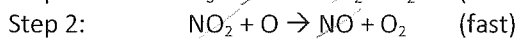
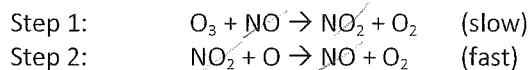


Reaction Mechanism Worksheet 1

1. Given the following mechanism, answer the questions below:



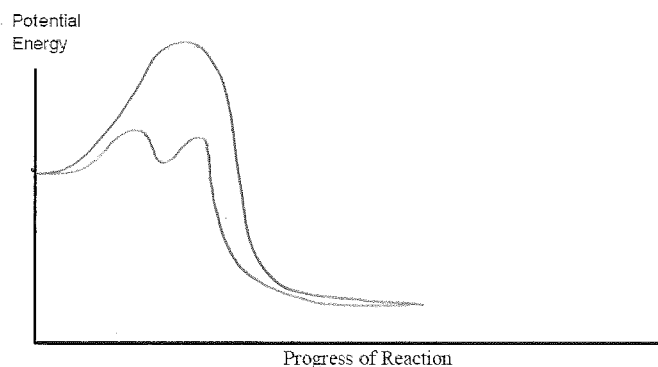
a) Give the equation for the *overall reaction*.



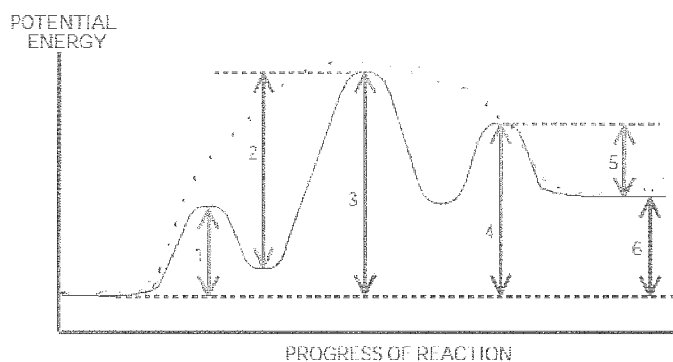
b) Which step is the *rate determining step*? step 1

c) What is an *intermediate* in this mechanism? NO_2

d) Given that the *uncatalyzed* overall reaction is a *slow exothermic* reaction, draw a *potential energy graph* which shows the possible shape of the curve for the *uncatalyzed* reaction. On the same graph, show a possible curve for the *catalyzed* reaction.



2. Given the following potential energy diagram for a 3-step reaction, answer the questions below:



a) Which arrow indicates the *activation energy* for the *first step of the reverse* reaction?

5

b) Which arrow indicates the *activation energy* for the *first step of the forward* reaction?

1

c) Which arrow indicates the *enthalpy change* (ΔH) for the *overall forward* reaction?

6

d) Which arrow indicates the *enthalpy change* (ΔH) for the *overall reverse* reaction?

6

e) Which arrow indicates the *activation energy* for the *overall forward* reaction?

3

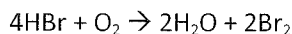
f) Which step would be the *rate determining step* in the *forward* reaction?

Step 2.

Why? largest activation energy

g) In a dashed line or another colour, sketch a possible curve that would represent the route for the *uncatalyzed* overall reaction. Label this on the graph.

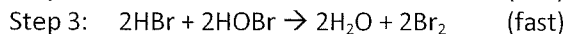
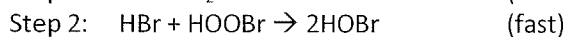
3. Given the reaction:



a) Would you expect this reaction to take place in a single step? NO

Why or why not? more than 2 reactant particles

b) This reaction is thought to take place by means of the following mechanism:



c) Identify the two *intermediates*. HOBr, HOBr

d) A catalyst is discovered which increases the rate of *Step 3*. How will this affect the rate of the *overall reaction*? will not affect the overall rate.

Explain your answer. Step 1 is the rate determining step
the products of the overall rxn cannot be formed faster than the products of the slowest step.

e) A catalyst is discovered which increases the rate of *Step 1*. How will this affect the rate of the *overall reaction*? it will increase the rate

Explain your answer. _____

f) Which step has the greatest *activation energy*? Step 1
 Why? Slowest

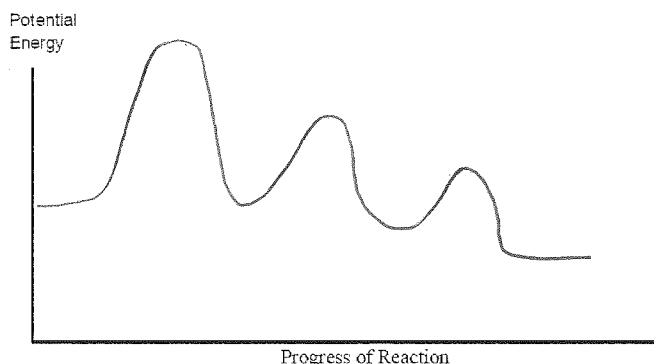
g) How many "peaks" will the potential energy diagram for the reaction mechanism have?
3

What do these "peaks" represent? each step

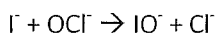
h) What do the "valleys" represent? reaction intermediates

i) Which step is called the *rate determining step* in this mechanism? Step 1, slowest step

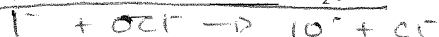
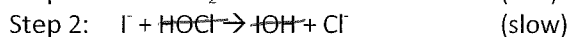
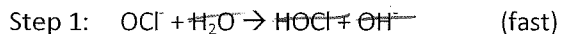
j) On the axis below, draw the shape of the curve you might expect for the reaction in this question. The overall reaction is *exothermic*. Make sure you make the "peaks" the correct relative sizes.



4. The equation for an *overall* reaction is:



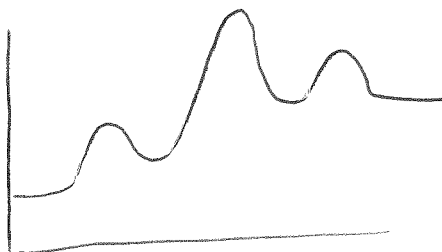
a) The following is a proposed *mechanism* for this reaction. One of the species has been left out. *Determine what that species is and write it in the blank space (on the line)*. Make sure the *charge* is correct if it has one.

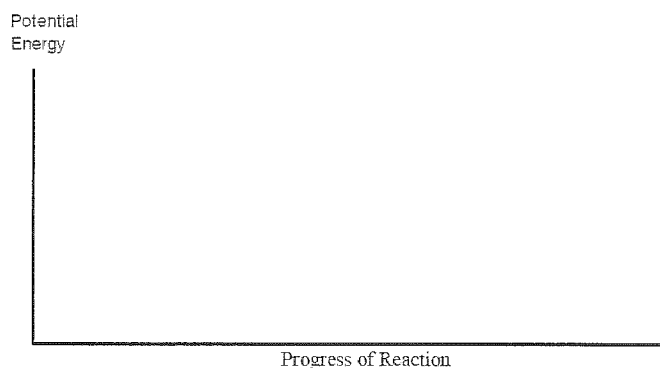


b) Which three species in the mechanism above are *intermediates*? HOCl, OH⁻, IOH

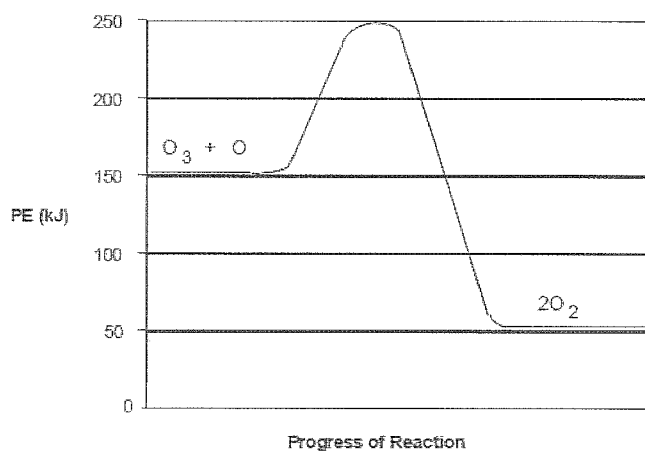
c) Step 2 is the *rate determining step*.

d) On the axis below, draw the shape of the curve you might expect for the reaction in this question. The overall reaction is *endothermic*. Make sure you make the "peaks" the correct relative sizes.





5. The following potential energy diagram refers to a very slow one-step reaction of ozone (O_3) and oxygen atoms in the upper atmosphere.



On the axis below, draw a potential energy diagram which could represent the *catalyzed mechanism* for the reaction:

