Name Mr. Snavik 29 Period AP1,2,3

Kinetics I

Fill in the blanks in the following sentences:

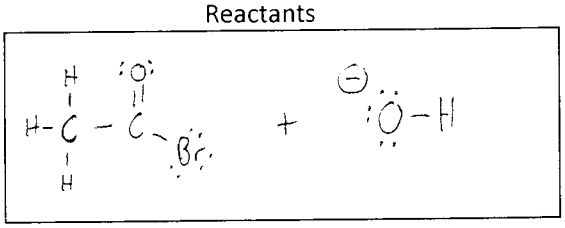
1. For a chemical reaction to occur, molecules must collide with enough kinetic energy and in the correct orientation. +2

Consider the following reaction:

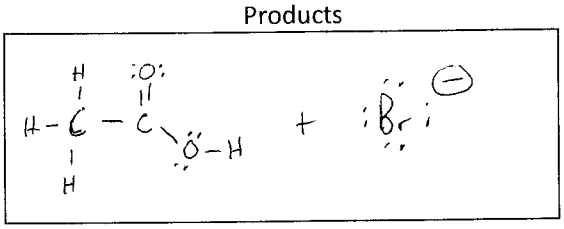
$$CH_3COBr + OH^- \rightarrow CH_3COOH + Br^-$$

2. In the appropriately labeled spaces below, draw Lewis structures for the reactants, products, and possible transition state(s). **[You will get full credit for drawing just one.]**

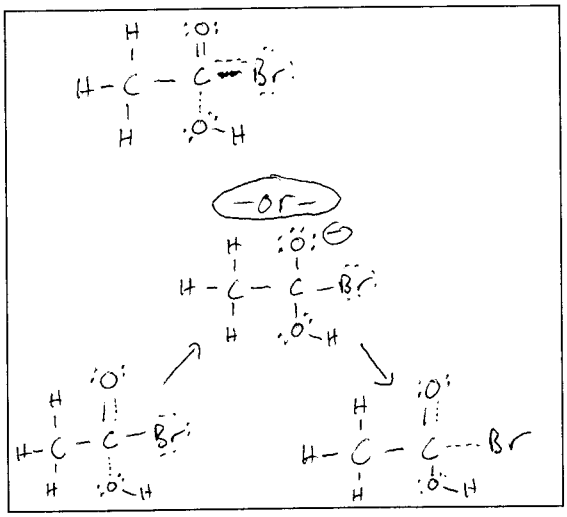
Reactants



Products



Transition State(s)



+10

3. Define **activation energy** (E_a).

Activation energy is the energy difference between the reactants and transition state. It is the energy needed to "kick" reactants over the transition-state, high-energy "hill". +2

+14

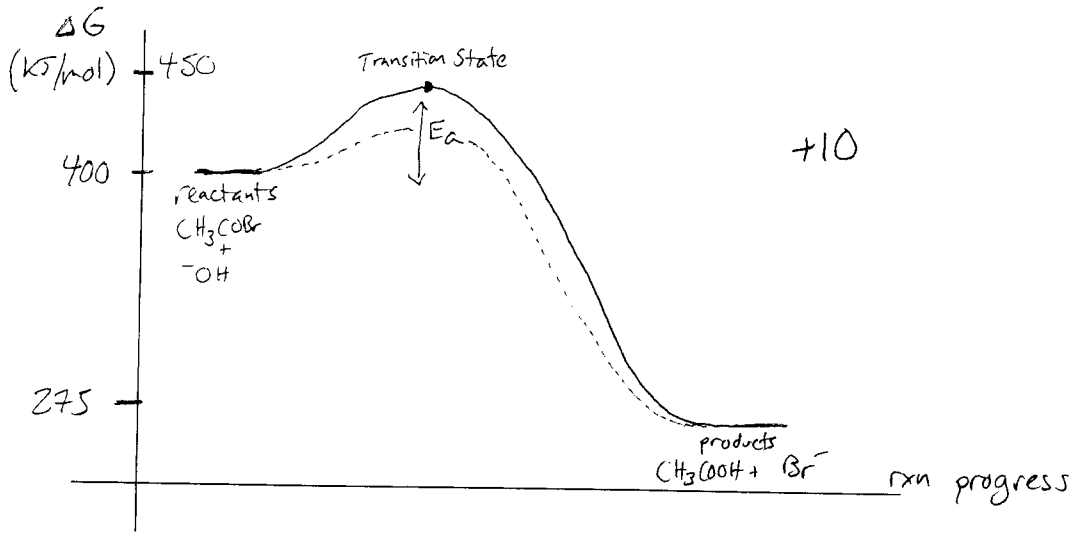
4. Given the following data,

$\Delta G_f(CH_3COBr) = 100$ kJ/mol $\Delta G_f(CH_3COOH) = 75$ kJ/mol

$\Delta G_f(OH^-) = 300$ kJ/mol $\Delta G_f(Br^-) = 200$ kJ/mol E_a (rxn in # 2) = 50 kJ/mol

draw a reaction profile on the plot below for the reaction from question (2). For full credit, you must

a) Label both axes with titles and units
b) Label the reactants, products, and transition state on a **solid** curve (———————)
c) Label the energies of the reactants, products, and transition state on the y-axis
d) Draw an arrow indicating the activation energy



+10

5. Draw a dotted line (- - - - - -) curve on the graph above showing the effect of a decrease in activation energy.

+1

6. What would happen to the rate of reaction if the activation energy decreased? Explain your answer.

The rate of reaction increases as activation energy decreases. At the same temperature, and thus same average kinetic energy, more molecules will more frequently have the energy to climb the lower-Ea hill than the hill with higher Ea. With more molecules with enough kinetic energy to reach the transition state, more product will be formed in a given time, increasing the rate of reaction. +2

7. Draw a plus line (+ + + + +) curve on the graph above showing the effect of a decrease in temperature.
Impossible to draw without knowing the enthalpy and entropy at every point on curve.

8. How would a decrease in temperature affect the rate of the reaction? Explain your answer.

A decrease in temperature would cause the reaction rate to decrease. At the same activation energy, a system at a lower temperature has molecules with a smaller average kinetic energy. At this smaller average KE, fewer molecules have enough energy to pass over the transition state, thus slowing the rate of forming product and the rate of reaction. +2

+5