

Test 4

Chemistry 2321

April 22, 2008

McMurry, Chapters 10 and 11

Name _____

Last name, First name (please print)

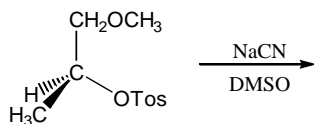
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Part 1. Multiple Choice. Choose the one best answer, and clearly mark that answer on the test below. (4 points each)1. Which term best describes the stereochemistry of an S_N1 reaction?

- a) complete inversion of stereochemistry
- b) complete retention of stereochemistry
- c) racemization of stereochemistry
- d) anti periplanar stereochemistry required

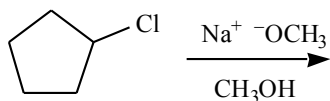
2. Which of the reactions below is the fastest?

- a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + :\text{CN}^- \xrightarrow{\text{DMSO}} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CN} + \text{OH}^-$
- b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + :\text{CN}^- \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CN} + \text{OH}^-$
- c) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br} + :\text{CN}^- \xrightarrow{\text{DMSO}} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CN} + \text{Br}^-$
- d) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br} + :\text{CN}^- \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CN} + \text{Br}^-$

3. Reaction of the following (S) tosylate with cyanide ion yields a nitrile product, that is, a product with a $-\text{CN}$ group. Which statement below is the best description of the stereochemistry of the product?

- a) The product has (S) stereochemistry.
 - b) The product has (R) stereochemistry.
 - c) The product is a mixture of (R) and (S) with slightly more (R) than (S).
 - d) The product is a mixture of (R) and (S) with slightly more (S) than (R).
4. When (R)-3-bromo-3-methylhexane reacts with a solution of H_2O and ethanol, the major product is 3-methyl-3-hexanol. What is/are the configuration(s) of the product obtained from this reaction?
- a) (R)-3-methyl-3-hexanol
 - b) (S)-3-methyl-3-hexanol
 - c) A mixture of (R) and (S), with slightly more (R) than (S).
 - d) A mixture of (R) and (S), with slightly more (S) than (R).
5. Which of the following is the best leaving group in an S_N1 or S_N2 reaction?
- a) I^-
 - b) Br^-
 - c) Cl^-
 - d) OH^-
 - e) OTos^-
6. Which of the following would be the best solvent for an S_N1 reaction?
- a) benzene
 - b) hexane
 - c) ethanol
 - d) dimethyl sulfoxide (DMSO)
 - e) diethyl ether ($\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$)

7. Which substance below is the most nucleophilic?
- H_2S
 - HS^-
 - CH_3COOH
 - CH_3COO^-
 - Cl^-
8. Which substance below would most likely undergo an $\text{S}_{\text{N}}1$ reaction?
- 2-bromohexane
 - 3-bromohexane
 - 3-bromo-3-methylhexane
 - 1-bromohexane
 - 2-bromo-3-methylhexane
9. What is the best description of the mechanism of the reaction below?

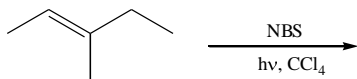


- free radical halogenation
 - $\text{S}_{\text{N}}1$
 - $\text{S}_{\text{N}}2$
 - E1
 - E2
10. What happens to the rate of an $\text{S}_{\text{N}}1$ reaction if the concentration of the nucleophile is doubled?
- The rate does not change.
 - The rate doubles.
 - The rate triples.
 - The rate quadruples.

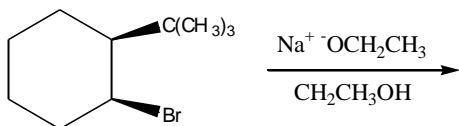
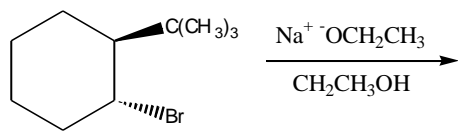
Part 2. Reactions. Draw the reactant, product, or reagents as indicated. Clearly indicate the regiochemistry and stereochemistry when appropriate. (4 points each)



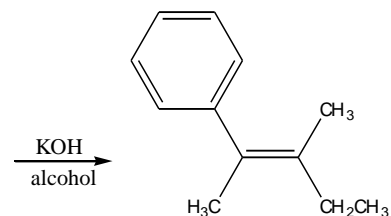
2. Draw all possible products for the following reaction:



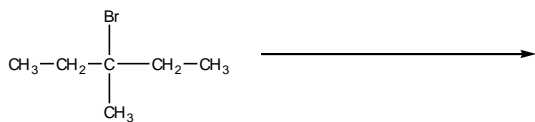
3. Consider the two reactions below. One of these reactions is much faster than the other. Draw a large X through the slower reaction, and draw the major product of the faster reaction.



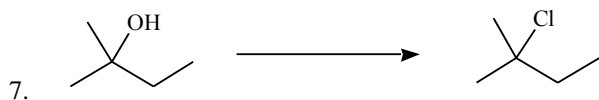
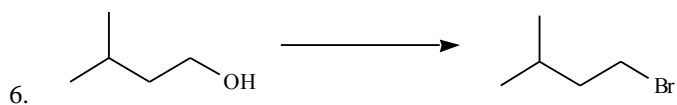
4. Draw the structure of an alkyl halide that would give *only* the compound shown below. Be sure to draw the alkyl halide with the appropriate stereochemistry, and label any chirality centers in the alkyl halide with the appropriate R/S designation.



5. Starting with 3-bromo-3-methylpentane, show the reagents required to make a Grignard reagent, and show the structure of the Grignard reagent:



Show the reagents required in the two reactions below.



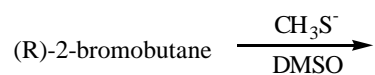
Part 3. Reaction Mechanisms and Short Answer. (4 points each)

When 2-bromo-2-methylpropane is heated with CH_3OH , two products are formed, an ether and an alkene. For questions 1 and 2, show the mechanism for the formation of each product. Use curved arrows to indicate each bond broken and each bond formed.

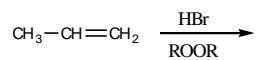
1. Mechanism for the formation of the ether:

2. Mechanism for the formation of the alkene:

3. Show the mechanism for the reaction below. Clearly show the stereochemistry of the reactant and product. Use a curved arrow for each bond broken and each bond formed.

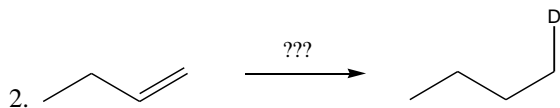


4. Show the initiation and propagation steps for the reaction below. (You do not need to use curved arrows.)



Part 4. Synthesis. Show how the following syntheses could be performed. Show all reagents and all intermediate compounds in your synthetic scheme. (4 points each).

1. Starting with (S)-2-butanol, show how you could synthesize (R)-2-bromobutane.



3. Starting with butane, show how 2,2-dimethylbutane could be synthesized. For your source of carbon, use *only* butane and any alkyl halide with three or fewer carbons.

