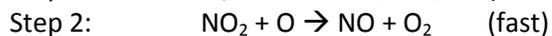


Reaction Mechanism Worksheet 1

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

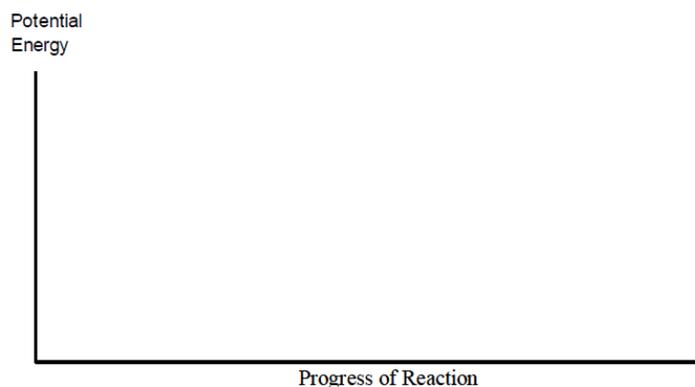


a) Give the equation for the *overall reaction*.

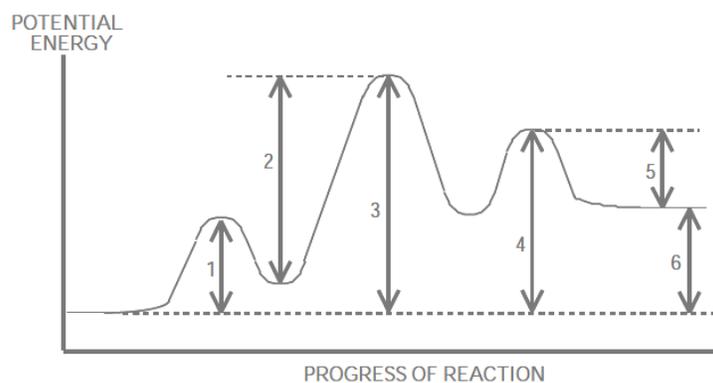
b) Which step is the *rate determining step*? _____

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

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?

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

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

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

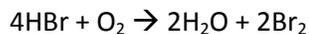
e) Which arrow indicates the *activation energy* for the *overall forward* reaction?

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

Why? _____

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.

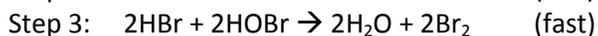
3. Given the reaction:



a) Would you expect this reaction to take place in a single step? _____

Why or why not? _____

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



c) Identify the two *intermediates*. _____

d) A catalyst is discovered which increases the rate of *Step 3*. How will this affect the rate of the *overall reaction*? _____

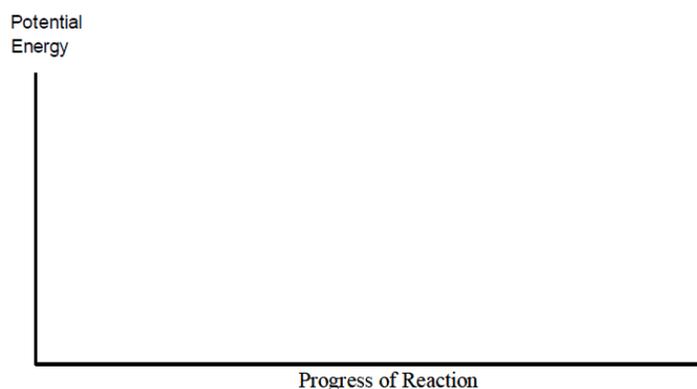
Explain your answer. _____

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

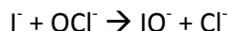
Explain your answer. _____

- f) Which step has the *greatest activation energy*? _____
 Why? _____
- g) How many “peaks” will the potential energy diagram for the reaction mechanism have?

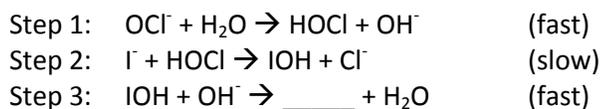
 What do these “peaks” represent? _____
- h) What do the “valleys” represent? _____
- i) Which step is called the *rate determining step* in this mechanism? _____
- j) On the axis below, draw the shape of the curve you might expect for the reaction in this question. The overall reaction is *exothermic*. Make sure you make the “peaks” the correct relative sizes.



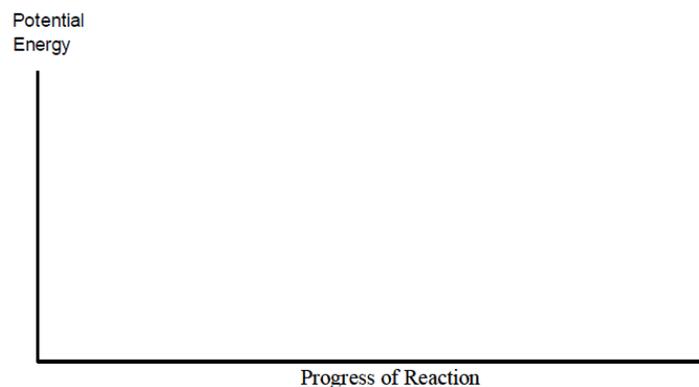
4. The equation for an *overall* reaction is:



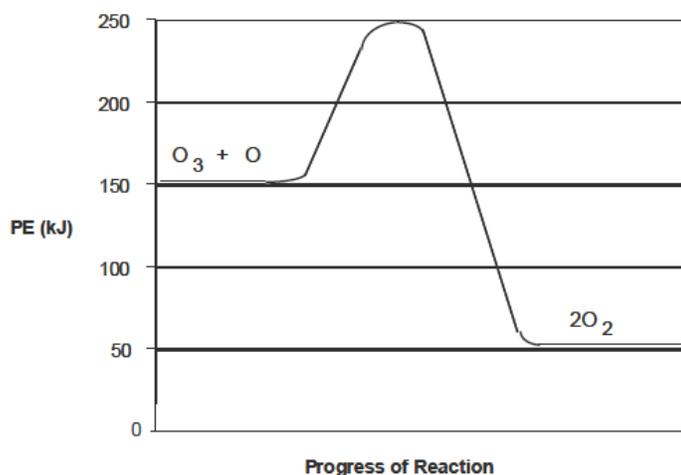
- a) The following is a proposed *mechanism* for this reaction. One of the species has been left out. *Determine what that species is and write it in the blank space (on the line)*. Make sure the *charge* is correct if it has one.



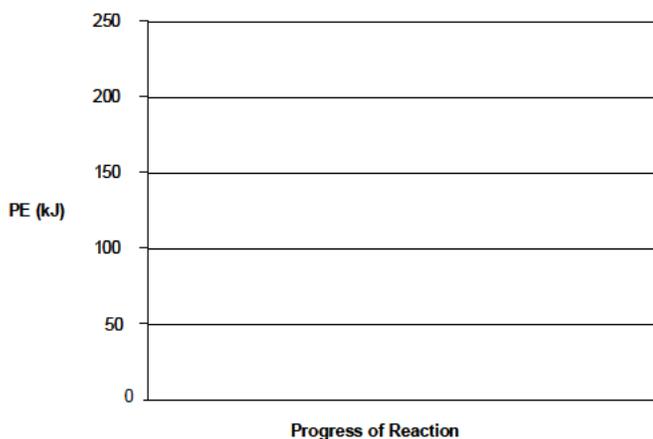
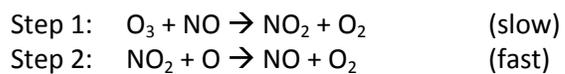
- b) Which three species in the mechanism above are *intermediates*? _____
- c) Step _____ is the *rate determining step*.
- d) On the axis below, draw the shape of the curve you might expect for the reaction in this question. The overall reaction is *endothermic*. Make sure you make the “peaks” the 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:



6. Consider the following reaction:



- a) The *first step* in each of the two proposed reaction mechanisms for the above reaction is listed below. If each proposed reaction mechanism consists of only *two steps*, *determine the second step for each mechanism*.

Proposed Mechanism 1



Proposed Mechanism 2



- b) Experimental data show that the rate of the reaction is *not* affected by a change in the [CO].

Which of these two mechanisms would be consistent with this data? _____

Explain your answer. _____
