

Reactions of acids, bases and salts – GCSE Combined Science Chemistry1. **No.1**

This question is about acids and bases.

What is the pH of sulfuric acid?

[1 mark]Tick (✓) **one** box.

1	☐	7	☐	14	☐
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An acid reacts with zinc to produce zinc chloride and hydrogen.

Which acid reacts with zinc to produce zinc chloride?

[1 mark]Tick (✓) **one** box.

Hydrochloric acid	☐
Nitric acid	☐
Sulfuric acid	☐

What type of substance is zinc chloride?

[1 mark]Tick (✓) **one** box.

Alkali	☐	Base	☐	Salt	☐
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An alkali is a base in solution.

Which compound is an alkali?

[1 mark]

Tick (✓) **one** box.

Sodium hydroxide

☐

Sodium nitrate

☐

Sodium sulfate

☐

The formula of the copper ion is Cu^{2+}

The formula of the oxide ion is O^{2-}

What is the formula of copper oxide?

[1 mark]

Tick (✓) **one** box.

Cu_2O_2

☐

CuO_2

☐

CuO

☐

A student reacts an acid with copper oxide.

The reaction between the acid and copper oxide is very slow at room temperature.

How could the student speed up the reaction?

[1 mark]

Complete the sentence to show how the student makes sure that **all** the acid reacts.

Choose the answer from the box.

[1 mark]

in excess	in solution	molten	soluble
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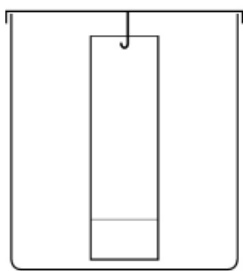
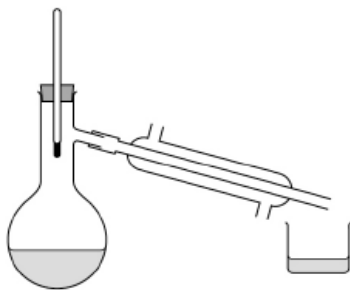
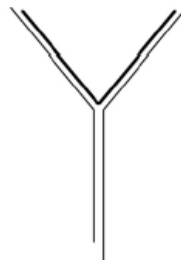
The student adds copper oxide to the acid until the copper oxide is _____.

The student filters the unreacted copper oxide from the solution.

Which apparatus does the student use?

[1 mark]

Tick (✓) **one** box.

☐☐☐☐

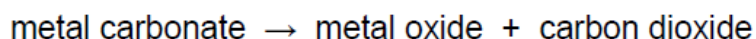
What process is used to produce crystals of a salt from a salt solution?

[1 mark]

2. No.3

Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:



The students made the following hypothesis:

‘When heated the same mass of any metal carbonate produces the same mass of carbon dioxide.’

The students heated a test tube containing copper carbonate.

Table 1 shows their results.

Table 1

Time the test tube containing copper carbonate was heated in mins	0	2	4	6
Mass of test tube and contents in g	17.7	17.1	17.0	17.0

Plan a method the students could use to test their hypothesis.

You should show how the students use their results to test the hypothesis.

You do **not** need to write about safety precautions.

[6 marks]

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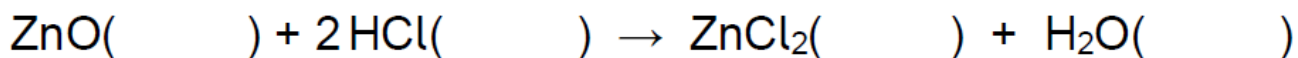
3. No.4

This question is about acids, alkalis and bases.

A student reacted zinc oxide powder with hydrochloric acid to produce zinc chloride solution.

Complete the equation for the reaction by writing the state symbols.

[2 marks]



Give **one** way that the student could speed up the reaction between zinc oxide powder and hydrochloric acid.

[1 mark]

Hydrochloric acid was the limiting reactant.

How could the student know when all the hydrochloric acid has reacted?

[1 mark]

How could the student obtain zinc chloride solution from the reaction mixture when all the hydrochloric acid has reacted?

[1 mark]

Describe how zinc chloride crystals are produced from zinc chloride solution.

[2 marks]

Sulfuric acid and sodium hydroxide react to produce sodium sulfate.

Sulfuric acid is gradually added to sodium hydroxide solution.

The pH of the mixture changes as the sulfuric acid is added until in excess.

Suggest the pH at:

- the start before sulfuric acid is added
- the end when sulfuric acid is in excess.

[2 marks]

pH at start = _____

pH at end = _____

Complete the symbol equation for the preparation of sodium sulfate.

You should balance the equation.

[2 marks]



A solution of hydrochloric acid had a hydrogen ion concentration of 1.0 mol/dm^3

Water was added to the hydrochloric acid until the pH increased by 1

What was the hydrogen ion concentration of the hydrochloric acid after water had been added?

[1 mark]

Tick (✓) **one** box.

100 mol/dm^3

☐

10 mol/dm^3

☐

0.10 mol/dm^3

☐

0.010 mol/dm^3

☐

4. No.2.1&2.2

Which acid should the student use?

[1 mark]

Tick (✓) **one** box.

Hydrochloric acid

☐

Nitric acid

☐

Sulfuric acid

☐

Suggest how the student would know that excess copper oxide has been added.

[1 mark]

5. No.2.3

There are four more stages, **A**, **B**, **C** and **D**, to make copper chloride crystals.

The stages **A**, **B**, **C** and **D** are not in the correct order.

Stage **A** Partially evaporate by heating with a water bath

Stage **B** Filter the mixture into an evaporating basin

Stage **C** Leave to crystallise

Stage **D** Remove and dry the crystals

Put stages **A**, **B**, **C** and **D** in the correct order.

[2 marks]

First stage _____

Second stage _____

Third stage _____

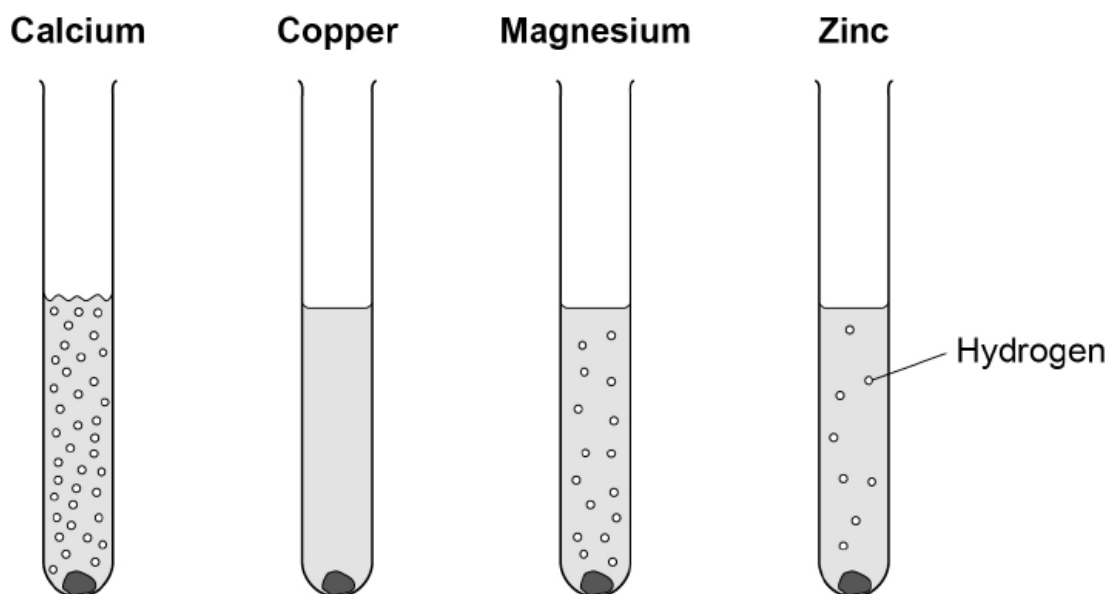
Fourth stage _____

6. No.6.1-6.4

This question is about reactions of metals.

Figure 7 shows what happens when calcium, copper, magnesium and zinc are added to hydrochloric acid.

Figure 7



What is the order of decreasing reactivity of these four metals?

[1 mark]

Tick (✓) **one** box.

Zn Ca Cu Mg

☐

Ca Cu Mg Zn

☐

Cu Zn Ca Mg

☐

Ca Mg Zn Cu

☐

A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

Name **two** variables that must be kept constant.

[2 marks]

1 _____

2 _____

What is the independent variable in this reaction?

[1 mark]

Predict the reactivity of beryllium compared with magnesium.

Give a reason for your answer.

Use the periodic table.

[2 marks]

Reason _____

7. No.7

This question is about salts.

Ammonium nitrate solution is produced when ammonia gas reacts with nitric acid.

Give the state symbol for ammonium nitrate solution.

[1 mark]

What is the formula of nitric acid?

[1 mark]

Tick (✓) **one** box.

HCl

☐

HNO₃

☐

H₂SO₄

☐

NH₄OH

☐

Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, OH⁻

A student adds universal indicator to solutions of nitric acid and ammonia.

What colour is observed in each solution?

[2 marks]

Colour in nitric acid

Colour in ammonia solution

The student gradually added nitric acid to ammonia solution.

Which row, **A**, **B**, **C** or **D**, shows the change in pH as the nitric acid is added until in excess?

[1 mark]

Tick (✓) **one** box.

	pH of ammonia solution at start	pH after addition of excess nitric acid	
A	10	7	☐
B	2	10	☐
C	7	1	☐
D	10	2	☐

Calculate the percentage by mass of oxygen in ammonium nitrate (NH_4NO_3).

Relative atomic masses (A_r): H = 1 N = 14 O = 16

Relative formula mass (M_r): $\text{NH}_4\text{NO}_3 = 80$

[3 marks]

Percentage by mass of oxygen = _____ %

Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

You do **not** need to write about safety precautions.

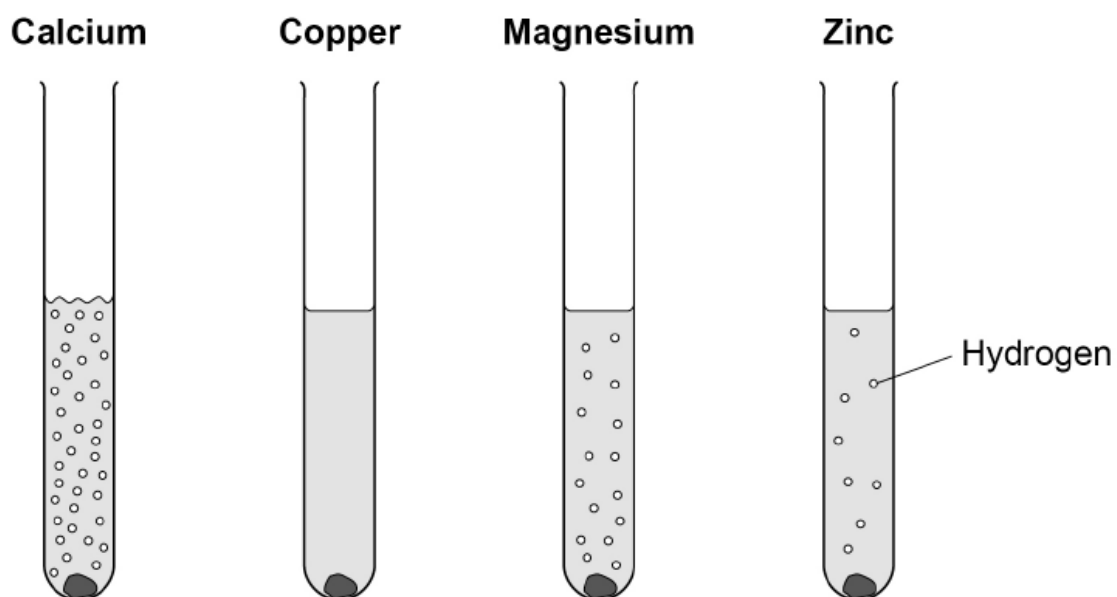
[6 marks]

8. No.1.1-1.3

This question is about reactions of metals.

Figure 1 shows what happens when calcium, copper, magnesium and zinc are added to hydrochloric acid.

Figure 1



What is the order of decreasing reactivity of these four metals?

[1 mark]

Tick (✓) **one** box.

Zn Ca Cu Mg

☐

Ca Cu Mg Zn

☐

Cu Zn Ca Mg

☐

Ca Mg Zn Cu

☐

A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

Name **two** variables that must be kept constant.

[2 marks]

1 _____

2 _____

What is the independent variable in this reaction?

[1 mark]

9. No.2

This question is about salts.

Ammonium nitrate solution is produced when ammonia gas reacts with nitric acid.

Give the state symbol for ammonium nitrate solution.

[1 mark]

What is the formula of nitric acid?

[1 mark]

Tick (✓) **one** box.

HCl

☐

HNO₃

☐

H₂SO₄

☐

NH₄OH

☐

Ammonia gas dissolves in water to produce ammonia solution.

Ammonia solution contains hydroxide ions, OH⁻

A student adds universal indicator to solutions of nitric acid and ammonia.

What colour is observed in each solution?

[2 marks]

Colour in nitric acid

Colour in ammonia solution

The student gradually added nitric acid to ammonia solution.

Which row, **A**, **B**, **C** or **D**, shows the change in pH as the nitric acid is added until in excess?

[1 mark]

Tick (✓) **one** box.

	pH of ammonia solution at start	pH after addition of excess nitric acid	
A	10	7	☐
B	2	10	☐
C	7	1	☐
D	10	2	☐

Calculate the percentage by mass of oxygen in ammonium nitrate (NH_4NO_3).

Relative atomic masses (A_r): H = 1 N = 14 O = 16

Relative formula mass (M_r): $\text{NH}_4\text{NO}_3 = 80$

[3 marks]

Percentage by mass of oxygen = _____ %

[6 marks]

[illegible]