

Activity 4.5

Temperature affects the solubility of gases

Does temperature have an effect on how quickly dissolved gas escapes from a soda?

In *Demonstration 4b*, students see bubbles of carbon dioxide gas escape from an open bottle of carbonated water. Students conclude that the gas must have been dissolved in the water. In *Activity 4.3* and *Demonstration 4a*, students realize that temperature affects the solubility of solids differently. Could temperature affect the solubility of gases, too? In this activity, students heat and cool carbonated water to find out whether temperature has an effect on how fast the dissolved gas leaves carbonated water.

Materials needed for each group

Club soda
Hot water
Cold water
4 Clear plastic cups

Notes about the materials

- Be sure you and the students wear properly fitting goggles.
- Use the bottle of club soda opened during *Demonstration 4b*.
- Materials may vary depending on how students decide to heat and cool the carbonated water.

Preparing materials

- Fill one of the students' clear plastic cups about $\frac{2}{3}$ of the way with carbonated water for each group. Students will split the carbonated water evenly into two cups during the activity.



Activity sheet

Copy *Activity sheet 4.5—Temperature affects the solubility of gases*, p. 211, and distribute one per student when specified in the activity.

Assessment

An assessment rubric for evaluating student progress during this activity is on pp. 218–219. For this formative assessment, check a box beside each aspect of the activity to indicate the level of student progress. Evaluate overall progress for the activity by circling either “Good”, “Satisfactory”, or “Needs Improvement”.

Activity 4.5

Temperature affects the solubility of gases

Question to investigate

Does temperature have an effect on how quickly dissolved gas escapes from a soda?

1. Introduce the idea that temperature might affect the solubility of a gas.

Remind students that when they dissolved solids in water, they discovered that temperature has an effect on the solubility of the solid. Since temperature had an effect on solids dissolving in water, maybe temperature has an effect on gases dissolving in water, too. Ask students a question like the following:

- Do you think gas bubbles stay in carbonated water better if the carbonated water is heated or if it is cooled?

2. As a class, design an experiment to test whether temperature affects how quickly gas escapes from soda.

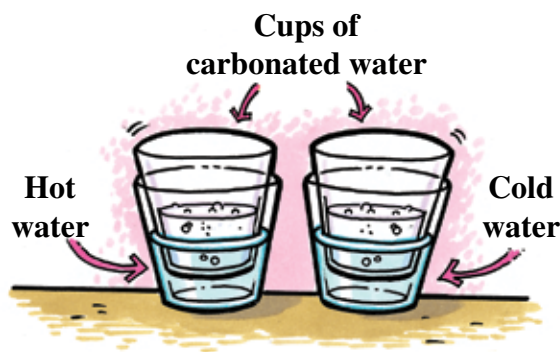


Distribute *Activity sheet 4.5—Temperature affects the solubility of gases*. Be sure to review the first paragraph of the activity sheet with students before they begin to plan their experiments. Students should realize that they can compare whether carbon dioxide gas is coming out or staying in solution by comparing the quantity of bubbles they see rise to the surface and pop. More bubbles rising and popping means more gas is coming out of solution.

Ask students how they might set up an experiment to see if the carbon dioxide gas in carbonated water stays dissolved or comes out of solution more if heated or cooled. Students should realize that they will need two cups of carbonated water. They will then need to heat one and cool the other. One simple way to heat and cool the cups is to use a hot or cold water bath like the one described below.

Procedure

1. Open a new bottle of club soda.
2. Fill two clear plastic cups about $\frac{1}{3}$ of the way with the soda.
3. Fill one empty cup about $\frac{1}{3}$ of the way with ice cold water and another empty cup about $\frac{1}{3}$ of the way with hot tap water.
4. Place one of the soda cups in the cold water and place the other soda cup in the hot water as shown.
5. Watch the surface of the soda in both cups.



3. Discuss student observations.

Expected results: More bubbles will form and rise to the surface in the soda placed in hot water.

Ask students questions like the following:

- Can you tell if there is a difference in the amount of gas that seems to be escaping from each sample of soda?
- What do you see that makes you think that?
- Based on what you observed in this experiment, why do you think people store soda pop in the refrigerator?

4. Have students add to the class list about dissolving.

Ask students: What did you find out about dissolving from this activity? Students should realize that dissolved gas comes out of solution faster from warm water than cold. The reverse is also true: Dissolved gas tends to stay dissolved better in cold water.

Tell students that soda isn't the only common example of liquid with dissolved gas in it. The water in which fish or other aquatic creatures live contains dissolved oxygen gas. These creatures use their gills to get the oxygen from the water in order to stay alive.