



#9662

NONMETALS

LANDMARK MEDIA, 2001

Grade Levels: 12-13+

22 minutes

DESCRIPTION

Experiments feature: (1) halogens as oxidizing agents; (2) bromine reacting with potassium; (3) detecting bromine in compounds; (4) combustion of sulphur and the formation of sulfuric acid; (5) properties of phosphorus; and (6) spontaneous ignition of white phosphorus.

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 Goals #3 and 5.)
 - 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 #2 and 7.)
 - 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, 4, and 6.)

INSTRUCTIONAL GOALS

1. To describe the properties of chlorine, bromine, and iodine.
2. To show that halogens act as oxidizing agents.
3. To show the reaction between bromine and potassium.
4. To demonstrate how to detect the presence of bromine in compounds.
5. To demonstrate how sulfur dioxide gas is made and then dissolved in water to form an acid.
6. To point out some properties of phosphorus.
7. To demonstrate the self-ignition of white phosphorus.

VOCABULARY

- | | |
|---------------------|---------------------------|
| 1. acid rain | 9. hydrochloric acid |
| 2. bromine | 10. indicator |
| 3. carbon disulfide | 11. iodine |
| 4. chlorine | 12. litmus |
| 5. combustion | 13. phosphorous pentoxide |
| 6. corrosive | 14. phosphorus |
| 7. crystalline | 15. potassium bromide |
| 8. halogen elements | 16. potassium hydroxide |

17. potassium permanganate
18. precipitate
19. silver nitrate
20. spontaneous ignition
21. sulfur
22. sulfur dioxide

BEFORE SHOWING

1. Point out placement of the halogen family on the periodic chart.
2. Review oxidation-reduction reactions.
3. Review spontaneous combustion and list examples.
4. Review the reactivity of alkali metals.

DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the reaction of chlorine with potassium bromide. Why does the colorless solution change to a characteristic color?
3. Pause at the section showing chlorine reacting with the potassium hydroxide. What is the basis for this reaction?
4. Pause after the section showing the reaction of bromine with potassium. Why is this a violent reaction?
5. Pause at the section showing the production of the precipitate silver bromide. What precipitates would be formed if testing for the presence of chlorine or iodine in compounds?
6. Pause at the section showing the self-ignition of white phosphorus that was dissolved in carbon disulfide. What can be said about the evaporation rate of carbon disulfide?



AFTER SHOWING

► Discussion Items and Questions

1. What are the physical properties of chlorine, bromine, and iodine?
2. How is liquid bromine stored?
3. How was chlorine prepared in the experiment in the video?
4. What happened when the chlorine reacted with potassium bromide? With potassium hydroxide?
5. What is the trend for the reactivity of halogens?
6. What happened when bromine reacted with the alkali metal potassium?
7. What chemical is used to detect the presence of bromine, chlorine, or iodine in compounds?
8. What compound is formed when sulfur burns in oxygen? Why does the combustion of the sulfur stop when it is placed in the cylinder?
9. What is formed when sulfur dioxide combines with water? What connection does sulfur dioxide have with acid rain?

10. What are some differences between white phosphorus and red phosphorus and what accounts for these differences? How can red phosphorus be changed into white phosphorus?
11. What is the purpose of the water in the smaller test tube?
12. What happens when the particles of white phosphorus formed on the bottom of the test tube are exposed to air? What compound is formed when the white phosphorus reacts with oxygen in air?
13. In which liquid is white phosphorus soluble?
14. What happened to the strip of filter paper dipped in a solution of white phosphorus and carbon disulfide after it was exposed to air?



► Applications and Activities

1. Develop a chart of the nonmetals mentioned in the video. Include color, odor, density, symbol, atomic number, atomic weight, discovery, common compounds containing that element, and practical uses.
2. Research and report on the three forms of sulfur.
3. Report on the following uses of sulfur dioxide: bleaching agent, making wine, preservation of foods, disinfectant, and refrigerant.
4. Research and report on acid rain.
 - a. What causes it?
 - b. How it is measured?
 - c. What are the affects of it?
 - d. How can it be reduced?
 - e. What areas in the world have been affected the most by acid rain?
5. Investigate and report on storing dangerous and corrosive chemicals.
6. The experiments performed in this video were performed with great care. Make a list of the special lab equipment that was used, special precautions that were taken, and the reason for each precaution.
7. Silver nitrate is useful in chemical analysis such as the detection of halides. Report on other practical uses of this compound.

RELATED RESOURCES

- [Carbon Dioxide/Chemical Reaction Rates #9654](#)
- [Electrolysis & Corrosion #9655](#)
- [Hydrogen #9658](#)
- [The Periodic Table: Reactions and Relationships #3497](#)





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.



- **THE CHEMISTRY OF NONMETALS**

http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch10/10_frame.html

Includes comprehensive information about sulfur, phosphorus, and the halogens, illustrated with graphics.

- **SULPHUR**

<http://www.webelements.com/webelements/elements/text/S/key.html>



Contains information about sulfur including key data, description, history, uses, and reactions.

- **PHOSPHORUS**

<http://nobel.scas.bcit.ca/resource/ptable/p.htm>

Includes information about phosphorus such as where it is found, its allotropes, and its uses.

Atomic Number = 15 Atomic Mass = 30.9738 amu

Phosphorus