

Reactions of acids with metals

5.4.2.1 · Chemistry · revision notes

Acids react with some metals to produce a salt and hydrogen. You need the reactions of magnesium, zinc and iron with hydrochloric and sulfuric acids.

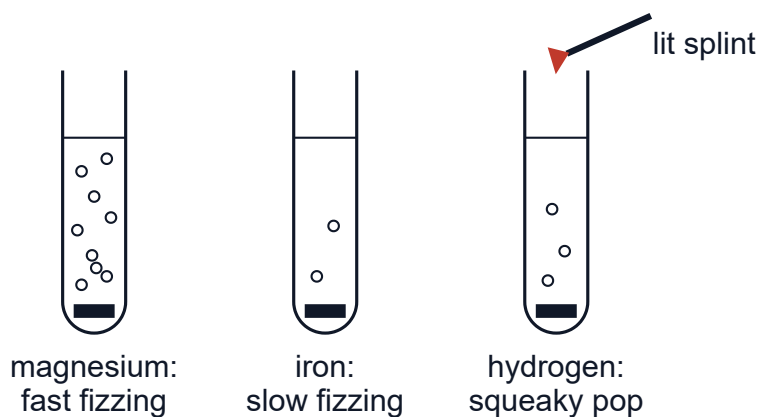
Key facts

- metal + acid → salt + hydrogen
- $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2$
- Hydrochloric acid → chlorides; sulfuric acid → sulfates
- $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$
- Hydrogen test: lit splint → squeaky pop

Notes

Metal + acid

- Acids react with some metals: **metal + acid → salt + hydrogen**.
- You need the reactions of **magnesium, zinc and iron** with dilute **hydrochloric acid** and dilute **sulfuric acid**.
- You see fizzing (bubbles of hydrogen) and the metal gets smaller. Magnesium reacts quickly, zinc steadily and iron slowly. Copper does not react with these acids.



Same acid, same size of metal: more bubbles per second means a more reactive metal.

- Test for hydrogen: hold a lit splint at the mouth of the test tube. Hydrogen burns with a **squeaky pop**.

Naming salts and writing equations

- Hydrochloric acid (HCl) makes **chlorides**. Sulfuric acid (H₂SO₄) makes **sulfates**.
- $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$
- $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$ (iron forms iron(II) chloride with dilute hydrochloric acid)
- Hydrogen is a diatomic gas, so it is always written H₂.

How to answer each type of question

Complete a word equation

1 to 2 marks

Grade 3

- The products are always a salt and hydrogen.
- Name the salt: metal name first, then chloride (hydrochloric acid) or sulfate (sulfuric acid).

Example. Complete the word equation.

zinc + hydrochloric acid → +

Model answer. zinc chloride (1) + hydrogen (1)

Describe how to compare the reactivity of two metals with acid

3 to 4 marks

Grade 5

- Use the same mass or size of each metal.
- Use the same volume and concentration of acid at the same temperature.
- Say what you measure: volume of gas in a set time, rate of bubbling or temperature rise.
- Say how you decide: the faster reaction shows the more reactive metal.

Example. Describe how a student could show that magnesium is more reactive than iron, using dilute sulfuric acid.

Model answer. Add the same mass / same size pieces of each metal (1) to the same volume and concentration of sulfuric acid (1)

Measure the volume of hydrogen made in a set time / compare the rate of bubbling (1)

Magnesium produces gas faster, so it is more reactive (1)

Don't lose marks

- ✗ Writing hydrogen as H instead of H₂.
- ✗ Naming salts wrongly, e.g. 'zinc hydrochloride' instead of zinc chloride.
- ✗ Saying copper reacts with dilute acid to give hydrogen.
- ✗ Mixing up the hydrogen test (lit splint, pop) with the oxygen test (glowing splint relights).

More tips

Memory tricks

- MASH: Metal + Acid → Salt + Hydrogen.
- Salt name = metal name + ending from the acid (hydrochloric → chloride, sulfuric → sulfate).
- Squeaky pop = hydrogen. A glowing splint relighting is the test for oxygen, not hydrogen.

Exam technique

- For observations, write 'fizzing' or 'bubbles'. 'Hydrogen is produced' is not an observation.
- In practical comparisons, say what you keep the same as well as what you measure.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Name the products of metal + acid

A salt and hydrogen, e.g. magnesium + hydrochloric acid → magnesium chloride + hydrogen.

Grade 4

Name the salt from the acid used

Hydrochloric acid gives chlorides and sulfuric acid gives sulfates.

Grade 4

Describe the test for hydrogen

A lit splint held at the mouth of the tube burns the hydrogen with a squeaky pop.

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