

ACTIVITY

13

WHEN THE OXYGEN GOES...

WHAT HAPPENS TO THE OXYGEN DISSOLVED IN WATER WHEN WATER TEMPERATURE INCREASES?

SCIENCE SKILLS:

- measuring
- organizing
- inferring
- experimenting
- communicating

CONCEPTS:

- Dissolved oxygen levels decrease as water temperature increases.

MATH AND MECHANICAL SKILLS PRACTICED:

- use of dissolved oxygen test kit
- averaging
- graphing

SAMPLE OBJECTIVES:

- Students will complete an experiment to determine the relationship between water temperature and dissolved oxygen.

INTRODUCTION:

The relationship between water temperature and dissolved oxygen is critical for many aquatic animals. This exercise demonstrates that relationship. If you carefully prepare the samples, the students will get surprisingly good results.

MATERIALS:

Shared by class:

- dissolved oxygen test kits
- turkey basters or large syringes (see Recipes)

Made by teacher at home before class date:

- eight pint or quart canning jars or other jars that seal
- two sets of four water samples sealed at temperatures indicated (see Recipes); two each of the following:
- water open to air with ice in it or in a refrigerator (4° C)
- water at about 25°C (leave sitting open at room temp.)
- water heated to and held at about 50°C for several hours, then sealed immediately; use hot tray or electric skillet
- water boiled for 10 minutes and sealed immediately
- thermometer good to 100°C such as a kitchen candy thermometer

LESSON PLAN:

BEFORE CLASS: Read through the lesson. See Recipes for ways to expand your dissolved oxygen test kit potential. Check the chemicals in the test kit to make sure they are all there. Refill any materials that are low.

Prepare the water samples. The cold and room temperature samples should be left open at the indicated temperature for 24 hrs. Leave one sitting out in the classroom and another open in a refrigerator or ice chest. The "canned" heated samples may be prepared at home any time as they are good until opened. Pour the water gently into the jars and put on canning lids. If the water is sealed in canning jars, it can cool without picking up additional oxygen. Do not open until ready to take a sample.

DURING CLASS:

METHODS: Is there a relationship between dissolved oxygen in water and the temperature of the water? How could we find out? Can the students help you design a way to test this question? Explain how you have treated the water samples ahead of time and sealed those that were heated above room temperature. How would they put these to use? Divide into groups to share the work. If possible, test the water in each jar twice to check the results.

Test the oxygen levels in each water sample and record the results. Do not open until just before using it. Be especially careful not to transfer water vigorously as this will add oxygen to the sample. Let it flow down the side of the sample bottle from the turkey baster or large syringe. The sealed jars may require adult help to open them.

RESULTS:

The students should get very straightforward results: the higher the temperature to which the water was heated, the less oxygen is present in solution in it. This is a simple relationship based on the physics of gases in solution.

CONCLUSIONS:

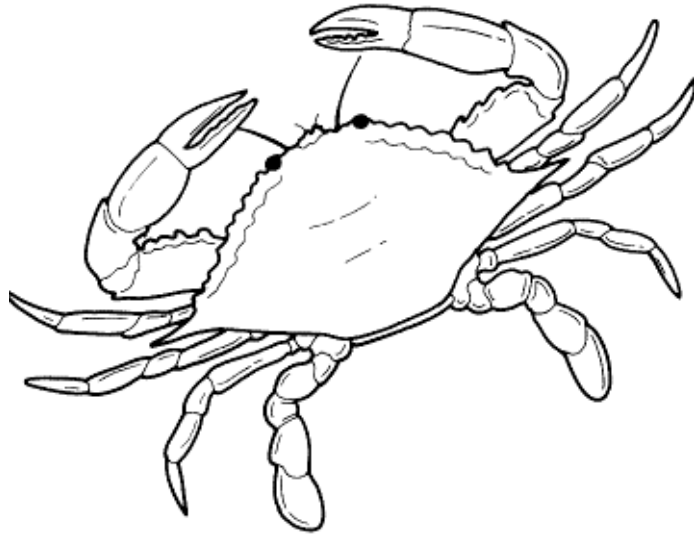
Cold water holds more dissolved oxygen than hot water. What is the consequence of this fact for the animals that live in warm water or in water that changes temperature? What happens to the dissolved oxygen in a shallow pond or marsh that heats up during a blistering hot summer day? Might this have consequences for the animals which must have oxygen for respiration during the heat of the day? Yes, in all these cases the animals may suffer from low oxygen availability. In very hot weather when bacteria that use oxygen are doing decomposition very rapidly, aquatic animals may die from lack oxygen.

USING YOUR CLASSROOM AQUARIUM:

Have your students test the dissolved oxygen in the aquarium water. Record the temperature and the dissolved oxygen. Compare it to the results of this experiment. Does your aquarium have more or less oxygen than the water sample heated to the same temperature? It may have more if it is filled with plants that are doing PHOTOSYNTHESIS. It may have less if it is full of animals or bacteria using oxygen.

EXTENSIONS:

1. Can your students suggest human activities which might result in low dissolved oxygen due to water temperature increases? If electric power generating plants use natural bodies of water for cooling, could the heating of the natural water cause problems for the plants and animals that live in it. Thermal pollution can be a problem, especially on bodies of water that are relatively small such as rivers and lakes. Dissolved oxygen may get so low that animals die. Because of this, cooling towers are built next to the power plants which allow the heat to be lost to the air before the cooling water is returned to the river or lake. Sometimes special lakes are built which are used only for the power plant cooling.



ACTIVITY 13
WHEN THE OXYGEN GOES . . .

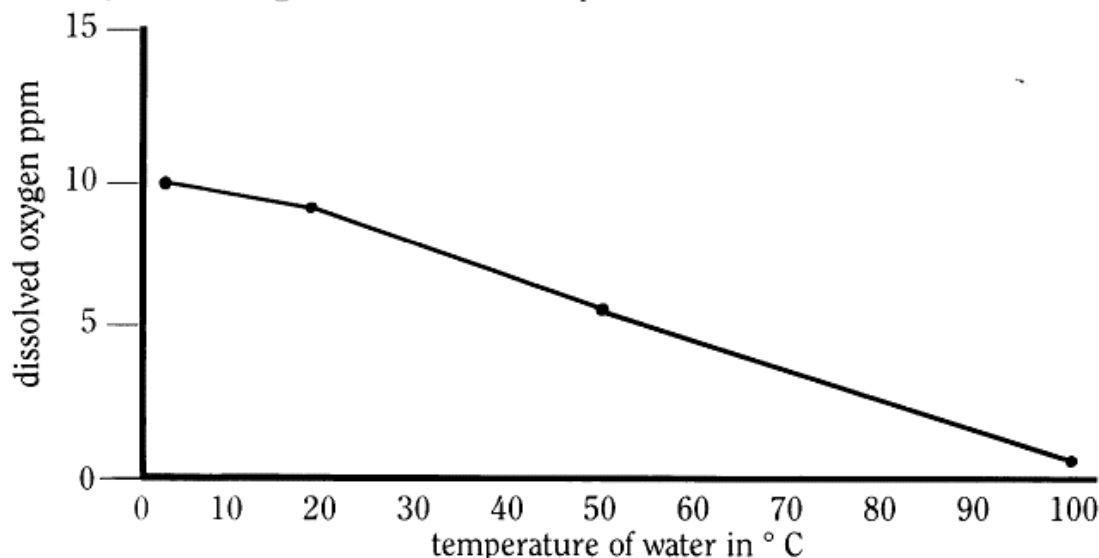
Name Possible answers

State the question you want to answer by doing this experiment. What happens to the dissolved oxygen in water when the water is heated.

Record the results from each group's tests:

temperature of water when sealed	dissolved oxygen in the water in parts per million		average
4°C	9.6	10.4	10 ppm
24°C	8.6	8.2	8.4 ppm
50°C	5.6	5.2	5.4 ppm
100°C	1.8	0.8	1.3 ppm

Graph the average result for each temperature:



What conclusion can you make based on the results of this experiment?

A water gets hot, it loses its dissolved oxygen.