

Chem 141  
Fall 2005  
Exam 2 alternate  
10/18/05

NAME: \_\_\_\_\_

LAB SECTION  
(Time, Day and TA): \_\_\_\_\_

Problems	Pages	Points	Grader
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

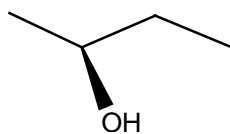
TOTAL \_\_\_\_\_points

% \_\_\_\_\_

1. Give the full name for each of the following compounds and include the R/S configurations where appropriate.

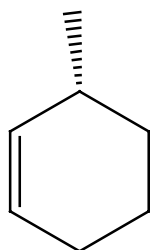
2 points each

a)



\_\_\_\_\_

b)



\_\_\_\_\_

c)



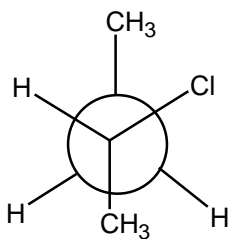
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d)



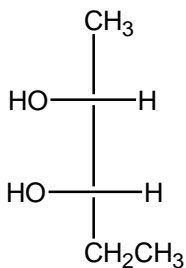
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e)



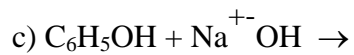
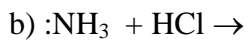
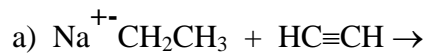
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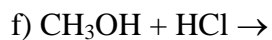
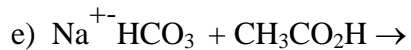
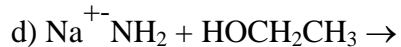
f)



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2) Provide the products for the following acid/base reactions. Provide arrows to illustrate the flow of electrons and charges where appropriate. 3 points each





3) Number the following compounds in order of acidity (1 most acidic to 5 least acidic).  
4 points

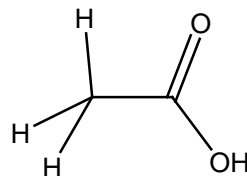
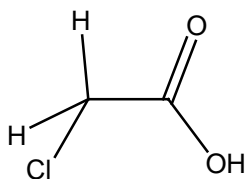
Methane ( $\text{CH}_4$ ) \_\_\_\_\_

Water ( $\text{H}_2\text{O}$ ) \_\_\_\_\_

Hydrofluoride ( $\text{HF}$ ) \_\_\_\_\_

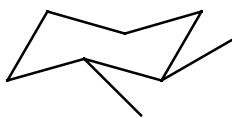
Ammonia ( $\text{NH}_3$ ) \_\_\_\_\_

4) Which compound has a lower pKa (circle) and mention in a sentence the effect which is responsible for the increased acidity. 3 points



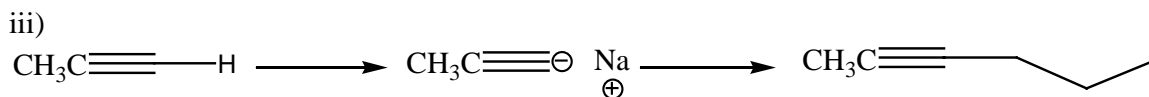
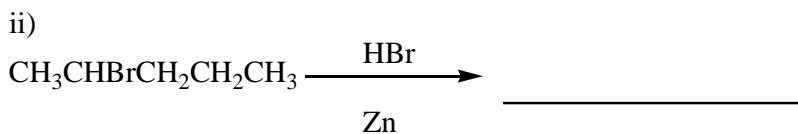
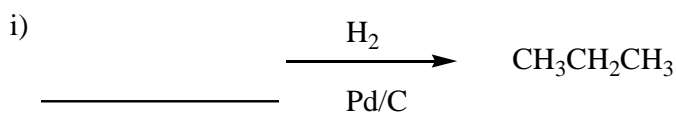
5) Why is it important to consider the solvent when using strong acids or bases involved in organic reactions? 2 points

6) Draw a Newman Projection between the 1<sup>st</sup> and 2<sup>nd</sup> carbons of the following cyclohexane. What named relationship would best define the two methyl substituents? What is the dihedral angle between these substituents? 4 points



7) A regular pentagon apex angles of 108°. Why does the energy minimized conformation distort the bond angles away from this near ideal sp<sup>3</sup> hybridized bond angle? 2 points

8) What are the reactants, reagents and products of the following reactions? Fill in the gaps on top of either the blank line or the empty arrow. 2 points each



9) Provide a full strategy towards the synthesis of 1-*n*-butyl-3-propylcyclopentane. Use an alkynide anion and hydrogenation of a carbon-carbon triple bond as key steps incorporated into your method. 6 points

10) Enantiomers are a pair of compounds which are the mirror image of each other. What is the one measurable physical property that differs between them? How is it noted when writing an R/S configuration? 3 points

11) You are out in the real world and have a job which requires you check incoming supplies. Your normal supplier of the drug Vermontium has been back-ordered for months so you order the supplies from another distributor. It arrives and just doesn't seem right. (R)-(+)-Vermontium usually has a specific rotation of  $+20^\circ$ . You place a sample of the newly delivered Vermontium in your polarimeter and measure a deflection of  $-18^\circ$ . What is the problem? What is the enantiomeric excess of the delivered Vermontium? And what is the absolute concentrations of the two enantiomers? 6 points

12) Number the following compounds for the ability to perform substitution reactions. (1= best leaving group, good at substitution reactions 4 = poor leaving group, not appropriate for substitution reactions) 4 points

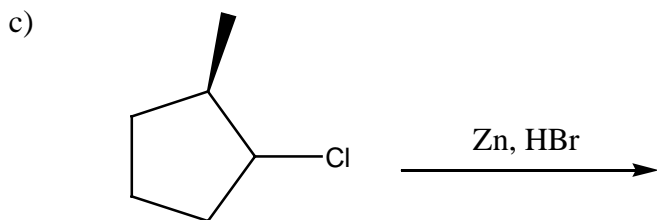
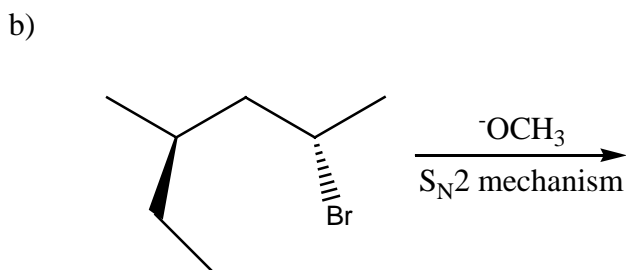
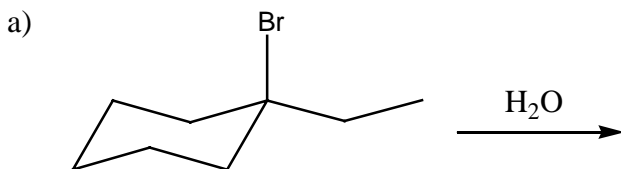
CH<sub>3</sub>F \_\_\_\_\_

CH<sub>3</sub>Br \_\_\_\_\_

CH<sub>3</sub>Cl \_\_\_\_\_

CH<sub>3</sub>I \_\_\_\_\_

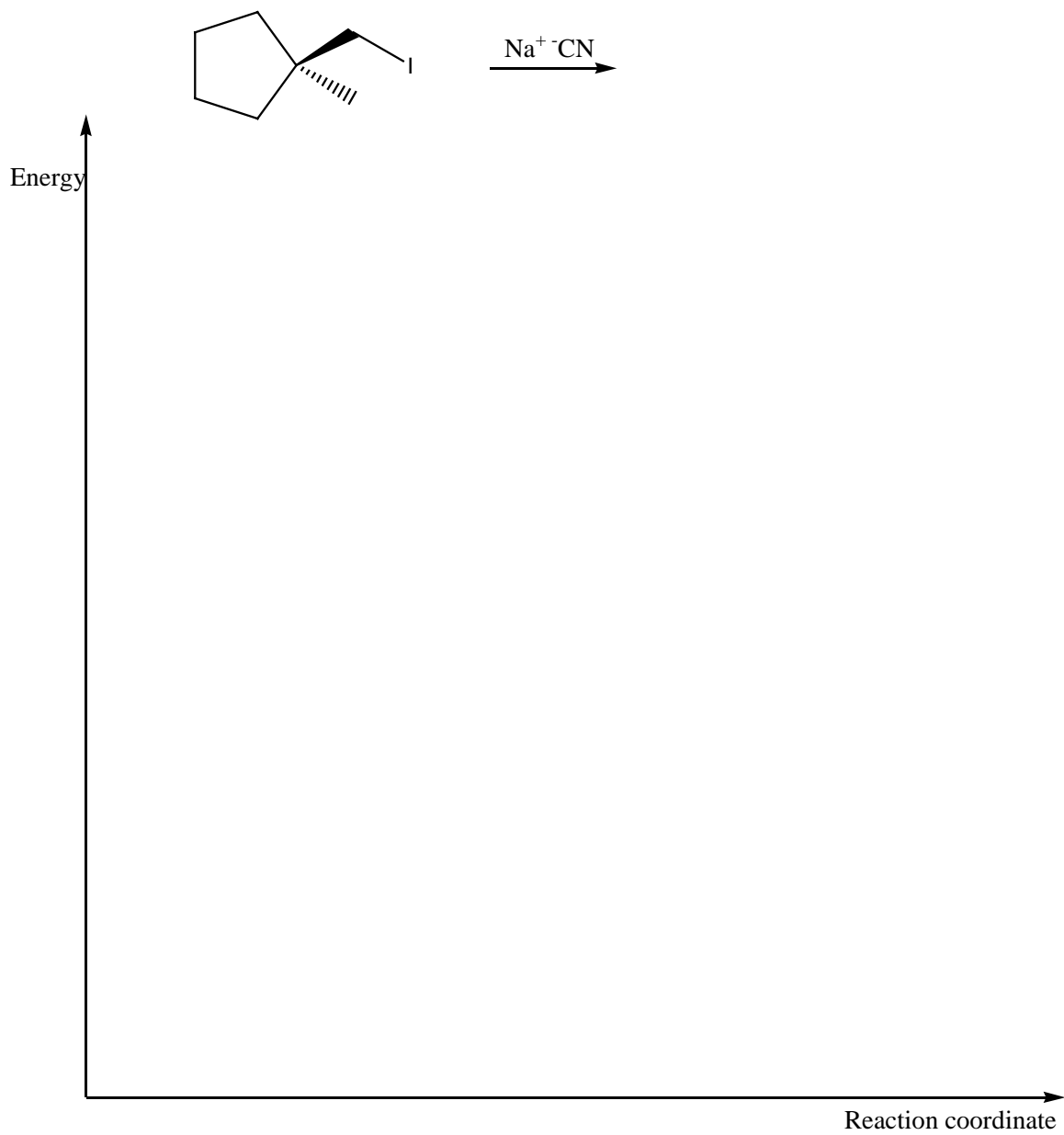
13) Draw the products of the following reactions. Include the stereochemistry where appropriate. 3 points each



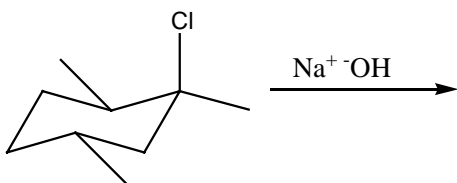
14) You are trying to deduce the mechanism for a new experiment you are checking. The reaction is a substitution and you are going to check the kinetics so see if it is either  $S_N1$  or  $S_N2$ . As part of your preparation you wonder if you run the reaction with different concentrations of the substrate and nucleophile what rates will result. Fill in the following table to show what you would expect for an initial rate change with concentration change of the substrate and nucleophile. 6 points

Initial [CH <sub>3</sub> CHICH <sub>2</sub> CH <sub>3</sub> ] mM	Initial [NaCN] mM	Initial Rate Prediction $S_N1$ molL <sup>-1</sup> s <sup>-1</sup>	Initial Rate Prediction $S_N2$ molL <sup>-1</sup> s <sup>-1</sup>
2.4	1.5	4.0	4.0
4.8	1.5		
2.4	3.0		
4.8	3.0		

15) Draw a free-energy diagram of the following reaction and include transition state diagrams of the structures which would be associated with each peak and trough. The reaction is exergonic. 6 points



16) Arrow push a  $S_N1$  mechanism for the following reaction and draw the transition state diagrams inside the square bracket to illustrate all the changes involved. What would you expect for a stereochemical outcome? 6 points



17) Why is a polar solvent, such as methanol, preferred for  $S_N1$  reactions? Include a diagram to illustrate. 3 points