

Electroplating

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Date Created: 2002

Subject: Chemistry, Physics

Grade Level: Middle and High School

Standards: Next Generation Science Standards (www.nextgenscience.org)

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

Manufacturing Skills:

- Measuring the volume of a liquid.
- Setting up a simple electrical circuit.

Schedule: One 40-minute class period

CCMR Lending Library Connected Activities:
 Batteries



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<u>Objectives:</u> Students learn the principles of electrochemistry and electroplating by coating a penny with zinc sulfate, and coating a nickel with copper sulfate.	<u>Vocabulary:</u> <table border="0"> <tr> <td>Electrochemistry</td> <td>Electrode</td> </tr> <tr> <td>Electroplating</td> <td>Anode</td> </tr> <tr> <td>Electrolysis</td> <td>Cathode</td> </tr> <tr> <td>Ion</td> <td></td> </tr> </table>	Electrochemistry	Electrode	Electroplating	Anode	Electrolysis	Cathode	Ion	
Electrochemistry	Electrode								
Electroplating	Anode								
Electrolysis	Cathode								
Ion									
<u>Students Will:</u> • Make a silvery penny • Answer observation questions about the silvery penny activity • Make a copper nickel • Answer observation questions about the copper nickel activity • Review and discuss the concepts they learned	<u>Materials:</u> For Each Student: Activity Sheet 1: <i>Making a Silvery Penny</i> Activity Sheet 2: <i>Making a Copper Nickel</i> For Each Group: Batteries ZnSO₄-0.5 Molar Solution (Zinc Sulfate) CuSO₄-0.5 Molar Solution (Copper Sulfate) Pennies Nickels Sandpaper Wire Nails Provided by Teacher: Safety Glasses Beakers								
Safety	Students should use safety goggles when working with the chemical solutions. They should also use caution when working with electrodes.								



Science Content for the Teacher:

What is Electrochemistry?

Electrochemistry is the mixture of Electricity and Chemistry.

Batteries and solar cells rely on electrochemistry. Researchers are working hard to make cheaper, more powerful, and environmentally friendly batteries.

Electrochemists study why some metals rust and corrode while others don't. Billions of dollars would be saved if cars didn't rust.

Pure aluminum, silver and many chemicals are made by electrolysis. Pure materials are essential for building computer chips, wires for power lines and other applications.

Electrochemistry lets you coat the surfaces of metals with others. Toasters, grills and fenders, camera cases and more products than you can name have special protective electroplated coatings.

Today we'll use electrochemistry to coat pennies and nickels.

Electroplating

The salt solution has metal ions (M^{++}) and acid ions (A^{-}). The battery has negative and positive electrodes.

M^{++} ions are attracted to the negative electrode (Opposite charges attract). They jump onto the electrode to form a metal coating.

A^{-} ions are attracted to the positive terminal. They attack the electrode and metal from it goes into solution.

Preparation:

1. Photocopy print materials (*Activity Sheets 1 and 2*) for each student.
2. Distribute materials evenly to each student.



Classroom Procedure:

Engage (Time: 15 mins)

Discuss the meaning of electrochemistry and electroplating outlined in 'Science Content' with the students. Discuss the terminology relevant to this activity. Rather than listing real-life uses of this process, see if students can guess materials made this way or their uses.

Explore (Time: 20 mins)

Distribute all materials (including Activity Sheets 1 and 2) to each student. Allow students enough time to work on each activity, assisting as necessary. Students should answer the observation questions pertaining to each activity after it is completed.

Explain (Time: 10 mins)

Review and discuss the concepts that were learned throughout the activity as a class. Have students present their findings and discuss their answers to the observation questions.

Extra Activities:

"Copper to Silver to Gold"

A copper penny is plated with zinc (to appear silver) and then heated to yield a top layer of brass (which appears gold)

"Copper to Silver to Gold." 2002. 29 Jun. 2015
 <<http://www.chymist.com/copper%20silver%20gold.pdf>>

Resources:

Google Presentation at:

https://docs.google.com/presentation/d/1kGxZnouAhTo2acTk4K_bKqqaxDoxq2pZXuAIcfODetO/edit

"electro cleaning before electroplating - Instructables." 2014. 29 Jun. 2015
 <<http://www.instructables.com/community/electro-cleaning-before-electroplating/>>



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Assessment:

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

4= exceeds expectations

3= meets expectations consistently

2= meets expectations occasionally

1= not meeting expectations

	Engage	Explore	Explain
4	Shows leadership in the discussion and an understanding of electrochemistry.	Completes work accurately while providing an explanation for what is observed.	Provides an in-depth explanation of findings. Fills out worksheet clearly.
3	Participates in the discussion and shows an understanding of electrochemistry.	Completes work accurately.	Provides clear explanation of findings. Fills out worksheet clearly.
2	Contributes to the discussion, but shows little understanding of electrochemistry.	Makes some mistakes with the procedure.	Provides a limited explanation of findings. Fills out some of the worksheet.
1	Does not participate in discussion. Shows no understanding of electrochemistry.	Does little to complete the procedure.	Is not clear in explanation of findings. Does not fill out worksheet.

