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**GCSE (9–1) Combined Science
(Chemistry) A (Gateway Science)
J250/03 Paper 3 (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 **20** pages. Any blank pages are indicated.

SECTION A

Answer **all** the questions.

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

1 What is the name of a reaction that releases heat energy into the surroundings?

- A endothermic
- B exothermic
- C oxidation
- D reduction

Your answer

[1]

2 Julie investigates the combustion of four liquid fuels.

She uses 1.0 g of each fuel.

Look at her results.

	Fuel	Temperature of water (°C)	
		before heating	after heating
A	butanol	21	41
B	ethanol	21	39
C	methanol	15	37
D	propanol	22	43

Which fuel releases the **most** energy into the water?

Your answer

[1]

3 What is the relative formula mass of calcium hydroxide, $\text{Ca}(\text{OH})_2$?

Use the Periodic Table to help you.

- A 57.1
- B 58.1
- C 74.1
- D 114.2

Your answer

[1]

4 The symbol for carbon is C.

The symbol for hydrogen is H.

A compound contains one carbon atom and four hydrogen atoms.

What is the formula of the compound?

A CH₄

B CH⁴

C C₄H

D C⁴H

Your answer

[1]

5 Lead is a metal.

Which statement is true about lead **because** it is a metal?

A It is a dull grey colour.

B It is in Group 4 of the Periodic Table.

C It is in Period 6 of the Periodic Table.

D It is malleable so can be easily shaped.

Your answer

[1]

6 Which technique is the best for separating pure water from a solution of sodium chloride in water?

A crystallisation

B chromatography

C filtration

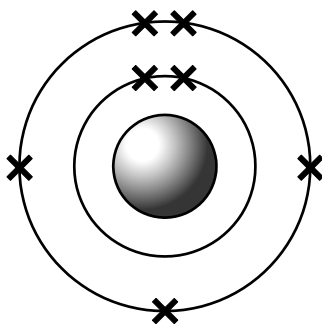
D distillation

Your answer

[1]

4

- 7 Look at the diagram of an atom of an element.



What is the position of this element in the Periodic Table?

- A It is in Group 5.
- B It is in Group 7.
- C It is in Period 5.
- D It is in Period 7.

Your answer

[1]

- 8 The **molecular formula** of benzene is C_6H_6 .

What is the **empirical formula** of benzene?

- A CH
- B C_2H_2
- C C_3H_3
- D C_6H_6

Your answer

[1]

[1]

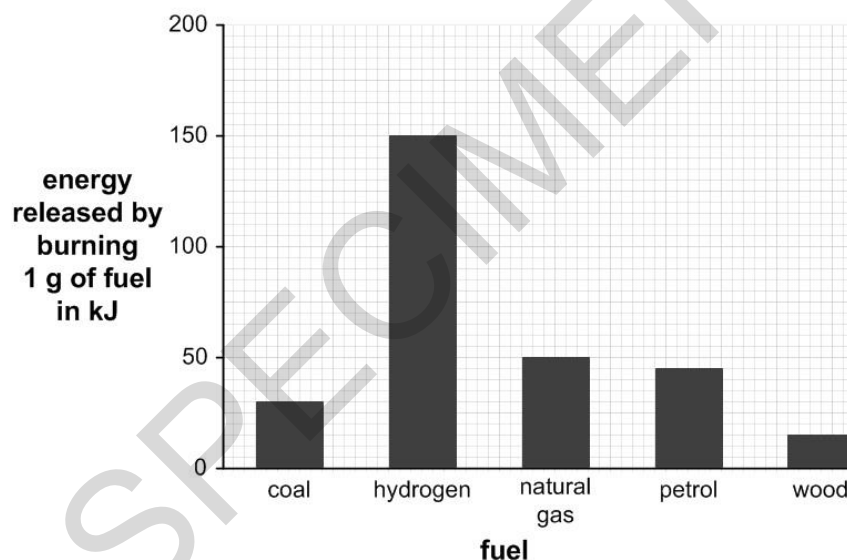
- 9 The table shows the indicator colour and pH of four different solutions of the same concentration.

Solution	Colour of universal indicator	pH
A	blue-green	10
B	orange	5
C	red	1
D	indigo	13

Which solution is a weak acid?

Your answer

- 10 The bar chart shows the amount of energy released when 1.0 g of each fuel is completely combusted. [1]



What mass of natural gas is needed to release the same amount of energy as 1.0 g of hydrogen?

- A 3.0 g
 B 3.3 g
 C 6.0 g
 D 10.0 g

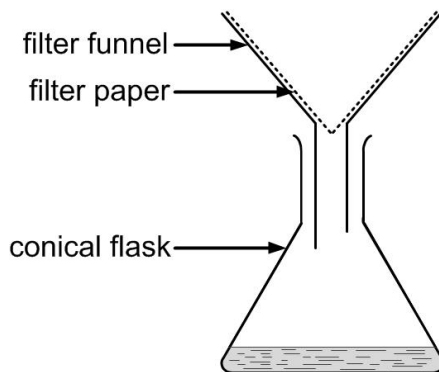
Your answer

[1]

SECTION B

Answer **all** the questions.

11 (a) Look at the diagram.



The equipment shown in the diagram can be used to separate a mixture of sand and water but cannot be used to separate salt from a solution in water.

Explain why.

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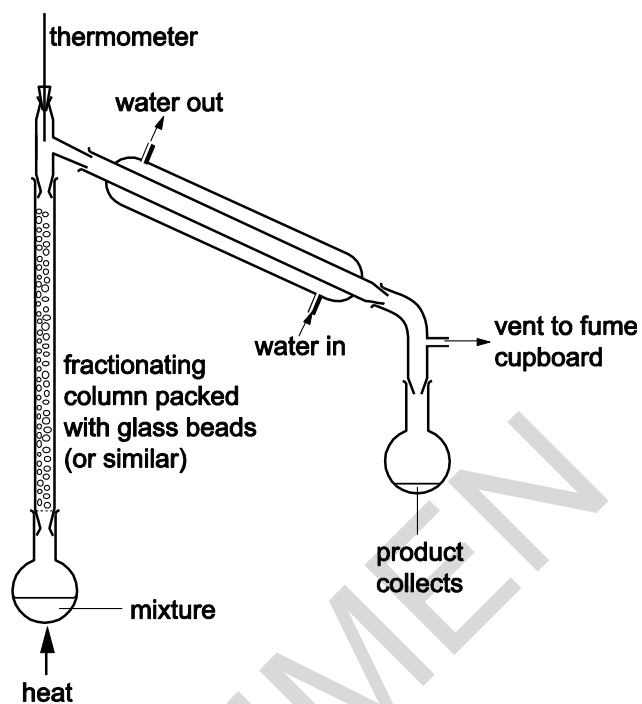
.....

[2]

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(b) Look at the diagram.

It shows equipment used for fractional distillation.



Crude oil is a mixture of liquids.

Explain how the equipment shown in the diagram can be used to separate these liquids.

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.....

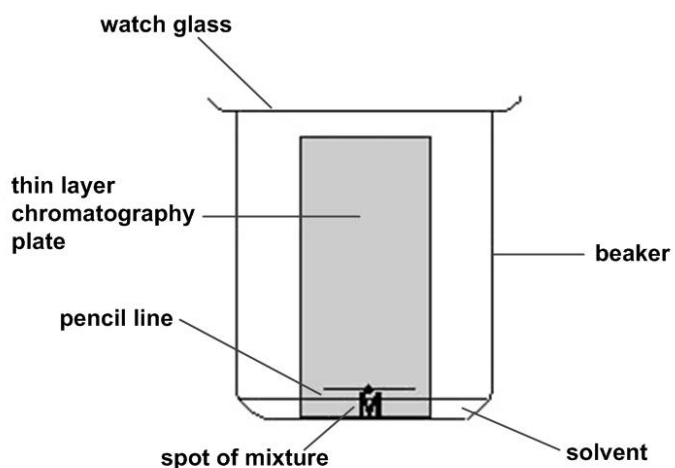
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[3]

(c) Look at the diagram of thin layer chromatography.

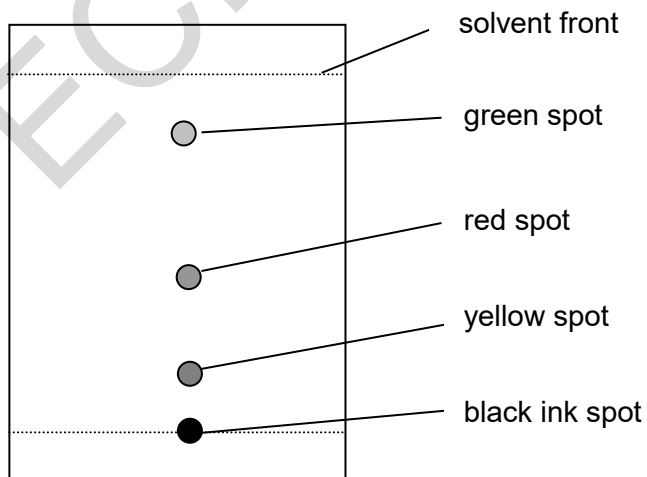


(i) The pencil line with the spot of mixture is above the level of solvent.

Why is this important?

.....
 [1]

(ii) Look at the diagram.



What is the R_f value of the green spot?

Use a ruler to help you.

R_f value = [2]

12 (a) Aluminium, Al , is heated with copper oxide, CuO .

Aluminium oxide, Al_2O_3 , and copper are made.

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

..... [2]

(ii) What are oxidation and reduction?

.....
 [1]

(iii) Which substance is reduced in this reaction?

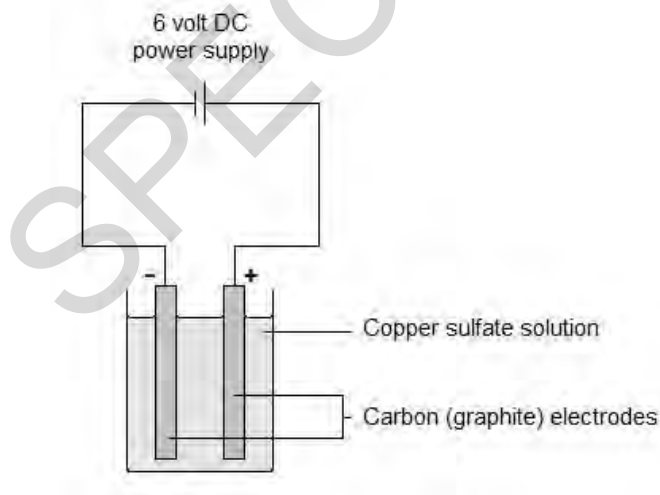
..... [1]

(iv) Which substance is oxidised in this reaction?

..... [1]

(b) Copper is also made by electrolysis of copper sulfate solution.

Look at the diagram of the apparatus used in this electrolysis.



(i) Describe what you would see at the cathode (negative electrode).

..... [1]

(ii) Molten copper chloride is electrolysed instead of copper sulfate solution.

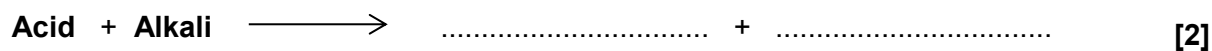
Copper is made.

Predict the **name** of the other substance that is made.

..... [1]

13 A student investigates a neutralisation reaction.

(a) Complete the general word equation for a neutralisation reaction.



(b) The student measures 25 cm³ of acid using a glass beaker. She measures the temperature of this acid.

She then adds 5 cm³ of alkali to the acid in the beaker. She records the maximum temperature obtained.

She repeats the experiments four more times using different volumes of alkali and repeats each test twice.

Look at the table of her results.

Volume of alkali (cm ³)	Temperature change (°C)			Mean temperature change (°C)
	Test 1	Test 2	Test 3	
0	0	0	0	
5	9	8	9	
10	10	11	12	
15	14	13	14	
20	18	17	17	
25	23	23	24	

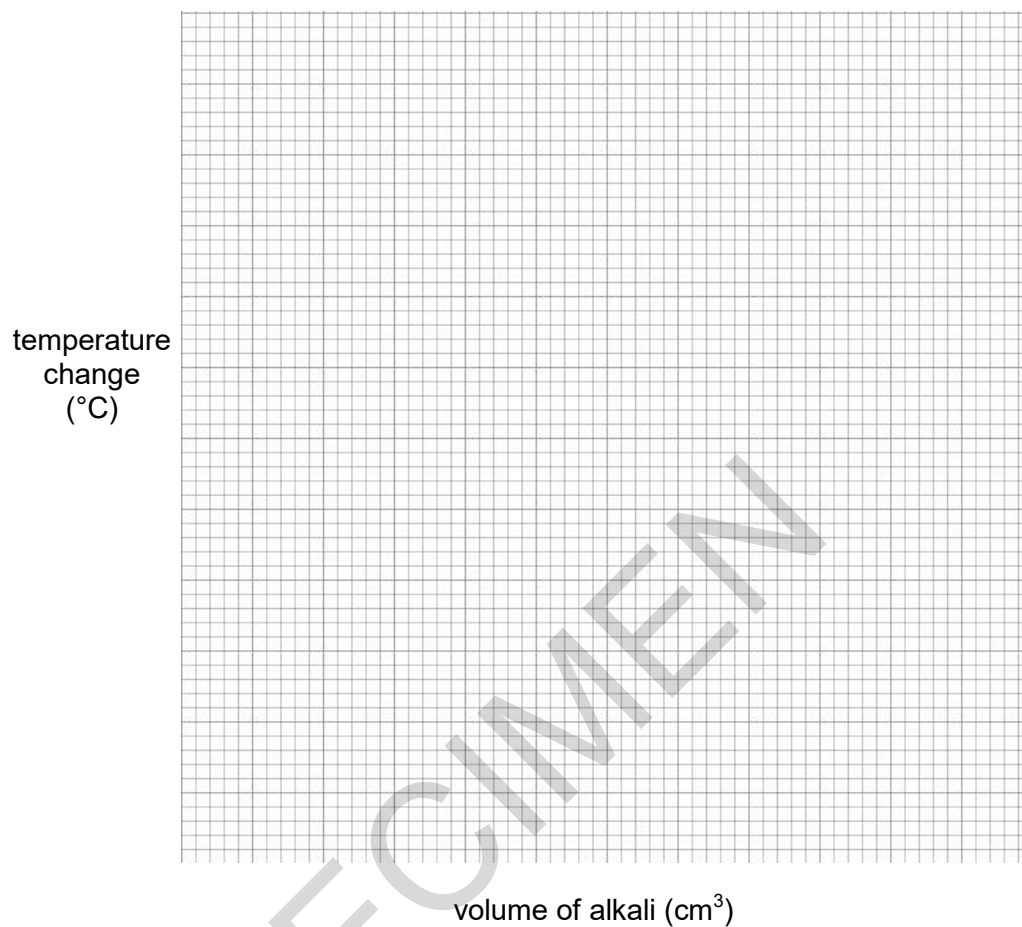
(i) Calculate the mean temperature change for 15 cm³ and write it in the space in the table.

Give your answer to one decimal place.

[2]

(ii) Plot the results from Test 1 on the grid provided.

[2]



(iii) One of the points is anomalous.

Which one?

Explain how you can tell from your graph.

.....

.....

..... [2]

(iv) Draw a line of best fit through the other points.

[1]

- (c) Her friend finds the expected temperature changes in a book.

He tells her that **all** of her temperature changes are lower than expected.

Suggest **one** improvement to her experiment and how this makes the experiment better.

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..... [2]

- (d) She wonders how the pH of the acid changes after she has added alkali to it.

- (i) Describe what she needs to do in her experiment to find the pH change at the end of the experiment.

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.....

..... [1]

- (ii) The acid and alkali react in a 1:1 ratio and are of the same concentration. What would she expect the pH to be when she has added 25 cm³ of alkali?

..... [1]

- 14 (a) Look at the information about an atom of an element.

Number of neutrons	8
Number of protons	7
Number of electrons	7

- (i) What is the mass number of the atom?

.....

[1]

- (ii) What is the name of the element?

Use the Periodic Table to help you work out the answer.

.....

[1]

- (b) Ethanol has the formula C_2H_5OH .

Show that the relative formula mass, M_r , of ethanol is 46.0.

The relative atomic mass, A_r , of C is 12.0, of H is 1.0 and of O is 16.0.

[2]

15 A scientist sees that bubbles of gas are made when he pours hydrochloric acid on to pieces of marble.

(a) The scientist thinks the gas produced is carbon dioxide.

Describe a test he would do to prove this and include the result of the test.

.....

.....

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

(b) The scientist suggests an equation for the reaction between hydrochloric acid and marble.



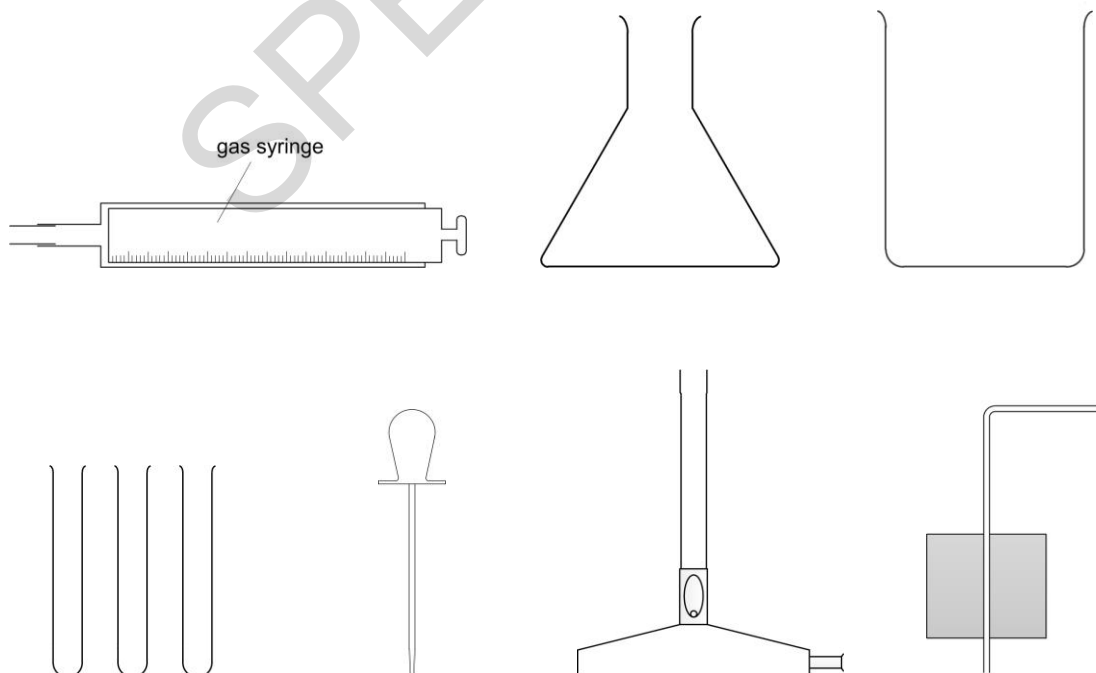
Balance the symbol equation by putting numbers in front of formulae.

You may put numbers in front of some or all of the formulae.

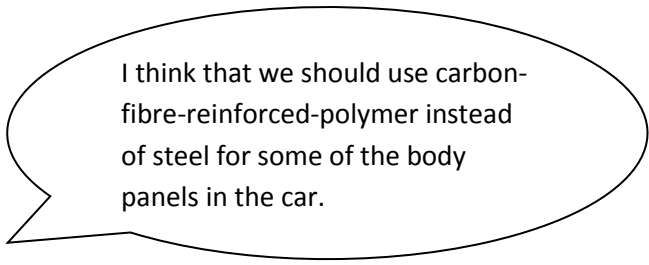
[1]

(c) The scientist wants to collect the gas.

He chooses some of the equipment shown in the diagrams.



(b) A car designer is discussing the material to use in a new car.



car designer

Discuss the arguments for and against the use of carbon-fibre-reinforced-polymer instead of steel for car body panels.

Use information from the table.

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..... [3]

(c) Power companies use aluminium wire for over-head power cables.

What are the **two** most important properties of aluminium for this use?

Use information from the table.

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..... [2]

(d) Some of the materials are alloys.

What is an alloy?

.....

..... [1]

END OF QUESTION PAPER

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