Chemistry CP

Name:

FFF#16: Kinetics Review Sheet

Section:

Potential Energy Diagrams

1. Define the following terms:
   a) Activation energy

   b) Activated complex

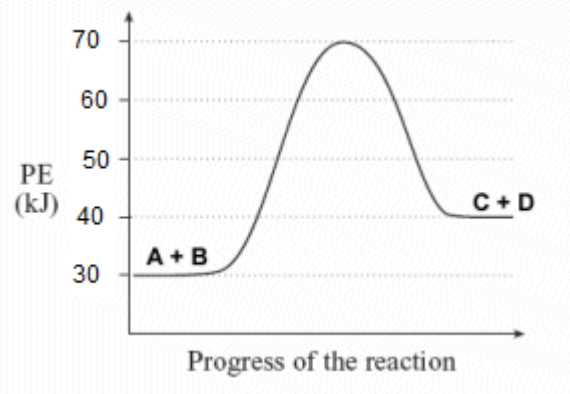
2. A potential energy diagram for the reaction A + B → C + D is shown below.
   a. Is the forward reaction endothermic or exothermic? Explain how you arrived at your answer.

   b. What is ΔH for the forward reaction? Be sure to include the correct sign

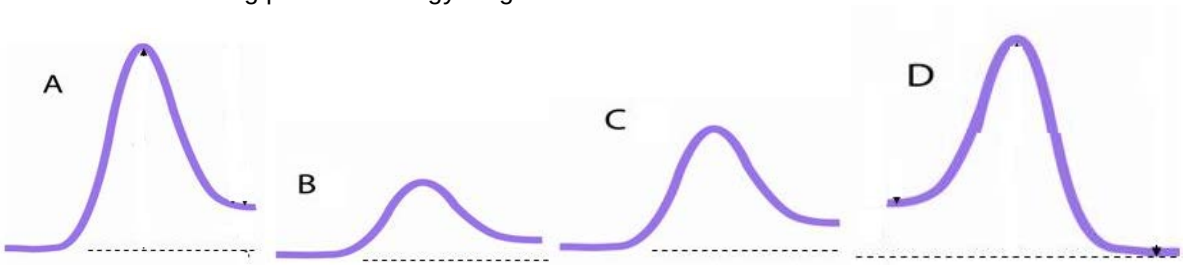
   c. What is the activation energy for the forward reaction?

   d. Label the position of the transition state in the diagram.

   e. What is the activation energy for the reverse reaction?



3. Consider the following potential energy diagrams



Which of these would you expect to have the fastest reaction rate? The slowest reaction rate? Explain your answers.

Collision Theory

8. What is the difference between a catalyst and an inhibitor?

9. Which of the following would have the greatest rate of reaction? Which would have the slowest rate of reaction? Explain your answer using collision theory.

a) 50 °C, powdered magnesium metal, 6.0 M HBr

b) 20 °C, powdered magnesium metal, 1.0 M HBr

c) 50 °C, magnesium ribbon, 6.0 M HBr

d) 20 °C, magnesium ribbon, 0.5 M HBr

Experimental Design

4. What reactant or product would you choose to measure in order to determine the rate of this reaction? Explain how you would measure the substance you chose. What else do you need to measure?

$Zn(s) + 2\ HCl\ (aq) \rightarrow H_2(g) + ZnCl_2(aq)$

Reaction Rates

5. Relative to automobile travel, which of these three variables does a reaction rate most closely resemble: the speed of the automobile, the distance it travels, or the time of travel? Explain your answer.

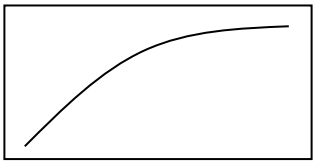
6. A friend tells you that you can recognize a fast reaction because it produces more product than a slow reaction. What other factors must be included to make this a correct statement?

7. Suppose substances A and B react to form C, as shown below.

$A + B \rightarrow C$

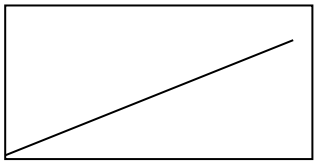
The rate of this reaction can be followed by measuring the mass of substance C, which forms over time. The two graphs below show two of the many possible results that could be found for this reaction. Determine whether the reaction rate is increasing, decreasing, or remaining constant over time for graph I and graph II.

Graph I



Time

Graph II

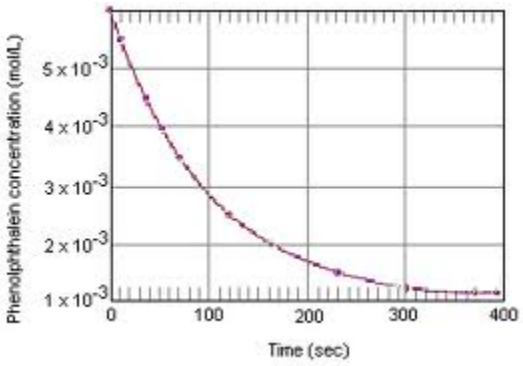


Time

8. Explain how you can tell from a plot of product concentration versus time—without actually calculating reaction rates—whether the reaction rate is increasing, decreasing, or remaining constant.

9. At 20^{o}C, a 3% solution of hydrogen peroxide produces 15 mL of oxygen gas in 120 seconds. What is the rate of this reaction?

10. One day in lab, a team of students decided to study the reaction kinetics of the indicator phenolphthalein in aqueous solution. The results are shown in the graph to the right.
    A) Is phenolphthalein a reactant or product? Justify your answer.



    B) Using the data in the graph, calculate the average rate of the disappearance of phenolphthalein between 100 and 300 seconds. Include units with your answer!

11. Look at the graph from problem 10 over the last 100 s. Without doing another calculation, determine how the rate of the reaction at this point compares with the rate you calculated in problem 9.

CHALLENGE QUESTION

12. In 60 seconds, 90% of 50 mL of a 3% solution of hydrogen peroxide decomposes at 20^{o}C in the presence of a catalyst. If the rate of this reaction doubles for each 10 degree increase in temperature, how long might it take for the same amount of this solution to decompose at 40^{o}C?

Answers to selected problems
9. (0.13 mL/sec)
12. (15 seconds)