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# GCSE (9–1) Chemistry A (Gateway Science)

## J248/01 Paper 1, C1–C3 and C7 (Foundation Tier)

**Thursday 17 May 2018 – Morning**

**Time allowed: 1 hour 45 minutes**



**You must have:**

- a ruler (cm/mm)
- the Data Sheet (for GCSE Chemistry A (inserted))

**You may use:**

- a scientific or graphical calculator
- an HB pencil



First name

Last name

Centre number

Candidate number

**INSTRUCTIONS**

- The data sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

**INFORMATION**

- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- Quality of extended responses will be assessed in questions marked with an asterisk (\*).
- This document consists of **28** pages.

**SECTION A**

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

**1** Which of these pH values shows the pH of a strong acid?

- A** 1
- B** 5
- C** 7
- D** 10

Your answer

[1]

**2** Which of these general properties correctly describes a metal?

- A** Ductile and good conductor of heat
- B** High density and forms negative ions
- C** Malleable and low density
- D** Shiny and brittle

Your answer

[1]

**3** A number of scientists contributed to the development of the atomic model.

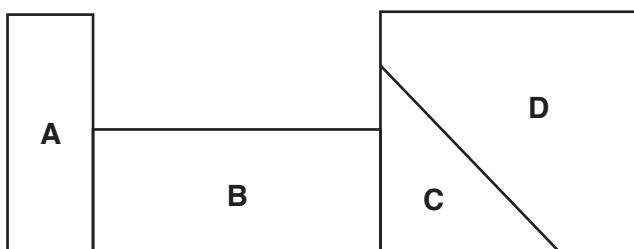
Which of these scientists discovered the electron?

- A** Bohr
- B** Dalton
- C** Rutherford
- D** Thomson

Your answer

[1]

4 This is a section of the Periodic Table.



In which section of the Periodic Table would you find **non-metals**?

Your answer

[1]

5 What is the typical size of the radius of an atom?

A  $10^{-2}$  m

B  $10^{-5}$  m

C  $10^{-10}$  m

D  $10^{-20}$  m

Your answer

[1]

6 Lead nitrate contains lead ions,  $\text{Pb}^{2+}$ , and nitrate ions,  $\text{NO}_3^-$ .

What is the formula for lead nitrate?

A  $\text{PbNO}_3$

B  $\text{Pb}(\text{NO}_3)_2$

C  $\text{Pb}_2\text{NO}_3$

D  $\text{Pb}_2(\text{NO}_3)_2$

Your answer

[1]

7 Look at the equation.



Which substance is **oxidised** in this reaction?

- A  $\text{CH}_4$
- B  $\text{CO}_2$
- C  $\text{H}_2\text{O}$
- D  $\text{O}_2$

Your answer

[1]

8 Look at the equation.



Which substance is the **oxidising agent** in this reaction?

- A  $\text{CH}_4$
- B  $\text{CO}_2$
- C  $\text{H}_2\text{O}$
- D  $\text{O}_2$

Your answer

[1]

9 Which statement about **covalent** bonding is true?

- A Electrons are transferred from one atom to another.
- B Electrons are delocalised.
- C Electrons are shared between atoms.
- D Ions are formed.

Your answer

[1]

10 The electronic structure of an atom of an element is 2.8.8.2.

In which **period** of the Periodic Table is this element found?

- A 1
- B 2
- C 4
- D 8

Your answer

[1]

11 The electronic structure of an atom of an element is 2.8.8.2.

In which **group** of the Periodic Table is this element found?

- A 1
- B 2
- C 4
- D 8

Your answer

[1]

12 What is the name of the gas made when zinc carbonate reacts with hydrochloric acid?

- A Carbon dioxide
- B Chlorine
- C Hydrogen
- D Oxygen

Your answer

[1]

13 Which equation represents **neutralisation**?

- A  $2\text{H}^+ \longrightarrow \text{H}_2$
- B  $\text{H}_2\text{O} \longrightarrow \text{H}^+ + \text{OH}^-$
- C  $\text{H}^+ + \text{OH}^- \longrightarrow \text{H}_2\text{O}$
- D  $2\text{OH}^- \longrightarrow \text{O}_2 + \text{H}_2$

Your answer

[1]

14 Which of these statements about nanoparticulate materials is correct?

- A Nanoparticles are much smaller than atoms.
- B Nanoparticulate materials can be used as catalysts.
- C Nanoparticulate materials have a very small surface area to volume ratio.
- D There are no risks when using nanoparticulate materials.

Your answer

[1]

15 Ethanol is a liquid at room temperature. It has a low melting point and boiling point.

Why?

- A Ethanol is an ionic compound.
- B The forces of attraction between ethanol molecules are strong.
- C The forces of attraction between ethanol molecules are weak.
- D There are no forces of attraction between ethanol molecules.

Your answer

[1]

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## SECTION B

Answer **all** the questions.

16 A student investigates the energy changes during some chemical reactions.

She measures the temperature at the start and end of each reaction.

Look at her results.

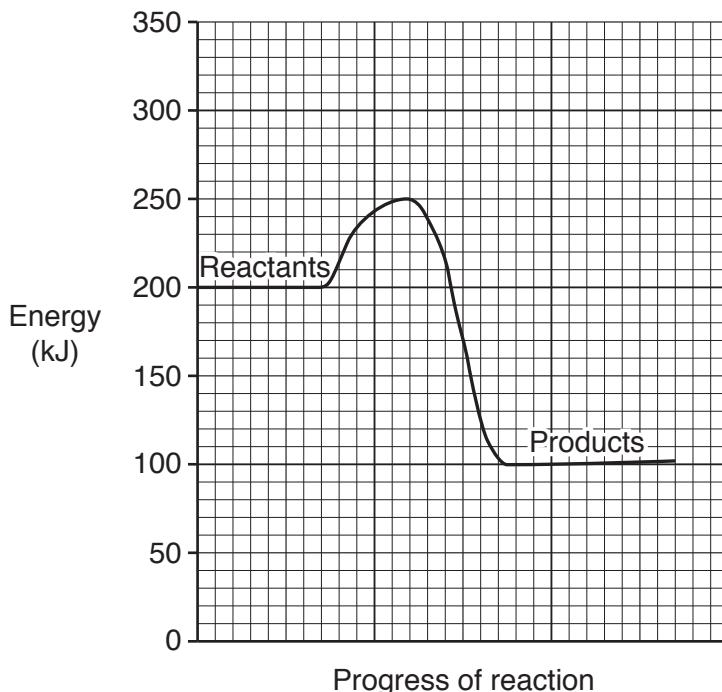
Reaction	Temperature at start (°C)	Temperature at end (°C)	Temperature change (°C)	Type of reaction
A	20	25	.....	Exothermic
B	18	10	.....	.....
C	21	35	.....	.....
D	20	20	.....	No reaction

(a) Complete the table. [3]

(b) Which reaction has the largest energy change?

Answer = ..... [1]

(c) Look at the reaction profile for reaction A.



(i) Calculate the energy change in this reaction.

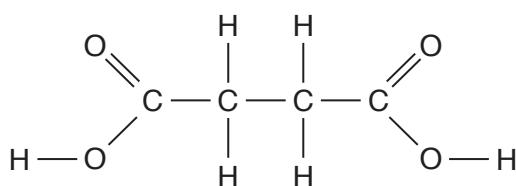
Answer = ..... kJ [1]

(ii) Calculate the activation energy.

Answer = ..... kJ [1]

10

17 Look at the diagram. It shows the displayed formula of succinic acid.



(a) Complete the table to show the number of atoms of each element in this displayed formula.

Element	Number of atoms
C	.....
H	.....
O	.....

[2]

(b) What is the **empirical formula** of succinic acid?

..... [1]

(c) Succinic acid has a melting point of 184 °C and a boiling point of 235 °C.

What is the state of succinic acid at 25 °C?

Explain your answer.

..... [2]

18 A student is separating some mixtures. She wants to make pure water from a solution of salt water. She filters the mixture.

Her method does not work.

(a) Explain why her method does not work and describe the method she should use.

.....  
.....  
.....  
.....

[2]

(b) The student wants to separate a mixture of two liquids.

The liquids are:

Liquid	Boiling point (°C)
Water	100
Ethanol	78

Which separation technique should she use?

Explain how the method works.

.....  
.....  
.....  
.....

[2]

12

(c) The student separates two solid substances **A** and **B**. She wants to check that they are **pure**.

(i) What is meant by a **pure solid**?

..... [1]

(ii) The student measures the melting points of four samples of solid **A**.

Look at her results.

Sample	Melting point (°C)
1	115
2	119
3	114–118
4	120–122

She knows that a pure sample of solid **A** has a melting point of 120 °C.

She concludes that sample 4 is the purest sample of solid **A**.

Do the results support her conclusion?

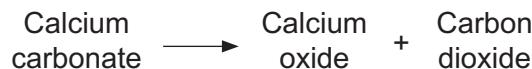
Explain your answer using evidence from the table.

.....  
.....  
.....  
.....  
.....

[3]

19 Two students heat some calcium carbonate,  $\text{CaCO}_3$ .

Look at the equation for the reaction.



(a) What is the meaning of (s) in the equation?

..... [1]

(b) Look at their results.

Mass of calcium carbonate (g)	Mass of calcium oxide (g)	Mass of carbon dioxide (g)
1.00	0.56	0.44
2.00	1.12	0.88
3.00	1.68	1.32
4.00	2.24	.....

Complete the table.

[1]

(c) Student A states:

'If I heat 20 g of calcium carbonate, I will make 8.8 g of calcium oxide and 11.2 g of carbon dioxide.'

Is student A correct?

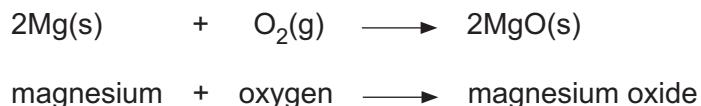
Explain your answer.

.....  
.....  
.....

[2]

(d) Student B investigates another reaction.

Look at the equations.



(i) Calculate the relative formula mass of magnesium oxide.

Answer = ..... [1]

(ii) Use the relative formula mass of magnesium oxide and the relative atomic masses of magnesium and oxygen to show if mass is conserved during this reaction.

.....  
.....  
.....

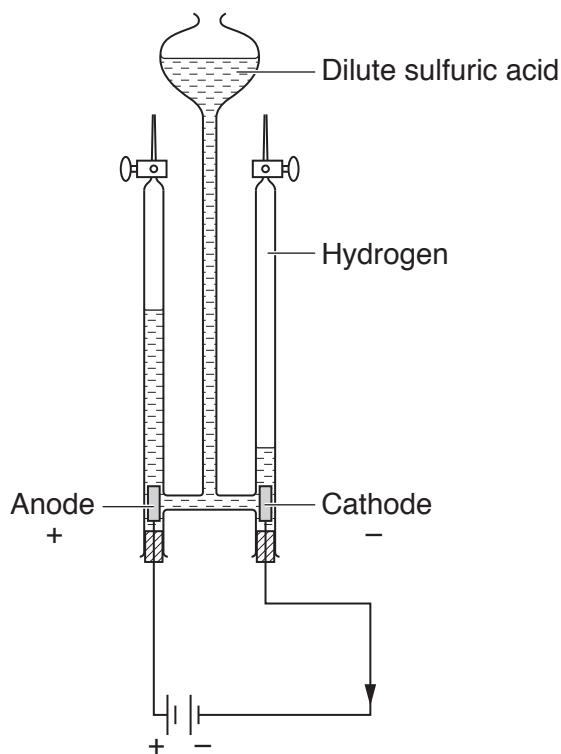
[2]

15

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20 A student electrolyses dilute sulfuric acid.



Hydrogen gas is made at the cathode.

The student measures the volume of hydrogen made at the cathode every 2 minutes for 10 minutes.

Look at his results.

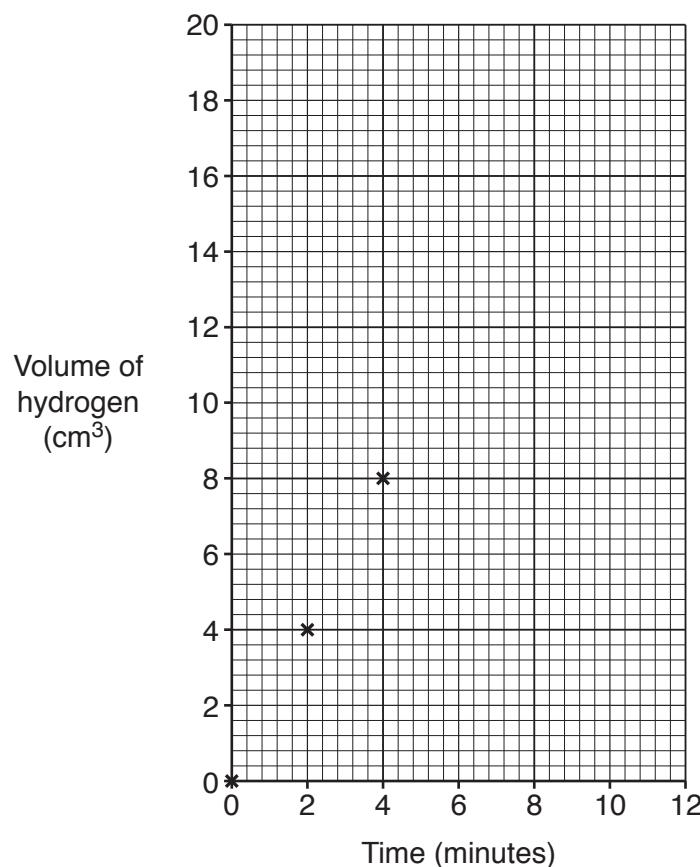
Time (minutes)	Volume of hydrogen (cm <sup>3</sup> )
0	0.0
2	4.0
4	8.0
6	14.0
8	16.0
10	20.0

17

(a) Plot the results on the grid. The first 3 points have been done for you.

Draw a line of best fit.

[2]



(b) One of the results is **anomalous**.

Circle the anomalous result on the graph.

[1]

(c) Sulfuric acid contains these particles.



Which particles are attracted to the **anode**?

..... [1]

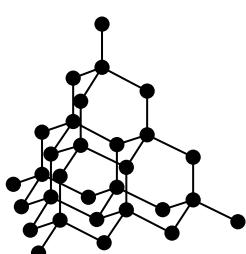
(d) The student also investigates the electrolysis of some molten (liquid) salts.

Complete the table.

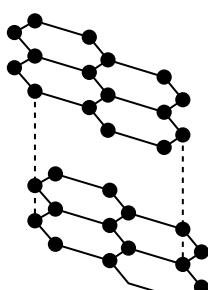
Molten salt	Formula	Product at cathode	Product at anode
Potassium chloride	$\text{KCl}$	Potassium	.....
Lead iodide	$\text{PbI}_2$	.....	Iodine

[2]

21 The diagrams show the structures of diamond and graphite.



**Diamond**



**Graphite**

One property of diamond is that it is very hard. One property of graphite is that it is slippery.

(a) Write about the other properties of diamond and graphite.

Diamond .....

.....

Graphite .....

..... [4]

(b) Describe the type of bonding between the carbon atoms in diamond.

..... [1]

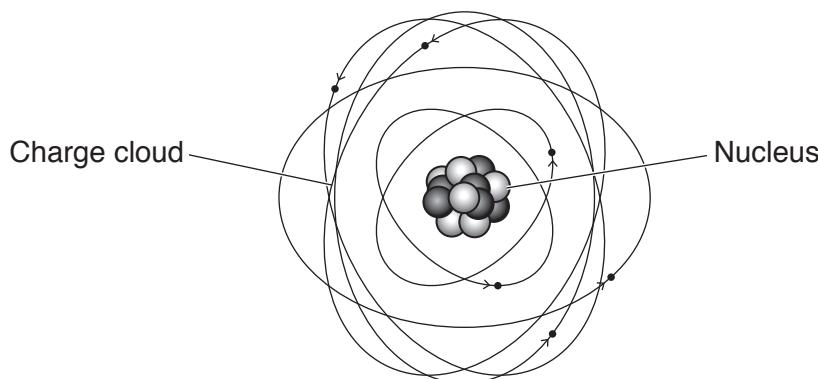
(c) Graphite is slippery.

Use the structure of graphite to explain why.

.....

..... [2]

22 Look at the diagram of an atom.



(a) Which particles are present in the charge cloud?

..... [1]

(b) Which **two** particles make up the nucleus?

..... and ..... [1]

(c) Most of the mass of an atom is in the nucleus.

Explain why.

.....  
.....  
..... [2]

(d) Look at these two atoms of chlorine.



What is the relationship between these two atoms of chlorine?

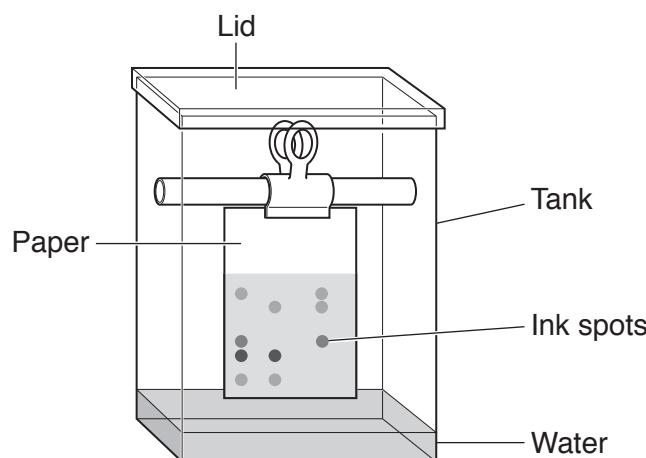
Explain your answer.

.....  
.....  
..... [2]

23 A forensic scientist is investigating the ink that has been used to forge the signature on a cheque.

She separates the colours in some inks using paper chromatography.

Look at the diagram of her apparatus.



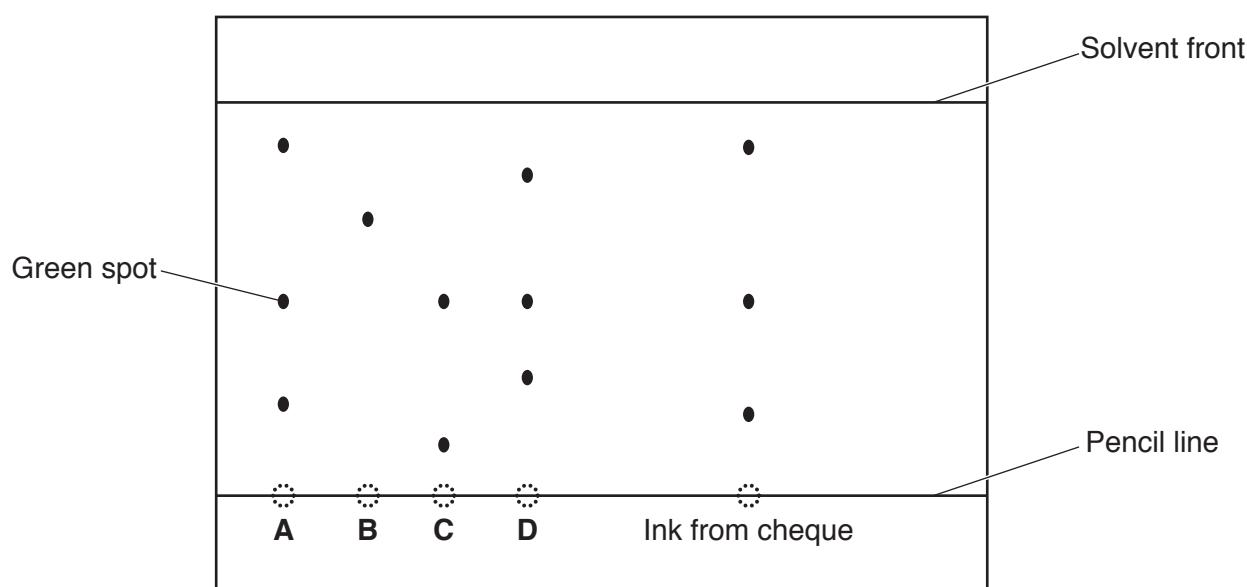
(a) What is the **mobile phase** in this experiment?

..... [1]

(b) Explain how paper chromatography separates the colours in ink.

..... [1]

(c) Look at the results of the scientist's experiment.



21

(i) Look at the green spot for ink A.

Calculate the  $R_f$  value for the green spot.

Answer = ..... [2]

(ii) Which ink was used to forge the signature on the cheque?

Explain how you can tell.

.....  
.....  
.....

[2]

**24\*** Look at the data about some substances.

Substance	Melting point (°C)	Boiling point (°C)	Does it conduct Electricity?	Density (g/cm³)
A	0	100	No	1.0
B	1085	2562	Good conductor	9.0
C	801	1413	Solid does not conduct but conducts when melted or when dissolved in water	2.2

What is the type of **bonding** present in each of substances **A**, **B** and **C**?

Explain how you can tell.

[6]

23

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25 Magnesium is an element. It is solid at room temperature.

(a) (i) **Solid** magnesium cannot be compressed.

Why?

..... [1]

(ii) **Solid** magnesium **cannot** flow, but **liquid** magnesium **can** flow.

Explain why.

.....  
.....  
.....  
..... [3]

(iii) Magnesium **gas** completely fills any container it is put in.

Explain why.

.....  
.....  
..... [2]

(b) Magnesium reacts with water. Magnesium hydroxide,  $Mg(OH)_2$ , and hydrogen,  $H_2$ , are made.

Write a balanced symbol equation for this reaction.

..... [2]

(c) Magnesium nitrate has the formula  $Mg(NO_3)_2$ .

Calculate the relative formula mass of magnesium nitrate.

Answer = ..... [1]

25

26 A student has a solution of hydrochloric acid,  $\text{HCl}$ , and a solution of sodium hydroxide,  $\text{NaOH}$ .  
He wants to make a pure, dry sample of sodium chloride.

(a) Describe how he can do this.

Include the apparatus he should use and his method.

41

(b) Write a **balanced symbol** equation for the reaction.

11

(c) The student also investigates other reactions.

The table shows the salts he can make from different starting materials.

Complete the table

Acid used	Other starting material	Salt made
Sulfuric acid	Copper oxide	.....
.....	Zinc carbonate	Zinc nitrate
Hydrochloric acid	.....	Magnesium chloride

〔3〕

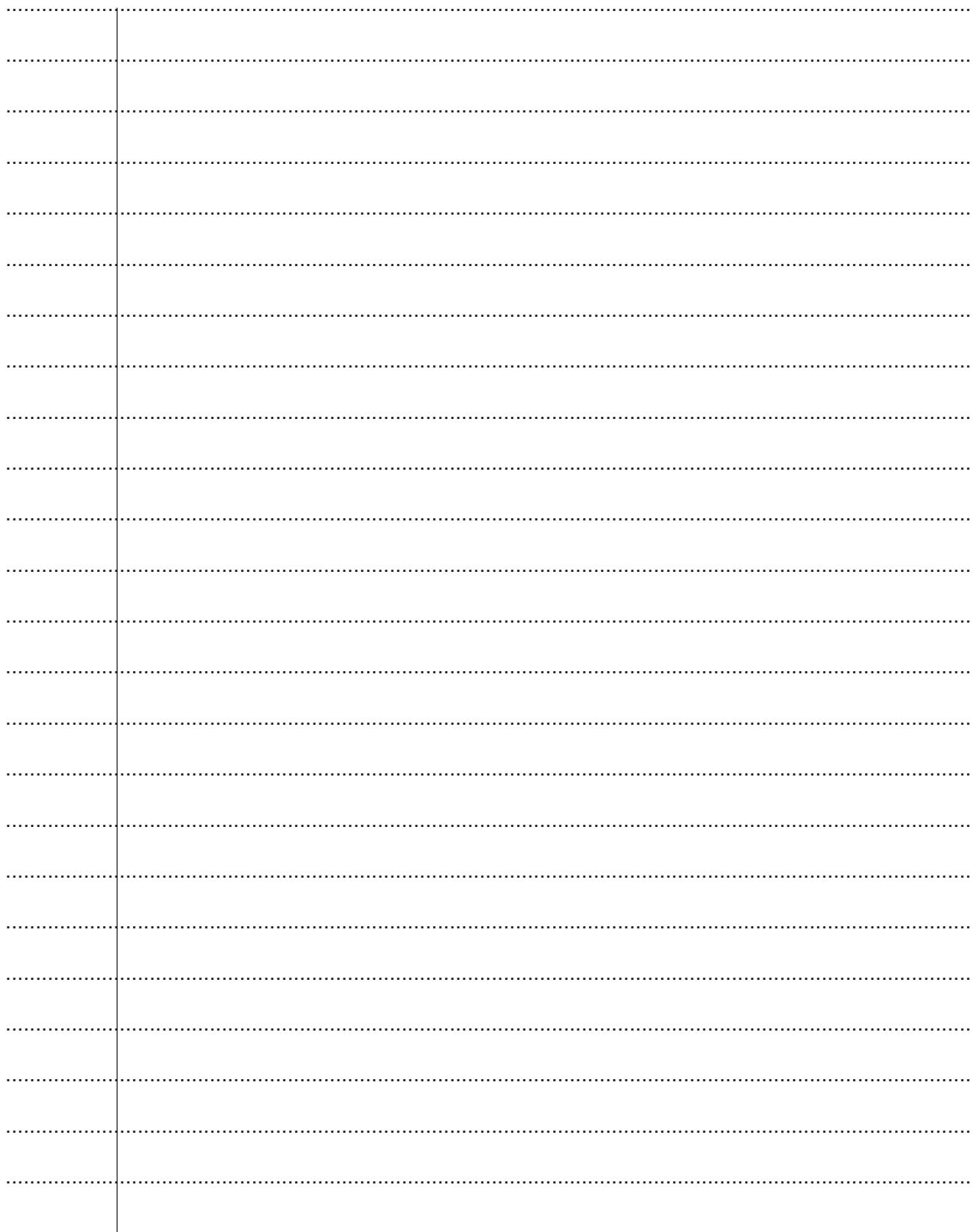
(d) What **type** of reaction happens when sulfuric acid reacts with copper oxide?

11

END OF QUESTION PAPER

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).





This image shows a blank sheet of handwriting practice paper. It features a vertical red line on the left side, likely representing a margin. To the right of this margin, there are 22 horizontal grey lines spaced evenly down the page, intended for practicing letter formation and alignment.



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