

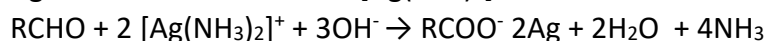
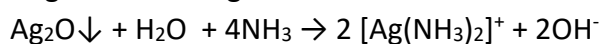
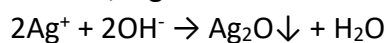
The scenario

Subject	Tollens' test
Length	4,40 min.
Main objectives	Learning the reaction of making a silver mirror.
Detailed objectives	Observation of the precipitation of silver on the glass surface under the influence of simple sugars. Understanding the reducing nature of glucose.
Structure and description of experiments:	
Introduction	Description: Glucose has reducing properties. As a result of heating the silver solution in the presence of glucose, Ag^+ ions are reduced to metallic silver, which precipitates in the form of a characteristic silver mirror. This reaction, known as the Tollens' test, is used to detect simple sugars and to produce a silver layer on the glass surface, e.g. when silvering Christmas tree decorations.
Main subject	Description: Understanding the silver ion reduction reaction under the influence of simple sugars.
Experiment	<p>Equipment: test tube, beaker with hot water, Pasteur pipettes</p> <p>Reagents: 0.3 M silver nitrate (V) solution, 0.3 M NaOH solution, 3 M ammonia solution, saturated glucose solution, 10% hydrochloric acid solution.</p> <p>Precautions: sodium hydroxide, ammonia, and sulfuric acid - toxic and caustic – make the experiment with extreme caution - work under a fume hood.</p> <p>Description: In a clean test tube (glass purity is critical here for the success of the reaction!) place 2 ml of 0.3 M silver nitrate (V) solution, then add 2 drops of 0.3 M NaOH solution to the same test tube. Observe the changes in the contents of the tube at this stage. Then add 3M ammonia solution dropwise to the test tube using a pipette, while swirling the contents of the test tube until complete dissolution of the precipitate. Remember to avoid using excess ammonia! Add a few drops of aqueous glucose solution to the solution obtained in this way, mix the contents of the test tube with a swirling motion, and then place the test tube with the mixture in a beaker with hot water for a few minutes. After precipitating the silver mirror, pour the contents of the test tube into a small beaker and rinse the test tube carefully with a small amount of distilled water using a wash bottle. Add a few ml of hydrochloric acid to the post-reaction solution collected in the beaker to precipitate the remaining silver in the form of chloride.</p> <p>Questions:</p> <ol style="list-style-type: none"> 1. Write down the equation of the reaction taking place in the test tube, leading to the formation of a silver mirror. 2. What practical applications does this method of obtaining metallic silver have? 3. Why is it important to neutralize the post-reaction solution with hydrochloric acid?

4. Which of the following substances will give a positive effect on the Tollens' test: formaldehyde, acetone, saccharose, fructose?

Conclusions: Aldehyde-containing sugars are oxidized to carboxylic acids while Ag^+ silver ions are reduced to metallic silver. This is observed as the formation of a metallic mirror on the surface of the glass. The reactions taking place are typical redox reactions.

Ketones give a negative test result. The exceptions are sugars belonging to ketoses, e.g. fructose.



Level: Secondary School