



Rewarding Learning

General Certificate of Secondary Education
2020–2021

Centre Number

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Candidate Number

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Single Award Science: Chemistry

Unit 2
Foundation Tier

MV18

[GSA21]

TUESDAY 24 NOVEMBER 2020, MORNING

Time

1 hour, plus your additional time allowance.

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 on blank pages.

Complete in black ink only.

Answer all **eleven** questions.

Information for Candidates

The total mark for this paper is 60.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **10**.

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

1 (a) The colours of universal indicator paper are given below.

Colour	red	orange	yellow	green	green-blue	indigo	purple
pH	0–2	3–4	5–6	7	8–9	10–11	12–14

(i) Use this information to complete the table below.
[2 marks]

Name	pH	Colour
battery acid	1	red
oven cleaner	13	
toothpaste	8	green-blue
lemon juice		orange

(ii) Name the weakest acid in the table above.
[1 mark]

(b) Complete the following sentence.

A liquid with pH 7 is described as a _____
solution. [1 mark]

(c) Four hazard symbols are shown below.



A



B



C



D

- (i) Which symbol **A**, **B**, **C** or **D** should be placed on a bottle to show it contains a **corrosive** substance?
[1 mark]

- (ii) What name is given to hazard symbol **B**?
[1 mark]

2 Most cars are made from steel.



(a) Give **two** properties that make steel a suitable material for making car bodies. [2 marks]

Choose from:

easily shaped

heavy

strong

weak

resistant to rust

1. _____

2. _____

(b) In the past, car bumpers were made from metal but now they are made from plastic.

Suggest **one** reason why plastic has replaced metal to make bumpers. [2 marks]

Explain your answer.

Reason _____

Explanation _____

- 3 The photograph below shows forensic scientists entering a crime scene.



- (a) Why do forensic scientists wear protective clothing when collecting evidence at a crime scene? [1 mark]

- (b) A forensic scientist found a fingerprint on a piece of broken white plate. He used a powder to see the fingerprint.



(i) Name the type of fingerprint shown opposite.
[1 mark]

(ii) Name the powder that the scientist could have used to see the fingerprint on the **white** plate. [1 mark]

(iii) Sometimes powder is not suitable to use to see a fingerprint.
Give **one** other way fingerprints can be made visible on a surface. [1 mark]

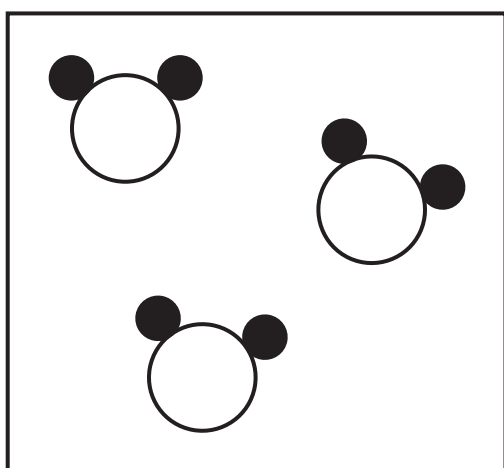
At the crime scene several pieces of evidence were found; a piece of paper with a fingerprint on it, a kitchen knife with some blood on it and a woollen hat with human hair on it.

(iv) Give **one** piece of evidence named above that would be described as trace evidence. [1 mark]

4 Substances can be classified as elements, compounds or mixtures.

(a) What is meant by the term mixture? [2 marks]

Particle diagrams can be used to represent elements, compounds and mixtures.



(b) What type of substance is represented by the particle diagram above? [1 mark]

Circle your answer.

a mixture

an element

a compound

(c) The word equations below show three chemical reactions. [2 marks]

copper + chlorine \longrightarrow copper chloride

copper carbonate \longrightarrow copper oxide + carbon dioxide

copper + sulfur \longrightarrow copper sulfide

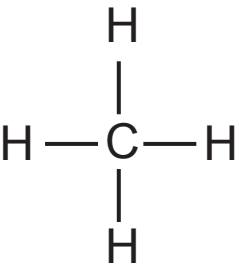
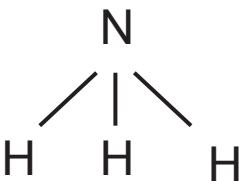

From the equations give **one** chemical that is:

a non-metallic element. _____

a compound containing oxygen. _____

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5 The diagrams below represent three different molecules.

		
methane	ammonia	water

(a) Use the diagrams to complete the following table.
[2 marks]

Name of molecule	Number of different elements in the molecule	Total number of atoms in the molecule
methane	2	5
ammonia		
water		

The formula for methane is CH_4 and the formula for water is H_2O .

(b) Give the formula for ammonia. [1 mark]

6 Below is some information about the element cobalt (${}^{59}_{27}\text{Co}$).

melting point	1495 °C
boiling point	2870 °C
atomic number	27
mass number	59

(a) How many protons are in an atom of cobalt? [1 mark]

(b) Calculate how many neutrons are in an atom of cobalt.
[1 mark]

A solid changes to a liquid at its melting point and then to a gas at its boiling point as shown below.



(c) Using information from the table calculate the temperature range over which cobalt is a liquid.
[2 marks]
(Show your working out.)

_____ °C

Some solids can turn directly into a gas when heated.

(d) What name is given to this change of state? [1 mark]

7 The table below gives information about four elements **A**, **B**, **C** and **D**.

Elements	Number of electrons			
	first shell	second shell	third shell	fourth shell
A	2	8	8	1
B	2	8	7	
C	2	1		
D	2	8		

(a) Which element (**A**, **B**, **C** or **D**) is a noble gas? [1 mark]

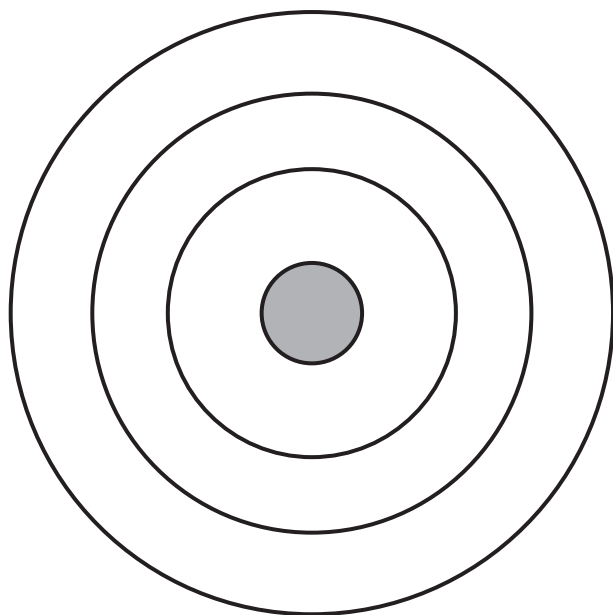
(b) Which **two** elements (**A**, **B**, **C**, **D**) are in the same Group of the Periodic Table? [1 mark]

_____ and _____

(c) Name the element labelled **A** in the table above.
[1 mark]

You may find your Data Leaflet helpful.

(d) Complete the diagram below to show the arrangement of all **16** electrons in an atom of sulfur. [1 mark]

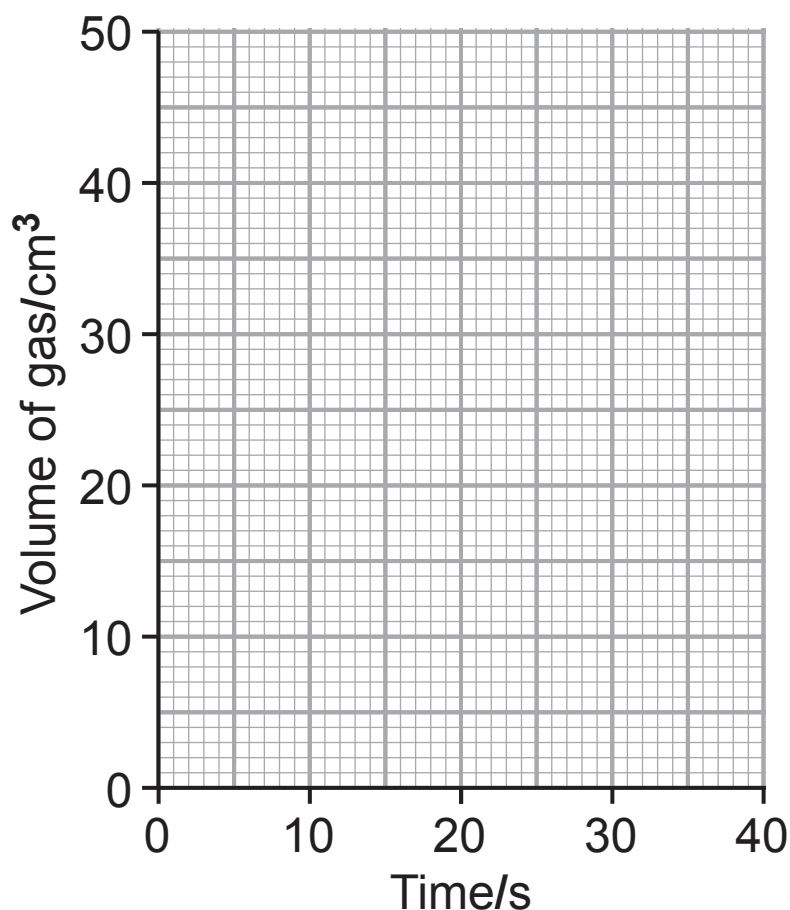


8 When hydrochloric acid is added to calcium carbonate a gas is produced.

The table below shows the volume of gas produced over 40 seconds.

Time/s	0	10	20	30	40
Volume of gas/cm³	0	11	23	34	45

(a) On the grid below plot a **line** graph for these results.
[3 marks]



(b) Describe the trend shown by these results. [1 mark]

(c) The gas produced during this reaction is carbon dioxide.

(i) Name the chemical used to test for carbon dioxide.
[1 mark]

(ii) Give the colour change observed during the test for carbon dioxide. [2 marks]

_____ to _____

- 9 (a) The table below gives some properties of the first five Group 1 elements.

Group 1 element	Melting point/°C	Boiling point/°C	Density/g/cm ³
lithium	180	1347	0.5
sodium	98	883	0.9
potassium	64	774	0.8
rubidium	39	688	1.5
caesium	28		1.8

- (i) Give **one** trend shown in the melting points of Group 1 elements. [1 mark]

- (ii) Predict the boiling point of caesium. [1 mark]

_____ °C

- (iii) Mary looked at the information in the table and concluded that:

“As you go down Group 1 the density of the elements increases.”

Give **one** piece of evidence from the table that shows this conclusion is incorrect. [1 mark]

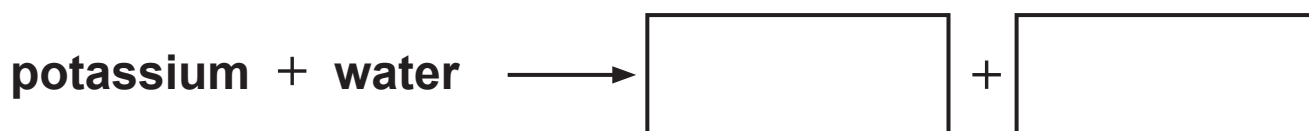
(b) (i) Give **two** observations you would expect when potassium reacts with water. [2 marks]

1. _____

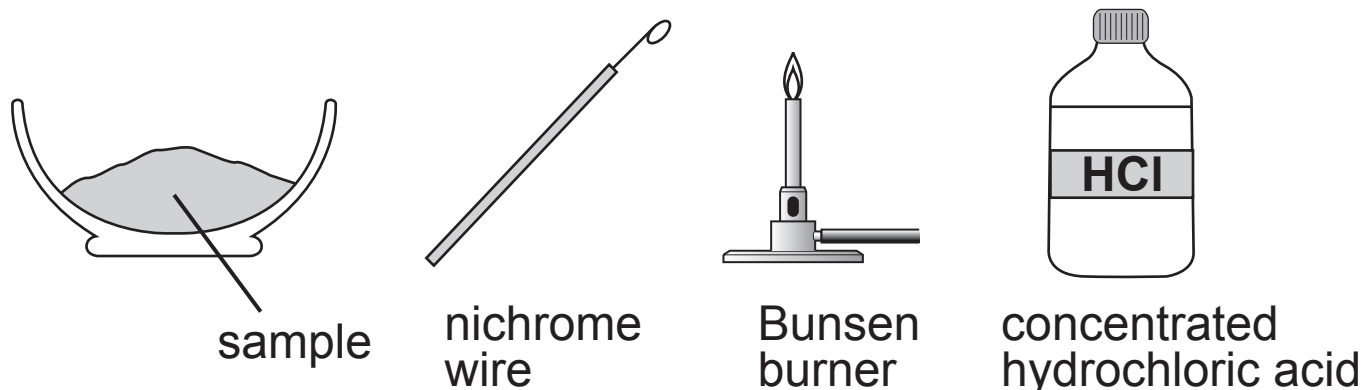
2. _____

(ii) Using your knowledge of Group 1 metals suggest **one** difference in the reactions of potassium with water and rubidium with water. [1 mark]

(iii) Write a word equation for the reaction of potassium with water. [2 marks]



10 Describe how you would carry out a flame test to compare samples of copper chloride and sodium chloride using the apparatus shown below. [6 marks]



Your answer should include:

- a detailed description of the method;
- **one** safety precaution apart from wearing safety glasses;
- the results you would expect to see for copper chloride and sodium chloride.

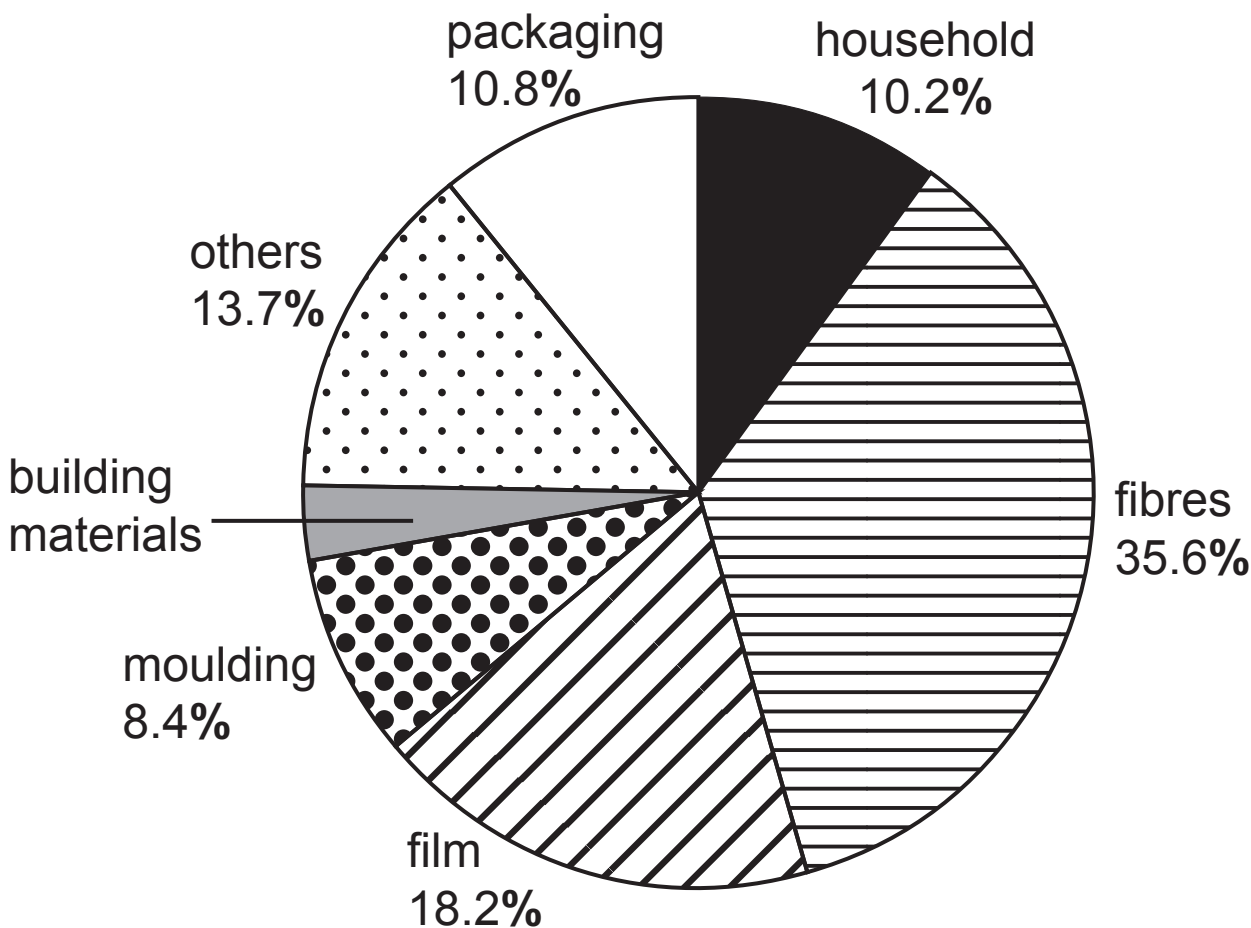
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

11 (a) The formula of propene is C_3H_6 .
Name the two elements present in propene. [1 mark]

_____ and _____

(b) Polypropene is a plastic made from propene.
Polypropene is brittle at temperatures below $5^\circ C$,
but it gets more flexible as it warms up, melting at
temperatures of $127^\circ C$ or higher.

The pie chart below shows uses of polypropene.



Use this information to answer the following questions:

- (i) Calculate the percentage of polypropene used in building materials. [2 marks]
(Show your working out.)

_____ %

- (ii) Explain why packaging made from polypropene should **not** be used in very cold conditions. [1 mark]

- (iii) Suggest **one** reason why polypropene is not suitable to make a container to hold boiling water. [1 mark]

- (c) Polypropene is non-biodegradable. What is meant by the term **non-biodegradable**? [2 marks]

This is the end of the question paper

SOURCES:

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Q2.....© Getty Images

Q3.....© Monty Rakusen / Science Photo Library

Q3(b).....© Getty Images

Q10.....Source: Principal Examiner

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Question Number	Marks
1	
2	
3	
4	
5	
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7	
8	
9	
10	
11	
Total Marks	

Examiner Number

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble
Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

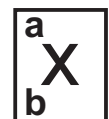
gcse examinations chemistry

THE PERIODIC TABLE OF ELEMENTS

Group

												1 H Hydrogen 1						4 He Helium 2	
		1	2											3	4	5	6	7	0
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10		
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18		
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36		
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	98 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54		
133 Cs Caesium 55	137 Ba Barium 56	139 La [*] Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86		
223 Fr Francium 87	226 Ra Radium 88	227 Ac [†] Actinium 89	261 Rf Rutherfordium 104	262 Db Dubnium 105	266 Sg Seaborgium 106	264 Bh Bohrium 107	277 Hs Hassium 108	268 Mt Meitnerium 109	271 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112								

* 58 – 71 Lanthanum series
 † 90 – 103 Actinium series



a = relative atomic mass (approx)
x = atomic symbol
b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103