

Section Review

Math  LINK

www.mcgrawhill.ca/links/atlchemistry

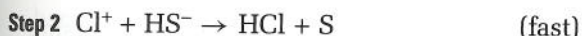
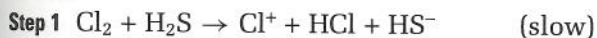
You probably know that compounds called chlorofluorocarbons (CFCs) are responsible for depleting the ozone layer in Earth's stratosphere. Did you know, however, that CFCs do their destructive work by acting as homogeneous catalysts? Use the Internet to find out how CFCs catalyze the decomposition of ozone in the stratosphere. To start your research, go to the web site above and click on **Web Links**. Communicate your findings as a two-page press release.

- 1 In your own words, describe how collision theory explains the factors that affect reaction rate.
- 2 Suppose that you have a solid sample of an organic substance. You are going to burn the substance in an analytical furnace and determine whether or not any unburned matter remains. The substance is somewhat hard, and you receive it in a solid chunk.
 - (a) Suggest two ways to increase the rate of burning so that your analysis will take less time.
 - (b) Explain why your suggestions would work, using the theories you learned in this section.
- 3 Consider the following reaction.
$$A_2 + B_2 \rightarrow 2AB \quad E_{a(\text{fwd})} = 143 \text{ kJ}, E_{a(\text{rev})} = 75 \text{ kJ}$$
 - (a) Is the reaction endothermic or exothermic in the forward direction?
 - (b) Draw and label a potential energy diagram. Include a value for ΔE .
 - (c) Suggest a possible activated complex.
- 4 Consider two exothermic reactions. Reaction (1) has a much smaller activation energy than reaction (2).
 - (a) Sketch a potential energy diagram for each reaction, showing how the difference in activation energy affects the shape of the graph.
 - (b) How do you think the rates of reactions (1) and (2) compare? Explain your answer.
- 5 In your own words, describe an elementary reaction.
- 6 Distinguish between an overall reaction and an elementary reaction.
- 7 Why do chemists say that a reaction mechanism is *proposed*?
- 8 Explain the difference between a reaction intermediate and an activated complex in a reaction mechanism.
- 9 Consider the reaction below.
$$2A + B_2 \xrightarrow{C} D + E$$
A chemist proposes the following reaction mechanism.
 - Step 1 $A + B_2 \rightarrow AB_2$
 - Step 2 $AB_2 + C \rightarrow AB_2C$
 - Step 3 $AB_2C + A \rightarrow A_2B_2 + C$
 - Step 4 $A_2B_2 \rightarrow D + E$
 - (a) What is the role of AB_2C and AB_2 ?
 - (b) What is the role of C ?
 - (c) Given a proposed reaction mechanism, how can you differentiate, in general, between a reaction intermediate and a catalyst?

- 10 Chlorine gas reacts with aqueous hydrogen sulfide (also known as hydrosulfuric acid) to form elemental sulfur and hydrochloric acid.



A proposed mechanism for this reaction is

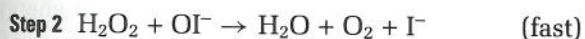


Sketch a potential energy diagram for this reaction, with labels to identify activation energy, transition state, rate-determining step, and any reaction intermediate.

- 11 Consider the following general endothermic reaction.



- (a) Explain why a catalyst has no effect on the change in total energy from reactants to products. Illustrate your answer with a potential energy diagram.
- (b) Explain the effect of a catalyst on a reaction that has similar products and reactants, but is an exothermic reaction. Illustrate your answer with a potential energy diagram.
- 12 The decomposition of hydrogen peroxide, H_2O_2 , may be catalyzed with the iodide ion. Chemists propose this reaction occurs according to the following mechanism.



- (a) Show that these two steps are consistent with the overall stoichiometry of the reaction.
- (b) How does this mechanism account for the fact that the iodide ion is a catalyst?
- (c) Draw and label a potential energy diagram for this mechanism, including the rate-determining step, the catalyst, and any reaction intermediate.
- (d) What effect would decreasing the concentration of hydrogen peroxide have on the overall rate?