

Relative Reactivities of Metals

In this investigation, you will observe the reactions of the metals copper, magnesium and zinc with four different solutions. Each solution contains a particular cation. The solutions you will use are copper(II)nitrate, $\text{Cu}(\text{NO}_3)_2$ (containing Cu^{2+}); magnesium nitrate, $\text{Mg}(\text{NO}_3)_2$ (containing Mg^{2+}); zinc nitrate, $\text{Zn}(\text{NO}_3)_2$ (containing Zn^{2+}); and silver nitrate AgNO_3 (containing Ag^+).

Before you begin, read *Gathering Evidence* to learn what you will need to do and note safety precautions.

Devise a systematic procedure that allows you to observe the reaction (if any) between each metal and each of the four ionic solutions. You will conduct each reaction in a separate well of your well plate using ten drops of 0.2 M solution and a small strip of metal.

Pre-Lab Questions

How many different combinations of metals and solutions will you need to observe?

How will you arrange things so you can complete your observations efficiently, yet know which metal and which solution are in each well?

Gathering Evidence

Before beginning, put on your goggles and wear them properly throughout the investigation.

Obtain 1-cm strips of each of the metals to be tested. Clean the surface of each metal strip by rubbing it with sandpaper or steel wool. Record observations of each metal's appearance in a data table.

Begin your planned procedure. If no reaction is observed, write "NR" in your data table. If a reaction occurs, record the changes you observe. (**Caution:** Avoid allowing the AgNO_3 solution come in contact with skin or clothing as it causes dark, non-washable stains.)

Dispose of all solid samples and solutions as directed by your teacher.

Wash your hands thoroughly before leaving the laboratory.

Data Table(s)

Interpreting Evidence

1. Which metal reacted with the most solutions? _____
2. Which metal reacted with the fewest solutions? _____

Making Claims

3. With which solutions (if any) would you expect silver metal to react? Explain your answer, citing evidence from your data and observations.
4. List the metals (including silver) in order, placing the most reactive metal first (the one reacting with the most solutions) and the least reactive metal last (the one reacting with the fewest solutions).
5. Refer to your "metal activity series" list from Question 4.
 - a. Write a brief explanation of why the outside surface of a penny is made of copper instead of zinc.
 - b. Which of the four metals mentioned in this investigation might be an even better choice than copper for the outside surface of a penny? What observational evidence supports your conclusion?
 - c. Why do you think the metal you chose in Question 5b is not used for the outside surface of a penny?
6. Given your new knowledge about the relative chemical activities of these four metals,
 - a. which metal is most likely to be found in an uncombined, or "free," (metallic) state in nature?
 - b. which metal is least likely to be found chemically uncombined with other elements

Reflecting on the Investigation

1. Reconsider your experimental design for this activity.
 - a. Would it have been possible to eliminate one or more of the metal-solution combinations and still obtain all information needed to create chemical activity ratings for the metals?
 - b. If so, which combination(s) could have been eliminated? Why?

Formal Lab Report

See next page for template and rubric

Title

by "1st Author (You)" and "2nd Author (Lab Partner)"

Submitted on "DATE"

Research Question:

Pre-Lab Questions:

Procedure:

Data:

Interpreting Evidence:

Making Claims:

Reflecting on the Investigation:

Appendix:

Rubric:

Title, Name(s), Date	/ 3
Research Question (Purpose/Objective)	/ 2
Pre-Lab Questions with Responses	/ 2
Procedure (Provide your procedure for the experiment)	/ 5
Data (Data Tables for all relevant qualitative and quantitative data, 2 tables expected)	/ 10
Interpreting Evidence	/ 4
Making Claims	/ 14
Reflecting on the Investigation – respond in the form of a paragraph conclusion that appropriately answers each question	/ 8
<i>Be sure to re-type questions and provide responses</i>	-----
Complete sentences, spell-check	/ 2
Total	/ 50