**Silver Plating lab (Christmas ornaments Chemist-TREE lab)**

In this lab, dextrose acts as an oxidizing agent and reduces silver ions to metallic silver. The metallic silver is deposited on the sides of the ornament, creating a mirror-like coating.

Materials:

* 0.25M dextrose (reducing agent) - dissolve **24.78 g of dextrose in 500 mL of distilled** **H2O** in a stoppered 500-mL volumetric flask.
* Dextrose solutions do not have a long shelf life. Only freshly made solutions should be used.
* 0.80M KOH – dissolve **22.44 g KOH in 500 mL of distilled H2O** in a stoppered 500-mL volumetric flask.
* 0.10M AgNO3(aq) (oxidizing agent)
* concentrated NH4OH(aq)
* isopropyl alcohol
* 1M HCl(aq)
* nitrile gloves, lab coat, and goggles
* parafilm
* three graduated cylinders (1 x 10-mL + 2 x 25-mL)
* one 1-mL disposable volumetric plastic micropipette
* small beakers
* 1L beaker (for waste Procedure:

1. Set a clean glass ornament bulb (with metal hanger removed) on top of a 250 mL beaker.

2. Add **10.00 mL of 0.25M dextrose solution** (use a separate and labelled 10-mL graduated cylinder) to the glass ornament bulb. This will be the reducing agent for the reaction.

3. Measure out **15.00 mL of 0.80M KOH** solution (use a 25-mL graduated cylinder) and set aside for **step #6**.

4. Add **20.00 mL of 0.10M AgNO3** solution (use a separate 25-mL graduated cylinder) to a clean 250-mL beaker (rinse with tap water between trials).

5. With gentle swirling, add concentrated NH4OH solution dropwise (use a 3-mL disposable volumetric plastic micropipette) to the AgNO3 solution in the beaker until a grey/black AgOH precipitate forms. Continue adding concentrated NH4OH solution dropwise with gentle swirling until a silver diamine ionic complex [Ag(NH3)2+] forms and **the solution JUST becomes clear and colorless**. Don’t add an excess of NH4OH.

6. Add 15.00 mL of KOH (measured out in **step #3**) to the beaker. The AgOH precipitate usually reappears so add the concentrated NH4OH solution dropwise with gentle swirling until **the solution JUST becomes clear and colorless.** Don’t add an excess of NH4OH.

7. Pour the contents of the beaker into the glass ornament bulb. Cover the opening with a layer of sarah wrap. Put your thumb over the top and swirl gently so

the liquid contacts the entire inner surface of the glass. Continue to swirl and within 3 minutes the entire inside of the ornament should be coated with a silver (Ag) mirror surface.

How it works:

We will create a silver coating on the inside of a glass ornament bulb by using the “silver mirror test” or “Tollen’s test”. We will mix AgNO3 (aq) with NH3 (aq) to produce a solution known as Tollen’s reagent. The Tollen’s test is used to qualitatively identify aldehydes. The reagent contains the silver diamine ion Ag(NH3)2+.  Although this ion is a very weak oxidizing agent, it will oxidize the aldehyde function group (-CHO) of dextrose, a sugar, to a carboxylate ion (COO-).  As this oxidation occurs, silver is changed from Ag+ to solid silver which is deposited on the glass.

CH2OH(CHOH)4CHO   +   2[Ag(NH3)2]+   +   3OH-   →

2Ag(s) +  CH2OH(CHOH)4COO-   +   4NH3   +  2H2O

***CH2OH(CHOH)4CHO = dextrose***

***[Ag(NH3)2]+   =  silver diamine ion***

8. It is VERY IMPORTANT to pour the remaining liquid (from the glass ornament) into the waste container (1 L beaker) with plenty of water. Rinse the inside and outside of the glass ornament with plenty of tap water. Rinse the inside of the ornament with **5.00 mL of isopropyl alcohol** to help it dry quickly. Dry the outside with paper towel.

9. Optional: You may protect the inside of the bulb from tarnishing (oxidizing) by coating it with a clear varnish or shellac.

Teacher Note: *The solution remaining in the 1-L waste beaker may form an explosive mixture (silver nitride) upon standing. You should acidify this waste by adding 1M HCl until all the AgCl has precipitated out. You can then collect the AgCl by filtering out and contain for landfill disposal (or rinse and dry for other lab use). The remaining solution can be diluted further and washed down the drain with plenty of water.*