



Rewarding Learning

General Certificate of Secondary Education
2021–2022

Centre Number

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Candidate Number

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Single Award Science: Chemistry

Unit 2

Foundation Tier



[GSA21]

GSA21

THURSDAY 24 FEBRUARY 2022, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **11**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included for your use.

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24GSA2101

- 1 (a) Given below are some hazard symbols and their names.
Using lines match each symbol to its name.

Hazard symbol

Name



caution



toxic



corrosive

[2]

- (b) Give **two** reasons why using hazard symbols is better than using words.

1. _____

2. _____

[2]



2 Metal can be used to make watering cans.



© Getty Images

(a) Give **two** reasons why metal is a suitable material for watering cans.

Choose from:

hard strong transparent brittle conductor

_____ and _____ [2]

(b) Watering cans can also be made of plastic. Give **one** advantage of using plastic instead of metal.

_____ [1]

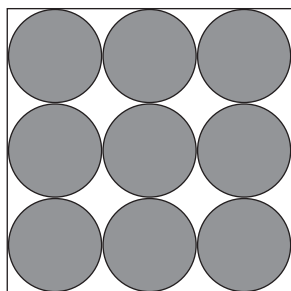
(c) Plastic is described as a synthetic material. What is meant by the term **synthetic**?

_____ [1]

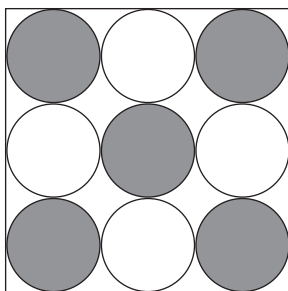
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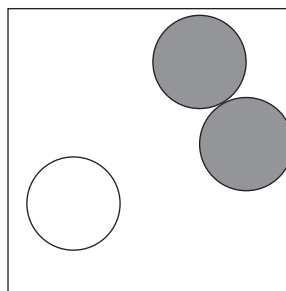
- 3 The diagrams below represent elements and mixtures in different states; solid, liquid or gas.



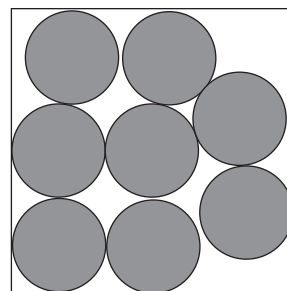
A



B



C



D

- (a) Which diagram (**A**, **B**, **C** or **D**) represents:

a solid element?

a mixture of gases?

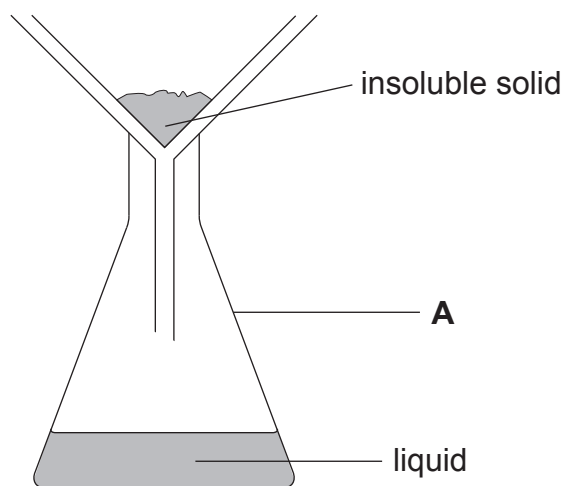
[2]

- (b) What name is given to the change of state from **solid** to **gas**?

[1]



A mixture of an insoluble solid and a liquid can be separated using the apparatus shown below.



Source: Principal Examiner

(c) What name is given to this method of separation?

_____ [1]

(d) Name the method used to separate the colours in ink.

Circle your answer.

distillation

chromatography

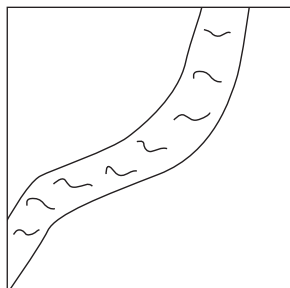
crystallisation

[1]

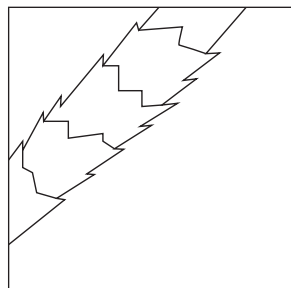
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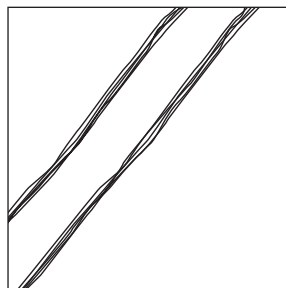
- 4 (a) Shown below are drawings of four different types of hair as seen under a microscope.



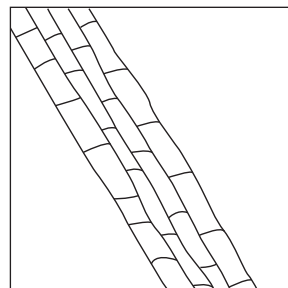
1



2

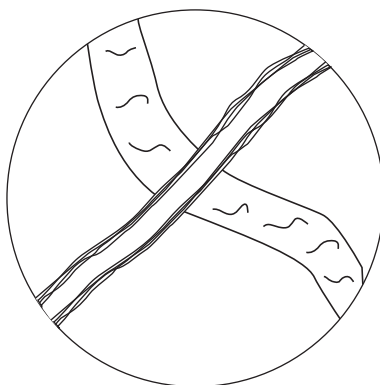


3



4

- (i) Use the drawings to identify which type(s) of hair (1, 2, 3, 4) are shown below.



[1]

- (ii) Hair is a type of trace evidence that can be collected at a crime scene. What is meant by the term **trace evidence**?

[1]



(b) Fingerprints are another useful type of evidence that can be collected.



© Getty Images

(i) Name the type of fingerprint pattern shown above.

_____ [1]

(ii) Name the powder that can be used to help see fingerprints on a **white** surface.

_____ [1]

(iii) Apart from powders, name **one** other way of making fingerprints visible.

_____ [1]

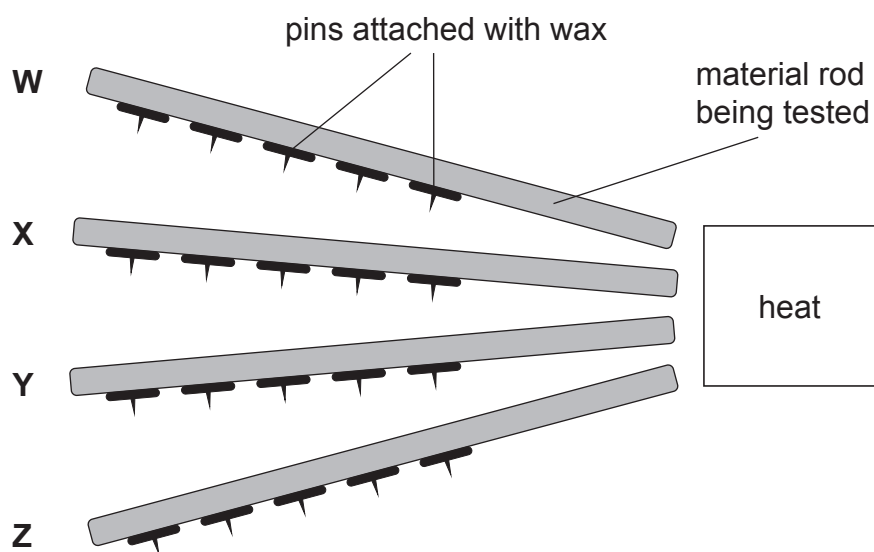
(iv) Apart from being used as evidence, give **one** other use for fingerprints.

_____ [1]

[Turn over



- 5 A student investigated how four materials (**W**, **X**, **Y** and **Z**) allow heat to pass through them. She used the apparatus shown below.



The number of pins still attached to each rod was recorded at 1, 3 and 5 minutes. The results are shown below.

Material	Number of pins attached		
	1 minute	3 minutes	5 minutes
W	5	4	3
X	4	3	2
Y	5	5	4
Z	5	5	5



(a) Put the materials (**W**, **X**, **Y** and **Z**) in order of conductivity.

_____ best conductor

_____ worst conductor

↓

[2]

(b) Suggest **one** way the student has made this investigation a fair test.

_____ [1]

[Turn over



- 6 Plants can be used to make indicators which can change colour in acids, alkalis and neutral solutions.

(a) Describe how an indicator can be made from beetroot.

[3]

(b) The table below shows the colour of beetroot indicator at different pH values.

pH	Colour of beetroot indicator
2	dark purple
4	dark purple
7	red
10	light green
13	light green

(i) What colour would beetroot indicator be in:

hydrochloric acid? _____

a neutral solution? _____

[2]

(ii) A student tested solution **X** and it turned beetroot indicator light green. He concluded that the pH of this solution **must** be 10. Explain why the student's conclusion is incorrect.

[1]





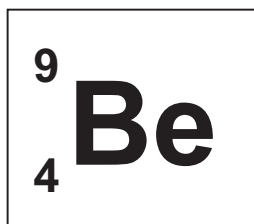
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(Questions continue overleaf)



- 7 (a) Beryllium is a Group 2 metal and is represented by the following symbol in the Periodic Table.

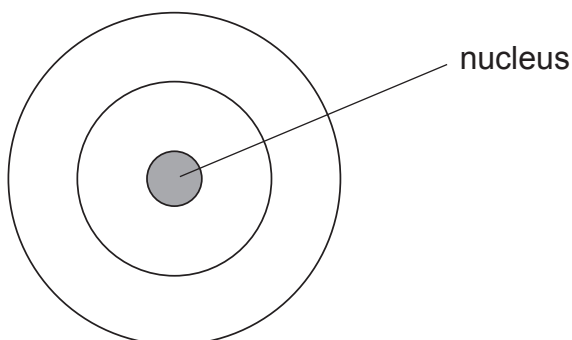


- (i) Complete the table below to give the numbers of protons and neutrons in a beryllium atom.

Particle	Number
electron	4
proton	
neutron	

[2]

- (ii) Complete the diagram below to show how the electrons are arranged in an atom of beryllium.



[1]



(iii) Describe fully how a beryllium ion is formed from a beryllium atom.

[2]

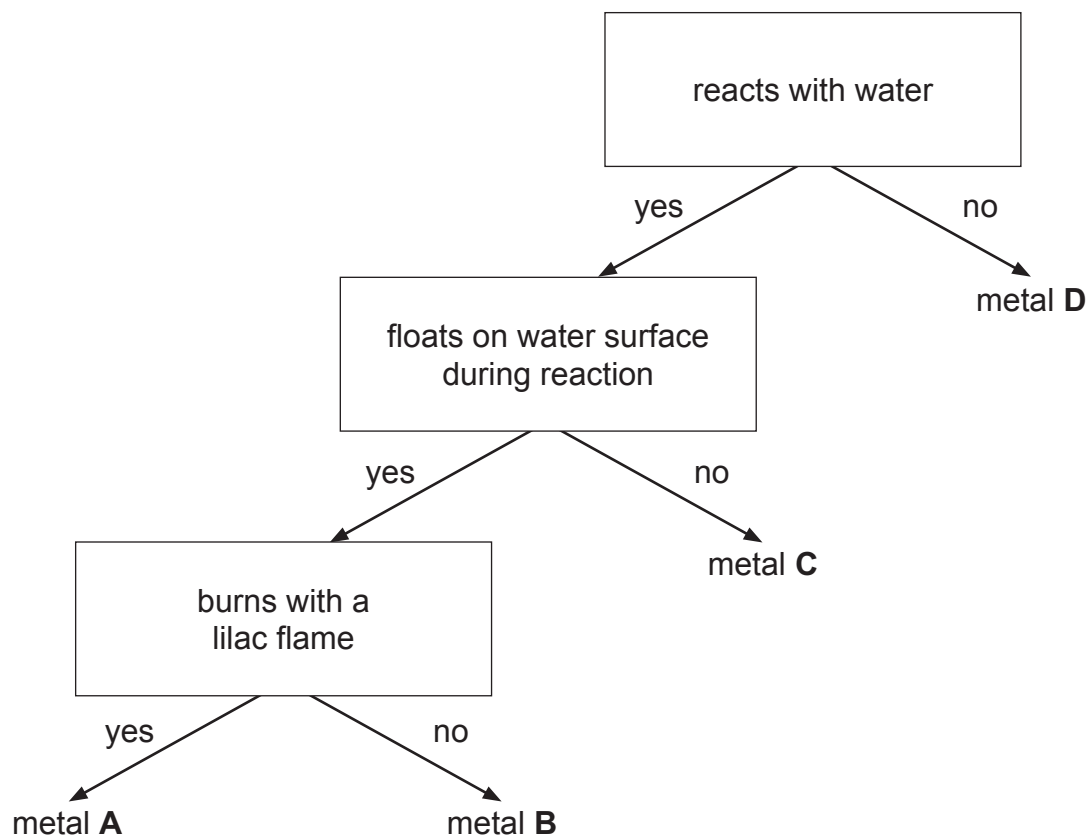
(b) What name is given to the elements in Group 2 of the Periodic Table?

[1]

[Turn over



- 8 (a) The diagram below gives observations about four metals (**calcium**, **copper**, **sodium** and **potassium**) when they are added to water.



- (i) Which letter (**A**, **B**, **C** or **D**) is describing the metal potassium?

_____ [1]

- (ii) Which of the four metals named above is represented by the letter **D**?

_____ [1]

- (b) When metals react with water, they produce hydrogen gas. Describe the test for hydrogen gas.

_____ [2]



- 9 Scientists are developing car engines that can use hydrogen as a fuel instead of petrol. The table below gives some information about hydrogen and petrol.

	Hydrogen	Petrol
state	gas	liquid
source	Produced from coal, oil or natural gas. Can also be produced by using solar power to break down water.	Produced by fractional distillation of crude oil.
equation for combustion	hydrogen + oxygen $\rightarrow$ water	petrol + oxygen $\rightarrow$ carbon dioxide + water
energy released when burnt	5750 kJ per litre	35000 kJ per litre

Use this information and your knowledge to answer the following questions.

- (a) Calculate how much more energy petrol produces per litre than hydrogen.

_____ kJ [1]

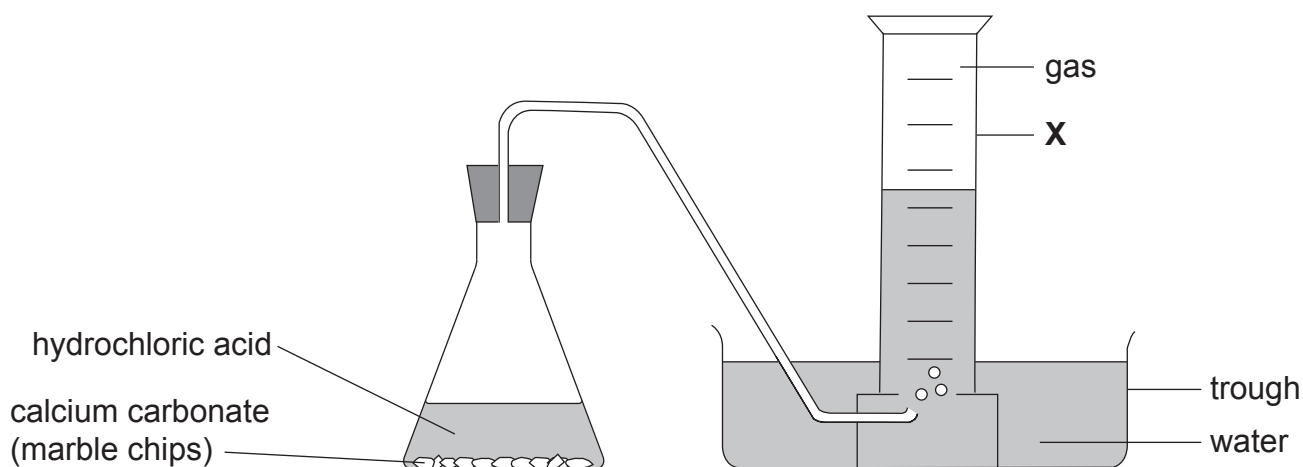
- (b) State **one** advantage of using hydrogen rather than petrol as a fuel. Explain your answer.

 _____ [2]

[Turn over



- 10 (a) A student investigated the reaction of hydrochloric acid with calcium carbonate using the apparatus shown below.



Source: Principal Examiner

- (i) Name the gas produced during this reaction.

_____ [1]

- (ii) Name the piece of apparatus labelled X that is used to collect the gas.

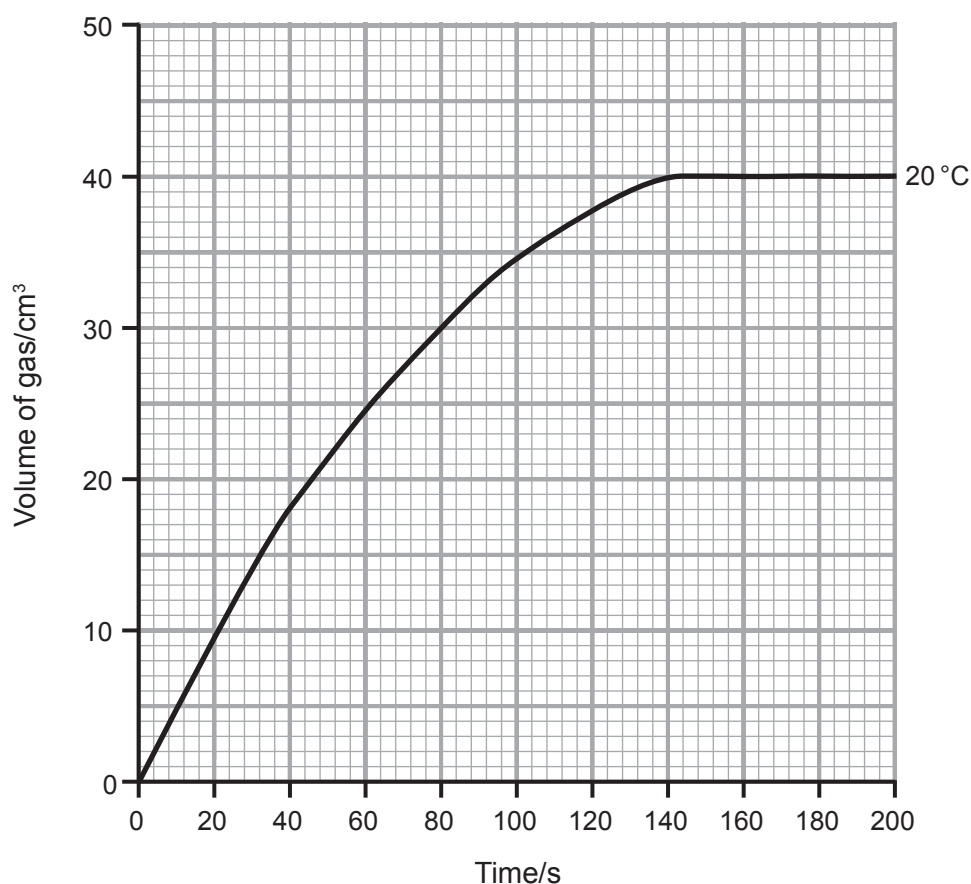
_____ [1]

- (b) The student recorded the volume of gas collected every 40 seconds at 20 °C and then repeated the experiment at 40 °C. Her results are shown below.

Time/s	Volume of gas produced/cm ³	
	20 °C	40 °C
0	0.0	0.0
40	18.0	28.0
80	30.0	38.5
120	38.0	40.0
160	40.0	40.0
200	40.0	40.0



The line graph below shows the results for the reaction at 20 °C.



(i) Describe fully the trend shown for the results at 20 °C.

_____ [2]

(ii) On the grid above plot and draw a line graph for the reaction at 40 °C. [3]

(iii) The investigation was then repeated at 60 °C. Predict the volume of gas that will be produced in 150 seconds at 60 °C.

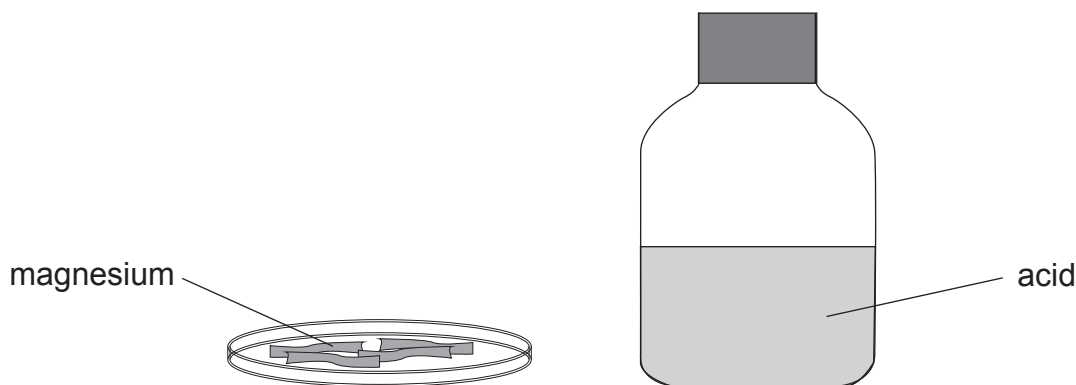
_____ cm³ [1]

[Turn over



- 11 The reaction of magnesium with excess acid is exothermic. This means the reaction gives out heat.

Describe an investigation to find out if the amount of magnesium added to the acid affects the amount of heat released.



Source: Principal Examiner

Your answer should include:

- the method you would use;
- the measurements that you would take;
- **two** things that would make it a fair test and
- what you would expect to find out.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.





[6]

[Turn over



12 Alkanes are one group of hydrocarbons.

(a) Complete the table below about some alkanes.

Alkane	Formula	Structure
propane	C_3H_8	
	CH_4	$\begin{array}{c} H \\ \\ H - C - H \\ \\ H \end{array}$
butane		$\begin{array}{ccccccc} & H & & H & & H & & H \\ & & & & & & & \\ H & - C & - & C & - & C & - & C - H \\ & & & & & & & \\ & H & & H & & H & & H \end{array}$

[3]

(b) Complete the word equation for the combustion of butane.



[2]

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Examiner Number

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