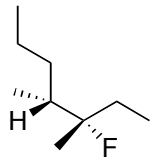
**CHE 171**
**Fall, 2005**
**Quiz 5 Answer Key**

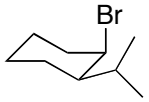
**Name:** _____
**Section:** **101** **102** **103**
**(*circle one*)**

1. Nomenclature.
   (a) Give an IUPAC name for the following compound. Is this a 1°, 2°, or 3° alkyl halide? (3 pts)

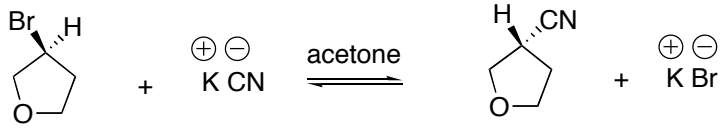



*(3S),(4R)-3-fluoro-3,4-dimethylheptane; 3°*

   (b) Show a structure for *cis*-1-bromo-2-isopropylcyclohexane in its most stable chair conformation. (3 pts)

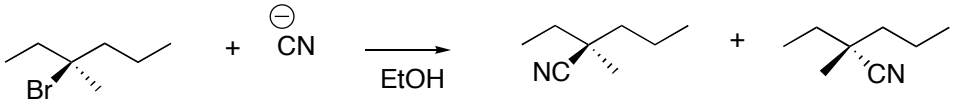



2. Does the equilibrium shown below favor products or reactants? Explain. (HCN has a p$K_a$ of 9; HBr has a p$K_a$ of –9). (4 pts)



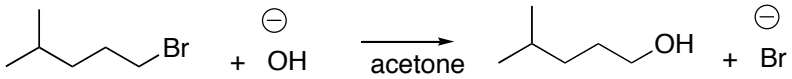

*HCN has a pKaof 9, which makes it a weaker acid than HBr; consequently CN- is a stronger base than Br-. The stronger the base the better the nucleophile, and the weaker the base the better the leaving group. Thus the equilibrium favors products (the more stable base).*

3. When pure (*S*)-3-bromo-3-methylhexane is treated with a weak nucleophile like cyanide ion ($CN^-$) in a polar protic solvent like ethanol ($CH_3CH_2OH$), a substitution reaction occurs. Draw the product(s) and specify whether or not it/they is/are optically active? (10 pts)

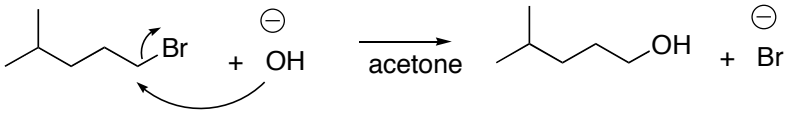



*a racemic mixture of products is generated from this $S_N1$ reaction; racemic mixtures are NOT optically active.*

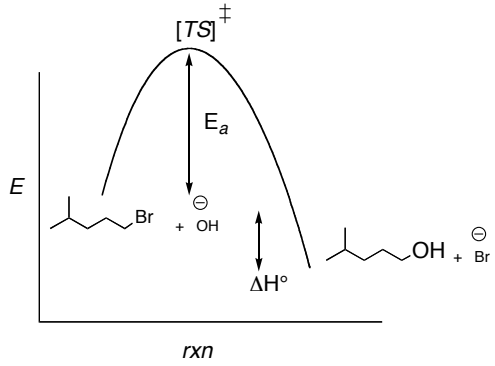
4. Consider the following reaction:



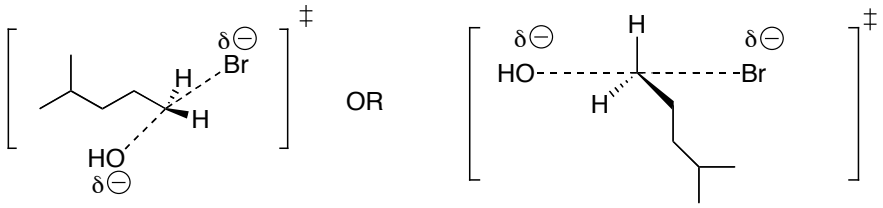

(a) Draw a mechanism using curved arrows. (5 pts)



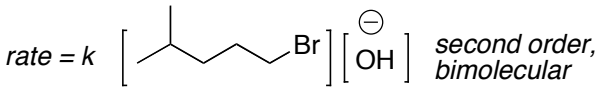

(b) Draw an energy diagram. Label the axes, the reactants, products, $E_a$ and $\Delta H°$. Assume the reaction is exothermic. (5 pts)




(c) Draw the structure of the transition state for the rate-determining step. (2 pts)



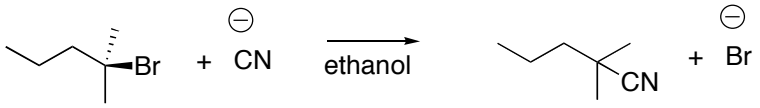

(d) What is the rate equation? What is the kinetic order of the reaction? (2 pts)



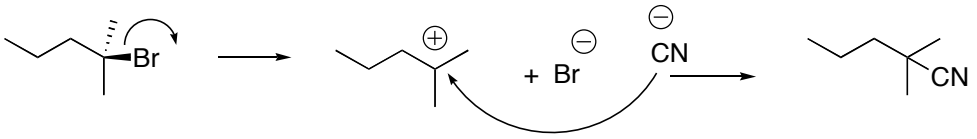

(e) What happens to the reaction rate if the concentration of hydroxide ion is doubled? (1 pt)

*The reaction rate is also doubled.*

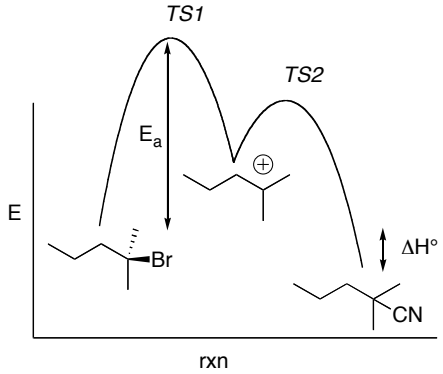
5. Consider the following reaction:



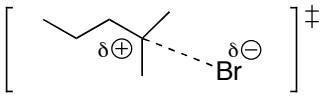

(a) Draw a mechanism using curved arrows. (5 pts)



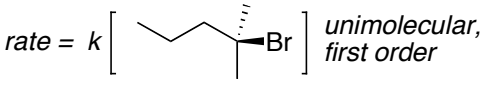

(b) Draw an energy diagram. Label the axes, the reactants, products, $E_a$ and $\Delta H°$. Assume the reaction is exothermic. (5 pts)




(c) Draw the structure of the transition state for the rate-determining step. (2 pts)




(d) What is the rate equation? What is the kinetic order of the reaction? (2 pts)




(e) What happens to the reaction rate if the concentration of cyanide ion is doubled? (1 pt)

*Doubling the concentration of the nucleophile has no effect on the rate of an $S_N1$ reaction since the nucleophile is not part of the r.d.s.*