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Catalog No. AP8981
Publication No. 8981

# Make Your Own Silver Mirror

## A Microscale Lab

### Introduction

Make a silvered test tube using a classic analytical test for silver.

### Concepts

- Oxidation–reduction
- Electroless plating
- Tollen's test
- Reducing sugars

### Background

Mirrors, or looking glasses, have been around since ancient times. The earliest mirrors were made by polishing disks of a metal such as bronze. These simple mirrors did not last very long due to oxidation of the metal by the atmosphere and abrasion of the metal from everyday use. Better mirrors were developed by backing glass with thin sheets of metal foil, usually silver. Those methods were used until a German chemist, Justus von Leibeg (1803–1873), first used the silvering process in 1835. This process, which plates the glass with a thin layer of silver atoms, is still used in the manufacture of the common household mirror.

Tollens' test is similar to the silvering process and is used by chemists to determine if an aldehyde is present in a solution. Treatment of the aldehyde with a solution of silver nitrate in ammoniacal sodium hydroxide produces a thin layer of silver on a glass surface. This process does not require any electricity and is called electroless plating. Most household mirrors are made with silver because light reflected from a silvered mirror has a slight pink tinge to it, giving human skin a "better" color. In this experiment, silver metal is produced. Dextrose, a reducing sugar, is used to reduce silver ions to silver metal that will be deposited on the inside of a small culture tube.

### Materials

Ammonium nitrate solution, $NH_4NO_3$, 12%, 4 drops
Dextrose solution, $C_6H_{12}O_6$, 5%, 8 drops
Silver nitrate solution, $AgNO_3$, 8%, 4 drops
Sodium hydroxide solution, NaOH, 10%, 8 drops
Water, distilled
Beaker, 400-mL (for waste)
Beral pipets, 4
Culture tubes
Parafilm®, 3 × 3 cm

### *Safety Precautions*

*Silver nitrate will stain skin and clothing. Avoid contact with eyes and skin. Ammonium nitrate solution is toxic by ingestion. It is a skin, eye, and respiratory irritant. Sodium hydroxide solution is strongly corrosive. Avoid all contact with skin and eyes. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.*

### Procedure

1. Fill a 400-mL beaker three-quarters full with water.
2. Obtain a culture tube and add the following amounts of solution to it in order:
   *a.* 8 drops of 10% sodium hydroxide

*b.* 8 drops of 5% dextrose

*c.* 4 drops of 12% ammonium nitrate

*d.* 4 drops of 8% silver nitrate

3. Quickly place a square of Parafilm over the culture tube and shake it vigorously. Continue shaking the tube for about 3 minutes.
4. Pour any remaining solution in the culture tube into the beaker filled with water. This is a safety precaution to prevent the possible formation of an explosive nitrate mixture.
5. Rinse the mirrored culture tube thoroughly but gently with distilled water.
6. Allow the tube to air dry.

## Post-Lab Questions

1. What is the product of the reaction?
2. Did the silver ions gain or lose electrons in the reduction process?
3. An oxidation reaction must take place along with a reduction reaction. Dextrose (a sugar) is the reducing agent for the reaction of silver ions in this experiment. What happened to the sugar molecules?

## Disposal

Consult your instructor for appropriate disposal procedures.