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Put a Shine on it

If you have any objects made from silver or plated with silver, you know that the bright, shiny surface of silver gradually darkens and becomes less shiny. This happens because silver undergoes a chemical reaction with sulfur-containing substances in the air. You can use chemistry to reverse the tarnishing reaction, and make the silver shiny again.

For this experiment you will need:

- a tarnished piece of silver
- a pan or dish large enough to completely immerse the silver in
- aluminum foil to cover the bottom of the pan
- enough water to fill the pan
- a vessel in which to heat the water
- hot pads or kitchen mitts with which to handle the heated water vessel
- baking soda, about 1 cup per gallon of water

Line the bottom of the pan with aluminum foil. Set the silver object on top of the aluminum foil. Make sure the silver touches the aluminum.

Heat the water to boiling. Remove it from the heat and place it in a sink. To the hot water, add about one cup of baking soda for each gallon of water. (If you need only half a gallon of water, use half a cup of baking soda.) The mixture will froth a bit and may spill over; this is why you put it in the sink.

Pour the hot baking soda and water mixture into the pan, and completely cover the silver.

Almost immediately, the tarnish will begin to disappear. If the silver is only lightly tarnished, all of the tarnish will disappear within several minutes. If the silver is badly tarnished, you may need to reheat the baking soda and water mixture, and give the silver several treatments to remove all of the tarnish.

When silver tarnishes, it combines with sulfur and forms silver sulfide. Silver sulfide is black. When a thin coating of silver sulfide forms on the surface of silver, it darkens the silver. The silver can be returned to its former luster by removing the silver sulfide coating from the surface.

There are two ways to remove the coating of silver sulfide. One way is to remove the silver sulfide from the surface. The other is to reverse the chemical reaction and turn silver sulfide back into silver. In the first method, some silver is removed in the process of polishing. In the second, the silver remains in place. Polishes that contain an abrasive shine the silver by rubbing off the silver sulfide and some of the silver along with it. Another kind of tarnish remover dissolves the silver sulfide in a liquid. These polishes are used by

dipping the silver into the liquid, or by rubbing the liquid on with a cloth and washing it off. These polishes also remove some of the silver.

The tarnish-removal method used in this experiment uses a chemical reaction to convert the silver sulfide back into silver. Many metals in addition to silver form compounds with sulfur. Some of them have a greater affinity for sulfur than silver does. Aluminum is such a metal. In this experiment, the silver sulfide reacts with aluminum. In the reaction, sulfur atoms are transferred from silver to aluminum, freeing the silver metal and forming aluminum sulfide. Chemists represent this reaction with a chemical equation.

The reaction between silver sulfide and aluminum takes place when the two are in contact while they are immersed in a baking soda solution. The reaction is faster when the solution is warm. The solution carries the sulfur from the silver to the aluminum. The aluminum sulfide may adhere to the aluminum foil, or it may form tiny, pale yellow flakes in the bottom of the pan. The silver and aluminum must be in contact with each other, because a small electric current flows between them during the reaction. This type of reaction, which involves an electric current, is called an electrochemical reaction. Reactions of this type are used in batteries to produce electricity.

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