

Department of Chemistry and Biochemistry

Chemistry 59-230/232

Time: 50 min.

Midterm #1

Oct. 22, 2008

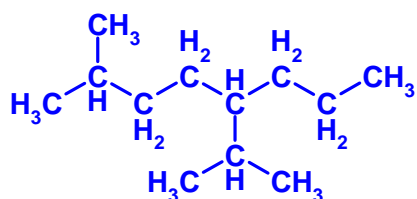
NAME \_\_\_\_\_ ID# \_\_\_\_\_

LAB SECTION – enter day/time/TA \_\_\_\_\_

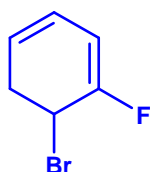
Note: **Please answer on the test paper.** There is an extra sheet for rough work at the back, but it will not be marked unless you specifically ask me to. Tests written in pencil will be marked, but cannot be returned for remarking. For the ‘promised’ size ranking, see the intro to **4a**. There are 80 marks on this exam.

- I. Give correct IUPAC names for the following compounds. Include stereochemical descriptors where relevant. (4 marks each, total 16 marks)

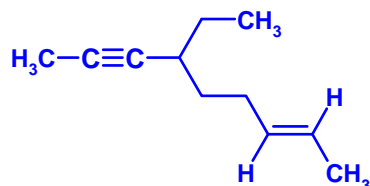
a



b.



c.



- d. Indicate for the structure in **1a** which carbon atoms are primary, secondary, tertiary and quaternary. You may redraw the structure or indicate with arrows (4 marks).

2. Draw structures which correspond to the following given names. Drawings showing only carbons and other non-hydrogen atoms are acceptable. Please include the appropriate stereochemical aspects of the structure where it is needed. (4 marks each, total 12)

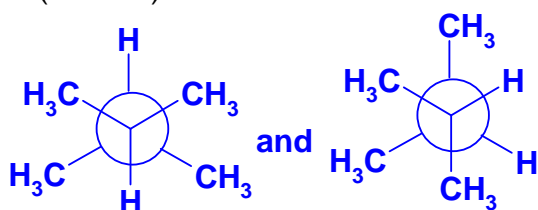
- a. 3,3-dimethyl-1,4-pentadiyne

b. *trans*-1-bromomethyl-4-iodocycloheptane

c. (Z)- 1-chloro-3-methyl-3-phenyl-1-butene

3. (Total 21 marks) For each of the (a-d) below, assign the appropriate terminology (structural isomers, geometric (cis/trans) isomers, different conformations of the same molecule, identical, not isomers at all) to the following.

a. (2 marks)



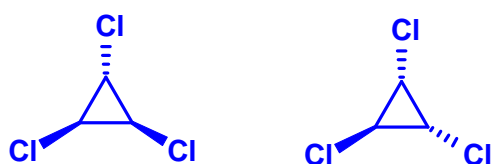
b. (2 marks)



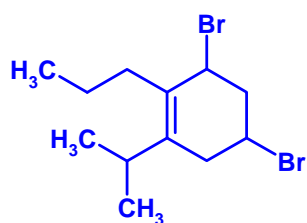
c. (2 marks)



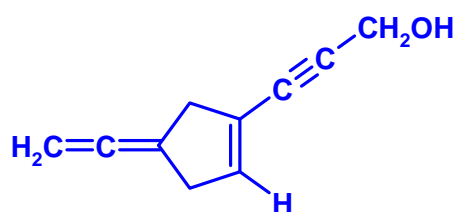
d. (2 marks)



e. Assign the Z- or E- stereochemical descriptor to the following systematically. Show your work. Do *not* give the complete name of the compound (6 marks).



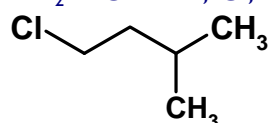
- f. Indicate the hybridization of each carbon atom in the following structure . (5 marks)



- g. What is the index of hydrogen deficiency of the structure in **f** (2 marks)?

**4** (Total 20 marks)

- a.** Draw the possible Newman projections of *all* the possible staggered and eclipsed conformations of the following compound, viewed down the C2-C3 bond. Rank them in terms highest to lowest stability. (In terms of size,  $\text{C}(\text{CH}_3)_3 > \text{CH}(\text{CH}_3)_2 > \text{CH}_2\text{CH}(\text{CH}_3)_2 \approx \text{CH}_2\text{CH}_3 > \text{CH}_3 \approx \text{CH}_2\text{Cl} > \text{NH}_2 > \text{OH} > \text{F}, \text{Cl}, \text{Br}, \text{I} > \text{H}$ ) (16 marks)



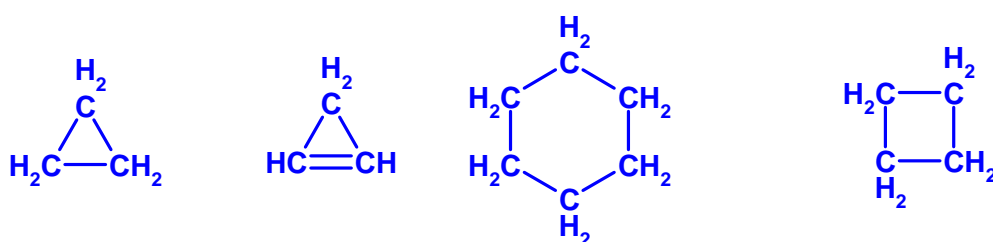
- b.** In the lowest energy conformation in **4a**, what is the relationship in orientation between the chloromethyl group and the methyl group(s) on the neighbouring carbon atom? (2 marks) Note: I am looking for terminology *more* detailed than staggered/eclipsed.

c. In the highest energy conformation **4a**, what is the relationship in orientation between the chloromethyl function and the methyl group(s) on the neighbouring carbon atom? (2 marks)

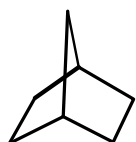
**5 (total 11 marks)**

a. Draw 1,2-dibromoethane in the sawhorse projection of its most stable conformation (5 marks).  
(For size rankings, see **4a**)

b. Rank the following compounds in terms of stability of the compound. Give your reasoning for your ranking. (6 marks)



**Bonus.** (Up to 5 additional marks) Only one possible *alkene* analogue of the following alkane (norbornane or bicyclo[2.2.1]heptane) is a known compound (i.e., a double bond can only be 'put' in one type of place). Which one is it (1 mark) and what is wrong with the other possibilities (the other 4 marks)?



# WebElements: the periodic table on the world-wide web

<http://www.webelements.com/>

1 hydrogen 1	2 helium 2	3 lithium 3	4 beryllium 4	5 boron 5	6 carbon 6	7 nitrogen 7	8 oxygen 8	9 fluorine 9	10 neon 10	11 sodium 11	12 magnesium 12	13 aluminum 13	14 silicon 14	15 phosphorus 15	16 sulfur 16	17 chlorine 17	18 argon 18	19 potassium 19	20 calcium 20	21 scandium 21	22 titanium 22	23 vanadium 23	24 chromium 24	25 manganese 25	26 iron 26	27 cobalt 27	28 nickel 28	29 copper 29	30 zinc 30	31 gallium 31	32 germanium 32	33 arsenic 33	34 selenium 34	35 bromine 35	36 krypton 36	37 rubidium 37	38 strontium 38	39 yttrium 39	40 zirconium 40	41 niobium 41	42 molybdenum 42	43 technetium 43	44 ruthenium 44	45 rhodium 45	46 palladium 46	47 silver 47	48 cadmium 48	49 indium 49	50 tin 50	51 antimony 51	52 tellurium 52	53 iodine 53	54 xenon 54	55 cesium 55	56 barium 56	57-70 lanthanoids	71 lutetium 71	72 hafnium 72	73 tantalum 73	74 tungsten 74	75 rhenium 75	76 osmium 76	77 iridium 77	78 platinum 78	79 gold 79	80 mercury 80	81 thallium 81	82 lead 82	83 bismuth 83	84 polonium 84	85 astatine 85	86 radon 86	87 francium 87	88 radium 88	89-102 actinoids	103 lawrencium 103	104 rutherfordium 104	105 dubnium 105	106 seaborgium 106	107 bohrium 107	108 hassium 108	109 meitnerium 109	110 unnilium 110	111 ununium 111	112 unbium 112	113 ununium 113	114 unquadium 114	115 ununium 115	116 unhexium 116	117 ununium 117	118 unoghexium 118	119 ununium 119	120 unbinium 120	121 untrium 121	122 unquadrium 122	123 unpentium 123	124 unsextium 124	125 unseptium 125	126 unoctium 126	127 unenneium 127	128 undecium 128	129 undecium 129	130 untrium 130	131 unquadrium 131	132 unpentium 132	133 unsextium 133	134 unseptium 134	135 unoctium 135	136 unenneium 136	137 undecium 137	138 undecium 138	139 untrium 139	140 unquadrium 140	141 unpentium 141	142 unsextium 142	143 unseptium 143	144 unoctium 144	145 unenneium 145	146 undecium 146	147 undecium 147	148 untrium 148	149 unquadrium 149	150 unpentium 150	151 unsextium 151	152 unseptium 152	153 unoctium 153	154 unenneium 154	155 undecium 155	156 undecium 156	157 untrium 157	158 unquadrium 158	159 unpentium 159	160 unsextium 160	161 unseptium 161	162 unoctium 162	163 unenneium 163	164 undecium 164	165 undecium 165	166 untrium 166	167 unquadrium 167	168 unpentium 168	169 unsextium 169	170 unseptium 170	171 unoctium 171	172 unenneium 172	173 undecium 173	174 undecium 174	175 untrium 175	176 unquadrium 176	177 unpentium 177	178 unsextium 178	179 unseptium 179	180 unoctium 180	181 unenneium 181	182 undecium 182	183 undecium 183	184 untrium 184	185 unquadrium 185	186 unpentium 186	187 unsextium 187	188 unseptium 188	189 unoctium 189	190 unenneium 190	191 undecium 191	192 undecium 192	193 untrium 193	194 unquadrium 194	195 unpentium 195	196 unsextium 196	197 unseptium 197	198 unoctium 198	199 unenneium 199	200 undecium 200	201 undecium 201	202 untrium 202	203 unquadrium 203	204 unpentium 204	205 unsextium 205	206 unseptium 206	207 unoctium 207	208 unenneium 208	209 undecium 209	210 undecium 210	211 untrium 211	212 unquadrium 212	213 unpentium 213	214 unsextium 214	215 unseptium 215	216 unoctium 216	217 unenneium 217	218 undecium 218	219 undecium 219	220 untrium 220	221 unquadrium 221	222 unpentium 222	223 unsextium 223	224 unseptium 224	225 unoctium 225	226 unenneium 226	227 undecium 227	228 undecium 228	229 untrium 229	230 unquadrium 230	231 unpentium 231	232 unsextium 232	233 unseptium 233	234 unoctium 234	235 unenneium 235	236 undecium 236	237 undecium 237	238 untrium 238	239 unquadrium 239	240 unpentium 240	241 unsextium 241	242 unseptium 242	243 unoctium 243	244 unenneium 244	245 undecium 245	246 undecium 246	247 untrium 247	248 unquadrium 248	249 unpentium 249	250 unsextium 250	251 unseptium 251	252 unoctium 252	253 unenneium 253	254 undecium 254	255 undecium 255	256 untrium 256	257 unquadrium 257	258 unpentium 258	259 unsextium 259	260 unseptium 260	261 unoctium 261	262 unenneium 262	263 undecium 263	264 undecium 264	265 untrium 265	266 unquadrium 266	267 unpentium 267	268 unsextium 268	269 unseptium 269	270 unoctium 270	271 unenneium 271	272 undecium 272	273 undecium 273	274 untrium 274	275 unquadrium 275	276 unpentium 276	277 unsextium 277	278 unseptium 278	279 unoctium 279	280 unenneium 280	281 undecium 281	282 undecium 282	283 untrium 283	284 unquadrium 284	285 unpentium 285	286 unsextium 286	287 unseptium 287	288 unoctium 288	289 unenneium 289	290 undecium 290	291 undecium 291	292 untrium 292	293 unquadrium 293	294 unpentium 294	295 unsextium 295	296 unseptium 296	297 unoctium 297	298 unenneium 298	299 undecium 299	300 undecium 300	301 untrium 301	302 unquadrium 302	303 unpentium 303	304 unsextium 304	305 unseptium 305	306 unoctium 306	307 unenneium 307	308 undecium 308	309 undecium 309	310 untrium 310	311 unquadrium 311	312 unpentium 312	313 unsextium 313	314 unseptium 314	315 unoctium 315	316 unenneium 316	317 undecium 317	318 undecium 318	319 untrium 319	320 unquadrium 320	321 unpentium 321	322 unsextium 322	323 unseptium 323	324 unoctium 324	325 unenneium 325	326 undecium 326	327 undecium 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