Reaction Rates and PE diagrams

1. Which of the reactions below would proceed most rapidly at room temperature? Why?

   Reaction A: $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} + NaNO_{3(aq)}$

   Reaction B: $C_3H_{8(g)} + 5\ O_{2(g)} \rightarrow 3\ CO_{2(g)} + 4\ H_2O_{(g)}$

2. Hydrogen reacts more rapidly with Cl_2 than with Br_2. What does this suggest about:

a) the strength of the bonds between the atoms in Cl_2 molecules and in Br_2 molecules?

b) the relative magnitude of the activation energies for the two reactions?

3. For each pair of reactants, identify which has the greater activation energy. Explain your choice:

a) A 1.00 cm cube of Fe reacting with 20.0 mL of 1.00 mol/L $HCl_{(aq)}$ producing $H_{2(g)}$ at a *rate of 1.00 ml/s* OR A 1.00 cm cube of Mg reacting with 20.0 mL of 1.00 mol/L $HCl_{(aq)}$ producing $H_{2(g)}$ at a *rate of 5.00 ml/s.*

b) A 2.00 g cube of Fe reacting with 20.0 mL of 1.00 Mol/L $HCl_{(aq)}$ OR 2.00 g of powdered Fe reacting with 20.0 mL of 1.00 Mol/L $HCl_{(aq)}$.

4. Describe the striking and burning of a match in terms of a potential energy diagram. What does the striking do? Where does the E_a for the match to keep burning come from?

5. A student carried out an experiment to measure the rate of decomposition of H_2O_2. She initially used 50.0 mL of 1.00 mol/L H_2O_2 and 1.00 g of MnO_2 as a catalyst. She wanted to determine how the RATE and the FINAL VOLUME of oxygen would change if she made changes to the experiment.
How would each of the following changes to the initial reaction affect the RATE and the FINAL VOLUME OF OXYGEN collected?

Change	effect on rate	effect on final volume
add 50.0 mL of 5.00 mol/L H_2O_2		
add 50.0 mL of 0.0100 mol/L H_2O_2		
add 50.0 mL of water before starting the reaction		
raise the temperature		
grind the same catalyst into a finer powder		
use 50.0 mL of 0.100 mol/L H_2O_2 instead of the original 1.00 mol/L H_2O_2		
do the reaction in a larger erlenmeyer flask		

6. Sketch potential energy diagrams for each of the following:
a) a fast exothermic reaction b) a slow exothermic reaction

c) an exothermic reaction that proceeds rapidly and releases a huge quantity of heat

7. Draw a potential energy diagram for a reaction in which $\triangle H$ = -80 kJ/mol and E_a = +28 kJ/mol for the forward reaction. Label both axes, the activation energy, $\triangle H$, the site of the activated complex, reactants, and products.

What is the E_a for the reverse reaction? _____