Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2021–2022

Double Award Science: Chemistry

Unit C1

Foundation Tier

[GDW21]

GDW21

FRIDAY 27 MAY 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 eight** questions.

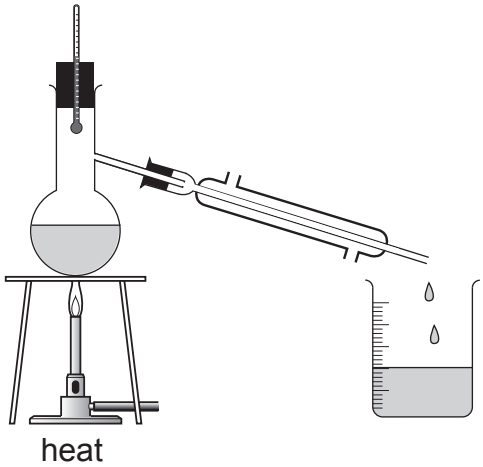
INFORMATION FOR CANDIDATES

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 **8**.
A Data Leaflet, which includes a Periodic Table of the elements is provided.

13752

16GDW2101

1 The diagram below shows one of the methods used to separate mixtures.



Source: Principal Examiner

(a) Complete the sentences below by **circling** the correct answers.

This method of separation is called

- filtration.
- evaporation.
- distillation.

Cold water circulates through the

- flask.
- condenser.
- beaker.

This apparatus could be used to separate

- sand from salt water.
- red dye from ink.
- pure water from sea water.

[3]

(b) Match the following metal ions to the colours of their flames by using straight lines.

Metal ion	Flame colour
lithium	brick red
copper	crimson
calcium	green-blue

[2]

2 Phosphorus has an atomic number of 15 and a mass number of 31.

(a) **(i)** Complete the table below to show the charge on a neutron and the number of electrons, protons and neutrons in an atom of phosphorus.

particle	**relative charge**	**number present in an atom of phosphorus**
proton	+1	
electron	–1	
neutron		

[4]

(ii) How many electron **shells** are there in an atom of phosphorus?

Circle the correct answer.

1 **2** **3** **4** **5**

[1]

(b) Complete the sentence below, using words from the list, to give the definition of a compound.

molecules **atoms** **elements** **ions**

separated **combined** **arranged** **mixed**

A compound is two or more _____ chemically

_____. [2]

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(Questions continue overleaf)

3 **(a)** Complete the word equation for the reaction of nitric acid with calcium carbonate.

nitric acid + calcium carbonate ⟶ + water +

[2]

(b) The four substances from the list below all react with sulfuric acid.
Choose substances from the list below to answer the questions which follow.

magnesium **sodium hydroxide** **copper oxide**

sodium hydrogencarbonate

How many of these reactions will:

produce a gas?

_____

produce a coloured solution?

_____

give sodium sulfate as a product?

_____ [3]

(c) When sulfuric acid is added to sodium hydroxide solution will the temperature rise, fall or stay the same?

_____ [1]

(d) The picture below shows a hazard symbol.

Source: © Getty Images

What does this hazard symbol mean?
Circle the correct answer from the list below.

toxic **corrosive** **caution** **flammable** **harmful**

[1]

[Turn over

4 Over 100 elements are known and they are arranged in the Periodic Table.

Use your Data Leaflet to help you answer this question.

(a) Complete the sentence below to describe an element.

An element is a substance that consists of only one type of

_____ and cannot be broken down into simpler

substances by _____ means. [2]

(b) Complete the sentences, about the Periodic Table, by **circling** the correct answers:

In the Periodic Table the vertical columns are called

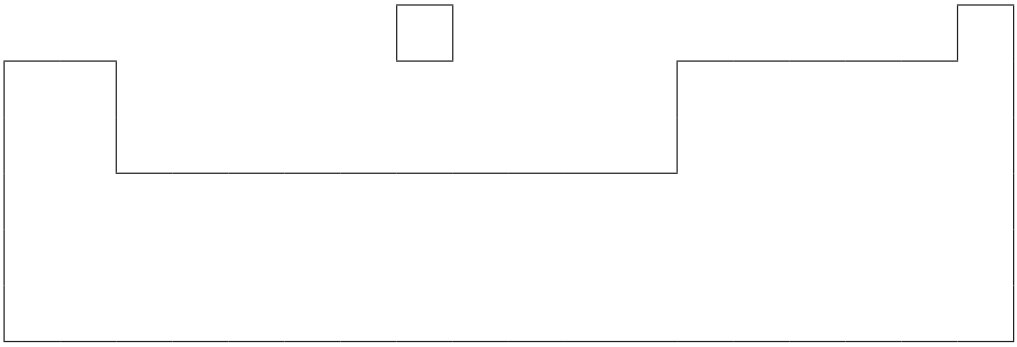
groups.
rows.
periods.

The horizontal rows are called

groups.
blocks.
periods.

[2]

(c) On the outline of the Periodic Table below shade in the area where the alkali metals can be found.



[1]

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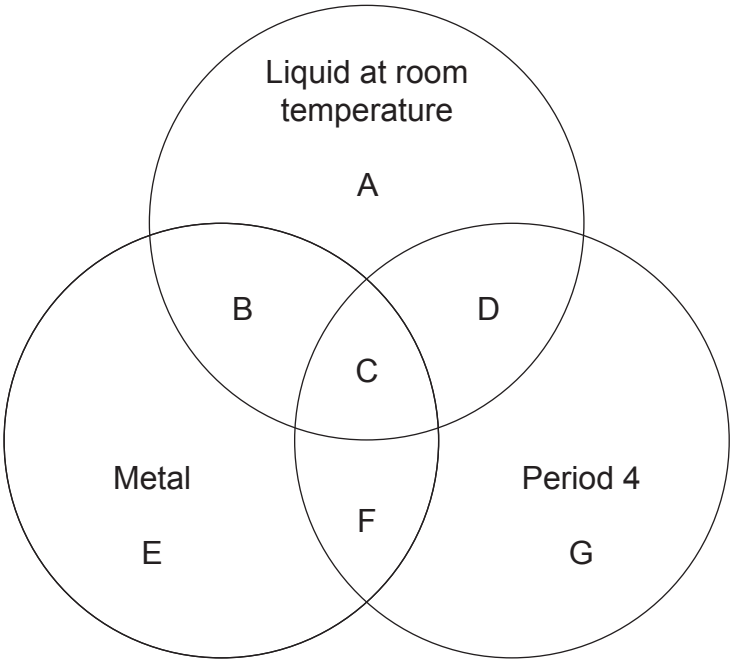
(d) Arsenic is an element in the periodic table with an atomic number of 33.
How many electrons would you expect arsenic to have in its outer shell?

_____ [1]

(e) Some methods of classifying elements are shown in the diagram below.
Different regions in the diagram are referred to as A, B, C, D, E, F or G.



Use the letters A, B, C, D, E, F or G to complete the table below.
Identify which region in the diagram each element belongs to.

The first one has been done for you.

element	region
copper	F
magnesium	
mercury	
bromine	

[3]

[Turn over

5 Three alkali metals A, B and C were investigated in a school laboratory.

The table below shows what happened when a small piece of each of these metals was dropped into a trough of water.

Metal	Did the metal sink?	Did the metal melt to form a ball?	Did the metal catch fire immediately?	Was fizzing observed?
A	no	yes	no	yes
B	no	no	no	yes
C	no	yes	yes	yes

(a) Use the information above to help you answer the following questions:

(i) Name the three alkali metals.

metal A _____

metal B _____

metal C _____ [3]

(ii) Give one **risk** associated with using these metals and explain how it can be safely managed in the laboratory.

Risk _____ [1]

How it is managed _____ [1]

(b) Hydrogen gas is produced when alkali metals reacts with water. Describe the test for hydrogen gas.

_____

_____ [2]

6 **(a)** **(i)** Complete the sentence below, to give the definition of an ion, by using words from the list.

protons **atoms** **charged** **neutral** **isotopes**

electrons **neutrons** **molecule**

Ions are _____ particles formed when

_____ gain or lose _____. [3]

(ii) Choose the **molecular ion** from the list below by circling it.

NaOH **Mg^{2+}** **Cl^-** **HCO_3^-** **H_2O**

[1]

(b) **(i)** Sodium oxide is an ionic compound with the formula Na_2O.

Describe fully the change to the electronic configuration of the **sodium atom** when it forms an ionic bond with oxygen.

_____

_____ [2]

(ii) Describe fully the change to the electronic configuration of the **oxygen atom** when it forms an ionic bond with sodium.

_____

_____ [2]

(c) Draw a dot and cross diagram of a molecule of hydrogen fluoride, HF.
Show outer shell electrons only.

[3]

[Turn over

7 **(a)** Complete the definition of relative atomic mass below:

The relative atomic mass of an atom is _____

compared with that of the _____ which has a mass of

exactly 12. [2]

(b) Calculate the relative formula mass (M_r) of each of the following substances.

(relative atomic masses: H = 1, C = 12, O = 16, Al = 27, S = 32, Cu = 64, Rb = 85)

rubidium hydroxide RbOH

_____ [1]

copper(II) sulfate $CuSO_4$

_____ [1]

aluminium hydrogencarbonate $Al(HCO_3)_3$

_____ [1]

(c) The relative formula mass (M_r) of iron(III) oxide is 160.

(i) Calculate the number of moles in 23.0 g of iron(III) oxide.
Give your answer to 2 decimal places.

_____ [2]

(ii) What is the mass, in grams, of 2.75 moles of iron(III) oxide?

_____ g [1]

[Turn over

8 The element carbon exists as allotropes including diamond and graphite.

Use your knowledge and understanding of the term allotropes and of the structure and bonding of carbon to:

- Define what is meant by the term allotrope
- Describe the bonding and structure of diamond
- Describe ways in which the bonding and structure of graphite is similar to and different from that of diamond

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

Definition of allotrope:

_____

_____

Description of the bonding and structure of diamond:

_____

_____

_____

_____

Description of ways in which the bonding and structure of graphite is similar to and different from that of diamond:

similarities: _____

_____

_____

differences: _____

_____

_____

_____ [6]

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THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
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	$C_3H_7COO^-$
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Propanoate	$C_2H_5COO^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

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

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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

gcse examinations

chemistry

11984.02

THE PERIODIC TABLE OF ELEMENTS

Group

1	2											3	4	5	6	7	0
							1 H Hydrogen 1										4 He Helium 2
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						

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

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

a X b

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

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