

Frosting Glass

Pure ionic compounds generally exist as crystalline solids. Try this activity and see how one such compound can be used to make frosted glass.

Materials

- flat, horizontal mirror (cosmetic, hand-held, etc.)
- small container (film canister, baby food jar, small cup, etc.)
- Epsom salts
- liquid dishwashing or laundry detergent
- tissues
- water
- tablespoon measure
- one of the following ionic compounds:
 - table salt
 - rock salt
 - baking soda
 - calcium chloride
- (optional) magnifying glass

Exploration

Step 1 Place one tablespoon of Epsom salts in the small container. Add two tablespoons of water. Stir (or shake, if the container has a lid) vigorously for a minute. Examine the mixture. If there is no solid left in the container, add more Epsom salts (a measured amount) and mix again. Repeat this process (keeping track of how much Epsom salts you add) until there is still solid in the container even after vigorous mixing. Indicate the solubility of Epsom salts by estimating the amount dissolved and the amount of water. Let the mixture stand until the undissolved solid is settled on the bottom of the container. What is the general chemical name of the liquid portion of the contents of the container?

Step 2 Rub a drop of detergent on the mirror and wipe it off with a tissue. Put several drops of the liquid from Step 1 on the mirror, being careful not to add any of the solid crystals. Tilt the mirror to spread the liquid, then run any excess onto a tissue. Fan the mirror with a piece of paper for a few minutes. Does a change occur? Where does the change begin? Draw a diagram of what you see. Examine the mirror with a magnifying glass, if you have one.

Step 3 Try blowing on the mirror. Does any change occur? Why?

Step 4 Repeat Steps 1 and 2 using one of the other ionic compounds listed in the Materials section in place of Epsom salts. How does its solubility compare with that of Epsom salts? How does what you see on the mirror differ from what you saw with Epsom salts? Draw a diagram of what you see on the mirror.

Step 5 Why do the crystals form on the mirror, but not in the small container that you used?

Challenge

What is a method of recovering a dissolved ionic compound, and how does the compound appear?

Frosting Glass

Concepts

crystallization, evaporation

Expected Student Responses to Exploration

Step 1 (a) Epsom salts is quite soluble in water:

2 tablespoons Epsom salts/3 tablespoons H₂O (71 g/100 mL H₂O)

(b) The liquid is a saturated solution (one in which the maximum amount of solid is dissolved at a particular temperature).

Step 2 (a) Crystals gradually form on the mirror.

(b) Crystals form first around the edges and then gradually move inward.

(c) Students should have a diagram of crystals they see.

Step 3 (a) The crystals begin to disappear.

(b) Breath contains water vapor in which the crystals redissolve.

Step 4 (a) Table and rock salt are about half as soluble; baking soda is about one tenth as soluble; calcium chloride is about the same as Epsom salts. (Table salt contains some sand which causes clouding in the solution.

(b) Crystals of the other substances will be smaller.

(c) Diagram of crystals.

Step 5 The crystals form on the mirror because as some water evaporates from the thin layer of liquid, there is not enough water remaining for the solid to remain dissolved. If the small container were allowed to sit long enough, sufficient water would eventually evaporate to deposit crystals.

Expected Student Answer to Challenge

A solid can be recovered from a liquid mixture by evaporating some of the solvent. The solid appears as small crystals.

Reference

Chemical Rubber Company (CRC), *CRC Handbook of Chemistry and Physics*; CRC Press: Cleveland, 1977.

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