Department of Chemistry and Biochemistry

Chemistry 59-230/232 **Midterm #2**
Time: 50 min. **Nov. 17, 2006**

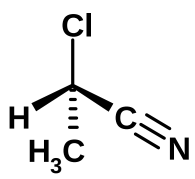
NAME ___________________________________**ID#**_______________________

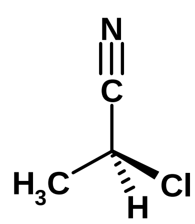
LAB SECTION (and TA) ____

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 <u>unless</u> asked. Tests written in pencil will be marked, but cannot be returned for remarking.*

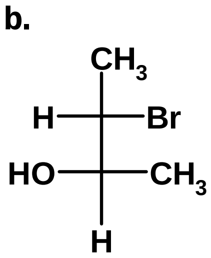
1. Identify the relationship between each of the following pairs (i.e., enantiomers, diastereomers, identical, structural isomers). Are any of the compounds <u>meso forms</u>? If so, indicate which one(s). (total 16 marks)

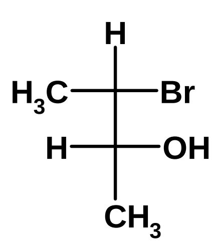
a.



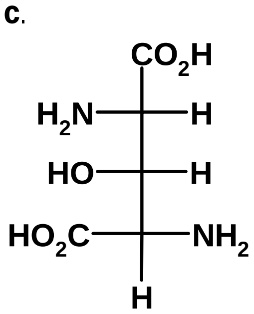


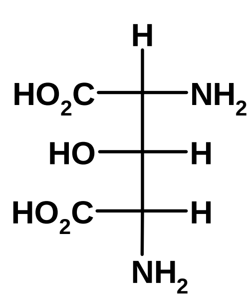
b.





c.





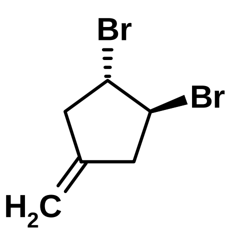
d. Assuming the substituents (NH_2, CH_3, CO_2H, etc.) on the drawn centres have appropriate conformation, could any of the above compounds be drawn in their overall most stable conformation? If so, indicate which one(s).

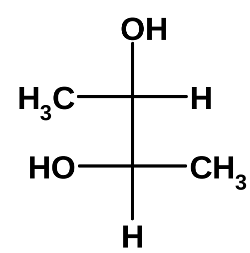
2. For the structures on the **<u>left</u>** side of **1a** and **1b** only, identify each chiral centre as (R)- or (S)-. Show how you arrived at your answer (5 marks each centre, total 15)

a.

b.

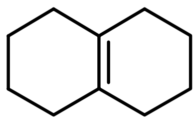
c) Do the following compounds rotate plane polarized light? I only need 'yes' or 'no'.(4 marks)





3. Draw the complete mechanism of the addition of bromine (Br_2) to cyclohexene. Show accurate intermediates, including stereochemistry, <u>and</u> indicate which is the slow (rate determining) step.(10 marks)

4. For each of the following reactions, fill in the blank with the structural formula of the required chemical. Show any required catalysts over the reaction arrow. Be sure to include stereochemistry where it is important. Note: There *may* be more than one reagent or more than one step required per blank. (Total 30 marks) a.

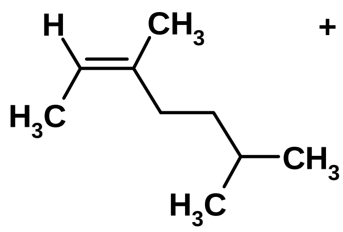


1) O_3

2) Zn

____

b.



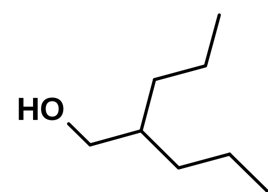
+ ICl

____

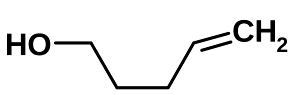
c.

________________ + 1) __________ 2) __________

an alkene
(which you should draw)



d.

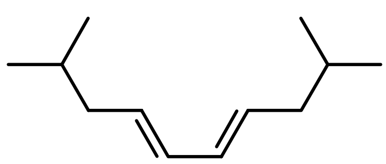


Br_2

__________ + __________

2 compounds

e.



H_2O

__________ __________

2 compounds

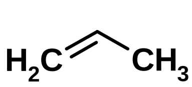
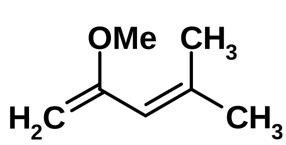
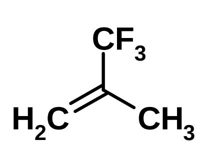
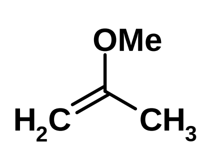
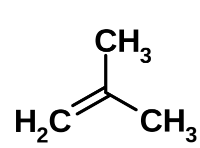
using both compounds

H_2, Pd°

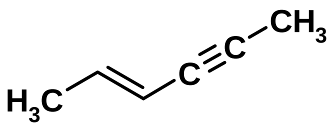
__________ __________

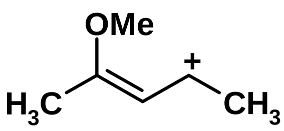
2 compounds

5a) Rank the following in terms of strength of rate of reaction with HCl, going from the fastest to slowest. Note: Me = CH_3 (5 marks)

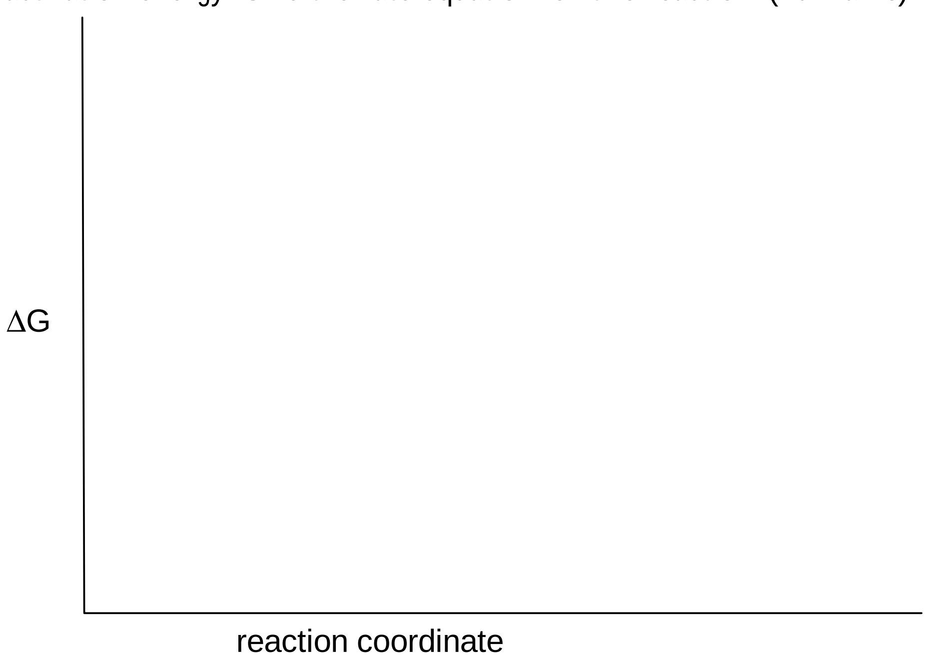
    

b) Draw all reasonable resonance forms for the following structures. For each of these, show the appropriate use of curved arrows demonstrating the electron movement leading to the other resonance forms (10 marks).

i. 

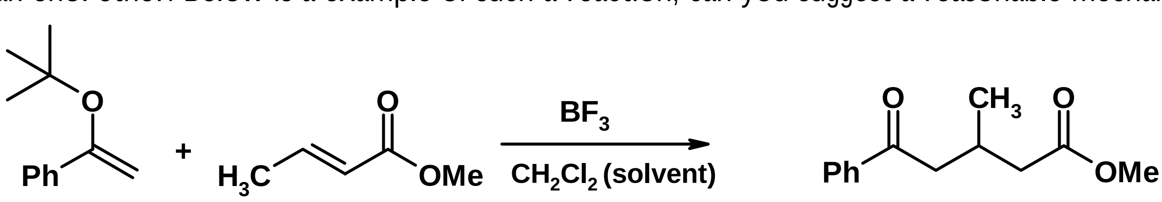
ii. 

6. Draw the energy profile and indicate the intermediates for the reaction of A and B to give C in 4 steps. A is consumed in the first step, while B is consumed in the second step. The final step has the highest activation energy. Give the rate equation for this reaction. (10 marks)



rate (v) =

Bonus. A reaction *related* to the reactions we've been studying is an important C-C bond forming reaction of alkenones or alkenoates called the Michael reaction. It can be caused to occur by Lewis acid in the presence of an enol ether. Below is a example of such a reaction; can you suggest a reasonable mechanism for the process?



Note: Me = CH_3

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									

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

*	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)