Department of Chemistry and Biochemistry

Chemistry 59-230/232 | **Midterm #1**

Time: 50 min. | **Oct. 13, 2006**

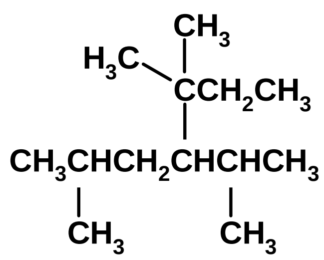
NAME ________________________________ **ID#** ________________

LAB SECTION – enter day/time/TA ____________________________

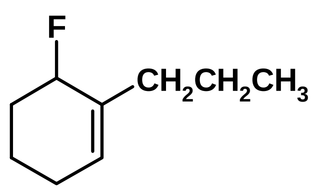
Note: ***Please answer on the test paper.*** *There is an extra sheet for rough work at the back, but it will* *<u>not</u>* *be marked. Tests written in pencil will be marked, but cannot be returned for remarking. For the 'promised' size ranking, see the intro to* ***5a****.*

1. Give correct IUPAC names for the following compounds. Include stereochemical descriptors where relevant. (4 marks each, total 24 marks)

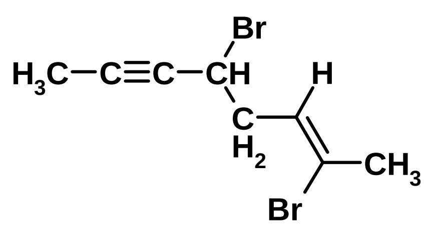
a



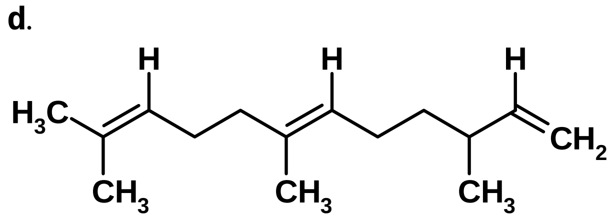
b.



c.



d.



e. Indicate for the structure in 1a which carbon atoms are primary, secondary, tertiary and quaternary.

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. One of these names is actually significantly wrong: indicate which one it is and write the correct name for the structure (we'll call that "d"). (4 marks each, total 16)

a. *(2E,5Z)*-2-bromo-5-iodo-6-methyl-2,5-octadiene

b. 4-(4-bromobutyl)nonane

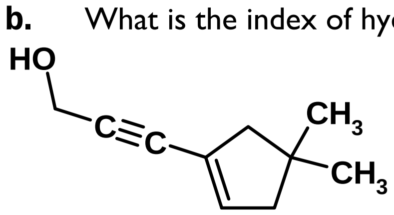
c. *trans* 1-chloromethyl-3-ethylcyclopentane

d.

3. (Total 11 marks)

a. What is the index of hydrogen deficiency of $C_9H_{14}Br_2$. Draw one reasonable structure for such a compound.(4 marks)

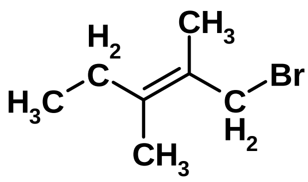
b. What is the index of hydrogen deficiency of the following compound? (2 marks)



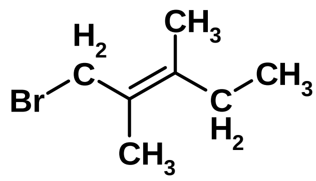
c. Indicate the hybridization of each carbon atom in the above structure (in 3b). (5 marks)

4. (Total 10 marks) For each of the (a-c) below, assign the appropriate terminology (structural isomers, geometric isomers, different conformations of the same molecule, identical) to the following.

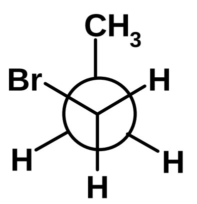
a. (2)



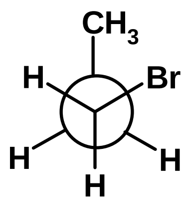
and



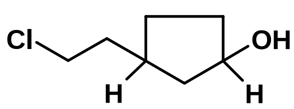
b. (2)



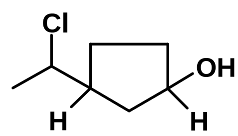
and



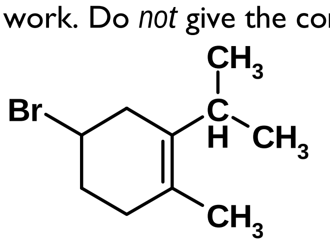
c. (2)



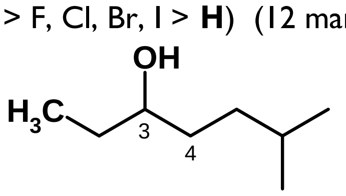
and



d. Assign the Z- or E- stereochemical descriptor to the following systematically. Show your work. Do *not* give the complete name of the compound (4 marks).



5. Draw the possible Newman projections of *all* the possible staggered and eclipsed conformations of the following compound, viewed down the C3-C4 bond. Rank them in terms highest to lowest stability. (In terms of size, $C(CH_3)_3$ > $CH(CH_3)_2$ > $CH_2CH(CH_3)_2$ ≈ CH_2CH_3 > CH_3 > NH_2 > OH > F, Cl, Br, I > **H**) (12 marks)

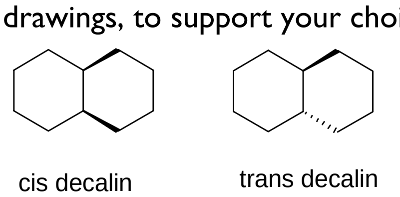


6a. Draw the Newman projection of structure of the **most stable** of the possible *eclipsed* conformations of 1-bromo-2-methylpropane as viewed down the C1-C2 bond. Give your reasoning why you consider this to be most stable possibility. (4 marks)

b. In **6a**, what is the relationship in orientation between the bromine function and each of the methyl groups.(2 marks) Note: I am looking for terminology *more* detailed than staggered/eclipsed.

7a. Draw the chair structure of 1-chloro-3-methylcyclohexane in its most stable conformation of its least stable configuration (one structure)(5 marks).

b. Which is the more stable, *cis*- decalin or *trans*- decalin? Give reasoning, including structural drawings, to support your choice (6 marks).



Bonus. (Up to 4 additional marks) As we've mentioned before, allenes are unusual in terms of their bonding at the central carbon. Their stereochemistry is also unusual to a first glance. Can you suggest the stereochemical relationship between the following two allenes (I need more detail than something like 'stereoisomers'), and assign an appropriate stereochemical descriptor to the left one?

Periodic Table of the Elements

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	0
1 H 1.0079																1 H 1.0079	2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050											13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.69	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.82	50 Sn 118.710	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.29
55 Cs 132.9054	56 Ba 137.327	57 *La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.9804	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 **Ac (227)	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns	108	109									

*	58 Ce 140.114	59 Pr 140.9076	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.9253	66 Dy 162.50	67 Ho 164.9303	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.967
**	90 Th 232.0381	91 Pa 231.0359	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Atomic masses are 1989 IUPAC values up to four decimal places.