546	-2204.545517
^t IM1-C	0.483988	0.519531	0.520475	0.419390	-2214.556187	-2214.520644	-2214.519700	-2214.620785	-2204.949585	-2204.42911	-2204.530195
^s IM3-D	0.476493	0.508125	0.509069	0.418543	-2105.025397	-2104.993765	-2104.992820	-2105.083347	-2096.016726	-2095.507657	-2095.598183
^s TS-D	0.474818	0.506622	0.507566	0.416057	-2104.991983	-2104.960179	-2104.959235	-2105.050744	-2095.993359	-2095.485793	-2095.577302

^s**IM4-D** 0.478383 0.510189 0.511133 0.419243 -2105.023911 -2104.992104 -2104.991160 -2105.083050 -2096.032699 -2095.521566 -2095.613456

- Ec, Uc, Hc and Gc designate zero-point correction and thermal correction to energy, enthalpy and Gibbs free energy, separately.
- E, U, H and G designate zero-point energies, thermal energies, thermal enthalpies, and thermal free energies.
- ^a The correction and free energy data (Ec, Uc, Hc, Gc, E, U, H and G) is based on the 6-311G** basis set for all the main group elements and a SDD basis set for Fe with SMD solvation model. And the solvation Energy is based on 6-31G* basis set for all the main group elements and a LanL2DZ basis set³² for Fe with SMD solvation model. This is because the single point energy refinements in benzene solvent with high basis set is not suitable for triplet transition state of (TPB)Fe(CO) with H₂, which seemly lead to singlet transition state. Indeed, several comparison are investigated and prove this adjustment is slightly change free energy data, and can not influence the comparison with other two complexes (TPB)Fe(N₂) and (TPB)Fe(CN^tBu).

3. The equilibrium and Gibbs free energy between ${}^t\text{IM4-A}$ and ${}^s\text{2}$

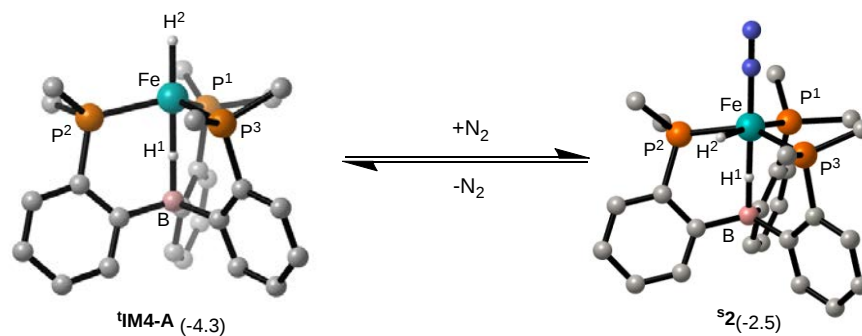


Figure S1. The equilibrium and Gibbs free energy between ${}^t\text{IM4-A}$ and ${}^s\text{2}$. The Gibbs free energies relative to ${}^t\text{1}$ are provided next to each species in parentheses. All H atoms other than those originated from the dihydrogen molecule are omitted for clarity. Fe atom is depicted in cyan, B in pink, P in orange, C in gray, N in blue and O in red. Hydrogen atoms are omitted for clarity.

4. The IRC and scan curves of associative transition state in singlet state.

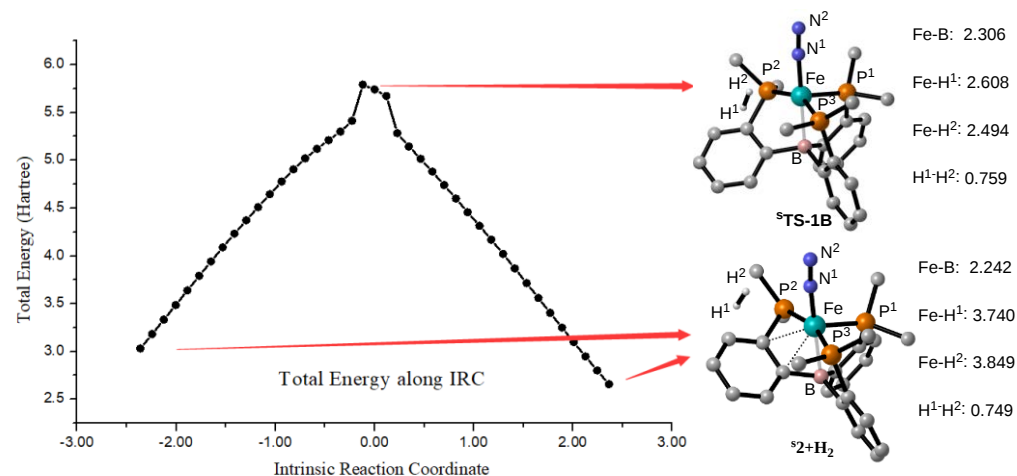


Figure S2. The IRC analysis and optimized structures of highest point and both end points.

The possible associative transition state (${}^s\text{TS-1B}$) in singlet state ((TPB)Fe(N₂), for example) did not connect the desired reactant and product. The imaginary frequency is relatively small (-228.46 cm^{-1}), which is actually corresponding to a collision-like movement. Evidence can be obtained from the IRC analysis. The optimized structures of both end points of the IRC curve lead identically to the separate (TPB)Fe(L) complex and free H₂ molecule.

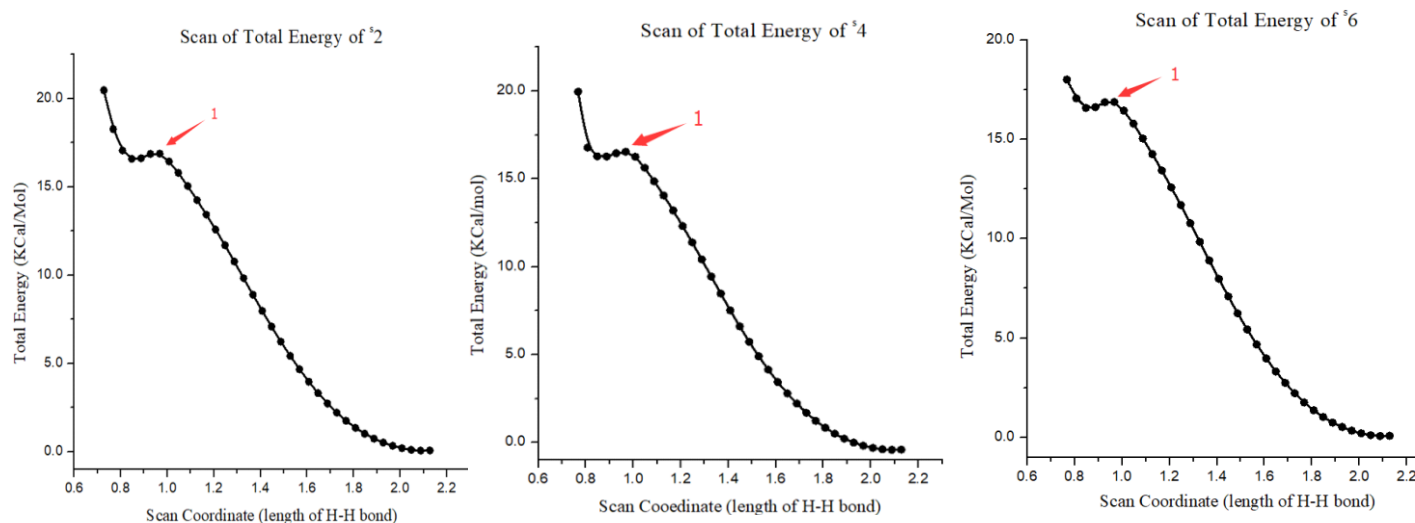


Figure S3. The curve of scanning length of H-H bond from product to reactant.

Exhaustive searching failed to locate the associative singlet transition states for both 11 , 13 , and 15 . Further investigation by scanning, from product to reactant and from reactant to product, found there is no obvious point for transition state. Though a point with slight higher energy (point 1, Figure S3) is exist, location transition state with point 1 as initial structure actually lead to the wrong transition state structure, exactly the same as previous sTS-1B. This is probably attributed to the strong Fe-B interaction, the rigid structure of the tetradentate ligand cage, and the steric hindrance caused by the interaction between Fe and one of the phenyl groups in singlet state complexes.

5. The energy surface profiles for the P-dissociated mechanism of hydrogen activation by complex **1**.

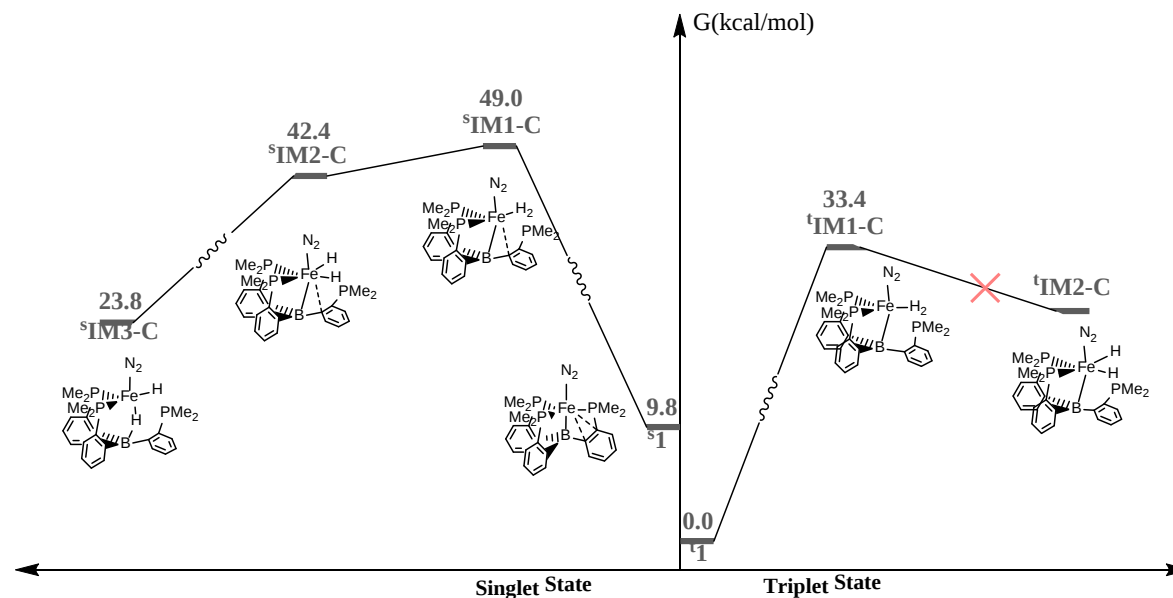


Figure S4. Potential energy surface profiles for the P-Dissociated Mechanism of hydrogen activation by catalyst **1**. Solvent-corrected free energies are in kcal/mol, relative to catalyst **t1**.

The dissociation of one phosphine arm of the TPB ligand is another possible way to enable H_2 activation, in which the auxiliary ligand remains at the axial site. Due to the little influence of auxiliary ligand on this mechanism, the complex **1** is taken as an example to evaluate this pathway. In the Figure S2, the energy surface profile of some important intermediates for the P-Dissociated Mechanism of hydrogen activation by complex **1** is displayed. Obviously, for the singlet complex **1**, the free energies of intermediates **sIM1-C** and **sIM2-C** are over 40.0kcal/mol, which extremely higher than other two mechanisms (associative mechanism and L-dissociative mechanism). And their structures show the interaction between Fe with one of phenyl groups, which is as same as reactant **s1**. For triplet complex **1**, the intermediate **tIM1-C** is partly distorted due to the weak dative interaction of H_2 molecule with Fe, even without the phenyl-Fe interaction. The free energy of **tIM1-C** is 33.4kcal/mol (higher than other two mechanisms), and the next intermediate **tIM2-C** is unable to be found for the unstable weak Fe-H interaction. The results indicate the mechanism with dissociation of phosphine arm is not suitable for H_2 activation by ferraboratrane complexes (TPB)Fe(L).

6. The energy surface profiles for the P-dissociated mechanism of H migration from $^s/t\text{IM3-A}$ to $^s/t\text{IM4-A}$.

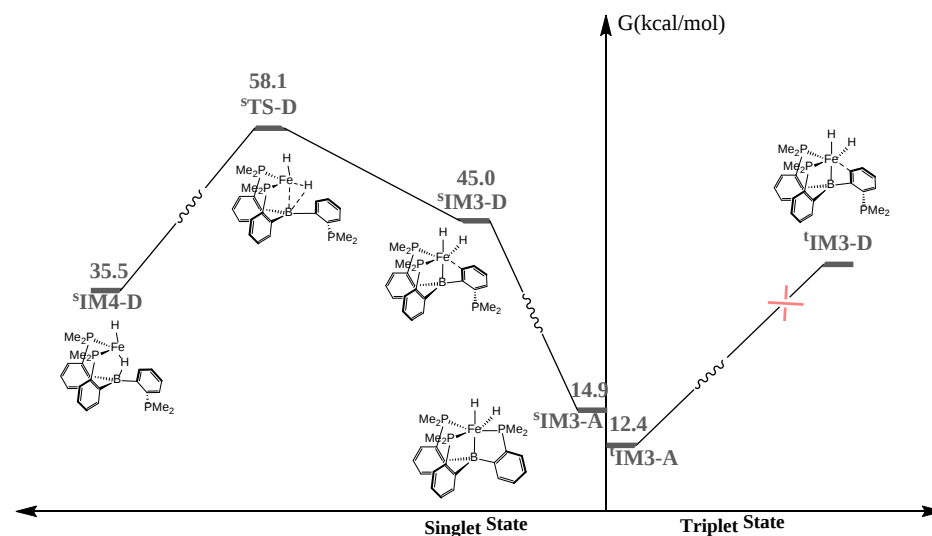


Figure S5. The energy surface profiles for the P-Dissociated Mechanism of H migration from $^s/t\text{IM3-A}$ to $^s/t\text{IM4-A}$. Solvent-corrected free energies are in kcal/mol, relative to catalyst $^t\text{1}$.

An alternative pathway for H migration after dissociation of one phosphine arm of the TPB ligand (Ref) is evaluated and the energy surface profiles for this possible pathway is shown in Figure S5. The results show this pathway is less favored for the following reasons. Firstly, the energy of the isomeric intermediate of singlet $^s\text{IM3-A}$ with dissociation of a phosphine arm, $^s\text{IM3-D}$, is about 30 kcal/mol higher than $^s\text{IM3-A}$, due to the strong interaction of Fe-P bond. Secondly, it should be noted that the triplet $^t\text{IM3-A}$ with dissociation of a phosphine arm is too unstable to be obtained. The two hydrides undergo reductive elimination to H_2 barrierlessly.

7. The Cartesian coordinates (xyz) for all optimized structures

CN ^t Bu				B	0.237706	0.565848	-0.896504
C	2.394986	0.000487	0.000418	C	-3.314857	-2.696376	0.252419
N	1.201982	0.000239	0.000612	H	-3.916183	-3.076995	-0.600465
C	-0.260822	-0.000124	-0.000046	C	1.795948	1.076238	-0.819268
C	-0.744047	-1.480998	-0.069099	C	4.097604	0.763962	0.089152
H	-1.854039	-1.514000	-0.070516	H	4.793714	0.225833	0.755398
H	-0.374644	-1.971950	-0.992992	C	-3.643454	-0.129242	-1.004748
H	-0.374501	-2.055801	0.805020	H	-4.356799	0.206707	-0.221981
C	-0.744267	0.799948	-1.247935	C	-2.192510	3.377734	0.375374
H	-1.854219	0.819399	-1.274328	H	-2.581709	3.710363	1.352853
H	-0.373456	1.845064	-1.211993	C	-1.152921	-3.004505	-2.124899
H	-0.376538	0.329029	-2.182806	H	-2.026181	-3.656009	-1.961451
C	-0.745448	0.680610	1.316339	C	1.101913	-1.360087	-2.513372
H	-1.855433	0.697935	1.343174	H	1.991479	-0.733223	-2.681299
H	-0.379095	0.124700	2.203900	C	4.575116	1.834942	-0.696485
H	-0.374360	1.724412	1.378205	H	5.636332	2.128767	-0.649116
^s 1				C	1.003210	-2.587059	-3.180590
				H	1.805193	-2.904869	-3.867854
Fe	-0.302958	-0.837600	0.804133	C	-1.206711	2.526907	-2.137154
P	-2.304613	-1.186885	-0.211604	H	-0.836950	2.208060	-3.127205
P	1.959710	-0.934572	1.060936	C	3.673604	2.535668	-1.530610
P	-0.761455	1.144504	1.661075	H	4.035372	3.381114	-2.139691
C	-0.822604	1.800471	-0.975435	C	-2.564996	4.073738	-0.798032
C	2.728437	0.400688	0.033941	H	-3.240626	4.942425	-0.735454
C	-1.079629	-1.733347	-1.468535	C	-2.073938	3.643026	-2.052130
C	2.710113	-0.760705	2.775280	H	-2.370900	4.179708	-2.968884
H	2.448642	0.222898	3.210684	C	-0.133784	-3.422975	-2.987490
C	0.484479	2.228016	2.571456	H	-0.210336	-4.389331	-3.511805
H	0.739674	1.772391	3.551671	N	-0.576534	-2.085587	2.129242
C	2.789848	-2.533772	0.519013	N	-0.729621	-2.811067	2.999872
H	3.896568	-2.448884	0.571370	H	-3.073234	0.729571	2.486036
C	-1.340871	2.252192	0.277012	H	-1.864794	0.576216	3.807416
C	2.312662	2.160951	-1.586104	H	0.058187	3.238033	2.749634
H	1.630118	2.729150	-2.239782	H	1.407700	2.330582	1.966914
C	-2.160826	1.182329	2.925205	H	2.294668	-1.556773	3.428548
H	-2.395078	2.214414	3.264475	H	3.816045	-0.860971	2.751504
C	0.056202	-0.841196	-1.658705	H	2.458576	-3.359746	1.183740

H	2.490134	-2.772942	-0.520369	C	-2.846542	-1.975607	-2.915446
H	-2.647176	-3.498329	0.623579	H	-2.922653	-2.558656	-3.848794
H	-4.012300	-2.419449	1.071399	C	-3.997477	-1.762984	-2.123338
H	-4.196316	-0.726113	-1.761079	H	-4.972353	-2.175666	-2.430116
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H	-2.315983	1.596210	-3.399308	H	-4.123325	0.135957	-2.541752
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H	-4.486295	0.862911	-0.090974	H	-1.056844	3.769421	-0.965973
H	-3.428283	-0.245671	0.872074	C	3.841516	3.245800	-0.442149
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*6				H	-3.050013	4.336807	-2.349550
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P	-1.965714	-1.208324	-0.974858	H	-1.462033	3.124279	1.697216
P	2.318675	-0.591977	-1.089153	C	2.735881	3.959576	0.068615
P	0.318818	-1.587161	1.678266	H	2.843311	5.019897	0.351197
C	-0.647964	1.097796	1.653688	C	-1.451681	1.033836	4.420230
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C	1.938800	-1.707659	2.633856	H	-4.604380	2.508726	-3.137400
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H	-3.101524	-1.039945	1.231074	C	-4.678104	-1.737143	-0.196130
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'6				H	1.088343	-4.890852	-2.736825
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P	-1.875466	1.108136	-1.450283	C	-3.879263	-2.698061	0.460596
P	0.002938	1.528039	1.918228	H	-4.344440	-3.592403	0.907960
C	0.333753	-1.300046	1.686734	C	1.179512	-1.596936	4.428717
C	-2.658218	-0.404841	-0.667375	H	1.499807	-1.705172	5.477632
C	1.933625	-1.255860	-1.490014	C	1.126798	-2.718495	3.572192
C	-3.258599	2.371856	-1.612265	H	1.412173	-3.715067	3.948568
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C	-1.775368	1.812785	2.455182	H	3.149317	-3.712827	-3.601224
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H	-2.614962	0.182386	-3.657124	H	-2.829021	3.286141	-2.073235
C	0.419084	-0.170358	2.571545	H	-4.101520	2.022139	-2.244892
C	-2.484768	-2.505283	0.552926	H	-1.303388	1.427386	-3.840864
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				H	3.066585	-0.283753	1.314793

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O 0.773716 4.719729 -0.961708

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H 4.136487 1.920815 -0.992468
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P -1.890130 -1.431621 -1.291248
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C -1.729870 -3.279771 -0.962675
H -1.436920 -3.799686 -1.900010

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 H 4.560425 -0.452056 -0.597225
 C -2.551809 -0.725620 0.304176
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H -2.686728 -3.707865 -0.593682
 H -0.940807 -3.444445 -0.202662
 H 3.889918 -2.602002 -2.115485
 H 3.099997 -1.689634 -3.453304
 H 4.003233 0.674939 -1.899721
 H 3.449930 0.919896 -0.200277
 H 1.501777 3.406579 -2.636726
 H -0.096861 3.522872 -3.454582
 H -1.894539 4.167080 -0.599412
 H -2.509411 2.514215 -0.190885

⁵IM2-A

Fe 0.202861 0.739295 1.104322
 P 2.171852 1.533987 0.358217
 P -2.049376 0.569312 1.301949
 P 0.862155 -1.326124 1.536429
 C 1.059248 -1.345251 -1.172743
 C -2.647229 -0.577343 -0.029494
 C 0.924635 2.215906 -0.808558
 C -2.825830 -0.068546 2.892325
 H -2.450471 -1.085018 3.119947
 C -0.279858 -2.717686 2.101510
 H -0.630506 -2.525267 3.137642
 C -3.060970 2.141330 1.077733
 H -4.149040 1.919935 1.029563
 C 1.598092 -2.017691 -0.033470
 C -2.007989 -1.883950 -1.975913
 H -1.252808 -2.220347 -2.705808
 C 2.225741 -1.540110 2.823609
 H 2.576192 -2.592563 2.896031
 C -0.091949 1.276754 -1.264222
 B -0.134442 -0.282581 -0.861345
 C 2.990005 2.996378 1.203220
 H 3.557121 3.636445 0.493442
 C -1.629645 -0.950204 -0.967952
 C -3.969065 -1.081049 -0.119151
 H -4.735146 -0.776458 0.614739
 C 3.644260 0.844460 -0.590417

H	4.371303	0.406725	0.126895	P	-2.078468	-1.141981	-1.271081
C	2.570936	-3.037518	-0.156085	P	0.036713	2.353775	-1.251515
H	2.976195	-3.544664	0.736035	P	2.070077	-1.179026	-1.240948
C	0.862981	3.607182	-1.151609	C	0.630718	-1.469417	1.123643
H	1.647011	4.292946	-0.792859	C	0.970309	2.466915	0.352802
C	-1.166538	1.865166	-2.034740	C	-2.642780	-0.384282	0.330055
H	-1.971112	1.201612	-2.388273	C	0.915121	3.529230	-2.429310
C	-4.310659	-1.993893	-1.140500	H	1.954524	3.178918	-2.595141
H	-5.334938	-2.395754	-1.206705	C	3.675087	-0.261843	-0.885831
C	-1.190619	3.214667	-2.403528	H	4.039769	0.224419	-1.815811
H	-2.000181	3.594606	-3.049024	C	-1.565589	3.295298	-0.955072
C	1.547412	-1.736289	-2.450532	H	-1.364535	4.325421	-0.589890
H	1.163671	-1.237606	-3.357614	C	1.667215	-2.077765	0.335960
C	-3.320916	-2.397934	-2.065725	C	1.716153	1.281603	2.340410
H	-3.575279	-3.119496	-2.860325	H	1.737296	0.376215	2.970204
C	3.044549	-3.398746	-1.438848	C	2.686694	-2.502356	-2.428294
H	3.813412	-4.181621	-1.544682	H	3.586985	-3.033190	-2.050644
C	2.533945	-2.743567	-2.582928	C	-1.588671	0.167569	1.135583
H	2.908906	-3.018388	-3.583227	B	-0.006431	-0.008598	0.720970
C	-0.166411	4.100167	-1.958192	C	-3.532179	-0.971483	-2.454462
H	-0.186052	5.163703	-2.247149	H	-4.448862	-1.480802	-2.086713
H	0.395408	1.137513	2.677073	C	0.934421	1.270373	1.146897
H	0.178688	1.927233	2.264577	C	1.713880	3.606015	0.752332
H	0.257483	-3.689743	2.083099	H	1.728273	4.513649	0.125935
H	-1.157119	-2.780012	1.427388	C	-2.108526	-2.998183	-0.956894
H	1.834816	-1.226434	3.814483	H	-1.870715	-3.541021	-1.896660
H	3.087081	-0.889324	2.569160	C	2.277613	-3.298265	0.720908
H	3.315782	0.052667	-1.288257	H	3.071871	-3.747594	0.101498
H	4.146664	1.657133	-1.157406	C	-4.003135	-0.299073	0.720240
H	2.221869	3.604041	1.721324	H	-4.795863	-0.728446	0.084938
H	3.700976	2.608889	1.963884	C	-1.992030	0.831470	2.332548
H	-2.747728	2.647437	0.143351	H	-1.219085	1.289409	2.972433
H	-2.867006	2.824534	1.931777	C	2.461367	3.583363	1.949982
H	-3.934553	-0.099603	2.828284	H	3.045106	4.466854	2.256073
H	-2.537017	0.607076	3.725338	C	-3.347052	0.924715	2.723311
¹IM2-A				H	-3.615155	1.447423	3.657026
Fe	0.008786	0.000745	-1.514381	C	0.228360	-2.180785	2.293494
				H	-0.579741	-1.762133	2.916454

C	2.464415	2.411943	2.740351
H	3.055037	2.378883	3.671496
C	1.861432	-3.963430	1.894777
H	2.331647	-4.916154	2.188366
C	0.827922	-3.401522	2.677522
H	0.486664	-3.918359	3.590393
C	-4.359856	0.354202	1.920201
H	-5.418564	0.426588	2.218389
H	0.143630	-0.402924	-3.366222
H	-0.156923	0.343446	-3.382335
H	4.455389	-0.957488	-0.508812
H	3.484152	0.519174	-0.123805
H	2.943279	-2.020550	-3.395507
H	1.879128	-3.240813	-2.610107
H	-1.342412	-3.246601	-0.195888
H	-3.105819	-3.324428	-0.590981
H	-3.753712	0.103140	-2.617788
H	-3.249240	-1.420948	-3.429968
H	-2.166825	2.750934	-0.200521
H	-2.143746	3.351036	-1.902131
H	0.938413	4.575153	-2.054589
H	0.383572	3.517150	-3.404396

***TS1-A**

Fe	0.205703	0.759895	1.109783
P	2.185550	1.525544	0.394913
P	-2.037560	0.641560	1.292585
P	0.835765	-1.322481	1.529712
C	1.033872	-1.399606	-1.161377
C	-2.660153	-0.521863	-0.016038
C	0.981580	2.167559	-0.843990
C	-2.845466	0.072487	2.891155
H	-2.528397	-0.959414	3.137729
C	-0.341237	-2.664535	2.135522
H	-0.699078	-2.417870	3.157467
C	-2.994809	2.236298	1.014823
H	-4.088961	2.050041	0.956647
C	1.563072	-2.067562	-0.016186

C	-2.047643	-1.895921	-1.926118
H	-1.298749	-2.270013	-2.644003
C	2.191518	-1.519590	2.823849
H	2.513745	-2.577781	2.932753
C	-0.052312	1.238629	-1.276025
B	-0.139557	-0.316322	-0.852815
C	2.998725	3.012519	1.193576
H	3.603624	3.608433	0.476593
C	-1.650195	-0.945304	-0.941975
C	-3.992889	-0.996570	-0.097748
H	-4.752987	-0.655215	0.625961
C	3.663296	0.773576	-0.496501
H	4.374949	0.360234	0.250275
C	2.519587	-3.103598	-0.127929
H	2.919279	-3.606462	0.769065
C	0.956467	3.543363	-1.244507
H	1.748196	4.226601	-0.898819
C	-1.100073	1.816823	-2.087386
H	-1.916236	1.158527	-2.423109
C	-4.354178	-1.927399	-1.096147
H	-5.387766	-2.305917	-1.154687
C	-1.084102	3.148838	-2.517501
H	-1.873498	3.519628	-3.192300
C	1.512209	-1.809063	-2.436475
H	1.135943	-1.313102	-3.348051
C	-3.372751	-2.379826	-2.007223
H	-3.642245	-3.115883	-2.783210
C	2.984214	-3.484977	-1.408235
H	3.740462	-4.280781	-1.507916
C	2.482605	-2.833230	-2.558507
H	2.852668	-3.123830	-3.556081
C	-0.045898	4.025358	-2.091922
H	-0.032388	5.075456	-2.426901
H	0.373139	1.003327	2.633200
H	0.137198	2.007389	2.079057
H	1.809093	-1.157229	3.800722
H	3.068534	-0.901326	2.544231
H	0.175130	-3.647547	2.165574

H -1.212092-2.735947 1.454140
H -2.786170 2.932816 1.854061
H -2.650906 2.707528 0.073512
H -3.954157 0.102425 2.826174
H -2.517203 0.746431 3.710269
H 4.185949 1.550380-1.094569
H 3.332996-0.045604-1.161393
H 2.218496 3.650671 1.652638
H 3.671981 2.650599 1.999730

^tTS1-A

Fe 0.137446 0.065641-1.786921
P 2.280955-0.735421-1.106374
P -1.963071-0.962245-1.421812
P -0.048250 2.260892-1.091535
C 0.706796 1.167238 1.321479
C -2.669458-0.584628 0.242966
C 1.877232-1.904609 0.277510
C -3.282671-0.492299-2.669849
H -3.476530 0.597624-2.610261
C -1.742344 3.065918-0.944489
H -2.201707 3.139794-1.952872
C -2.000967-2.838764-1.540624
H -3.024562-3.232478-1.361790
C 0.688931 2.405949 0.609330
C -2.119157 0.221388 2.466027
H -1.388756 0.592057 3.204262
C 0.857190 3.559034-2.107670
H 0.762078 4.580380-1.680438
C 0.687816-1.566360 1.003794
B -0.081585-0.146566 0.753153
C 3.157297-1.774750-2.402475
H 4.095452-2.232439-2.021398
C -1.670311-0.144144 1.163374
C -4.035941-0.682387 0.604507
H -4.786813-1.024347-0.127889
C 3.712138 0.318281-0.487700
H 4.079950 0.959986-1.316773

C 1.248522 3.585544 1.158217
H 1.225625 4.532575 0.593606
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H 3.535454-3.310042-0.001935
C 0.277194-2.484378 2.014254
H -0.640179-2.273482 2.587905
C -4.445530-0.320659 1.906310
H -5.508702-0.380708 2.190569
C 1.012754-3.656948 2.303796
H 0.660323-4.344980 3.090393
C 1.343272 1.163921 2.596494
H 1.399629 0.221304 3.166975
C -3.481294 0.135177 2.833928
H -3.794523 0.432854 3.848620
C 1.864445 3.552943 2.429721
H 2.312273 4.467357 2.851765
C 1.916989 2.335217 3.143864
H 2.410967 2.296354 4.129199
C 2.193274-3.952264 1.587699
H 2.767375-4.867009 1.807431
H -0.209342 0.693837-3.237014
H 0.252721-0.636687-3.212011
H 0.434300 3.556920-3.133551
H 1.932521 3.294003-2.175039
H -1.666364 4.082414-0.502688
H -2.390041 2.437812-0.300705
H -1.656455-3.150663-2.548791
H -1.311522-3.261415-0.782239
H -4.233083-1.043831-2.505158
H -2.901081-0.721850-3.686138
H 4.546080-0.323286-0.130880
H 3.366410 0.965746 0.340869
H 2.471540-2.571213-2.754679
H 3.403514-1.125527-3.268744

^sIM3-A

Fe -0.220785 0.763725-1.135488
P -2.262247 1.416158-0.507344

P 2.007322 0.839243 -1.282667
 P -0.727193 -1.378480 -1.519771
 C -0.909083 -1.505951 1.146967
 C 2.712944 -0.300139 0.010889
 C -1.220508 2.028450 0.897878
 C 2.868367 0.373128 -2.884249
 H 2.625971 -0.671485 -3.160891
 C 0.561353 -2.588530 -2.167493
 H 0.892097 -2.271063 -3.178815
 C 2.838112 2.491095 -0.947829
 H 3.943878 2.389600 -0.899616
 C -1.392116 -2.210184 0.005290
 C 2.194692 -1.764994 1.884117
 H 1.470460 -2.216943 2.582092
 C -2.070347 -1.634715 -2.811902
 H -2.322400 -2.710012 -2.935080
 C -0.087030 1.198652 1.269023
 B 0.175368 -0.340230 0.821286
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 H -3.832910 3.387211 -0.529243
 C 1.733252 -0.828648 0.914691
 C 4.078261 -0.667659 0.100754
 H 4.815372 -0.250463 -0.606585
 C -3.738577 0.502457 0.223634
 H -4.389852 0.130662 -0.596674
 C -2.271176 -3.312190 0.121425
 H -2.638553 -3.843197 -0.773065
 C -1.366327 3.347139 1.424218
 H -2.222921 3.966507 1.115201
 C 0.868261 1.808826 2.158879
 H 1.753890 1.224362 2.451702
 C 4.504231 -1.586964 1.084581
 H 5.564856 -1.880397 1.148035
 C 0.682937 3.082506 2.717452
 H 1.412581 3.477648 3.443306
 C -1.351051 -1.940277 2.425915
 H -1.010101 -1.414169 3.334287
 C 3.554675 -2.138210 1.974092

H 3.875154 -2.866336 2.737911
 C -2.699841 -3.722405 1.405271
 H -3.395581 -4.570831 1.510880
 C -2.243608 -3.031990 2.552459
 H -2.589923 -3.345192 3.551581
 C -0.445639 3.860044 2.349254
 H -0.597302 4.861666 2.784054
 H -0.315506 0.713329 -2.657563
 H -0.139245 2.208986 -1.706730
 H -1.717025 -1.229515 -3.782001
 H -2.982790 -1.079346 -2.515525
 H 0.140195 -3.614205 -2.231910
 H 1.436354 -2.597370 -1.487424
 H 2.567410 3.197058 -1.760391
 H 2.463332 2.901731 0.010368
 H 3.971496 0.481520 -2.809175
 H 2.493123 1.043540 -3.685263
 H -4.335356 1.183337 0.867457
 H -3.394238 -0.361927 0.821755
 H -2.353816 3.642088 -1.560003
 H -3.685283 2.581459 -2.133849

'IM3-A

Fe -0.212905 0.061628 -1.838366
 P -2.224796 1.002244 -0.971236
 P 1.985715 0.821776 -1.425446
 P -0.305826 -2.141197 -1.190313
 C -0.765839 -1.167168 1.345298
 C 2.729651 0.263439 0.174412
 C -1.604958 2.071866 0.417070
 C 3.170788 0.274253 -2.770202
 H 3.246995 -0.831679 -2.767392
 C 1.273763 -3.159468 -1.220065
 H 1.674864 -3.178710 -2.255043
 C 2.230062 2.684307 -1.435106
 H 3.297823 2.950752 -1.282162
 C -0.950823 -2.335701 0.546623
 C 2.207896 -0.620595 2.377044

H 1.479393 -0.954345 3.134246
 C -1.441861 -3.230057 -2.218133
 H -1.463882 -4.281831 -1.860783
 C -0.445485 1.568232 1.095997
 B 0.144089 0.075510 0.819723
 C -3.069007 2.167822 -2.174045
 H -3.942235 2.689467 -1.726926
 C 1.738619 -0.123159 1.126917
 C 4.114598 0.182568 0.459906
 H 4.860041 0.483240 -0.295407
 C -3.720082 0.095683 -0.273473
 H -4.191408 -0.506629 -1.079475
 C -1.627167 -3.473739 1.049967
 H -1.766155 -4.367705 0.419873
 C -2.174151 3.323565 0.754867
 H -3.062385 3.696259 0.218876
 C 0.119367 2.403704 2.104175
 H 1.020484 2.061475 2.638658
 C 4.547728 -0.308516 1.711287
 H 5.624283 -0.388978 1.933115
 C -0.442483 3.657231 2.438844
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 C -1.313592 -1.181127 2.660279
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 C 3.588593 -0.712408 2.667001
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 H -2.691386 -4.344185 2.748719
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 H -2.423905 -2.288056 4.181246
 C -1.594985 4.120089 1.768353
 H -2.034036 5.098822 2.021073
 H 0.004342 -0.736368 -3.225045
 H -0.255615 1.106438 -3.020794
 H -1.085003 -3.208412 -3.267802
 H -2.471674 -2.817449 -2.193452
 H 1.085334 -4.200049 -0.880018
 H 2.023881 -2.690904 -0.552167

H 1.879461 3.090466 -2.406204
 H 1.623244 3.130809 -0.621704
 H 4.183308 0.712756 -2.640001
 H 2.754776 0.591150 -3.748214
 H -4.466432 0.819561 0.118080
 H -3.404139 -0.581954 0.542360
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 H -3.415420 1.576134 -3.047198

***TS2-A**

Fe 0.190367 -0.654673 -1.485189
 P -2.007918 -0.105402 -1.638888
 P 2.364444 -0.142318 -1.448135
 P -0.012310 -2.304647 -0.005974
 C -0.723256 -0.329903 1.757087
 C 2.661132 0.829500 0.111158
 C -2.124412 1.513388 -0.726323
 C 3.782339 -1.387879 -1.491401
 H 3.758401 -2.046191 -0.602584
 C 1.529194 -3.204416 0.589773
 H 2.047012 -3.682482 -0.266819
 C 2.949587 0.983907 -2.837649
 H 4.016573 1.268767 -2.716284
 C -0.772030 -1.742722 1.590279
 C 1.829769 1.680318 2.231291
 H 1.015304 1.819963 2.960484
 C -1.043015 -3.798326 -0.505624
 H -1.134036 -4.536837 0.318718
 C -1.033039 1.798708 0.159075
 B 0.000770 0.635361 0.657146
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 C 1.546520 1.041697 0.984529
 C 3.962896 1.280432 0.457939
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 C -3.537704 -1.051741 -1.077158
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 H -1.362601 1.299967 3.074957
 C 3.121887 2.130502 2.575129
 H 3.290591 2.624189 3.546598
 C -1.935336-2.029656 3.728390
 H -2.401129-2.681769 4.485056
 C -1.919620-0.626570 3.905508
 H -2.380657-0.180865 4.802605
 C -3.087576 3.742087-0.366509
 H -3.877301 4.484104-0.567245
 H 0.443778-2.059136-2.084387
 H 0.247163 0.863523-1.954994
 H -0.552830-4.286009-1.373309
 H -2.056572-3.477805-0.815983
 H 1.255169-3.984982 1.331219
 H 2.215999-2.482394 1.075085
 H 2.828816 0.456904-3.808707
 H 2.319717 1.894565-2.853496
 H 4.771259-0.884306-1.534924
 H 3.665911-2.017925-2.398790
 H -4.444627-0.414894-1.154279
 H -3.412530-1.369016-0.022008
 H -1.757839 1.021581-3.828222
 H -2.470390-0.623410-4.014948

'TS2-A

Fe -0.190228 0.672433-1.541953
 P 2.120303 0.317789-1.571836
 P -2.232172-0.221220-1.547097

P -0.490020 2.394416 0.009531
 C 0.548841 0.461281 1.700188
 C -2.507351-1.214235 0.005214
 C 2.401520-1.240027-0.585769
 C -3.779155 0.833272-1.719957
 H -3.896837 1.503124-0.847341
 C -2.133832 3.136852 0.550936
 H -2.659422 3.573104-0.323870
 C -2.522746-1.432376-2.950542
 H -3.523560-1.908953-2.873312
 C 0.281515 1.860962 1.605900
 C -1.640667-1.995112 2.136811
 H -0.835536-2.051169 2.887706
 C 0.410896 3.976065-0.469848
 H 0.325215 4.765535 0.307434
 C 1.329516-1.675169 0.262989
 B 0.074665-0.680292 0.607232
 C 2.708051-0.099537-3.305405
 H 3.763981-0.443831-3.320384
 C -1.399521-1.312127 0.905910
 C -3.760989-1.808733 0.308301
 H -4.599755-1.724880-0.403080
 C 3.466318 1.497670-0.996314
 H 3.464347 2.407895-1.632689
 C 0.625796 2.757391 2.651228
 H 0.408809 3.834468 2.551508
 C 3.578716-2.011320-0.740809
 H 4.396168-1.658393-1.392494
 C 1.483937-2.945682 0.885234
 H 0.668827-3.338274 1.514500
 C -3.952942-2.503682 1.519383
 H -4.928298-2.962526 1.749038
 C 2.650130-3.727685 0.715316
 H 2.728040-4.709635 1.211144
 C 1.218958 0.021231 2.883563
 H 1.489947-1.042395 2.985025
 C -2.885271-2.586419 2.440693
 H -3.025133-3.107334 3.402465

C	1.262036	2.285108	3.816927
H	1.534961	2.983651	4.624489
C	1.562779	0.908358	3.925624
H	2.077401	0.525934	4.822854
C	3.711131	-3.256198	-0.085807
H	4.624852	-3.857696	-0.218314
H	-0.832783	1.402958	-2.878329
H	-0.095644	-0.886789	-1.523121
H	-0.026899	4.353606	-1.417569
H	1.483137	3.758333	-0.645916
H	-1.973874	3.932991	1.308994
H	-2.770170	2.346551	0.997982
H	-2.447841	-0.887689	-3.914462
H	-1.739574	-2.215808	-2.924006
H	-4.689727	0.203851	-1.813493
H	-3.669421	1.453223	-2.633167
H	4.467827	1.020556	-1.053492
H	3.269176	1.792045	0.054241
H	2.056462	-0.892776	-3.723435
H	2.610245	0.804408	-3.941863

^sIM4-A

Fe	0.081684	-1.118776	-1.363282
P	-2.151719	-0.548600	-1.412997
P	2.208375	-0.349467	-1.556850
P	0.172627	-2.360398	0.436022
C	-0.369291	0.030874	1.875831
C	2.574072	1.008745	-0.298371
C	-2.321102	1.226699	-0.779318
C	3.809955	-1.314794	-1.745508
H	4.091416	-1.781170	-0.780112
C	1.825454	-3.126144	0.900964
H	2.188591	-3.758438	0.064251
C	2.183390	0.595821	-3.192007
H	3.091445	1.226889	-3.298703
C	-0.300032	-1.398669	1.965331
C	1.903230	2.546663	1.466912
H	1.146370	2.938995	2.166032

C	-0.914941	-3.888739	0.442025
H	-0.775999	-4.502999	1.356861
C	-1.282270	1.817789	0.025129
B	-0.003376	0.911515	0.528806
C	-2.761930	-0.456018	-3.191048
H	-3.778234	-0.018737	-3.281431
C	1.528200	1.521407	0.550559
C	3.892906	1.535196	-0.220536
H	4.687428	1.142158	-0.875490
C	-3.592496	-1.431892	-0.588760
H	-3.695829	-2.451128	-1.016513
C	-0.588987	-2.072666	3.184405
H	-0.526413	-3.172710	3.237233
C	-3.481562	1.971238	-1.120494
H	-4.280198	1.510519	-1.725680
C	-1.467557	3.174998	0.411099
H	-0.679086	3.674336	0.997723
C	4.216591	2.563340	0.687802
H	5.244342	2.958563	0.734044
C	-2.615681	3.916757	0.056561
H	-2.712028	4.968369	0.374350
C	-0.768225	0.720631	3.058903
H	-0.873188	1.818330	3.026895
C	3.211759	3.068056	1.540243
H	3.448574	3.862918	2.266913
C	-0.962557	-1.354016	4.337007
H	-1.187537	-1.886226	5.275539
C	-1.057356	0.054067	4.267045
H	-1.363385	0.631985	5.155017
C	-3.636698	3.310676	-0.705218
H	-4.540299	3.876099	-0.985348
H	0.107690	0.176462	-0.478317
H	0.106275	-2.376211	-2.305642
H	1.734121	-3.746865	1.817887
H	2.563177	-2.320754	1.092412
H	3.624805	-2.122084	-2.484082
H	4.653931	-0.688481	-2.103205
H	2.129864	-0.122557	-4.036641

H 1.293621 1.259360 -3.228736
H -2.767646 -1.484835 -3.606683
H -2.057123 0.155056 -3.793034
H -3.399070 -1.514182 0.500131
H -4.540554 -0.874170 -0.741700
H -1.980007 -3.596681 0.362118
H -0.650436 -4.494359 -0.448749

^tIM4-A

Fe 0.007843 -0.000271 -1.898787
P 1.911488 -1.294392 -1.369674
P -2.070878 -0.997986 -1.388996
P 0.182559 2.296332 -1.375570
C 0.550096 1.500750 1.364558
C -2.553930 -0.759999 0.406982
C 1.933167 -1.827048 0.428237
C -3.545375 -0.367761 -2.368907
H -3.668470 0.720184 -2.190811
C -1.337297 3.369221 -1.653253
H -1.616960 3.338200 -2.727349
C -2.234371 -2.853794 -1.652338
H -3.236919 -3.222192 -1.346649
C 0.612388 2.586492 0.426347
C -2.060912 -0.051742 2.680229
H -1.369946 0.372941 3.427015
C 1.481598 3.255393 -2.336387
H 1.517855 4.331343 -2.064680
C 1.015110 -1.238841 1.363174
B -0.006124 -0.002908 0.981862
C 2.125450 -2.887103 -2.343625
H 3.048496 -3.441018 -2.072026
C -1.589548 -0.270360 1.351903
C -3.886818 -1.049789 0.808887
H -4.614762 -1.435780 0.075941
C 3.597547 -0.496406 -1.617437
H 3.727113 -0.233454 -2.688440
C 1.020308 3.884645 0.839340
H 1.053675 4.712386 0.111382

C 2.850482 -2.832192 0.841298
H 3.557990 -3.268035 0.116318
C 1.049078 -1.754963 2.692390
H 0.326906 -1.370253 3.431255
C -4.306791 -0.845376 2.138276
H -5.344249 -1.071074 2.433865
C 1.953043 -2.758244 3.099155
H 1.937957 -3.124041 4.139371
C 0.963606 1.793113 2.698034
H 0.981566 0.978278 3.440567
C -3.385401 -0.331398 3.076285
H -3.700430 -0.143332 4.116220
C 1.395212 4.139654 2.173410
H 1.712318 5.150318 2.477733
C 1.376003 3.079014 3.104957
H 1.687418 3.252718 4.148469
C 2.871265 -3.296310 2.171556
H 3.585477 -4.078600 2.475752
H -0.001397 0.000136 -0.282705
H 0.014550 0.002064 -3.478684
H -1.156827 4.423226 -1.351983
H -2.179886 2.966234 -1.054655
H -3.331805 -0.520537 -3.447293
H -4.493168 -0.885370 -2.110430
H -2.068972 -3.089690 -2.724709
H -1.463377 -3.376491 -1.049893
H 2.162833 -2.628113 -3.422261
H 1.247608 -3.543718 -2.174604
H 3.653594 0.432599 -1.013717
H 4.419513 -1.175293 -1.304791
H 2.478866 2.804497 -2.156177
H 1.249136 3.162410 -3.417716

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Fe -0.017796 0.494955 -1.705844
P 2.195267 -0.027801 -1.460971
P -2.144017 -0.264397 -1.660388
P -0.150600 2.343903 -0.401969

C 0.472583 0.660393 1.798370
 C -2.582783-0.899952 0.065505
 C 2.187372-1.562400-0.355505
 C -3.659307 0.690265-2.241021
 H -3.854028 1.553482-1.574624
 C -1.811590 3.188822-0.138964
 H -2.226728 3.513536-1.116455
 C -2.319020-1.823437-2.695139
 H -3.298083-2.318625-2.519268
 C 0.420763 2.020413 1.348068
 C -1.999075-1.551685 2.342229
 H -1.261753-1.639683 3.157902
 C 0.865824 3.800611-1.013882
 H 0.710820 4.713153-0.400268
 C 1.149003-1.741960 0.627010
 B -0.004012-0.604766 0.865290
 C 3.126075-0.543138-3.005438
 H 4.179270-0.835205-2.808340
 C -1.572252-1.045003 1.079926
 C -3.927936-1.276042 0.334234
 H -4.698553-1.172111-0.447058
 C 3.504287 1.052202-0.636642
 H 3.750783 1.909629-1.299135
 C 0.797944 3.088940 2.205770
 H 0.751783 4.131426 1.848887
 C 3.208352-2.537272-0.504173
 H 3.999634-2.403802-1.258822
 C 1.194810-2.929899 1.407486
 H 0.394714-3.113746 2.143753
 C -4.309153-1.785808 1.592065
 H -5.357913-2.067205 1.780684
 C 2.214175-3.895837 1.257115
 H 2.208985-4.805184 1.880791
 C 0.945208 0.440142 3.123790
 H 1.039060-0.595503 3.492486
 C -3.334776-1.921203 2.603725
 H -3.615864-2.307318 3.597539
 C 1.245109 2.834775 3.518665

H 1.541093 3.669376 4.174641
 C 1.322844 1.500031 3.975113
 H 1.686498 1.285233 4.993648
 C 3.229867-3.698224 0.299205
 H 4.028806-4.445749 0.166110
 H -0.089722-0.121393-0.301083
 H 0.068343 0.033647-3.281944
 H -1.710610 4.073676 0.525175
 H -2.514347 2.470565 0.330074
 H 0.561451 4.020533-2.059063
 H 1.942648 3.541098-1.011673
 H 3.119955 1.440603 0.327421
 H 4.429393 0.467061-0.448741
 H 2.586046-1.378027-3.494377
 H 3.117126 0.320370-3.702683
 H -1.501711-2.524187-2.429674
 H -2.211219-1.557082-3.766558
 H -4.570529 0.057908-2.289207
 H -3.442287 1.074525-3.259792

***IM5-A**

Fe -0.105693 0.696501-1.610308
 P 2.103061 0.152680-1.554929
 P -2.257948-0.045899-1.591543
 P -0.174615 2.442438-0.117198
 C 0.518953 0.433641 1.782249
 C -2.567571-1.002731 0.010409
 C 2.221237-1.468543-0.599232
 C -3.773024 1.070878-1.751382
 H -3.813129 1.794916-0.914791
 C -1.768535 3.319474 0.388894
 H -2.237212 3.806051-0.493007
 C -2.686244-1.311763-2.913461
 H -3.709741-1.722620-2.780556
 C 0.454020 1.844037 1.538172
 C -1.871802-1.947288 2.148023
 H -1.101925-2.113996 2.919757
 C 0.869362 3.962773-0.512913

H 0.778261 4.759136 0.255679
 C 1.217751 -1.801692 0.375104
 B 0.028164 -0.730651 0.731310
 C 2.893841 -0.205314 -3.222065
 H 3.960742 -0.501240 -3.139585
 C -1.514197 -1.248062 0.958212
 C -3.882827 -1.483901 0.259309
 H -4.686517 -1.305681 -0.473879
 C 3.493525 1.159918 -0.764654
 H 3.656186 2.095477 -1.342432
 C 0.858940 2.775607 2.533443
 H 0.801162 3.858747 2.334809
 C 3.303428 -2.350959 -0.847623
 H 4.074040 -2.092555 -1.591901
 C 1.348802 -3.052481 1.037353
 H 0.577109 -3.355613 1.764252
 C -4.192930 -2.193144 1.436980
 H -5.218742 -2.556808 1.610569
 C 2.423347 -3.933690 0.781398
 H 2.484523 -4.897401 1.313945
 C 1.033241 0.027979 3.049449
 H 1.142037 -1.049282 3.259901
 C -3.178065 -2.418903 2.391471
 H -3.404833 -2.957983 3.326269
 C 1.344279 2.337955 3.781808
 H 1.658465 3.070469 4.543004
 C 1.434888 0.951491 4.036268
 H 1.827865 0.590539 5.001249
 C 3.411174 -3.580180 -0.160259
 H 4.254488 -4.257957 -0.370650
 H -0.136344 -0.272330 -0.440426
 H 0.026787 -0.512412 -2.607684
 H -1.568399 4.091117 1.162677
 H -2.479100 2.578453 0.807991
 H 0.528667 4.379160 -1.485534
 H 1.935594 3.678160 -0.611334
 H 3.218287 1.424191 0.276049
 H 4.441700 0.581378 -0.747765

H 2.319976 -1.004430 -3.731016
 H 2.833702 0.715041 -3.841904
 H -1.945272 -2.133835 -2.868346
 H -2.610132 -0.831905 -3.912428
 H -4.723826 0.498112 -1.776386
 H -3.684253 1.640422 -2.701734

^sIM2'-A

Fe -0.119606 0.445969 -1.502343
 P 2.191805 0.229207 -1.361237
 P -2.309365 -0.170819 -1.528959
 P -0.319930 2.327651 -0.250462
 C 0.611707 0.507557 1.581352
 C -2.638892 -0.918738 0.136574
 C 2.321709 -1.420151 -0.502801
 C -3.797137 0.927193 -1.906077
 H -3.869689 1.760401 -1.181725
 C -1.953755 3.120850 0.253763
 H -2.473755 3.546202 -0.630409
 C -2.712253 -1.580012 -2.719392
 H -3.746157 -1.953471 -2.561111
 C 0.448338 1.910810 1.374650
 C -1.724156 -1.680141 2.248704
 H -0.878025 -1.808007 2.943794
 C 0.564394 3.871563 -0.875575
 H 0.510049 4.704511 -0.142858
 C 1.158100 -1.772262 0.266027
 B 0.024117 -0.611375 0.502950
 C 3.088845 -0.020634 -3.002383
 H 4.150246 -0.315909 -2.860259
 C -1.485740 -1.096065 0.966472
 C -3.936583 -1.318343 0.556395
 H -4.807396 -1.173255 -0.105585
 C 3.450260 1.339088 -0.504028
 H 3.588527 2.274885 -1.087594
 C 0.883328 2.873751 2.322062
 H 0.741211 3.952090 2.134337
 C 3.405510 -2.314441 -0.669985

H	4.290955	-2.021599	-1.259355	C	-2.604542	-1.019412	0.089897
C	1.130566	-3.090789	0.804465	C	2.362684	-1.330297	-0.606312
H	0.246764	-3.417536	1.377105	C	-3.867429	0.948328	-1.767126
C	-4.125564	-1.904328	1.823532	H	-3.950601	1.704781	-0.964036
H	-5.132216	-2.212777	2.149948	C	-2.013267	3.089670	0.453254
C	2.204643	-3.993843	0.627706	H	-2.557206	3.545382	-0.401024
H	2.146248	-5.007118	1.060249	C	-2.724444	-1.447338	-2.818775
C	1.280163	0.124090	2.783367	H	-3.737918	-1.877668	-2.670886
H	1.472148	-0.945745	2.970831	C	0.412934	1.842276	1.473010
C	-3.008392	-2.082233	2.672084	C	-1.652587	-1.880942	2.147760
H	-3.142823	-2.530492	3.671026	H	-0.799320	-2.020505	2.831549
C	1.520781	2.454758	3.508229	C	0.482387	3.939499	-0.653219
H	1.867849	3.197057	4.245354	H	0.426755	4.726897	0.128241
C	1.723880	1.072120	3.730666	C	1.248589	-1.756964	0.194708
H	2.238436	0.734585	4.646216	B	0.053977	-0.657198	0.471493
C	3.353118	-3.605878	-0.097266	C	2.968656	0.159457	-3.104939
H	4.193711	-4.306114	-0.231466	H	4.045571	-0.098643	-3.019493
H	-0.020977	-1.156170	-1.768520	C	-1.439654	-1.214967	0.901908
H	0.130087	-0.816837	-2.568067	C	-3.885135	-1.485639	0.493278
H	-3.674361	1.354779	-2.924403	H	-4.765292	-1.325850	-0.152607
H	-4.746794	0.351761	-1.882571	C	3.399609	1.447854	-0.575123
H	-2.610854	-1.230556	-3.769446	H	3.493473	2.405487	-1.131533
H	-2.003120	-2.416850	-2.556429	C	0.825643	2.758711	2.475458
H	-1.774040	3.934178	0.988449	H	0.660563	3.842414	2.347374
H	-2.603895	2.356746	0.725713	C	3.492425	-2.157864	-0.811318
H	0.086060	4.206207	-1.821055	H	4.341039	-1.811100	-1.425564
H	1.628358	3.644683	-1.084397	C	1.314558	-3.075304	0.726349
H	3.063397	0.928403	-3.579597	H	0.467834	-3.459277	1.319152
H	2.573111	-0.803667	-3.594596	C	-4.047784	-2.154405	1.722510
H	4.429449	0.819631	-0.432853	H	-5.042390	-2.513379	2.033719
H	3.101796	1.597557	0.514083	C	2.434971	-3.911867	0.512173
^sTS1'-A				H	2.449832	-4.928877	0.939367
Fe	-0.166845	0.528881	-1.474575	C	1.277348	-0.001437	2.783234
P	2.138520	0.332090	-1.422934	H	1.493128	-1.075203	2.911403
P	-2.341815	-0.132801	-1.523360	C	-2.920594	-2.347327	2.553523
P	-0.376342	2.348487	-0.116031	H	-3.033972	-2.857229	3.525033
C	0.605883	0.433887	1.600432	C	1.467817	2.288295	3.639005
				H	1.797617	2.995565	4.417293

C	1.697344	0.899970	3.784859
H	2.215114	0.521261	4.682212
C	3.534341	-3.452624	-0.245686
H	4.410160	-4.101136	-0.410848
H	-0.088780	-0.999418	-1.486429
H	0.067622	-0.685683	-2.488282
H	-3.777039	1.475727	-2.741105
H	-4.798668	0.343565	-1.784932
H	-2.664525	-1.001231	-3.834624
H	-1.973482	-2.259755	-2.749345
H	-1.834927	3.871404	1.221788
H	-2.641389	2.292752	0.900088
H	-0.011032	4.324128	-1.571660
H	1.546365	3.739642	-0.887321
H	2.881694	1.121837	-3.653670
H	2.449697	-0.625207	-3.691155
H	4.394522	0.954504	-0.552112
H	3.079693	1.663899	0.462588

^tTS-1B

Fe	-0.226975	0.580069	-1.694860
P	2.443394	0.195532	-1.430869
P	-2.649555	-0.380601	-1.477581
P	-0.487859	2.463155	-0.282557
C	0.667939	0.645470	1.451652
C	-2.632877	-1.062682	0.268462
C	2.426951	-1.419717	-0.475727
C	-4.347203	0.425602	-1.658880
H	-4.452143	1.258664	-0.934706
C	-2.187669	3.037340	0.279665
H	-2.776158	3.393801	-0.592063
C	-2.919339	-1.923467	-2.526647
H	-3.786824	-2.516271	-2.165515
C	0.400860	2.038661	1.278525
C	-1.502590	-1.555363	2.361954
H	-0.599384	-1.547423	2.992869
C	0.259897	4.082631	-0.870176
H	0.185993	4.889643	-0.110870

C	1.254860	-1.720187	0.304331
B	0.076666	-0.576409	0.486270
C	3.327518	-0.237049	-3.037940
H	4.347085	-0.650225	-2.884632
C	-1.405051	-1.077620	1.016905
C	-3.845988	-1.537613	0.842819
H	-4.776413	-1.528252	0.251883
C	3.784052	1.207767	-0.570309
H	3.971370	2.139449	-1.146610
C	0.828924	3.013246	2.217473
H	0.603716	4.080466	2.053080
C	3.499011	-2.341909	-0.563549
H	4.396126	-2.099439	-1.157562
C	1.213452	-2.996379	0.931864
H	0.320887	-3.277535	1.513423
C	-3.890558	-2.021686	2.163895
H	-4.839377	-2.383981	2.592095
C	2.280291	-3.919444	0.833689
H	2.206338	-4.898269	1.336771
C	1.435346	0.298851	2.606998
H	1.712444	-0.755494	2.767808
C	-2.705069	-2.021356	2.930509
H	-2.717921	-2.379109	3.973585
C	1.562365	2.628316	3.357812
H	1.903060	3.384830	4.083119
C	1.871447	1.261599	3.542979
H	2.463647	0.945297	4.417941
C	3.435339	-3.590527	0.094647
H	4.274156	-4.301340	0.016856
H	-0.056817	-0.965726	-1.216641
H	0.009169	-1.008427	-2.211001
H	-4.418556	0.846517	-2.684709
H	-5.191855	-0.280983	-1.514263
H	-3.094119	-1.628774	-3.583605
H	-2.009398	-2.555823	-2.486773
H	-2.102429	3.860325	1.020909
H	-2.720229	2.186410	0.750476
H	-0.269081	4.411672	-1.789449

H 1.327308 3.919404 -1.123656
H 3.410187 0.683966 -3.654037
H 2.718261 -0.974899 -3.599048
H 4.735352 0.639036 -0.489817
H 3.441789 1.481537 0.447408
N -0.334978 2.140908 -4.325815
N -0.297697 1.575909 -3.342263

'TS-3B

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P 0.336135 2.592735 -0.932886
P 0.563808 0.365108 2.055368
C -1.910790 -0.611815 1.313293
C -1.515681 2.706632 -0.684870
C -1.355694 -2.366666 -1.444337
C 0.999380 4.246731 -0.299996
H 0.794163 4.348305 0.784967
C 0.446262 2.073840 2.834273
H 1.411541 2.610186 2.715151
C 0.525467 2.880437 -2.787828
H -0.012532 3.794472 -3.119403
C -1.060793 -0.425526 2.447467
C -3.646147 1.685941 -0.125648
H -4.246639 0.809146 0.165251
C 1.803317 -0.455395 3.206764
H 1.541979 -0.339451 4.280161
C -2.090746 -1.134529 -1.322475
B -1.613675 -0.007630 -0.211283
C 1.381320 -3.471891 -1.624291
H 0.967475 -4.453765 -1.938953
C -2.245500 1.512152 -0.360534
C -2.173648 3.963892 -0.795427
H -1.596658 4.866665 -1.054908
C -0.130963 -3.842286 0.807865
H 0.802353 -4.101378 1.353616
C -1.429607 -0.860289 3.747094
H -0.750406 -0.699875 4.601580
C -1.797024 -3.397812 -2.309229

H -1.231306 -4.341784 -2.384865
C -3.239457 -0.993282 -2.150629
H -3.815199 -0.054703 -2.109921
C -3.558925 4.084824 -0.575438
H -4.053420 5.066220 -0.662590
C -3.669287 -2.017620 -3.026071
H -4.565488 -1.864427 -3.650967
C -3.136832 -1.303982 1.561699
H -3.810521 -1.517166 0.715796
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H -5.380919 3.003936 -0.037085
C -2.658167 -1.520018 3.955226
H -2.941023 -1.867261 4.962385
C -3.508668 -1.747624 2.849511
H -4.463306 -2.281971 2.990583
C -2.956958 -3.232598 -3.099273
H -3.288725 -4.039342 -3.773386
H -0.271516 0.044962 -1.417634
H 0.577389 -0.081539 -1.914578
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H 0.120898 2.004904 -3.334816
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H 2.802217 -0.002955 3.031496
H 1.864308 -1.535953 2.963156
H 2.343570 -3.649344 -1.096921
H 1.586953 -2.859447 -2.525988
H -0.536486 -4.763278 0.335935
H -0.871091 -3.455928 1.536402
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N 3.989527 0.004758 -0.213962
C 5.433197 -0.105372 -0.368860
C 5.798901 0.249748 -1.844188
C 6.113180 0.890644 0.621229
C 5.847006 -1.573897 -0.038924

H 5.296015 -0.443813 -2.549421
H 5.484239 1.285978 -2.086937
H 6.897117 0.170334 -1.990686
H 5.835179 0.653815 1.669477
H 7.217553 0.823419 0.525881
H 5.803700 1.933941 0.402451
H 6.946519 -1.688550 -0.145404
H 5.563746 -1.837252 1.001387
H 5.348936 -2.284920 -0.730372

^tTS-5B

P -2.381574 -0.939231 -0.958339
P 2.629637 -0.323650 -1.261504
P 0.499575 -1.915843 1.385746
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C -2.461509 0.919888 -1.188602
C 4.334511 -1.039926 -0.890667
H 4.434742 -1.249565 0.193274
C 2.199866 -1.974324 2.182366
H 2.810996 -2.775584 1.716405
C 2.897037 0.230554 -3.041701
H 3.755563 0.930591 -3.125632
C -0.428089 -0.643358 2.351390
C 1.369845 2.940440 1.002438
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C -0.205108 -3.571823 1.919953
H -0.119219 -3.741200 3.014235
C -1.333158 1.688677 -0.733995
B -0.133397 0.952498 0.129664
C -3.222213 -1.633593 -2.492197
H -4.261765 -1.267726 -2.630676
C 1.320160 1.727221 0.245713
C 3.756449 2.058030 -0.152599
H 4.702375 1.711551 -0.600277
C -3.700049 -1.293730 0.343604
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C -0.863561 -0.850971 3.686584

H -0.621709 -1.790600 4.211179
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H -4.417397 0.945241 -2.176967
C -1.354676 3.083402 -1.013507
H -0.495588 3.703392 -0.711190
C 3.754311 3.259168 0.581516
H 4.683385 3.839678 0.702331
C -2.442523 3.702518 -1.671923
H -2.417587 4.787272 -1.870005
C -1.514225 1.520710 2.331235
H -1.810285 2.446160 1.811339
C 2.547476 3.696877 1.169314
H 2.524664 4.625210 1.764093
C -1.626123 0.132987 4.347454
H -1.972336 -0.031197 5.380678
C -1.957464 1.320428 3.656367
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C -3.555110 2.936263 -2.076300
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H 0.026453 -0.347769 -2.277068
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H 5.167495 -0.375206 -1.203639
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H 1.981544 0.737347 -3.408175
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H 2.704886 -0.999071 2.032616
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H -1.273574 -3.626513 1.627623
H -3.245507 -2.741092 -2.407734
H -2.620770 -1.368568 -3.385576
H -4.680707 -0.857916 0.055320
H -3.385319 -0.862013 1.314148
C 0.412295 -3.021213 -1.621838
O 0.511317 -4.102221 -2.070426
Fe 0.264679 -1.340559 -0.910696

^sIM1-C

C	1.523037	2.136573	-2.044386	H	-0.665813	1.885071	3.584130
C	0.999892	1.570405	-0.847094	H	-3.277923	1.052068	2.318232
C	1.565603	2.012415	0.380602	H	-1.797602	-1.355858	-1.995544
C	2.571546	3.004266	0.434309	H	0.910598	-4.592720	-2.922028
C	3.054752	3.567464	-0.767271	H	-1.384094	-3.518819	-3.093912
C	2.539154	3.119904	-2.005490	H	-4.676223	-1.958927	0.002063
B	-0.200652	0.480208	-0.768129	H	4.704418	-2.187557	1.159635
P	0.867156	1.052830	1.792603	H	5.211781	-0.585803	-1.232875
C	-0.204208	2.332108	2.679048	H	0.399864	3.212800	2.985447
C	0.188106	-1.093570	-1.111911	H	-1.010330	2.668664	1.996096
C	-0.810257	-1.815869	-1.866549	H	1.864873	0.398275	3.959634
C	-0.578742	-3.038592	-2.514872	H	3.068552	0.283924	2.619136
C	0.697967	-3.632185	-2.424049	H	-3.665366	-0.589868	2.944444
C	1.709029	-2.973695	-1.700964	H	-4.725664	0.168731	1.697612
C	1.499634	-1.727383	-1.047125	H	-3.678116	-2.862565	1.206973
P	3.005286	-0.977815	-0.158669	H	-3.158662	-2.804352	-0.510546
C	4.208201	-0.860800	-1.623678	H	3.872358	-0.048528	-2.300697
C	-1.661373	1.016676	-1.261309	H	4.299346	-1.802852	-2.206968
C	-1.819270	2.019989	-2.262330	H	3.949014	-3.366982	0.031204
C	-3.090636	2.416134	-2.732951	H	3.062948	-2.828350	1.510561
C	-4.261985	1.820502	-2.215390	Fe	-0.363269	-0.807585	1.190132
C	-4.145438	0.842304	-1.204496	N	-0.810456	-0.878814	2.961788
C	-2.867974	0.463608	-0.724893	N	-1.068900	-0.953244	4.069215
P	-2.596760	-0.699775	0.695334	H	-0.181214	-2.446260	1.274109
C	-3.638234	-2.221595	0.300635	H	0.639782	-2.083675	1.501631
C	-3.676547	0.055309	2.041759				
C	2.258731	0.902205	3.051779	*IM2-C			
C	3.743433	-2.501428	0.696891	C	1.637818	2.487645	-1.589400
H	2.700234	-3.449281	-1.654063	C	0.992958	1.719276	-0.580311
H	2.995431	3.326307	1.399892	C	1.270216	2.047984	0.776756
H	3.840859	4.339516	-0.740421	C	2.139833	3.107721	1.122105
H	2.933858	3.537562	-2.946606	C	2.763557	3.860911	0.102959
H	1.153663	1.791468	-3.024861	C	2.517464	3.542093	-1.251745
H	-0.929583	2.510704	-2.683019	B	-0.089691	0.556172	-0.860523
H	-3.167169	3.195797	-3.508953	P	0.441798	0.879076	1.948033
H	-5.255332	2.127916	-2.580603	C	-0.793293	1.983632	2.848815
H	-5.057802	0.393363	-0.776320	C	0.357421	-0.932653	-1.285018
H	2.665295	1.893722	3.346224	C	-0.598444	-1.662971	-2.085872

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 C 1.006961-3.370451-2.691876
 C 1.975756-2.707022-1.914005
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 C 4.332038-0.403727-1.672165
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 C -2.960941 2.602237-2.685150
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 C -4.047718 0.977870-1.232792
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 N -0.952374-2.158577 3.694327
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 H 1.095697-1.619965 1.308657

^sIM3-C

Fe -1.105375 -0.780849-1.454966
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 C -1.980258 1.811926 0.594687
 C 4.788361-1.334052-0.277650
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 C 3.489342-1.082363-2.840157
 H 4.334805-0.423963-3.135683
 C 0.010948-1.894938 1.518388
 C 1.738929 2.850714 0.037986
 H 0.878052 3.331121 0.527799
 C -2.941007-1.861750 1.339664
 H -2.938514-2.549176 2.212113
 C -0.717233 1.476791 1.183771
 B 0.478304 0.557184 0.495391
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 H -2.265858 3.475487-2.022261

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 C 3.951113 1.692037 -1.200698
 H 4.831567 1.248206 -1.693846
 C -4.195258 1.216761 -1.325387
 H -4.438812 0.815779 -2.331682
 C 0.258720 -2.919991 2.468551
 H -0.363500 -3.829634 2.486437
 C -2.933542 2.612666 1.283110
 H -3.901146 2.853037 0.814469
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 H -1.190644 3.166380 4.190075
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 H 2.516955 0.269523 2.420189
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 C 2.117266 -1.638398 3.379377
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