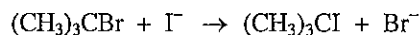


Test 4A
Chemistry 2321
April 27, 2005
McMurry, Chapters 10 and 11

Name Answer Key
Please Print

Part I. Multiple Choice. Choose the one best answer, and mark the answer on the answer form that you provided. (4 points each)

1. Consider the following reaction:



If no other changes are made, what is the effect of doubling the concentration of iodide ion on the rate of the reaction?

- a) no change
- b) doubles the rate
- c) triples the rate
- d) quadruples the rate
- e) halves the rate

2. Which of the following alkyl halides would be expected to react the fastest under $\text{S}_{\text{N}}2$ conditions?

- a) 1-bromo-2-methylbutane
- b) 2-bromo-2-methylbutane
- c) 2-bromo-3-methylbutane
- d) 1-bromo-3-methylbutane
- e) 2-bromo-2,3-dimethylbutane

3. Which of the following is the best nucleophile in an $\text{S}_{\text{N}}2$ reaction?

- a) CH_3O^-
- b) Cl^-
- c) H_2O
- d) OH^-
- e) NH_3

Know general order of nucleophilicity, top of page 353
 $\text{H}_2\text{O} < \text{CH}_3\text{CO}_2^- < \text{NH}_3 < \text{Cl}^- < \text{OH}^- < \text{CH}_3\text{O}^- < \text{I}^- < \text{CN}^- < \text{HS}^-$

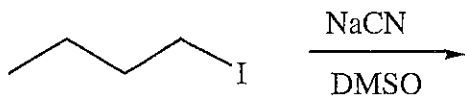
4. Which of the following correctly identifies the characteristics of an $\text{S}_{\text{N}}2$ reaction?

- | | Number of steps | stereochemistry |
|-------------------------------------|-----------------|-----------------|
| <input type="radio"/> a) | 1 | racemization |
| <input checked="" type="radio"/> b) | 1 | inversion |
| <input type="radio"/> c) | 1 | retention |
| <input type="radio"/> d) | 2 | racemization |
| <input type="radio"/> e) | 2 | retention |

5. Which of the substances below will react the fastest when treated with NaCN and DMSO ?

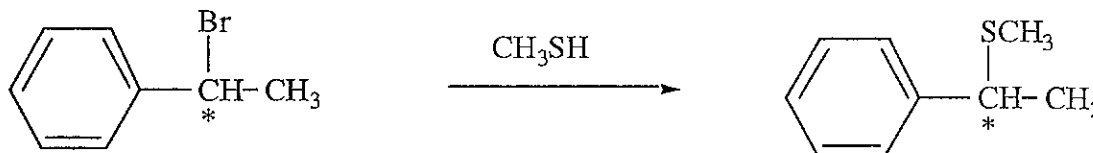
- a) $\text{CH}_3\text{-F}$
- b) $\text{CH}_3\text{-Cl}$
- c) $\text{CH}_3\text{-Br}$
- d) $\text{CH}_3\text{-I}$
- e) $\text{CH}_3\text{-OTos}$

6. Consider the reaction of 1-iodobutane with the cyanide ion:



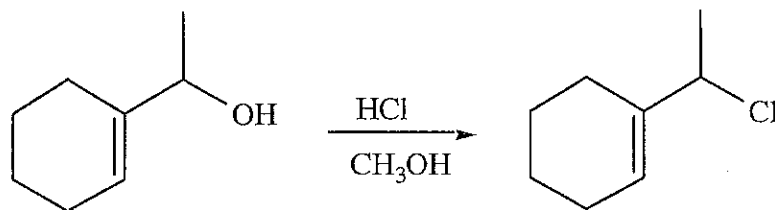
What would happen to the rate of the reaction if the concentration of both the cyanide ion and the 1-iodobutane are doubled?

- a) no change
 - b) rate doubles
 - c) rate triples
 - d) rate quadruples
 - e) rate is halved
7. When (S)-1-bromo-1-phenylethane undergoes a substitution reaction with methanethiol (CH_3SH), the product is the compound shown.



What is/are the configuration(s) of the product obtained from this reaction?

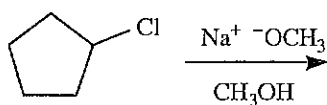
- a) A mixture of (R) and (S), with slightly more (R) than (S).
 - b) A mixture of (R) and (S), with slightly more (S) than (R).
 - c) (R) only
 - d) (S) only
8. Which term below best describes the mechanism of the following reaction?



- a) $\text{S}_{\text{N}}1$
 - b) $\text{S}_{\text{N}}2$
 - c) E1
 - d) E2
 - e) Free Radical Halogenation
9. Which alkyl halide is expected to react the fastest under $\text{S}_{\text{N}}1$ conditions?

- a) $(\text{CH}_3)_3\text{Cl}$
- b) $(\text{CH}_3)_3\text{CBr}$
- c) $(\text{CH}_3)_3\text{CCl}$
- d) $(\text{CH}_3)_3\text{CF}$
- e) They would all react at the same rate.

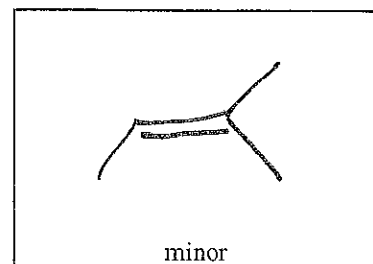
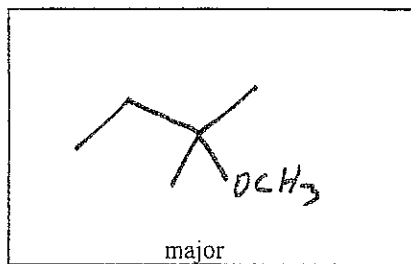
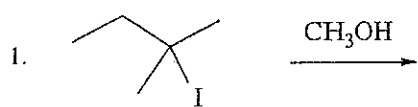
10. What is the best description of the mechanism of the reaction below?



- a) free radical halogenation
- b) $\text{S}_{\text{N}}1$
- c) $\text{S}_{\text{N}}2$
- d) E1
- e) E2

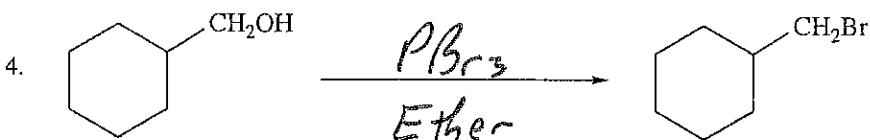
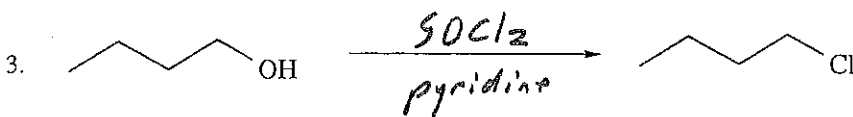
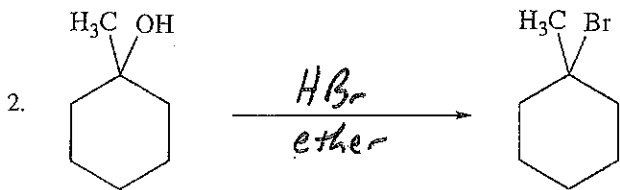
Test 4 Answer Key (Spring 2005)

Part II. Reactions. Draw the reactant, product, or reagents as indicated. Clearly indicate the regiochemistry and stereochemistry when appropriate. (Each response is worth 4 points, for a total of 32 points.)

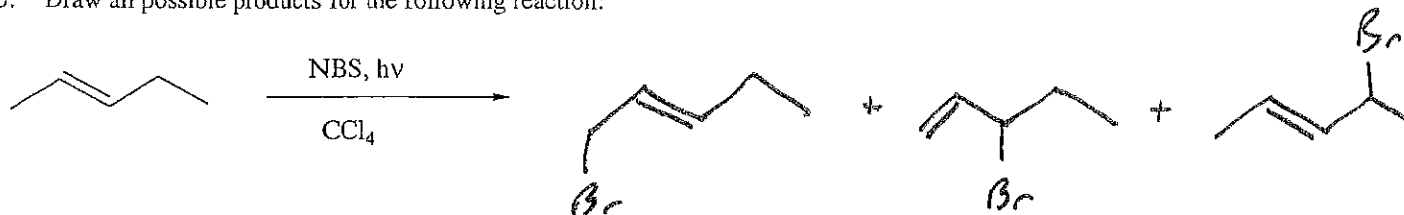


Sol
Sol is major product because Methyl solvent

For questions 2-4, show the reagents needed in order to accomplish the transformation shown.

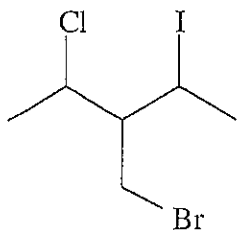


5. Draw all possible products for the following reaction:



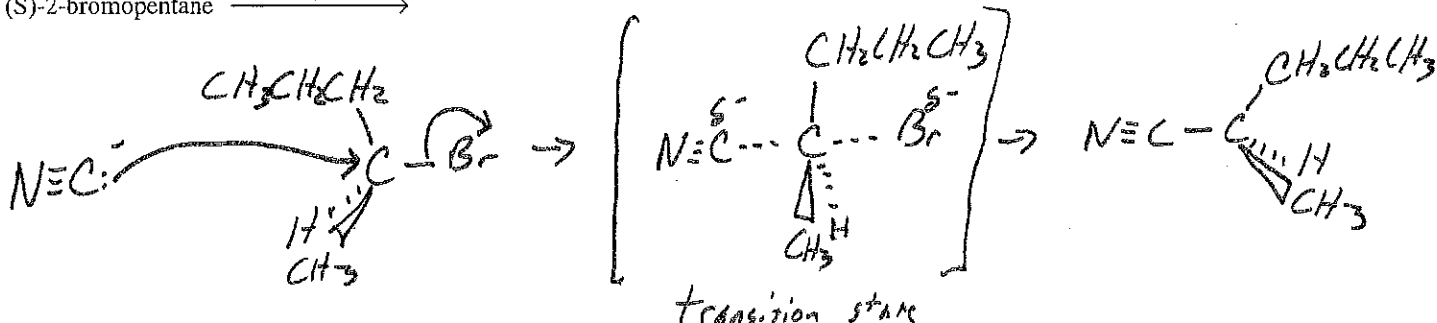
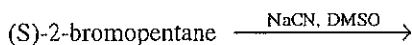
Part III. Short Answer and Mechanisms. (4 points each)

1. Give the IUPAC name of the following structure:

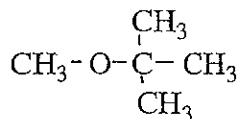


3-(bromomethyl)-2-chloro-4-iodopentane

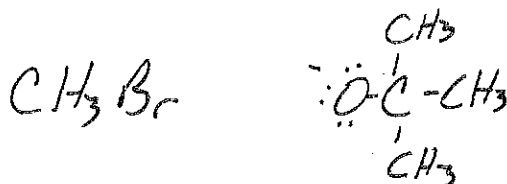
2. Draw the complete mechanism for the reaction below:



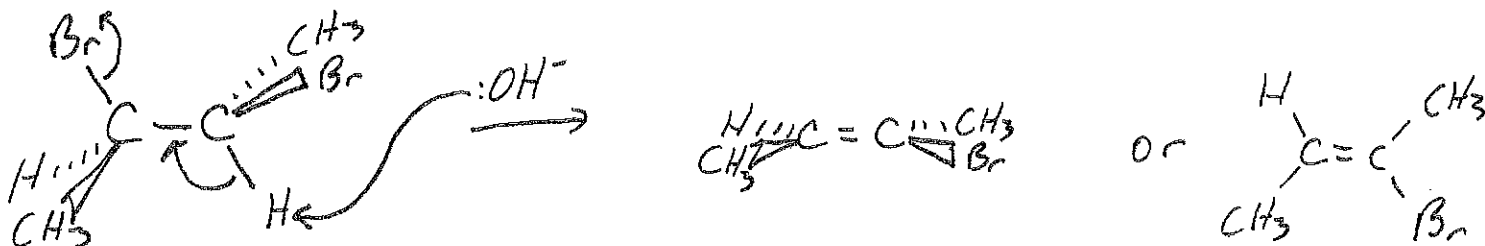
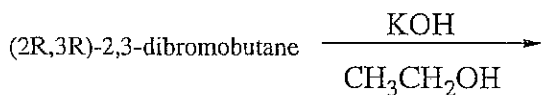
3. Ethers can often be prepared by the S_N2 reaction of alkoxide ions, RO^- , with alkyl halides. Suppose you wanted to prepare methyl t-butyl ether, shown below:



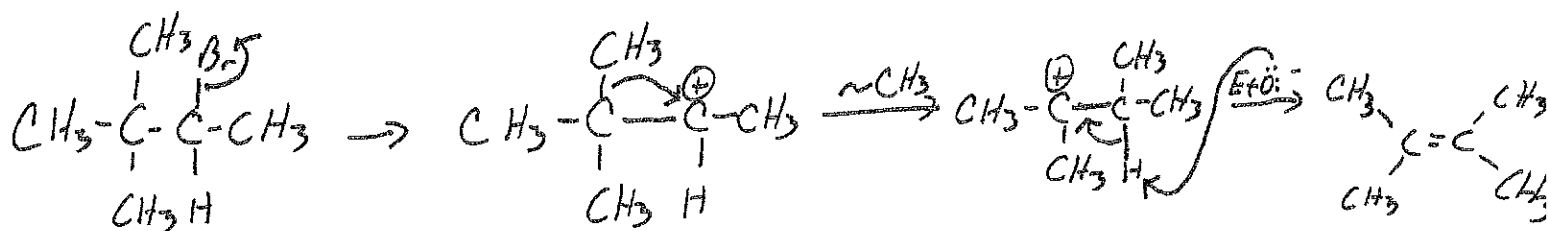
Draw the structure of the alkyl halide and the alkoxide ion that could be used to prepare this ether.



4. Draw the complete mechanism for the following reaction using the curved arrow formalism. (Assume only one equivalent of base reacts.)

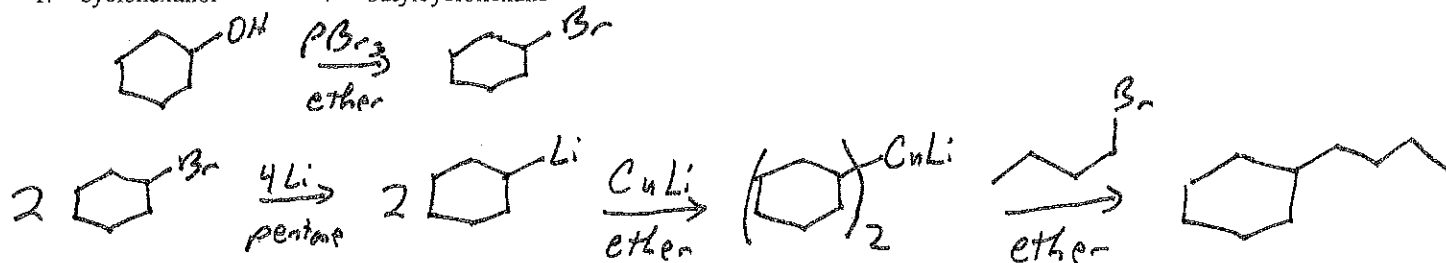


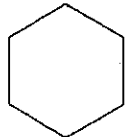
5. When 3-bromo-2,2-dimethylbutane is heated with a dilute solution of sodium ethoxide in ethanol, the reaction follows first order kinetics. Along with the substitution product, one of the products formed is 2,3-dimethyl-2-butene. Show the mechanism for the formation of this product using the curved arrow formalism.



Part IV. Synthesis. Show how the following syntheses could be performed. More than one step may be required. Show all reagents and all intermediate compounds in your synthetic scheme. (4 points each)

1. cyclohexanol $\xrightarrow{??}$ butylcyclohexane



2.  $\xrightarrow{??}$ 