reviewed 2008 10 23

First Name _____ Last Name _____

Student ID _____ Signature _____

Chemistry 161, A1
Midterm Examination - 05 November 2004

Instructions

Closed book exam; no calculators.

Physical models permitted.

Only answers on the front side of each page will be marked, unless requested otherwise.

Write in pen (to permit potential remarking).

Time allowed: 50 min.

There are **16** questions on **7** pages.

Potentially Useful Data

Mini Periodic Table
H, He, Li, Be, B, C, N, O, F, .., Cl,.., Br,.., I

Approx. pK_a Values	
"acid"	pK_a
H_2SO_4	-3
H_3O^+	-2
CH_3CO_2H	5
NH_4^+	9
phenol, C_6H_5OH	10
1,3-dicarbonyl	9 - 13
Methanol, CH_3OH	16
H_2O	16
Ethanol, CH_3CH_2OH	16
Acetone, CH_3COCH_3	20
terminal alkyne	25
NH_3	33

Page #	**Maximum**	**Score**			
1	11				
2	11				
3	11				
4	11				
5	7				
6	9				
7	10				
Total	70				

/2 01. Show the electron configuration for the O atom, incl. spatial orientation (1s, 2s, $2p_x$, $2p_y$, $2p_z$)

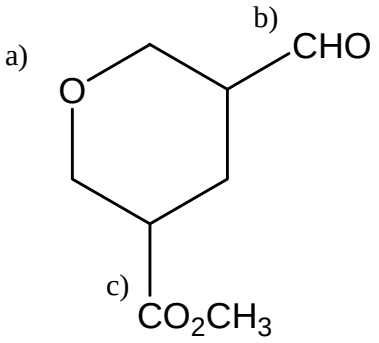
_____

/4 02. Explain the following terms by description, example , sketch ….

a) conformationally rigid molecule (*example, please & brief comment*)

b) racemate

/5 03. Consider



Identify the functional groups (*pay attention to the letters).*

a) _____ b) _____ c) _____

d) What is the number of π bonds? ___

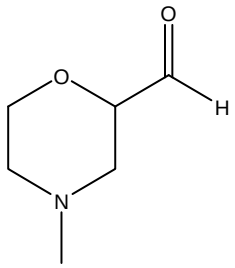
e) What is the number of sp^2 hybridized *carbon atoms*? ____

/5 04. a.) Write a chemical equation for the mono-chlorination of ethane.

b.) What type of reaction mechanism is involved? _____

c.) Show the first step of this reaction using proper “curved arrows”.

/2 05. Determine the molecular formula for the following bond-line structure.

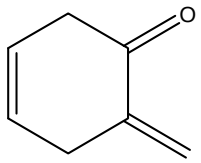


/4 07. Acetone, CH_3COCH_3, is a ketone and can act as Bronsted-Lowry acid or base.
Show the conjugate acid and conjugate base of acetone.
Include non-bonding electrons and formal charges.

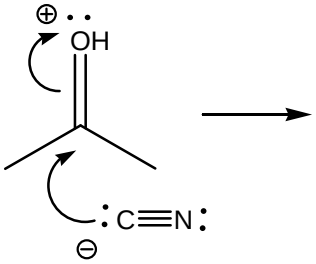
_____ _____
Conjugate Acid Conjugate Base

/8 06. **For all questions below, show all missing nonbonding electrons and formal charges in both reactants and products.**

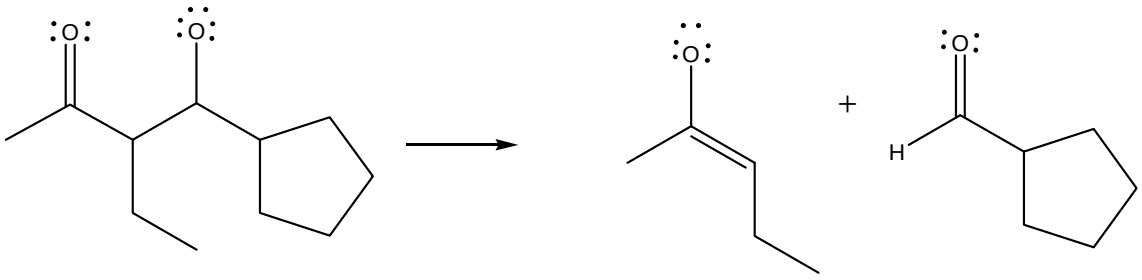
a. Write another significant resonance structure for



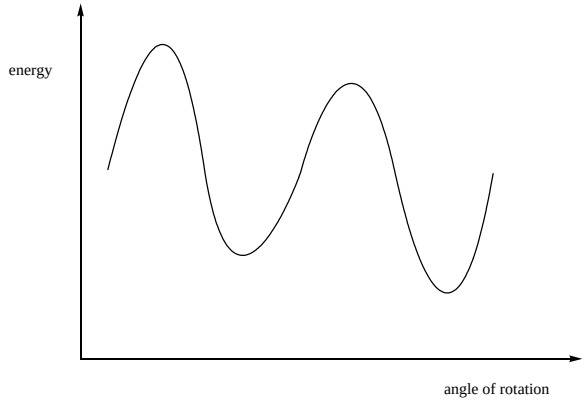
b. What is the result of the a reaction indicated by the “curved arrows”?



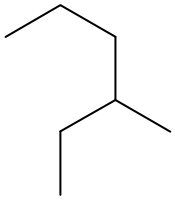
c. Place appropriate “ curved arrows” to effect the following reaction.

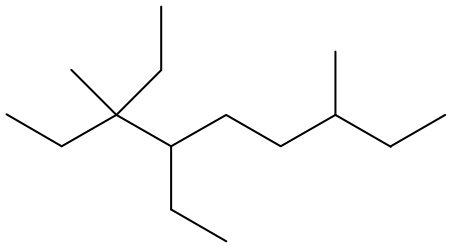


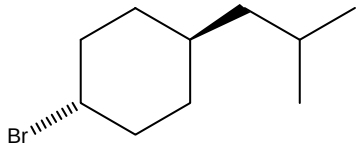
/4 08. The following indicates an energy diagram related to the conformations of butane . (rotation around the C2 - C3 bond). On the diagram, point out where the 2 methyl groups a.) are anti , b.) have a gauche relationship, c.) are eclipsed. Use the letters.



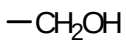
/7 09. Provide names for the following. Ignore R/S designations..

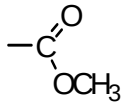
a. 

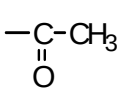
b. 

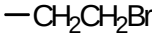
c. 

/4 10. Rank the following groups according to the CIP priority rules (Cahn - Ingold – Prelog).

a. 

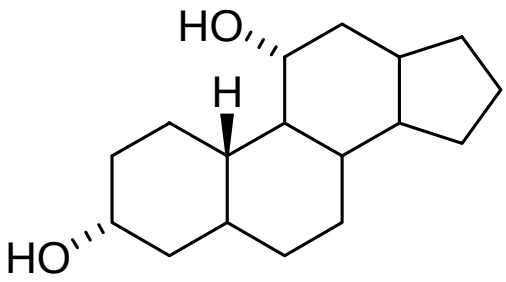
b. 

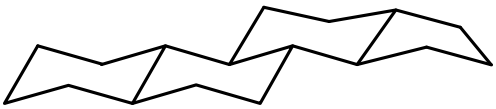
c. 

d. 

Use the letters; highest priority first: _____ _____ _____ _____

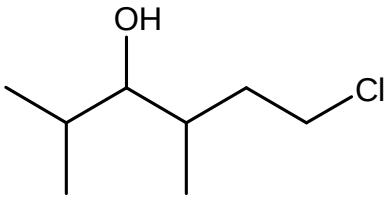
/4 11. Consider the following steroidal compound



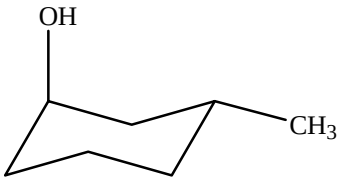


Place the -OH groups on the structure to the right and indicate whether they are equatorial (eq) or axial (ax).

/4 12. On the following, indicate all stereogenic centers by locating stars (*) at the proper places.



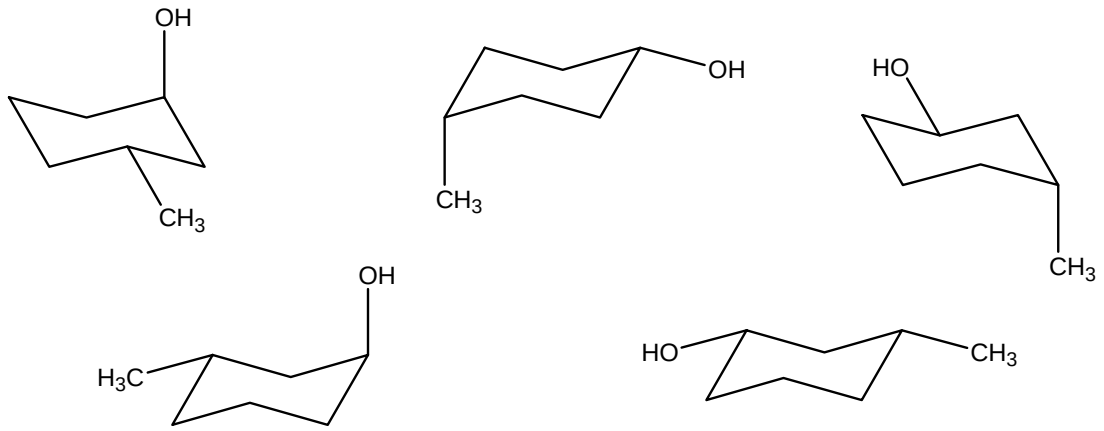
Total number of stereogenic centers: _____

/5 13. Consider 

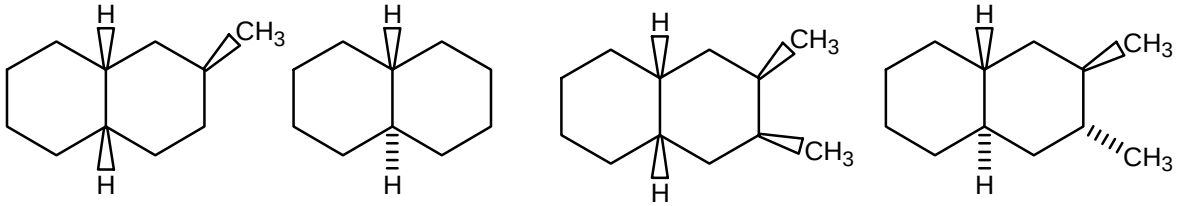
Compare each of the following with the above and indicate whether it is:

a) identical conformer, b) different conformer, c) enantiomer, d) diastereomer,

e) constitutional isomer, f.) not an isomer. Use the letters.

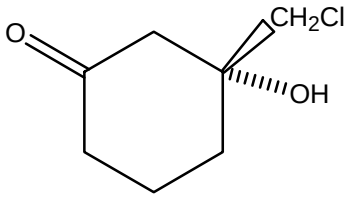


/4 14. Consider the following decalin structures and write underneath whether they are chiral (ch.) or achiral (ach.). Also indicate a plane of symmetry where appropriate. (*wrong answers: -0.5 each)*

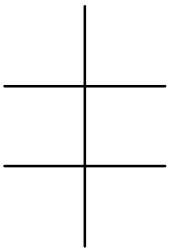


/4 15. Determine whether the following has R or S configuration.

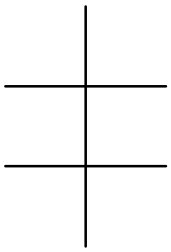
Priority assignments **must** be shown.



/4 16. Many isomers of dibromobutane are possible. Using the Fischer templates below, show the structures requested underneath. You need to show only the **Br (bromine)** atoms. (There might be several possibilities.)



a.) meso-2,3-dibromobutane



b.) an achiral dibromobutane other than a.)