

Reactions of metals with water and dilute acids

Aims

Hydrogen is produced when a metal reacts with water or a dilute acid. In general, the more reactive the metal, the faster the reaction and the greater the rate of bubbling.

You are going to investigate the reactions of magnesium, zinc, iron and copper with water, dilute hydrochloric acid and dilute sulfuric acid.



Apparatus

Eye protection

Heat-resistant mat

Bunsen burner

Test tubes and test-tube rack

Test tube holder

Dropping pipette

Wooden splints

Dilute hydrochloric acid

Dilute sulfuric acid

Pieces of magnesium, zinc, iron and copper

Method

1. Put the test tubes in the test-tube rack.
2. Use the dropping pipette to add no more than 2 cm³ of water to each test tube.
3. Add the piece of magnesium to one of the test tubes. Observe and record any signs of a reaction.
4. If the reaction is slow, or there is no visible reaction, **gently warm** the contents of the test tube. Allow to cool for a short time, then record your observations.



Clamp the test tube holder around the neck of the test tube. Hold the test tube at about 45° and point it away from people. Warm with the air hole half open. **Do not boil the contents.**

5. Repeat steps 3 and 4 for the other metals.
6. Repeat the experiment using dilute hydrochloric acid, then with dilute sulfuric acid.

Results

Metal	Observations in:		
	Water	Dilute hydrochloric acid	Dilute sulfuric acid
Magnesium			
Zinc			
Iron			
Copper			

Analysis

1. List the metals in order of reactivity (from most reactive to least reactive) using your results.
2. Explain why you placed each metal where you did.

Evaluation

Describe how you could improve or extend your investigation. Explain your answer.

Results

Metal	Observations in:		
	Water	Dilute hydrochloric acid	Dilute sulfuric acid
Magnesium			
Zinc			
Iron			
Copper			

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Model results

(If iron filings are used instead of foil or a nail, the bubbling will be rapid)

Metal	Observations in:		
	Water	Dilute hydrochloric acid	Dilute sulfuric acid
Magnesium	No visible reaction in cold or warm water.	Rapid bubbling, metal gets smaller and disappears. Warming is not needed.	Rapid bubbling, metal gets smaller and disappears. Warming is not needed.
Zinc	No visible reaction in cold or warm water.	Steady bubbling. Fast bubbling in warm acid.	Steady bubbling. Fast bubbling in warm acid.
Iron	No visible reaction in cold or warm water.	Bubbles form on the surface. Slow bubbling in warm acid.	Bubbles form on the surface. Slow bubbling in warm acid.
Copper	No visible reaction in cold or warm water.	No visible reaction in cold or warm acid.	No visible reaction in cold or warm acid.

Technician's notes

Per pair of students

Heat-resistant mat

Bunsen burner

4 × test tubes

Test-tube rack

Test tube holder



Dropping pipette

Wooden splints

3 × pieces (about 15 mm × 5 mm) of:

- copper
- iron (or small steel nails instead)
- magnesium
- zinc

Access to:

- 1 mol/dm³ hydrochloric acid 
- 0.5 mol/dm³ sulfuric acid 
- Deionised or distilled water

Allow about 20 cm³ per pair of students.