SCOPE, SEQUENCE, and COORDINATION

A National Curriculum Project for High School Science Education

This project was funded in part by the National Science Foundation. Opinions expressed are those of the authors and not necessarily those of the Foundation. The SS&C Project encourages reproduction of these materials for distribution in the classroom. For permission for any other use, please contact SS&C, National Science Teachers Association, 1840 Wilson Blvd., Arlington, VA 22201-3000.

Copyright 1996 National ScienceTeachers Association.

SCOPE, SEQUENCE, and COORDINATION

SS&C Research and Development Center
Gerry Wheeler, *Principal Investigator*
Erma M. Anderson, *Project Director*
Nancy Erwin, *Project Editor*
Rick McGolerick, *Project Coordinator*
Arlington, Va., 703.312.9256

Evaluation Center
Frances Lawrenz, *Center Director*
Doug Huffman, *Associate Director*
Wayne Welch, *Consultant*
University of Minnesota, 612.625.2046

Houston SS&C Materials Development and Coordination Center
Linda W. Crow, *Center Director*
Godrej H. Sethna, *School Coordinator*
University of Houston-Downtown, 713.221.8583

Houston School Sites and Lead Teachers
Jefferson Davis H.S., Lois Range
Lee H.S., Thomas Ivy
Jack Yates H.S., Diane Schranck

California Coordination Center
Tom Hinojosa, *Center Coordinator*
Santa Clara, Calif., 408.244.3080

California School Sites and Lead Teachers
Sherman Indian H.S., Mary Yarger
Sacramento H.S., Brian Jacobs

Iowa Coordination Center
Robert Yager, *Center Director*
University of Iowa, 319.335.1189

Iowa School Sites and Lead Teachers
Pleasant Valley H.S., William Roberts
North Scott H.S., Mike Brown

North Carolina Coordination Center
Charles Coble, *Center Co-Director*
Jessie Jones, *School Coordinator*
East Carolina University, 919.328.6172

North Carolina School Sites and Lead Teachers
Tarboro H.S., Ernestine Smith
Northside H.S., Glenda Burrus

Puerto Rico Coordination Center*
Manuel Gomez, *Center Co-Director*
Acenet Bernacet, *Center Co-Director*
University of Puerto Rico, 809.765.5170

Puerto Rico School Site
UPR Lab H.S.

* * * * * * * * * * * *

Pilot Sites
Site Coordinator and Lead Teacher
Fox Lane H.S., New York, Arthur Eisenkraft
Georgetown Day School, Washington, D.C., William George
Flathead H.S., Montana, Gary Freebury
Clinton H.S., New York, John Laffan*

*not part of the NSF-funded SS&C Project.

Advisory Board

Dr. Rodney L. Doran (Chairperson), University of Buffalo

Dr. Albert V. Baez, Vivamos Mejor/USA

Dr. Shirley M. Malcom, American Association for the Advancement of Science

Dr. Shirley M. McBay, Quality Education for Minorities

Dr. Paul Saltman, University of California-San Diego

Dr. Kendall N. Starkweather, International Technology Education Association

Dr. Kathryn Sullivan, Ohio Center of Science and Industry

Project Associates

Bill G. Aldridge
SciEdSol, Henderson, Nev.

Dorothy L. Gabel
Indiana University

Stephen G. Druger
Northwestern University

George Miller
University of California-Irvine

Student Materials

Learning Sequence Item:

967

Factors that Affect Reaction Rates

March 1996
Adapted by:Mohamad Elkhatib and Linda W. Crow

Contents

This micro-unit was adapted by **Mohamad Elkhatib** (Davis High School, Houston) and
Linda W. Crow (Baylor College of Medicine, Houston)

Science as Inquiry

Motion to Dye For

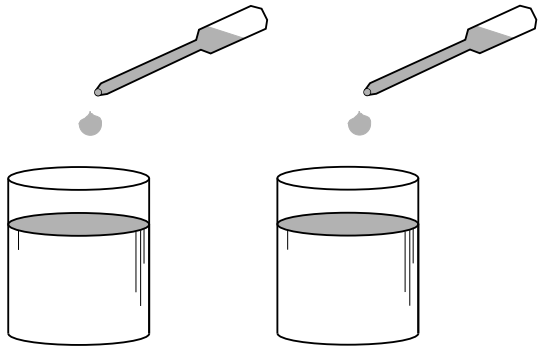
How does temperature affect the motion of particles in a liquid?

Overview:

Watch the movement of the dye carefully. What does it show?

Procedure:

Fill a large container 3/4 full with very hot water. Allow it to sit for a minute. Add one drop of dye (or ink) to the center of the container. Observe. Repeat the procedure, but this time using cold water.



Questions:

1. Describe the movement of the food coloring in hot water.

2. Describe the movement of the food coloring in cold water.

3. In each case, how does the temperature of the water affect the motion of the dye?

Science as Inquiry

All Stirred Up

How does stirring affect mixing?

Overview:

Have you ever used a sugar cube in tea or coffee? How did you get it to dissolve? Find out by trying this activity.

Procedure:

Place a sugar cube into a beaker and add 50 mL of cool tap water. Time how long it takes the sugar cube to dissolve. Next, create at least 2 methods to speed up this dissolving time. Remember to change only one variable at a time. Keep careful records of your trials.

Questions:

1. How did your methods affect the dissolving time?

2. If you could change more than one variable, what would you do to shorten the dissolving time as much as possible?

Student Sheet

Science as Inquiry

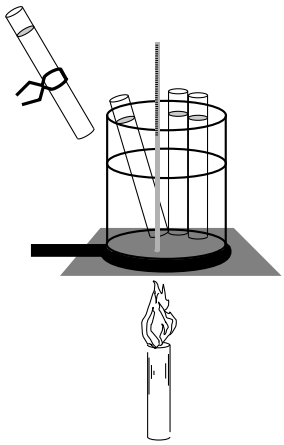
Temperature Changes

How does temperature affect reaction rate?

Overview:

Can heating a solution change the reaction rate? Think again of dissolving sugar in hot and cold tea.

Procedure:



Place a small piece of magnesium in a test tube half-filled with vinegar. Notice that a gas is produced. How can you tell if a gas is being produced? Time how long it takes for the magnesium to completely react with the vinegar.

With five other test tubes half-filled with vinegar, vary the temperature of the vinegar (making it both colder and hotter) and repeat the experiment at least 5 times. Time how long it take the magnesium to completely react in each case. Describe your experiments and construct a graph of temperature versus time.

Questions:

1. How can you tell if a gas is being produced?

2. How can you tell if the magnesium has reacted completely?

3. How did heating the vinegar affect the reaction?

4. How did cooling the vinegar affect the reaction?

5. Using your graph, predict how fast the reaction would occur if you heated the vinegar to 60°C.

Science as Inquiry

Other Indicators

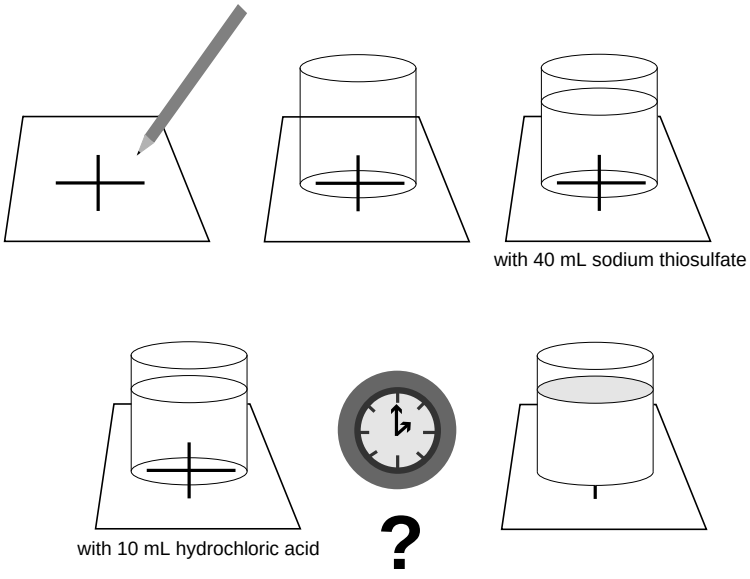
How do concentration and temperature affect a reaction?

Overview:

Sometimes when you add some common liquids to ice tea, the color changes. Some reaction has occurred! Watch the next procedure and see if you can detect any change.

Procedure:

Draw a cross with a dark pencil on a piece of white paper. Then place a 100 mL beaker on the cross and add 40 mL of sodium thiosulfate solution into the beaker. Finally, add 10 mL of hydrochloric acid and time how long it takes for the mixture to become so cloudy that you can no longer see the cross.



Repeat the experiment but vary the temperature of the sodium thiosulfate by heating it. Also, repeat the experiment and vary the amounts of sodium thiosulfate, hydrochloric acid and water. Keep in mind the total volume (sodium thiosulfate plus hydrochloric acid, plus weater) in each case must equal 50 mL.

Questions:

1. How did the temperature of the sodium thiosulfate solution affect the rate of the reaction?

2. How did the amount of sodium thiosulfate, water and hydrochloric acid affect the rate of the reaction?