

OCR

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**GCSE (9–1) Combined Science
(Chemistry) A (Gateway Science)
J250/04 Paper 4 (Foundation Tier)
Sample Question Paper**

F**Date – Morning/Afternoon**

Time allowed: 1 hour 10 minutes

You must have:

- the Data Sheet

You may use:

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre
numberCandidate
number**INSTRUCTIONS**

- 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.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **60**.
- 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 **24** pages. Any blank pages are indicated.

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

- 1 Some students want to clean a sample of muddy water.

What is the first technique they would use?

- A crystallisation
- B evaporation
- C filtration
- D sedimentation

Your answer

[1]

- 2 The following statements are about pollutants in the air.

One of the statements is **incorrect**.

Which one?

- A Carbon monoxide is a toxic gas made by the incomplete combustion of fuel in a car engine.
- B Oxides of nitrogen are made when nitrogen combines with hydrogen in a car engine.
- C Sulfur dioxide is made when sulfur impurities in fossil fuels burn.
- D Particulates are tiny pieces of carbon made when petrol or diesel burns in a car engine.

Your answer

[1]

- 3** Liz adds small pieces of metal to some samples of acid.
She uses the same volume and concentration of acid every time.
She times how long it takes for the reaction to finish.
Look at her results.

Metal	Time taken for reaction to finish in seconds
iron	62
calcium	26
zinc	35
lithium	15

Liz does another experiment. This time she adds a small piece of sodium to the acid.

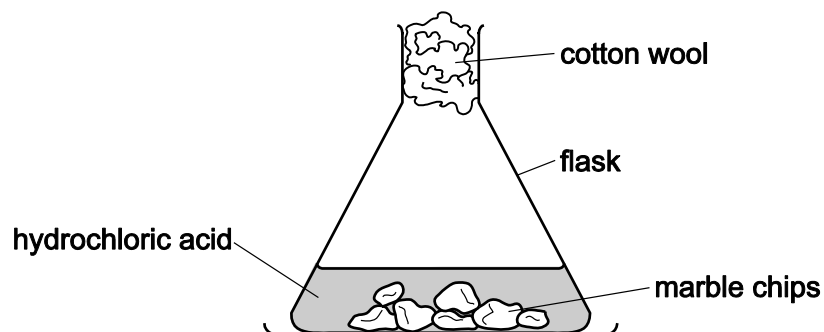
What is the best prediction for the time taken for this reaction to finish?

- A** 8 s
B 15 s
C 20 s
D 40 s

Your answer

[1]

- 4 Phil is investigating the reaction between marble chips and dilute hydrochloric acid.



He wants to increase the rate of the reaction.

Which of these would increase the rate of this reaction?

- A increase the size of the marble chips
- B use hydrochloric acid at a lower temperature
- C add water to the reaction mixture
- D use a more concentrated hydrochloric acid solution

Your answer

[1]

- 5 Crude oil is a mixture of straight chain alkanes. What is the molecular formula of hexane that has a chain length of six carbon atoms?

- A C_6H_6
- B C_6H_{12}
- C C_6H_{14}
- D C_6H_{24}

Your answer

[1]

6 Aluminium is extracted from its ore by electrolysis.

Which of these statements **explains** why aluminium can only be extracted by electrolysis?

- A Aluminium is higher than iron in the reactivity series.
- B Aluminium is lower than carbon in the reactivity series.
- C Aluminium is higher than carbon in the reactivity series.
- D Aluminium is lower than sodium in the reactivity series.

Your answer

[1]

7 Which relative molecular mass, M_r , is **not** correct for the molecule given?

	Molecule	M_r
A	Ammonia, NH_3	17.0
B	Carbon dioxide, CO_2	44.0
C	Methane, CH_4	16.0
D	Oxygen, O_2	16.0

Your answer

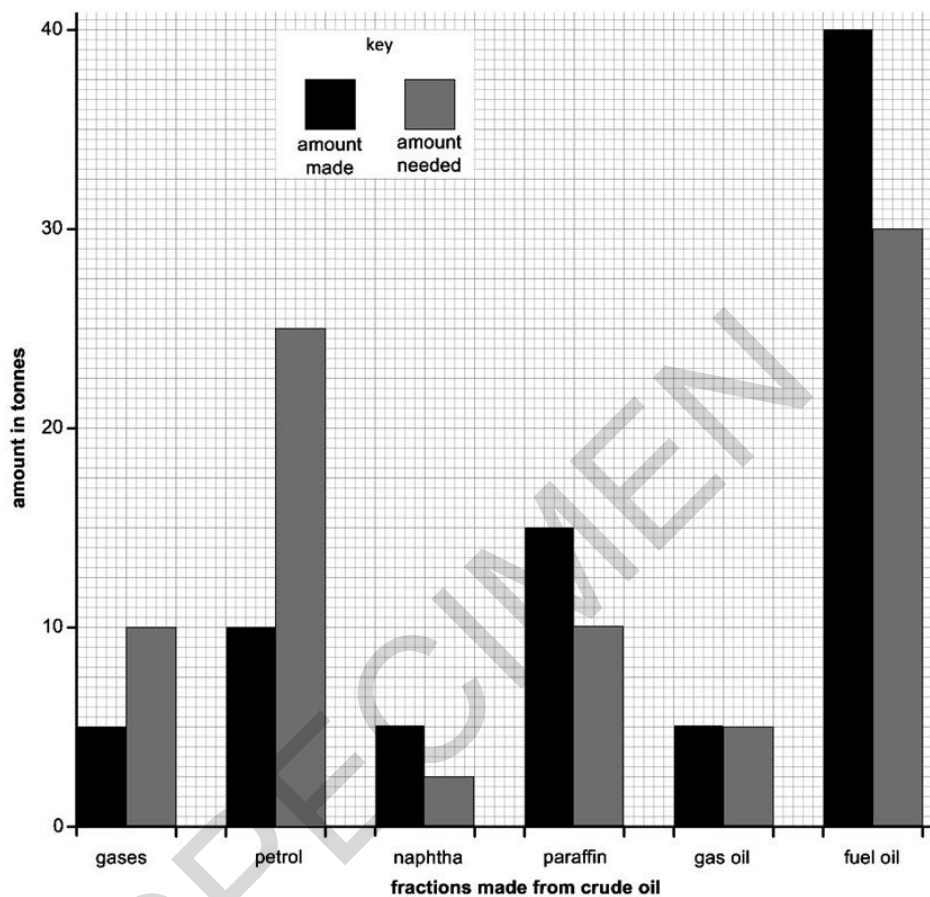
[1]

8 Fractional distillation separates the substances in crude oil into useful fractions in a refinery.

Look at the bar chart.

It shows the amount of some of the fractions made from 100 tonnes of crude oil.

It also shows the amount of each fraction needed for everyday uses.



Cracking converts large molecules into smaller more useful molecules to make supply meet demand.

What percentage of petrol is produced by cracking?

- A 25%
- B 40%
- C 50%
- D 60%

Your answer

[1]

- 9 Which row in the table gives correct information about sulfur dioxide?

	Source	Problem caused
A	incomplete combustion of fuel	acid rain
B	combustion of impurities in fuel	acid rain
C	incomplete combustion of fuel	leaves solid deposits on buildings
D	high temperature reaction between gases in the air	leaves solid deposits on buildings

Your answer

[1]

- 10 Look at the table.

It shows some fractions made from the fractional distillation of crude oil and their boiling ranges.

Fraction	Boiling range (°C)
LPG	less than 25
petrol	85 – 110
diesel	150 – 290
fuel oil	290 – 390
bitumen	greater than 400

A hydrocarbon called eicosane has a boiling point which is 3.5 times the boiling point of petrol.

To which fraction does eicosane belong?

- A** diesel
- B** LPG
- C** fuel oil
- D** bitumen

Your answer

[1]

SECTION B

Answer **all** the questions.

- 11 (a) Describe what is meant by the greenhouse effect.

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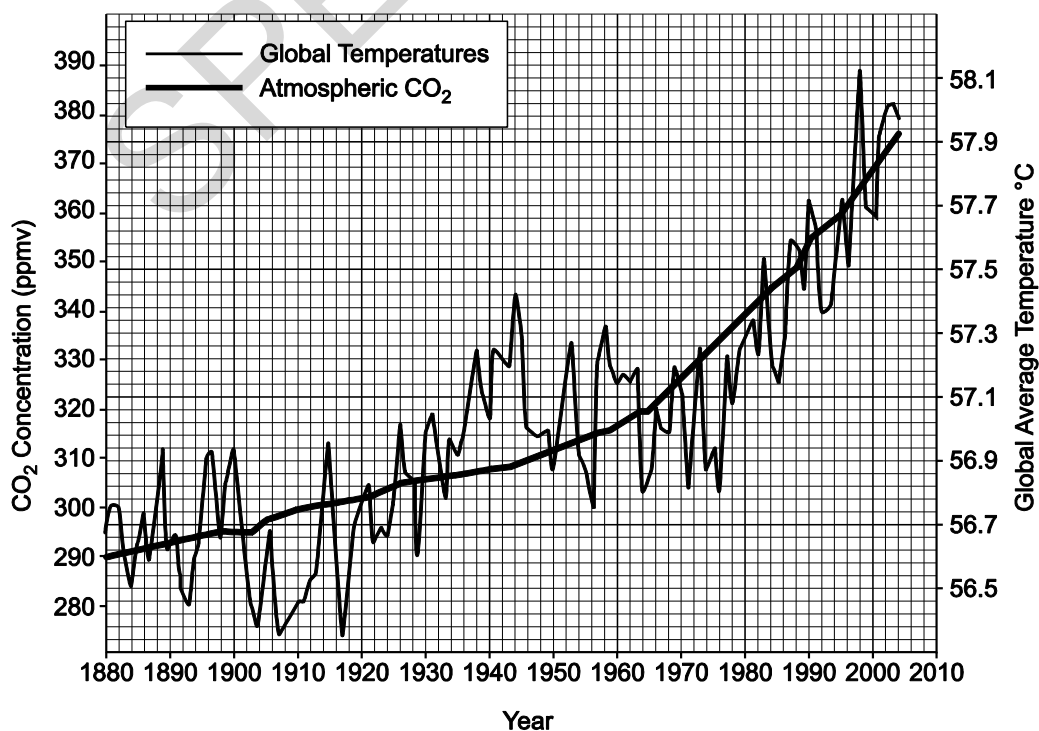
[2]

- (b) Look at the graph.

It shows how

- global temperatures
- atmospheric carbon dioxide, CO₂, levels

changed between 1880 and 2005.



Calculate how much the atmospheric CO₂ increases from 1900 to 1960.

increase in atmospheric CO₂ ppmv

[2]

SPECIMEN

12 Harry investigates the reaction between zinc and sulfuric acid, H_2SO_4 .

Zinc sulfate, ZnSO_4 is made.

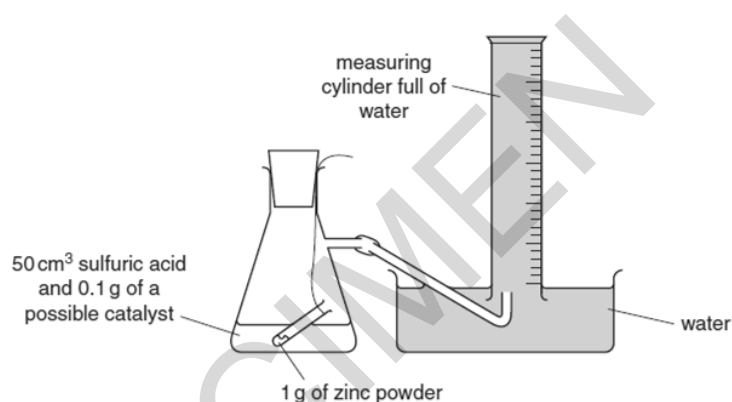
(a) Write a balanced symbol equation for this reaction.

..... [1]

(b) Harry does several experiments.

He wants to find a substance that is a catalyst for the reaction.

The diagram shows the apparatus he uses.



The flask is shaken to start the reaction.

Harry records the time taken to collect 50 cm^3 of gas.

Look at the table. It shows Harry's results.

Possible catalyst used	Appearance of catalyst	Time to collect 50 cm^3 of gas in seconds	Other observations
no catalyst added		65	colourless solution made
copper sulfate	blue solid	10	colourless solution made and the zinc powder was coated with a pink solid
copper powder	red-brown powder	19	red-brown powder remains
copper lumps	red-brown lumps	56	red-brown lumps left behind
sodium chloride	white solid	65	colourless solution made

Which **two** substances could Harry use as a catalyst for the reaction?

Explain your answer. Use information from the table to help you.

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..... [3]

(c) Explain how a catalyst works using ideas about activation energy.

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..... [2]

(d) Calculate the rates of reaction when copper powder and copper lumps are used.

Give your answer to **three** significant figures.

Give an explanation for the difference in the rates.

copper powder

copper lumps

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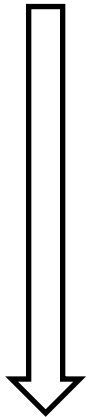
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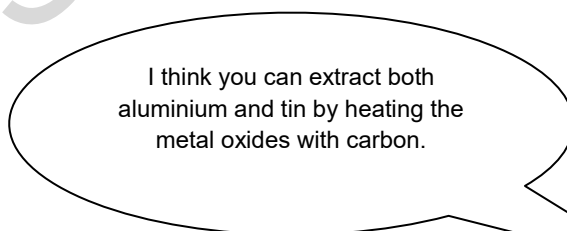
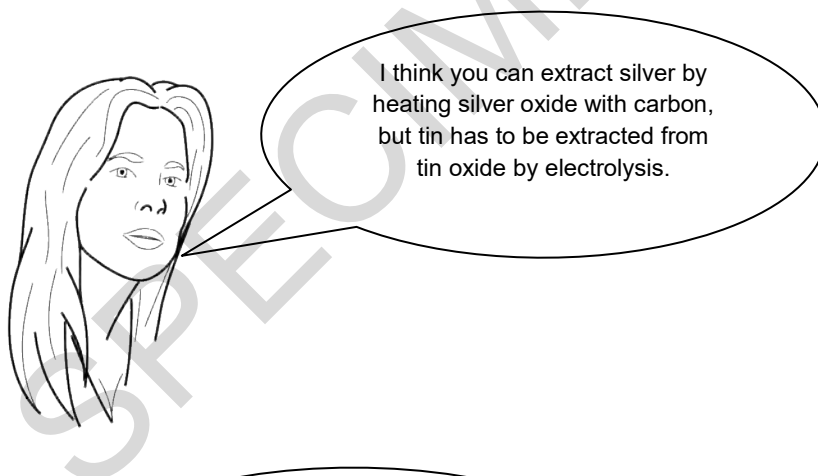
13 Sarah and Jon want to extract some metals from their ores.

Look at the reactivity series of some metals.

The element carbon is also included in the reactivity series.

sodium	MOST REACTIVE
calcium	
aluminium	
carbon	
tin	
copper	
silver	
gold	
LEAST REACTIVE	

Sarah and Jon make some predictions.

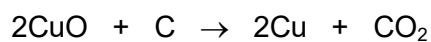


- (a) Comment on which part of each prediction is correct.

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- (b) Copper is extracted by heating copper oxide, CuO, with carbon.

Look at the equation for the reaction.



Copper oxide is **reduced** in this reaction.

How can you tell?

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..... [1]

SPECIMEN

14 This question is about life-cycle assessment.

(a) Describe the stages in a life-cycle assessment.

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(b) A supermarket is considering whether to sell plastic or paper carrier bags to customers for their shopping.

They do a life-cycle assessment of both plastic and paper carrier bags.

Look at the table. It gives some information from the life-cycle assessments.

	Plastic bag	Paper bag
Total energy use in MJ	2622	763
Fossil fuel use in kg	23.2	14.9
Solid waste produced in kg	7.0	33.9
Greenhouse gas emissions in tonnes	0.08	0.04
Fresh water use in litres	264	4564

(i) How many more times is fresh water used to make paper bags than is used to make plastic bags?

Give your answer to the nearest whole number.

..... more times

[1]

- (ii) Even though more fresh water is used, the supermarket decides to sell paper bags to its customers.

Explain why this is the best decision. Use information from the table to help you.

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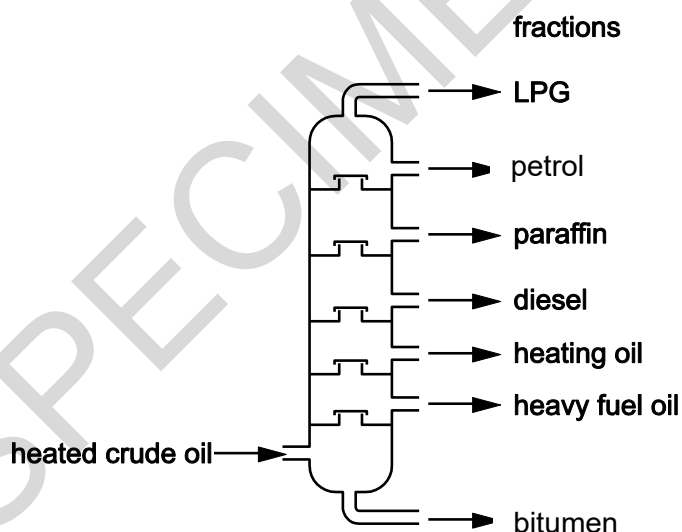
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- (c) The plastic for the carrier bags is made from crude oil.

Crude oil is separated into different parts by **fractional distillation**.

Look at the diagram.

It shows a fractionating column.



Crude oil contains a mixture of hydrocarbons that boil at different temperatures.

Describe **how** crude oil can be separated using a fractionating column.

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(d) Fractional distillation separates fractions because they have different boiling temperatures.

Explain why the fractions have different boiling temperatures.

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..... [2]

SPECIMEN

15 The Group 7 elements are called the halogens.

Look at the table.

It shows some information about the halogens.

Element	Colour	State at room temperature	Melting point in °C	Boiling point in °C
fluorine	pale yellow	gas	-188
chlorine	pale green	gas	-101	-35
bromine	orange	liquid	-7	59
iodine	dark grey	solid	114	184
astatine	black	solid	302

(a) Use ideas about trends down a group to complete the table to predict

- the **melting point** of fluorine
- the **boiling point** of astatine.

[2]

(b) Why do Group 7 elements all react in a similar way?

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[1]

(d) Sodium chloride is made by reacting sodium with chlorine.

Alison wants to obtain solid sodium chloride from a solution of sodium chloride.

She suggests filtering the solution.

Alison will not obtain solid sodium chloride by this method.

Suggest what method Alison should use.

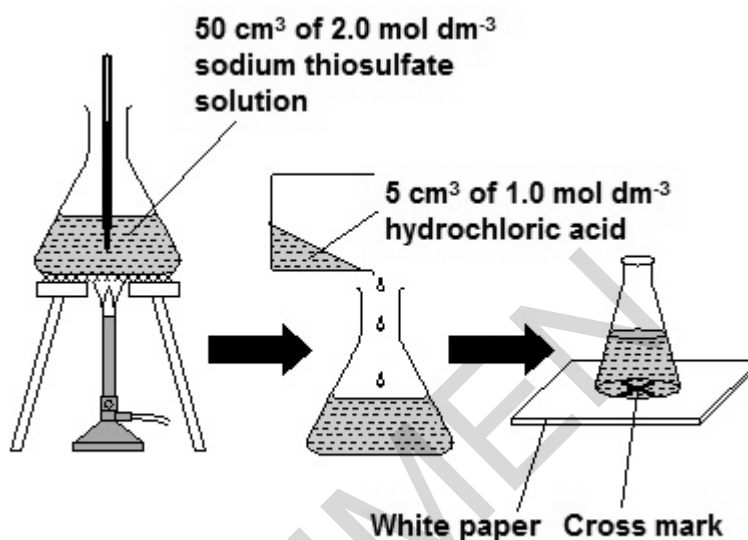
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SPECIMEN

16 This question is about rates of reaction.

Mark investigates the reaction between sodium thiosulfate and hydrochloric acid at different temperatures.

(a) Look at how Mark does the experiment.



1. He measures 50 cm³ of sodium thiosulfate into the conical flask and heats it to the required temperature. He records the temperature.
2. He takes the flask off the tripod and gauze and places it on the bench.
3. He adds 5 cm³ of hydrochloric acid and then places the flask on the cross.
4. He times how long it takes for the cross to disappear.

How should Mark improve his method?

Explain your answer.

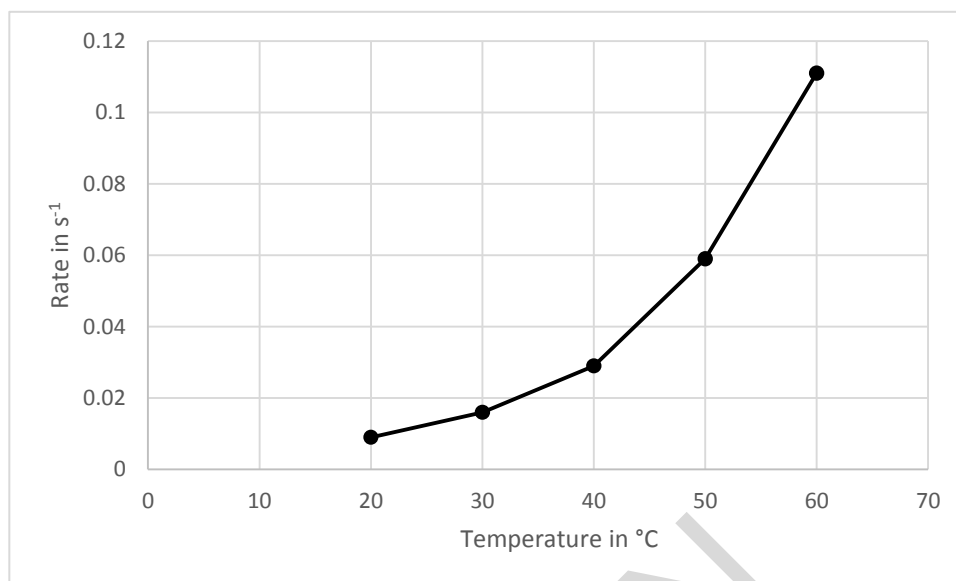
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- (b) Look at the graph. It shows Mark's results at different temperatures.



When is the reaction fastest?

Use the graph to explain your answer.

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- (c) Explain why the rate of reaction of sodium thiosulfate and hydrochloric acid is different at different temperatures.

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..... [2]

17 This question is about the reactivity series of metals.

Kevin heats mixtures of metals and metal oxides.

Look at the table. It shows Kevin's results.

	Magnesium, Mg	Lead, Pb	Iron, Fe	Copper, Cu
Magnesium oxide, MgO	no reaction	no reaction	no reaction	no reaction
Copper oxide, CuO	magnesium oxide and copper formed	lead oxide and copper formed	iron oxide and copper formed	no reaction
Lead oxide, PbO	magnesium oxide and lead formed	no reaction	iron oxide and lead formed	no reaction
Iron oxide, Fe₂O₃	magnesium oxide and iron formed	no reaction	no reaction	no reaction

(a) Use Kevin's results to deduce an order of reactivity for the metals.

Explain how you used the results to put the metals in order of reactivity.

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[4]

(b) In another experiment, Kevin reacts copper with silver nitrate, AgNO₃.

Silver and copper nitrate, Cu(NO₃)₂, are formed.

Write a **balanced symbol** equation for the reaction.

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[2]

END OF QUESTION PAPER