

Diffusion of Food Coloring in “Motionless” Water

Introduction

Use this simple demonstration to illustrate the concept of diffusion. A drop of food coloring slowly diffuses in a beaker of water until the color is evenly dispersed throughout the solution.

Concepts

- Diffusion
- Molecular motion
- Kinetic theory

Materials

Food coloring, any dark color, 1 drop

Beaker, 250- or 400-mL

Water, tap, approximately 200 mL

Stopwatch (optional)

Safety Precautions

Although this activity is considered nonhazardous, please follow all regular laboratory safety guidelines.

Procedure

1. Add approximately 200 mL of room temperature tap water to a beaker.
2. Place the beaker in the front of the classroom at a location where students can easily view the demonstration.
3. Leave the beaker undisturbed for several minutes so that the water will be “still” when the food coloring is added.
4. Add a single drop of food coloring to the water and watch as the color of the water slowly changes (see Figure 1). Keep vibrations that may agitate the liquid to a minimum. It may take up to 20 minutes for the food-dye molecules to disperse evenly throughout the water.
5. Ask students to explain what caused the colored molecules to move and disperse evenly, therefore creating a solution.
6. (*Optional*) To test additional variables, set up two beakers of water. One beaker containing room temperature water will serve as a control. A second beaker, or beakers, may contain different “test factors” such as hot water, cold water, soapy water, or a solution containing water and a few milliliters of an alcohol (such as isopropyl alcohol). Have students time how long it takes for the color to disperse completely in each beaker and then explain any differences that are observed.

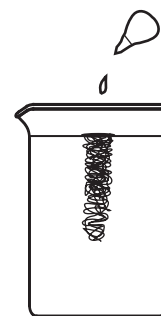


Figure 1.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The resulting solutions may be disposed of according to Flinn Suggested Disposal Method #26b.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

- Constancy, change, and measurement
- Evolution and equilibrium

Content Standards: Grades 5–8

Diffusion of Food Coloring in “Motionless” Water *continued*

Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

Content Standard B: Physical Science, structure and properties of matter, chemical reactions

Tips

- Placing a white piece of paper behind the beaker or placing the beaker(s) on a light box may make it easier for students to view the demonstration.
- Show students an additional example of diffusion using air. Spray one spritz of perfume, air freshener, or other scented spray away from students. See how long it takes before the students farthest away can smell the scent.

Discussion

Diffusion is defined as molecular movement of molecules across a gradient, specifically from an area of high concentration to an area of lower concentration. Ultimately, the concentration gradient will be eliminated, resulting in an equal distribution of molecules throughout a given area. Molecules are constantly in motion whether it is apparent or not. Students may look at a still glass of water and believe that water molecules must be motionless, because they do not see any evidence of movement. Many factors will increase the rate at which molecules move and may affect the rate of diffusion. Some of these factors include heat, stirring, or the addition of a chemical that interferes with hydrogen bonding between water molecules. This demonstration should help students understand diffusion and the fact that molecules are constantly in a state of motion, even when it is not apparent.

Materials for *Diffusion of Food Coloring in “Motionless” Water* are available from Flinn Scientific, Inc.

Catalog No.	Description
V0003	Food Coloring Dyes, Set of 4

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.