

1	35.98	HS	ethyl as whole	35.98
2	45.17		ts-	45.17
3	47.18		ligands as whole	47.18
4	51.05		ts-	51.05
5	61.94		ts-	61.94
6	66.61		ethyl methyls	66.61
7	70.93		ethyl as whole	70.93
8	71.55		ethyl methyls	71.55
9	76.79		ethyl as whole + Cr-I bending	76.79
10	79.76		ts-	79.76
11	84.22		ethyl as whole	84.22
12	86.43		ts-	86.43
13	93.94		ts-	93.94
14	94.06		ethyls Cr-I stretching	94.06
15	96.97		ts-	96.97
16	99.74		ethyls as whole	99.74
17	101.70		ethyls as whole	101.70
18	105.53		ts-	105.53
19	112.06		ts-	112.06
20	117.53		ts-	117.53
21	118.82		ts-	118.82
22	120.64		Cr-I stretch + Ethyls	120.64
23	131.89		Cr-I stretch + Ethyls	131.89
24	144.06		Cr-I stretch + Ethyls	144.06
25	150.52		ethyls as whole	150.52
26	153.45		ethyls as whole	153.45
27	156.64		ethyl torsion	156.64
28	168.81		ethyl + Cr-I stretching	168.81
29	183.31		Cr-I stretch + chelate libration	183.31
30	189.60		ethyl torsion	189.60
31	192.71		ethyl Torsion Cr-I bending	192.71
32	196.43		ethyl torsion	196.43
33	203.72		ethyl emtyhl vibr	203.72
34	212.43		ethyl + chelate ring	212.43
35	214.45		ethyl + chelate ring	214.45
36	217.81		ethyl + chelate ring	217.81
37	231.19		ethyl torsion	231.19
38	235.31		Cr-I bending + ethyl torsions	235.31
39	245.45		ethyl torsion	245.45
40	246.99		Cr-I bending or Cr-Pstretching	246.99
41	261.32		Cr-I bending or Cr-Pstretching	261.32
42	264.16		Cr_I bending or Cr-P stretching	264.16
43	266.32		Me rotation	266.32
44	268.19		Me rotation	268.19
45	269.35		Me rotation + some chelate ring CH2 swir	269.35
46	275.32		Me rotation + some chelate ring CH2 swir	275.32
47	276.82		Me rotation	276.82
48	279.04		Me rotation	279.04
49	290.97		Me rotation + some chelater ring CH2 swi	290.97
50	297.33		Me rotation + some chelater ring CH2 swi	297.33
51	300.74		Me rotation + some chelate ring CH2 swir	300.74
52	314.14		Me rotation + some chelate ring CH2 swir	314.14
53	321.03		Me rotation + some chelate ring CH2 swir	321.03
54	337.95		chelate CH2 swinging + Me rotation	337.95
55	352.05		chelate CH2 swinging + Me rotation	352.05

56	373.41	Chelate CH2 swinging + Me rotation+ C	373.41
57	401.50	chelate CH2 swinging + Me rotation + C	401.50
58	422.09	Cr-P stretching + Et swinging	422.09
59	432.23	Cr-P stretching + Et swinging	432.23
60	445.01	Cr-P stretching + Et swinging + CH2 ch	445.01
61	449.02	Cr-P stretching + Et swinging + CH2 ch	449.02
62	558.18	Cr-P stretching	558.18
63	563.18	Cr-P stretching	563.18
64	569.54	Cr-P stretching	569.54
65	577.46	Cr-P stretching	577.46
66	623.86	P-CH2(ethyl) stretching, P-Cr bending	623.86
67	627.76	P-CH2(ethyl) stretching, P-Cr bending	627.76
68	632.17	P-CH2(ethyl) stretching, P-Cr-P torsion	632.17
69	633.76	P-CH2(ethyl) stretching, P-Cr bending	633.76
70	638.85	P-CH2(ethyl) stretching P-Cr bending	638.85
71	640.67	P-CH2(ethyl) stretching P-Cr bending	640.67
72	650.90	P-CH2(ethyl) stretching P-Cr torsion	650.90
73	655.28	P-CH2(ethyl) stretching P-Cr bending	655.28
74	741.02	CH2(ethyl) swinging	741.02
75	742.75	CH2(ethyl) swinging	742.75
76	746.76	CH2(ethyl) swinging	746.76
77	757.64	CH2(ethyl) swinging	757.64
78	778.52	CH2(ethyl) swinging	778.52
79	781.67	CH2(ethyl) swinging	781.67
80	784.26	CH2(ethyl) swinging	784.26
81	791.83	CH2(ethyl) swinging	791.83
82	840.91	CH2(chelate) sw in phase	840.91
83	844.39	CH2(chelate) sw in phase	844.39
84	915.69	CH2(chelate) sw out of phase	915.69
85	918.29	CH2(chelate) sw out of phase	918.29
86	995.62	ethyl C-C stretching	995.62
87	995.89	ethyl C-C stretching	995.89
88	998.09	ethyl C-C stretching	998.09
89	998.35	ethyl C-C stretching	998.35
90	1000.98	ethyl C-C stretching	1000.98
91	1002.64	ethyl C-C stretching	1002.64
92	1003.08	ethyl C-C stretching + P-C stretching	1003.08
93	1003.23	ethyl C-C stretching + P-C stretching	1003.23
94	1011.69	chelate C-C stretching	1011.69
95	1012.32	chelate C-C stretching	1012.32
96	1022.54	ethyl CH2 out-of-plane swinging	1022.54
97	1023.62	ethyl CH2 out-of-plane swinging	1023.62
98	1029.29	ethyl CH2 out-of-plane swinging	1029.29
99	1032.87	ethyl CH2 out-of-plane swinging	1032.87
100	1045.85	ethyl CH2 out-of-plane swinging	1045.85
101	1047.83	ethyl C-C stretching	1047.83
102	1051.02	ethyl C-C stretching	1051.02
103	1054.79	ethyl C-C stretching	1054.79
104	1056.76	ethyl C-C stretching	1056.76
105	1057.70	ethyl C-C stretching	1057.70
106	1058.62	ethyl C-C stretching	1058.62
107	1063.44	ethyl C-C stretching	1063.44
108	1069.39	ethyl C-C stretching	1069.39
109	1071.49	ethyl C-C stretching + CH2 out-of-plane	1071.49
110	1071.61	ethyl C-C stretching + CH2 out-of-plane	1071.61

111	1073.63	ethyl C-C stretching + CH2 out-of-plane	1073.63
112	1122.23	ethyl CH2 out-of-plane swinging	1122.23
113	1125.57	chelate CH2 out-of-plane swinging	1125.57
114	1156.68	chelate CH2 out-of-plane swinging	1156.68
115	1158.91	chelate CH2 out-of-plane swinging	1158.91
116	1270.21	ethyl CH2 out-of-plane swinging	1270.21
117	1273.69	ethyl CH2 out-of-plane swinging	1273.69
118	1275.19	ethyl CH2 out-of-plane swinging	1275.19
119	1276.39	ethyl CH2 out-of-plane swinging	1276.39
120	1276.51	ethyl CH2 out-of-plane swinging	1276.51
121	1277.62	ethyl CH2 out-of-plane swinging	1277.62
122	1281.01	ethyl CH2 out-of-plane swinging	1281.01
123	1283.47	ethyl CH2 out-of-plane swinging	1283.47
124	1284.45	chelate CH2 out-of-plane swinging	1284.45
125	1286.30	chelate CH2 out-of-plane swinging	1286.30
126	1292.57	chelate and ethyl CH2 out-of-plane swir	1292.57
127	1295.05	chelate and ethyl CH2 out-of-plane swir	1295.05
128	1302.25	chelate and ethyl CH2 out-of-plane swir	1302.25
129	1305.56	chelate and ethyl CH2 out-of-plane swir	1305.56
130	1308.82	chelate and ethyl CH2 out-of-plane swir	1308.82
131	1311.20	chelate and ethyl CH2 out-of-plane swir	1311.20
132	1313.96	chelate and ethyl CH2 out-of-plane swir	1313.96
133	1316.15	chelate and ethyl CH2 out-of-plane swir	1316.15
134	1319.61	chelate and ethyl CH2 out-of-plane swir	1319.61
135	1321.90	chelate and ethyl CH2 out-of-plane swir	1321.90
136	1426.98	CH3-C bending	1426.98
137	1427.58	CH3-C bending	1427.58
138	1427.93	CH3-C bending	1427.93
139	1429.03	CH3-C bending	1429.03
140	1431.15	CH3-C bending	1431.15
141	1431.85	CH3-C bending	1431.85
142	1432.65	CH3-C bending	1432.65
143	1433.64	CH3-C bending	1433.64
144	1476.52	ethyl/chelate -CH2 δ	1476.52
145	1477.84	ethyl/chelate -CH2 δ	1477.84
146	1481.42	ethyl/chelate -CH2 δ	1481.42
147	1484.01	ethyl/chelate -CH2 δ	1484.01
148	1484.32	ethyl/chelate -CH2 δ	1484.32
149	1484.83	ethyl/chelate -CH2 δ	1484.83
150	1486.73	ethyl/chelate -CH2 δ	1486.73
151	1489.67	ethyl/chelate -CH2 δ	1489.67
152	1491.17	ethyl/chelate -CH2 δ	1491.17
153	1493.98	ethyl/chelate -CH2 δ	1493.98
154	1498.57	ethyl/chelate -CH2 δ	1498.57
155	1500.30	ethyl/chelate -CH2 δ	1500.30
156	1512.31	methyl δ	1512.31
157	1512.74	methyl δ	1512.74
158	1512.91	methyl δ	1512.91
159	1513.08	methyl δ	1513.08
160	1513.97	methyl δ	1513.97
161	1515.24	methyl δ	1515.24
162	1515.27	methyl δ	1515.27
163	1515.54	methyl δ	1515.54
164	1518.01	methyl δ	1518.01
165	1519.04	methyl δ	1519.04

166	1519.15	methyl δ	1519.15
167	1520.05	methyl δ	1520.05
168	1522.39	methyl δ	1522.39
169	1522.88	methyl δ	1522.88
170	1523.73	methyl δ	1523.73
171	1524.74	methyl δ	1524.74
172	3009.24	CH stretching	3009.24
173	3009.54	—	3009.54
174	3009.81		3009.81
175	3010.35		3010.35
176	3010.76		3010.76
177	3012.91		3012.91
178	3013.89		3013.89
179	3014.13		3014.13
180	3017.29		3017.29
181	3022.16		3022.16
182	3024.98		3024.98
183	3027.53		3027.53
184	3028.38		3028.38
185	3029.35		3029.35
186	3034.28		3034.28
187	3035.91		3035.91
188	3037.99		3037.99
189	3038.14		3038.14
190	3040.84		3040.84
191	3048.43		3048.43
192	3081.51		3081.51
193	3081.86		3081.86
194	3082.48		3082.48
195	3082.70		3082.70
196	3083.18		3083.18
197	3084.77		3084.77
198	3088.52		3088.52
199	3089.82		3089.82
200	3090.19		3090.19
201	3091.15		3091.15
202	3091.18		3091.18
203	3091.78		3091.78
204	3093.06		3093.06
205	3093.70		3093.70
206	3097.70		3097.70
207	3100.33		3100.33
208	3101.61		3101.61
209	3103.60		3103.60
210	3104.48		3104.48
211	3108.20		3108.20
212	3113.88		3113.88
213	3115.05		3115.05
214	3116.26		3116.26
215	3117.69		3117.69
216	3120.48		3120.48
217	3123.42		3123.42
218	3125.67		3125.67
219	3129.05	CH stretching	3129.05

LS ethyl/ethylene as whole
ethyl/ethylene as whole
ethyl as whole
ethyl/ethylene as whole
ethyl/ethylene as whole
ethyl as whole
ethyl as whole
ethyl/molecule as whole
ethyl as whole + Cr-I bending
ethyl as whole
ethyl as whole
ethyl as whole + Cr-I stretching
ethyl as whole
ligand as whole + Cr-I bending
ethyls rotation
ethyls rotation
ethyls rotation
ethyl as whole
ethyl as whole
ethyl as whole
ethyl rotation
ligand as whole
ligand as whole
ethyl rotation
ethyl rotation
ligand as whole
ligand as whole
ligand as whole + symm. Cr-P stretching
ligand as whole + symm. Cr-P stretching
ligand as whole + asym. Cr-P stretching
ligand as whole + asym. Cr-P stretch/bending
ligand as whole + asym. Cr-P stretching
Cr-I stretching
ligand as whole
ligand as whole + some Cr-I stretch and Cr-P bending
ligand as whole + some Cr-I stretch and Cr-P bending
Cr-stretching + chelate ring libration
Cr-stretching + chelate ring libration
Cr-P stretching or Cr-I bending
Cr-I stretching
Me rotation
Me rotation
Me rotation + chelate CH2 swinging
Me rotation
Cr-P stretching + Me rotation
Me rotation + Cr-P stretching
Me rotation
Me rotation
Me rotation
Me rotation + chelate CH2 swinging
Cr-P stretching + Me rotation
Cr-P stretching + chelate libration
Me rotation + CH2 chelate swinging
CH2 chelate swinging + some Cr-P bending
CH2 chelate swinging + some Cr-P bending

CH2 chelate swinging + Cr-P stretching
CH2 chelate swinging + Cr-P stretching
Cr-P stretching
Cr-P stretching
Cr-P stretching/chelate libration
Cr-P stretching/chelate libration
Cr-P stretching
Cr-P stretching
Cr-P stretching
chelate libration + Cr-P stretching
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
P-CH2 stretching, Cr-P bending
CH2(ethyl) swinging

CH2(ethyl) swinging
CH2(chelate)swinging in phase
CH2(chelate)swinging in phase
CH2(chelate)swinging out of phase
CH2(chelate)swinging out of phase
ethyl C-C stretching

ethyl C-C stretching + P-C stretching
ethyl C-C stretching + P-C stretching
chelate C-C stretching
chelate C-C stretching
ethyl CH2 out-of-plane swinging

ethyl CH2 out of plane swinging
ethyl C_C stretching

ethyl C-C stretching
ethyl C-C stretching +CH2 out-of-plane swinging
ethyl C-C stretching + CH2 out of plane swinging

ethyl C-C stretching + CH2 out of plane swinging
chelate CH2 out-of-plane swinging
chelate CH2 out-of-plane swinging
chelate CH2 out-of-plane swinging
chelate CH2 out-of-plane swinging
ethyl CH2 out-of-plane swinging

_____ ethyl/chelate CH2-out-of-plane swinging

CH3 bending

CH3 bending

ethyl/chelate CH2 δ

_____ -

ethyl/chelate CH2 δ

methyl δ

methyl δ
C-H stretching

CH stretching