



#9658

HYDROGEN

LANDMARK MEDIA, 2001

Grade Levels: 9-12

11 minutes

DESCRIPTION

Demonstrates the production and collection of hydrogen in a chemistry lab, and testing of its purity. Also shows and explains other chemical reactions related to this element.

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 #1.)
 - Benchmark: Understands that chemical reactions either release or consume energy (i.e., some changes of atomic or molecular configuration require an input of energy; others release energy) (See Instructional Goals #1, 3, and 5.)

Subject Area: Science – Nature of Science

- ★ Standard: Understands the nature of scientific inquiry
 - Benchmark: Designs and conducts a scientific investigation (e.g., formulates hypotheses, designs and executes investigations, interprets data, synthesizes evidence into explanations, proposes alternative explanations for observations, critiques explanations and procedures) (See Instructional Goals #1, 2, and 3.)
 - Benchmark: Establishes relationships based on evidence and logical argument (e.g., provides causes for effects) (See Instructional Goals #2 and 4.)

INSTRUCTIONAL GOALS

1. To demonstrate the production of hydrogen by the reaction of hydrochloric acid and zinc.
2. To show the “pop” test for hydrogen gas.
3. To show what happens when hydrogen is ignited in air.
4. To demonstrate how hydrogen burns in oxygen and in chlorine.
5. To demonstrate how hydrogen acts as a reducing agent.



VOCABULARY

1. anhydrous copper (II) sulfate
2. apparatus
3. chlorine
4. cylinder
5. density
6. hydrated
7. hydrochloric acid
8. ignite
9. inverted
10. Kipp's gas generator
11. mercury (II) oxide
12. oxidized
13. oxygen
14. reducing agent
15. zinc

BEFORE SHOWING

1. Obtain a balloon filled with helium. Discuss what properties of helium make it a suitable gas for balloons. Discuss why hydrogen, which is lighter than helium, cannot be used to fill balloons.
2. List several compounds that contain hydrogen.



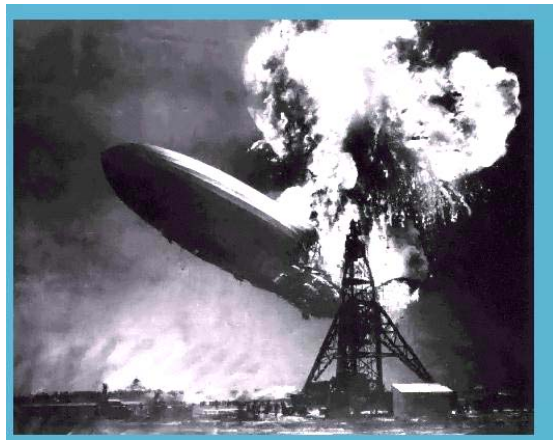
DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the bubbling in the apparatus before the experiment begins. What causes the bubbling?
3. Pause at the section showing the water in the test tube being displaced by hydrogen. What does this indicate about the solubility of hydrogen in water?
4. Pause at the scene showing the test tube being held for the hydrogen test. Why is it held upside down?
5. Pause at the section showing the oxidation of mercuric oxide. Point out the appearance of the small amount of mercury in the reaction tube.

AFTER SHOWING

► Discussion Items and Questions

1. What two reactants are needed to produce hydrogen gas?
2. What is the name of the apparatus used in the experiment?
3. What test is used to tell if the hydrogen collected is pure?
4. What happens if a mixture of hydrogen and oxygen is ignited?
5. What happens when hydrogen burns in oxygen?
6. What happens when hydrogen burns in chlorine?
7. What color is mercuric (II) oxide?
8. In what way does hydrogen act as a reducing agent?
9. What happens to the hydrogen when it reacts with the mercuric oxide?



10. What is the purpose of the anhydrous copper (II) sulfate?
11. What color does the anhydrous copper (II) sulfate become after the reaction occurs?

► Applications and Activities

1. Draw a diagram of the Kipp's gas generator used in the experiment in the video. Label the parts and write an explanation of how the apparatus works.
2. Make a chart about hydrogen. Include information such as its discovery, physical properties, chemical properties, preparation in the lab, and commercial uses.
3. Report on the airship *Hindenburg* which was involved in a tragic incident in 1937.
4. Write a summary of what was observed in each of the experiments in the video.
5. Research other methods of producing hydrogen in the laboratory.
6. Report on the uses of mercury and precautions that must be followed when handling it.
7. Using chemistry graphics found in some word processors, illustrate the step-by-step process of the reduction of mercuric oxide.
8. Report on the use of hydrogen as rocket fuel.



RELATED RESOURCES

- [Carbon Dioxide/Chemical Reaction Rates #9654](#)
- [Hydrocarbons #9657](#)
- [Oxygen #9664](#)



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.

• KIPP'S GENERATOR

http://mattson.creighton.edu/History_Gas_Chemistry/Kipps.html

Includes pictures and diagrams to explain how the Kipp's generator works. The setting up of the apparatus for the reaction of hydrochloric acid and zinc is shown step-by-step.

• LINKS TO CHEMISTRY EXPERIMENTS, DEMONSTRATIONS

http://www.chemistrycoach.com/Links%20to%20chemistry_experiments.htm

Includes a long list of sites that contain lectures, demonstrations, and experiments related to topics in chemistry.