Name: _____

Whittier College

Organic Chemistry: CHEM 231A

Test # 3

120 Points Total

November 4, 2002

1. Answer the following questions: (24 points – 6 pts each)

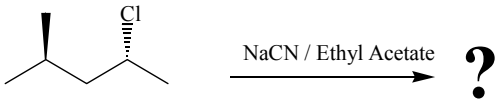
1a. What is a solvent? How might it affect a reaction? Explain briefly.

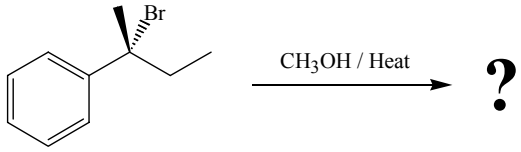
1b. What is an enantiomer? Provide two structures that demonstrate what an enantiomer is. Explain briefly.

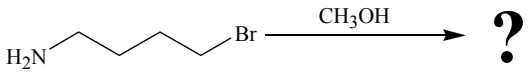
1c. What makes a nucleophile a good nucleophile? Explain briefly.

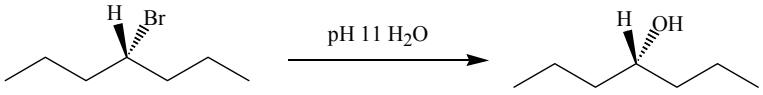
1d. What is a leaving group and what kind of reactions need one? What determines how good a leaving group is? Explain briefly.

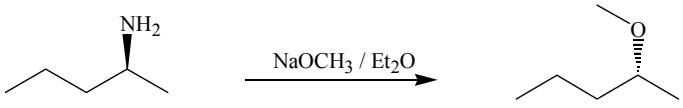
2. Consider the following reactions. Predict the product in the absence of a product and explain thoroughly your rationale **OR** discuss whether the product will be formed as drawn and explain thoroughly: (35 points – 7 points for each)

2a. 

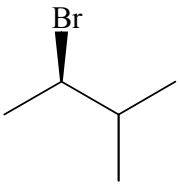
2b. 

2c. 

2d. 

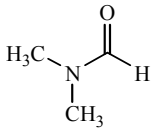
2e. 

3. Consider and explain thoroughly the following reaction of (R) 2-bromo-3-methyl butane with sodium hydrogen sulfide: (25 points)



NaSH / Solvent → **Product**

100 % Optically Pure
Optical rotation of + 73°

Solvent	**Reaction Time**
H_2O	120 minutes
CH_3OH	95 minutes
	20 minutes

3a. What is the product of the reaction? (2 points)

3b. Explain the rate data (4 points)

3c. What is the mechanism for the reaction? Include a drawing of the transition state and an energy diagram (7 points)

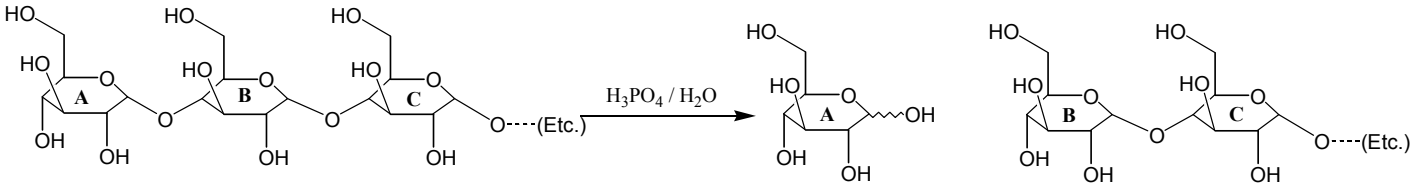
3d. What is the optical purity of the product? What is the optical rotation of the product? Briefly explain (3 points)

3e. If the water solution of sodium sulfide is acidified, the reaction does not occur unless heated. Explain these results (3 points)

3f. What is the mechanism and product for the acidified reaction? 4 points

3g. What is the optical purity of this reaction? What is the optical rotation for this reaction? Briefly explain. (2 points)

4. Our bodies use glycogen as way to store glucose, the main source of energy in our bodies. When glycogen is placed in phosphoric acid and water, glycogen will break apart to form glucose and a smaller glycogen molecule as is depicted in the reaction below. Consider and explain thoroughly the following questions about this reaction: (17 points)



Glycogen **Glucose** **Glycogen - 1 glucose unit**

4a. Circle the atoms and/or molecules that have changed in the above reaction? (1 points)

4b. What are the nucleophiles, electrophiles, acids and/or bases that may be involved in this reaction? (1 points)

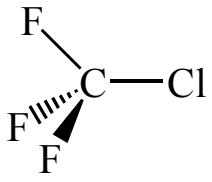
4c. What kind of reaction is this? Explain. (3 points)

4d. Why is phosphoric acid required in this reaction? (2 pts)

4e. Draw the mechanism for this reaction (5 pts)

4f. Why does the molecule fragment the way that it does? (Hint: Is there an alternative way that it could fragment; pay attention to the stereochemistry of the products to see this) (5 points)

5. CFC-11, a common chlorofluorocarbon (CFC) used in air conditioning and refrigeration units, is seen below. This particular CFC is exceptionally bad for the environment. It has a lifetime of 46 years in the atmosphere, which means that it is extremely inert. Even when placed in basic water, this molecule is extremely stable. Consider the following questions related to CFC-11 (19 points).



CFC-11

5a. If CFC-11 reacted with basic water, what reaction might you predict would occur? Show the mechanism and explain your rationale. (6 points)

5b. Why would the pH of water influence the reaction at all? (4 points)

5c. Why would this molecule have a longer lifetime in the atmosphere than in water? Explain which factors would effect the rate of the reaction. (3 points)

5d. What might be some reasons why this molecule does not react with basic water? Explain (6 points)