# #9659

# METALS 1

LANDMARK MEDIA, 2001
Grade Levels: 10-12
12 minutes

## DESCRIPTION

Lab experiments show how magnesium, zinc, iron, and copper react with hydrochloric and nitric acids. Also shows the displacement of two metals from salts.

## ACADEMIC STANDARDS

**Subject Area: Science – Physical Sciences**

★ Standard: Understands the structure and properties of matter

- Benchmark: Knows that substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties (See Instructional Goal #3.)
- Benchmark: Knows factors that influence reaction rates (e.g., types of substances involved, temperature, concentration of reactant molecules, amount of contact between reactant molecules) (See Instructional Goals 1 and 2.)
- Benchmark: Knows that many elements can be grouped according to similar properties (e.g., highly reactive metals, less-reactive metals, highly reactive nonmetals, almost completely nonreactive gases) (See Instructional Goals #1, 2, and 3.)

## INSTRUCTIONAL GOALS

1. To demonstrate the reaction of certain metals with hydrochloric acid.
2. To show the reaction between nitric acid and certain metals.
3. To point out that a more reactive metal displaces a less reactive metal from its compounds.

## VOCABULARY

1. copper
2. copper (II) sulfate
3. corrosion
4. displaces
5. hydrochloric acid
6. iron
7. iron (II) sulfate
8. magnesium
9. metal oxides
10. nitrates
11. nitric acid
12. nitrogen dioxide
13. oxidizing agent
14. reactivity
15. zinc


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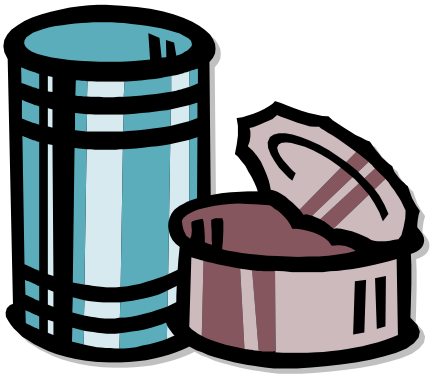
## BEFORE SHOWING

1. List some common metals and review their properties.
2. Display samples of magnesium, zinc, iron, and copper. Describe the appearance of each metal.
3. Introduce the metal reactivity series; metals listed in order of how quickly they undergo a chemical reaction such as burning or dissolving in acid.
   a. Explain how the order of the metals in the series is determined.
   b. Explain the general rules of displacement based on this list.
   c. Include hydrogen in the list to show which metals can displace it from acid.
4. Demonstrate two metals that have different reaction rates when burned in a flame such as magnesium and copper. Explain that this video focuses on the reaction rates of metals in acids.

## DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause after the experiment that shows metals reacting with hydrochloric acid. Write the chemical equations for the reactions on the board or overhead.
3. Pause after the experiment that shows metals reacting with nitric acid. Write the chemical equations for the reactions on the board or the overhead.



## AFTER SHOWING

### ► Discussion Items and Questions

1. Which metal reacted readily with hydrochloric acid? Which metal did not react at all?
2. Zinc reacted with hydrochloric acid yet it is used to protect iron from corrosion. Explain.
3. Why didn't the copper react with the acid?
4. What evidence indicates a gas was produced during these reactions? What is the name of the gas?
5. Which metals reacted with nitric acid? Why?
6. The reaction of the metals with hydrochloric acid produced a colorless gas while the reaction with nitric acid produced a brown gas. Explain.
7. What happened to the iron plate that was placed into the solution of copper (II) sulfate? Why?
8. What happened to the copper plate that was placed into the solution of iron (II) sulfate? Why?
9. What conclusions can be made based on a metal's ability to react?
   a. Items made from reactive metals will be more likely to corrode or tarnish.
   b. Reactive metals are more likely to be found as ores in nature and will have to be extracted. Nonreactive metals are found free in nature, ready for use.
   c. The reactivity series helps predict which chemical reactions will occur in the laboratory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## ► Applications and Activities

1. Create a table of information about magnesium, zinc, copper, and iron. Research to find the following:
   a. chemical symbol
   b. color of metal
   c. luster
   d. ductility, malleability
   e. abundance in nature
   f. method of extraction from ores
   g. uses
2. Design reactivity of metal posters to be displayed on the walls of the classroom or laboratory.
3. Report on the classification of acids according to strength. Include pH values, a list of acids according to strength, and common uses of acids.
4. Research the restoration process that the Statue of Liberty underwent in 1984 to preserve the metallic surfaces.
5. Report on different methods that are used to extract metals from their ores.
6. Report on the metals that are used to make jewelry (gold, silver, and platinum). Include information about levels of purity, factors that determine prices, and jewelry care.
7. Develop a worksheet that lists possible chemical reactions. Determine if a reaction will occur or not, based on the reactivity series. Examples include:
   a. Mg + CuSO4
   b. Cu + MgCl2
   c. Ag + HCl
   d. Zn + CuSO4
   e. Au + H2SO4


## RELATED RESOURCES

- Electrolysis & Corrosion #9655
- Metals 2 #9660
- The Periodic Table: Reactions and Realtionships #3497
- The Reactivity of Elements #8878


### World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.


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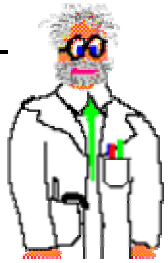


- **THE REACTIVITY (ELECTROCHEMICAL) SERIES**

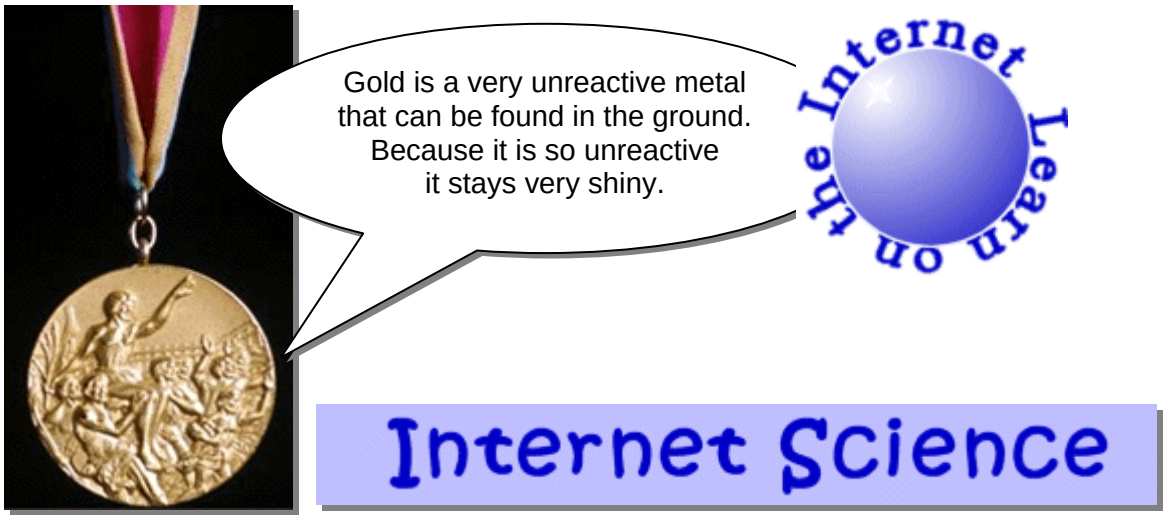
http://richardbowles.tripod.com/chemistry/reactivity/reactivity.htm

Includes animations that show the reaction of metals in acids. Also uses graphics to explain how iron is extracted from ores.

- **INTERNET SCIENCE**

http://www.science.learnontheinternet.co.uk/topics/metals.html#head3

Contains information about the reactivity series, common reactions of metals, displacement reactions, and extraction from ores. Includes a "story of true romance" that helps explain the displacement process.





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