Chemistry CP

Name:

Kinetics Problem Set

Section:

A. Monitoring Reactions

1. Describe an experiment you could carry out to compare the reaction rate of magnesium metal and 1M HBr with the reaction rate of mangesium metal and 0.25M HBr.

2. A solution of copper (II) sulfate is blue. When you put zinc into this solution, the following reaction takes place: $CuSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$ What property of this reaction could you follow if you were interested in comparing the rates of its reaction under different conditions?

B. Factors Affecting Reaction Rates

3. Hydrogen and iodine react at 400°C, according to the equation, $H_2(g) + I_2(g) \rightarrow 2HI\ (g)$. How would the rate of reaction be affected by the following:
    a) increasing the temperature
    b) increasing the concentration of hydrogen
    c) increasing the concentration of both the hydrogen and the iodine
    d) adding a catalyst

4. Which will react faster: zinc and 3M hydrochloric acid, or zinc and 1 M hydrochloric acid?

5. Use collision theory to explain why increasing the concentration of hydrochloric acid would cause an increase in the rate of its reaction with zinc.

6. Which will burn faster: a solid log, a split log, or wood shavings?

7. When you pour a solution of lead (II) nitrate, $Pb(NO_3)_2$, into a solution of potassium iodide, KI, you notice the formation of a yellow solid as soon as the solutions meet. Would you expect this reaction to take place at the same rate if you mixed solid lead nitrate with solid potassium iodide? Explain.

8. Why is 6M hydrochloric acid more hazardous to skin and eyes than 0.2 M hydrochloric acid?

9. Using collision theory described in this chapter, explain the following:
    a) Sugar dissolves faster in a cup of hot coffee than in cold lemonade.
    b) A sugar cube dissolves more slowly than granulated sugar.
    c) Stirring a teaspoon of sugar helps it dissolve faster than not stirring it.

10. White phosphorus reacts rapidly with oxygen when exposed to air. What can you say about the magnitude of the activation energy for this reaction?

11. The metallic luster of fine copper wool doesn't readily change unless it is put into a crucible and heated at a high temperature. This causes the copper to darken as it reacts with oxygen. How, do you think, does the activation energy of this reaction compare with that of the phosphorus reaction described in question 10?

12. If you add 1.0 g of manganese dioxide to 1.0 L of 3 % hydrogen peroxide, the solution will fizz. When the fizzing stops, how much manganese dioxide would you expect to recover? Explain your answer.

13. The reaction represented by this equation takes place very slowly (if at all) at room temperature:

$CH_3CH_2OH(l) \rightarrow CH_2CH_2(g) + H_2O$

However, in the presence of an acid (H^+), the reaction takes place much faster. It is believed to follow this mechanism:

$CH_3CH_2OH + H^+ \rightarrow CH_3CH_2OH_2^+$

$CH_3CH_2OH_2^+ \rightarrow CH_3CH_2^+ + H_2O$

$CH_3CH_2^+ \rightarrow CH_2CH_2 + H^+$

Give two reasons why the acid can be considered a catalyst for the reaction.

C. Reaction Pathways

14. Sketch a potential-energy curve for an endothermic reaction. Label the parts representing the activated complex, activation energy, and change in enthalpy.

15. Repeat question 14, this time for an exothermic reaction.

16. How does a catalyst affect the activation energy for a reaction? Sketch two potential energy curves for a reaction, one showing the uncatalyzed reaction, and the other showing the catalyzed reaction. Label each curve.