

Hydrogen peroxide is a compound that can be made to quickly decompose into the element oxygen and another compound, water. In this activity, you will decompose hydrogen peroxide by adding a catalyst, which is a chemical that helps speed up the process.

Safety



- Hydrogen peroxide solution is corrosive.
- Be careful around open flames.
- Tie back long hair.

Materials

- liquid dish soap
- medium test tube in a test tube rack
- hydrogen peroxide (H_2O_2) solution
- candle and lighter
- scoopula
- potassium iodide (KI) crystals
- 2 wooden splints

What to Do

1. Put one drop of dish soap into the test tube.
2. Carefully pour hydrogen peroxide solution into the test tube until it is no more than $\frac{1}{3}$ full.

3. Light a candle.
4. Use a scoopula to obtain about 1 mL (the size of a pea) of potassium iodide (KI) crystals and drop them into the test tube. You should see bubbles appear, making a foam as oxygen collects in the soapy water.
5. Light a wooden splint and blow it out, leaving a few embers glowing.
6. Place the glowing splint in the soap bubbles, keeping it above the solution. Observe.
7. Repeat steps 5 and 6 several times.
8. Clean up and put away the equipment you have used.

What Did You Find Out?

1. What happens to a glowing splint when it is placed in pure oxygen?
2. If you have practised the burning splint test for hydrogen in a previous investigation, compare the test for oxygen with the test for hydrogen, using a lit splint for both.
 - (a) How are the procedures different?
 - (b) How do the observations differ?

Covalent Compounds

Non-metal, non-metal

In **covalent compounds**, atoms combine by sharing electrons to form molecules. A **molecule** is a group of atoms in which the atoms are bound together by sharing one or more pairs of electrons. The shared pairs of electrons form covalent bonds that keep the atoms together. Carbon dioxide and water are examples of covalent compounds.

The smallest possible particle of water is a single molecule. A water molecule is composed of two hydrogen atoms and one oxygen atom. The formula for water shows this two-to-one relationship using element symbols and a subscript number: H_2O . Figure 3.2 on the next page shows three common ways of modelling a water molecule. In all three cases, the covalent bonds that hold the water molecule together are formed by the atoms of oxygen and hydrogen sharing pairs of electrons.

3-1B The Synthesis and Detection of Copper

Conduct an INVESTIGATION

SkillCheck

- Observing
- Predicting
- Evaluating information
- Working co-operatively

Inquiry Focus

In this activity, you will transform copper(II) chloride into pure copper metal. This is similar to how copper ore is processed into metallic copper in smelting operations.

Question

How can copper be extracted from a compound of copper, purified, and then tested to verify success?

Procedure

1. Carefully pour 100 mL of copper(II) chloride solution into a 400 mL beaker.
2. Roll a 10 cm by 10 cm piece of aluminum foil into a small cylinder (try rolling it around a pencil). Place it in the solution. Wait and observe.
3. After the reaction has slowed down, or no longer than 5 min later, pick out the larger pieces of aluminum foil, using crucible tongs.
4. Add about 30 mL of water to the solution and let the brown solid settle for about 1 min. Pour the top part of the liquid into the other 400 mL beaker.
5. Pour the contents of the second beaker and all waste materials into the waste container provided by your teacher. Do not pour it down the sink.
6. Fill the first beaker again with water until it nearly reaches the top. Let the solids settle again for 1 to 2 min. Be patient. Then pour out the top part of the water. This process washes the copper, which is collecting at the bottom of the first beaker. Repeat until your copper product appears clean.
7. Add about 25 mL of hydrochloric acid solution (HCl) to the copper in the first beaker, and let it sit for about 1 min. Then begin rinsing again with water, as in steps 4 and 6. The hydrochloric acid helps to clean the copper.
8. Pour out as much water as you can, then pour your copper product onto a paper towel, using a wooden splint as needed to make the transfer.
9. Light a Bunsen burner. Pick up a piece of copper with crucible tongs and place it in the Bunsen burner flame. Observe the colour of the flame.
10. Wash all materials into the waste container provided.
11. Clean up and put away the equipment you have used.

Analyze

1. What colour changes showed that a chemical change took place when aluminum was placed in the copper(II) chloride solution?
2. Describe what happens when copper is placed in a Bunsen burner flame.

Conclude and Apply

1. List several properties of copper that distinguish it from another metal, such as iron.

Safety



- Wear protective clothing and safety goggles.
- Hydrochloric acid is corrosive.
- Be careful around open flames.

Materials

- copper(II) chloride solution
- two 400 mL beakers
- aluminum foil
- crucible tongs
- waste container
- dilute hydrochloric acid solution (HCl)
- wooden splint
- paper towel
- Bunsen burner

