SIOP LESSON PLAN

LESSON TOPIC: Chemical Interactions
UNIT FOCUS: Chemical Reactions

Lesson # 12 **Length of lesson 75-90 minutes (two periods)**

STATE SCIENCE STANDARDS:
- Explain how activation energy is related to chemical reactions.
- Identify factors that affect the rate of a chemical reaction.

LESSON TOPIC: Controlling Chemical Reactions

OBJECTIVES:

Language

- Students will read a passage identify and discuss cause and effect.
- Students will make if-then statements in order to summarize what affects the rate of chemical reactions.

Content

- Students will perform a scientific investigation in order to observe chemical reactions, predict how substances will react when mixed, determine evidence of a reaction, and draw conclusions about chemical reactions.
- Students will identify what factors affect rates of reaction in order to explain how they do so.

KEY VOCABULARY: activation energy, concentration, catalyst, enzyme, inhibitor, surface area, spoil, "if…..then...", "when ___ happens, then ___ occurs"

MATERIALS: safety goggles, lab aprons, 125 mL of vitamin C solution at three temperatures, iodine, 3 plastic cups**,** spoon, two antacid tablets, two plastic cups, cold tap water, hot tap water, note cards, textbook and teachers' edition of *Science Explorer: Chemical Interactions* (pp. 69-71), graphic organizers: "Catalyst/Inhibitor and Cause/Effect" and "Affecting the Rate of Chemical Reactions"

PREPARATION:
1. Make transparencies of the student versions of the Catalyst/Inhibitor and Cause/Effect graphic organizers.

2. Decide on the number of groups for the Discover Activity[i] on p. 66 in *Science Explorer: Chemical Interactions* and organize supplies (safety goggles, lab aprons, 125 mL of vitamin C solution at three temperatures, iodine, 3 plastic cups, spoon, two antacid tables, two plastic cups, cold tap water, hot tap water) for groups.

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MOTIVATION: (25 minutes)

**Read and explain the content and language objectives of this lesson to the students. Say, "Let's look at our language objectives for today" and then read language objectives aloud and discuss. "Now let's look at our content objectives for today." Read content objectives aloud and discuss.

Building Background:

- Have the students write down in their notebooks examples of endothermic and exothermic reactions they have used. Have them share out.
- Do the Building Background activity with students on page 66 of the textbook. Have students consider the question,"Why do we keep some foods in a refrigerator?" using Compass Groups:
  - Put the students into groups of four.
  - Tell the groups to assign each member a different direction (north, south, east, or west).
  - Explain you will ask a question, then call out a direction. The student assigned that direction will answer.
- After several minutes, call on different "directions" to share what their group discussed. Record student responses and get students to infer that the lower temperature of the refrigerator slows down the decomposition process. Link this fact to the new concept for today: **temperature** is one of the factors that can slow down or speed up a chemical interaction.
- Next ask the compass groups what will happen to a piece of food in your stomach if you take a small bite of an apple versus a large bite. Call on another direction and record student responses again. Get students to infer that food with smaller surface area will result in quicker digestion. Tell students **surface area** is another factor that affects the rate of a chemical reaction.
- Then ask the compass groups to consider what happens to frozen orange juice if you add only a half can of water. Call on another direction and record student responses. Get students to infer that the orange juice will be thicker and sweeter if less water is added. Tell students that **concentration** is the other factor that affects the rate of a chemical reaction.
- Pre-teach the vocabulary term **spoil.**
- Have students make a vocabulary chart in their notebooks that includes the word, a picture, a definition in the student's own words, and a sentence for **surface area, concentration,** and **spoil.** Add to word wall.
- Preteach **if-then** statements. Ask the students what happens to food in the refrigerator if the electricity goes off. Collect responses and rephrase into an *if…then…* statement (e.g., If the electricity goes out, then the food goes bad or spoils.). Preteach the

sentence frame *when___,then ___ occurs* (e.g., When I chew my food into smaller pieces, then quicker digestion occurs.)

- Preteach the terms **inhibitors** and **catalysts.** Explain that they are substances that affect the rate of reactions and point out the difference between **inhibitors** and **catalysts** by making an analogy. In their compass groups, ask the students to Think-Square-Share what factors might make traffic go slower (e.g., speed bumps, stop lights, cops) and what factors might make traffic go faster (e.g., time of day, no trucks or buses). Then make the analogy that things that slow traffic down are **inhibitors** and things that increase the flow of traffic are **catalysts.** Have students add these words to their vocabulary charts in the vocabulary section in their notebooks and add them to the word wall.

PRESENTATION: (25 minutes)

- Have students infer how **surface area**, **concentration**, **inhibitors**, **catalysts**, and **temperature** affect rates of reactions.
- Display the Cause and Effect chart and have students copy it into their notebooks. Give students a few minutes to silently read the section on pages 69-70 in the science text. Then, as a class, fill out the Cause and Effect chart. Once the chart is finished, ask students to use the information to formulate if-then statements. Model one if necessary.
- Display the Catalyst/Inhibitor transparency and have the students copy it into their notebooks. Then divide the students into two groups and assign one half of the students to read the "Catalyst" section on page 71 and the other half, "Inhibitor." Tell students to complete the part of the organizer that corresponds to their assigned section in the book. They may work with a partner who read the same section.
- Then tell the students to find someone in the class who read the section they did not. They should share information to complete the rest of their graphic organizers.
- Define the word **enzyme.** Have students add the word to their vocabulary chart in notebooks and add to the word wall.

PRACTICE & APPLICATION: (15-20 minutes)

- Have students stay in compass groups and do Discover Activity on p. 66 of the textbook.
- For the *Discover* Activity, students work in groups. They are given three 125-mL solutions of vitamin C and water – one at room temperature, one at about 75ºC, and one chilled to between 5ºC and 10ºC. Students should add 3 drops of iodine to each container and stir with a clean spoon, then compare changes observed in the solutions.
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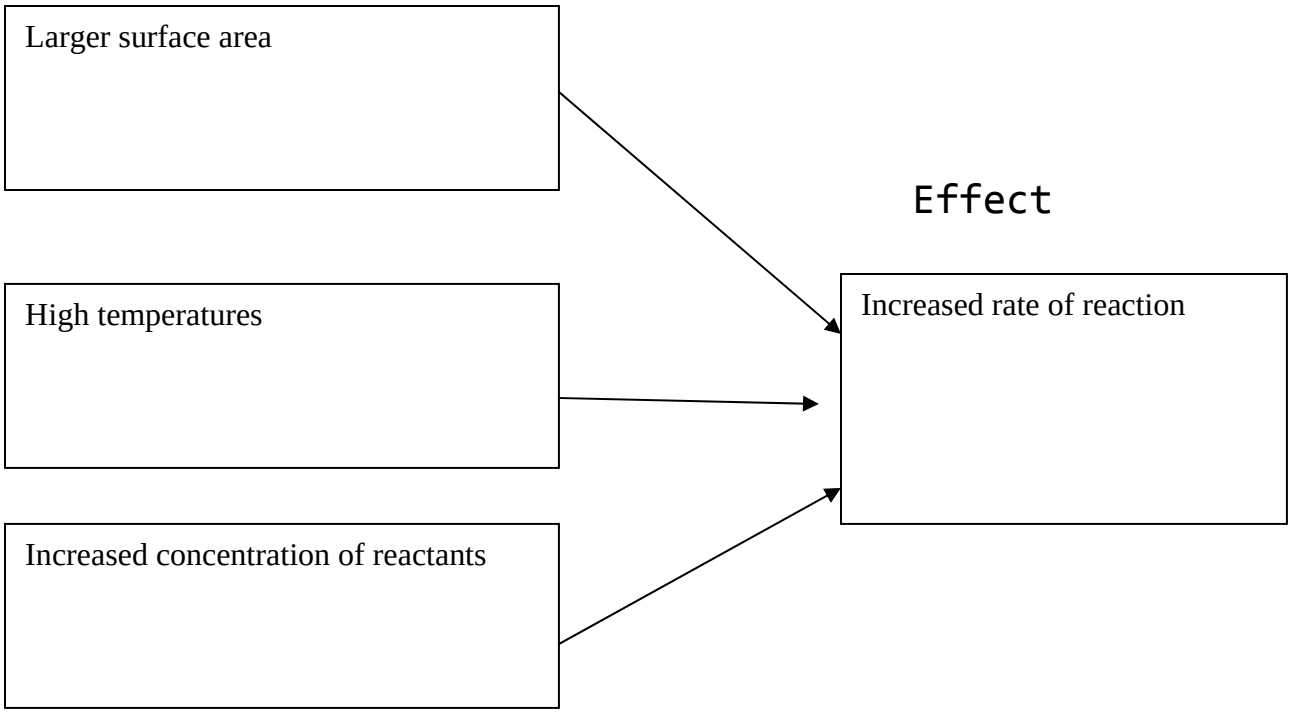
- Once they have finished the activity, have groups discuss the "Think it Over" question and share out using their directions.
- To facilitate peer interaction pre-teach and praise students who use sentence frames such as "If…then", "When…..occurs then….."

REVIEW & ASSESSMENT: (5 minutes)

- Ask students to recall some of the reactions they learned about today (either in the experiments or in the readings). Have them then name the activation energy involved in each reaction and decide if the reactions were exothermic or endothermic, using the Stand up-Sit down response. (Students stand if it is exothermic; sit if endothermic.)
- Review the objectives. Say, "Let's see if we met our language objectives for today." Read and assess language objectives. Go over key vocabulary. "Now let's see if we met our content objectives for today." Read and assess content objectives.

Causes



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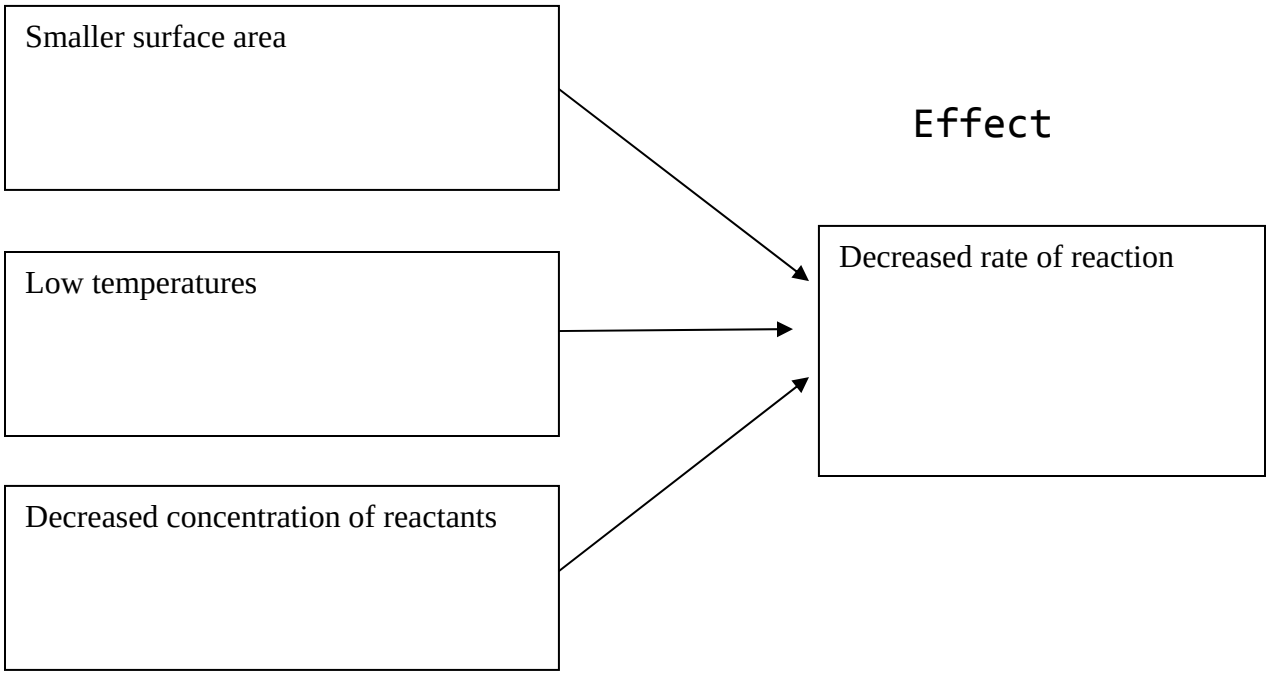

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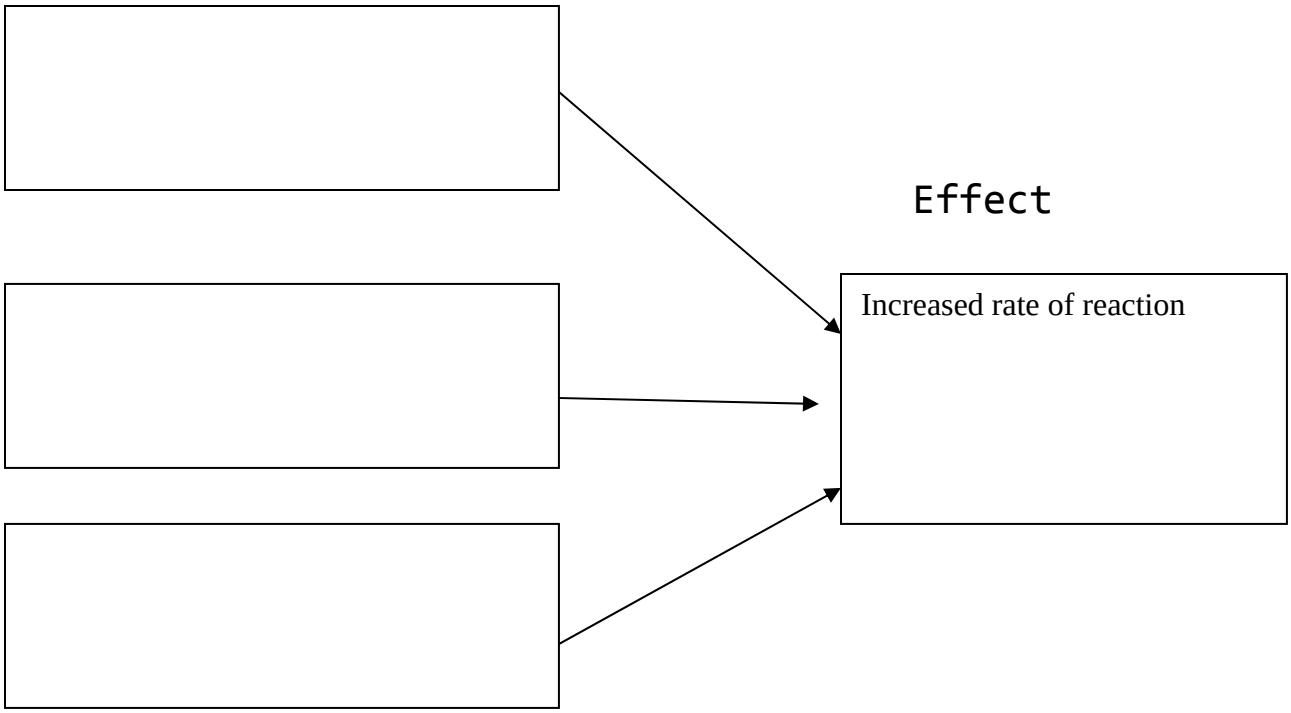

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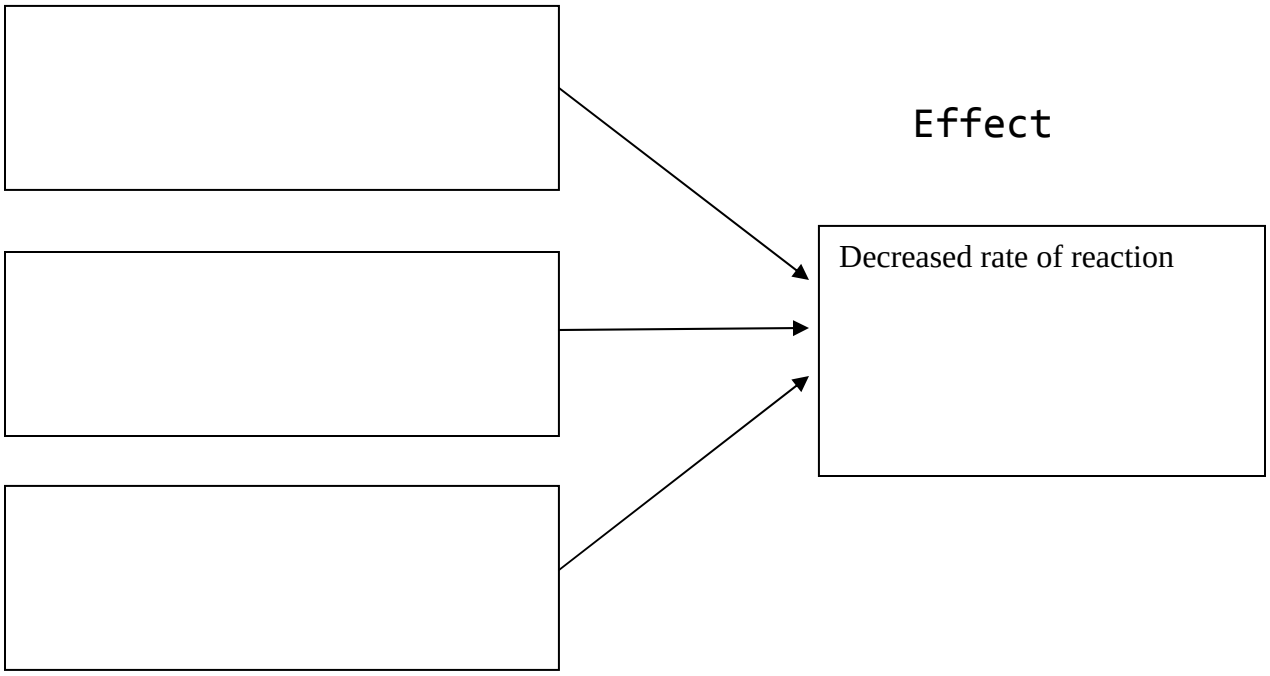


Affecting the Rate of Chemical Reactants – Teacher Version

Catalyst

What It Does

Increases rate of reaction

How It Works

Lowers the activation energy

Inhibitor

What It Does

Decreases rate of reaction

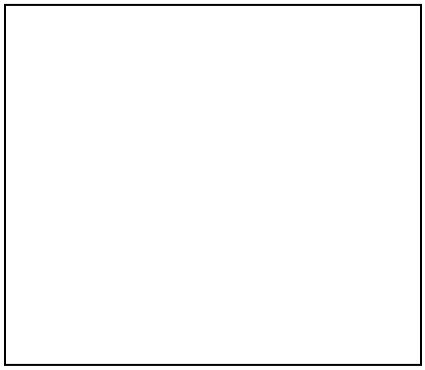
How It Works

Prevents reactants from coming together

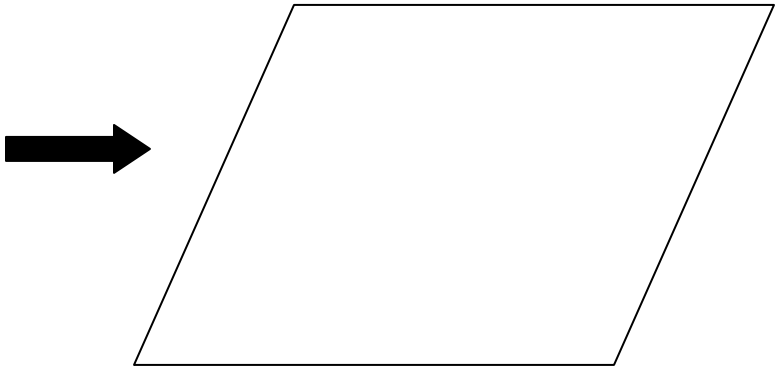
Affecting the Rate of Chemical Reactants

Catalyst

What It Does

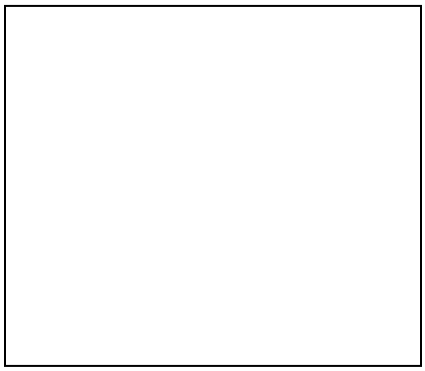


How It Works

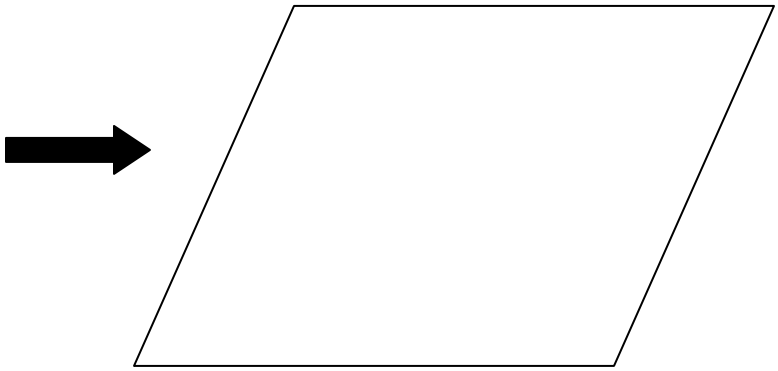


Inhibitor

What It Does



How It Works



Reference:

Science Explorer: Chemical Reactions. Teacher's edition. 2007. Boston, MA: Pearson Education.

Sample Vocabulary Chart

Word	Definition
Picture	Sentence