

EVAPORATION, SURFACE AREA, TEMPERATURE, AND SEAWATER

OVERVIEW

Experimenting with container size and shape, students will investigate the *evaporation* rate of seawater.

CONCEPTS

- The evaporation of rate of water increases with temperature and exposed surface area.

MATERIALS

- 2 Half gallon milk cartons, two half gallon plastic milk containers or two 2-liter bottles, and wide bowls large enough to hold at least 1 liter (1 quart).
- Water
- Salt (NaCl)
- Measuring cup



PREPARATION

Fresh water can be used for this activity, however the “Extension” involves measuring the density of synthetic seawater. Teacher or students can mix synthetic seawater by adding approximately 35 grams of salt to 965 grams (965 ml) of fresh water.

Cut carton tops off or open them up so they expose a square or rectangular cross-section.

This can be done as a class activity, or by breaking class into groups and providing each group with a set of materials.

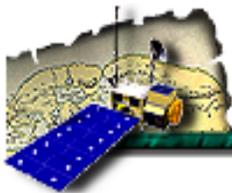
PROCEDURE

Engagement

What are the differences between the three kinds of containers? Under the same conditions, which containers will lose water the fastest by evaporation and why? Will the exposed surface area of the containers affect the rate of evaporation? Will temperature affect the rate of evaporation? What are some everyday examples that might give insight into these questions?

Activity

1. Measure and add 1 liter (~1 quart) of water to each container. Mark the water level with a pen or pencil.
2. Place one set of containers (carton, plastic container, and bowl) in a sunny location and the other complete set in a dark location.
3. Allow the water to evaporate over several days to a week or more. Check water level periodically.
4. When the water has dropped significantly, use the measuring cup to determine how much water remains in each container. Record your results. Calculate how much water evaporated from each container by subtracting the measure amount from the original amount of water (1 liter).



Visit to an Ocean Planet



Explanation

Evaporation occurs when water molecules move fast enough to escape their liquid state and become vaporous. Three major variables control rate of evaporation: the temperature of the liquid, which directly affects the velocity of the water molecules, the surface area of the liquid, which affects how much interchange can occur with the air, and the atmospheric pressure. In this experiment, you varied the surface area exposed and the temperature of the liquid (sunny containers would have had a higher average temperature). Both higher temperatures and larger surface areas increase the rate of evaporation.

EXTENSION

Measure the *density* of the water in each container at the beginning and end of the experiment. You can measure the density using a purchased *hydrometer* or by measuring mass and volume of each sample, and then dividing mass by volume (see *Measuring the Density of Water* activity). How might changes in seawater density over time affect the oceans?

Alternatively, you may wish to have a third container in the sunny location which is stirred each morning and late afternoon. This will change the density and temperature *gradients* induced by the process of evaporation. You might also wish to measure the temperature of all containers each morning and afternoon to better quantify the relationship between evaporation and temperature. What do your quantitative data tell you about this relationship? Do your data agree with what you originally thought the relationship between evaporation and temperature would be?

LINKS TO RELATED CD ACTIVITIES, IMAGES, AND MOVIES

Activity *Measuring the Density of Water*

VOCABULARY

density

evaporation

gradient

hydrometer

SOURCE

Orange County Marine Institute and San Juan Institute activity series.