



General Certificate of Secondary Education
2023–2024

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Double Award Science: Chemistry

Unit C1

Foundation Tier



[GDW21]

GDW21

THURSDAY 22 FEBRUARY 2024, 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 **4(a)**.

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

14375



16GDW2101

- 1 (a) The hazard symbol below would be found on a bottle of concentrated acid. What does the symbol tell you about concentrated acid?



[1]

Three experiments were completed with different indicators as shown in the table below. Only **one** set of results is correct.

Experiment	Indicator	Colour in alkali	Colour in neutral	Colour in acid
1	red litmus paper	red	red	blue
2	universal indicator paper	red	green	purple
3	blue litmus paper	blue	blue	red

- (b) Which experiment (1, 2 or 3) shows the correct results?

[1]

- (c) Name an indicator which can be used to measure pH.

[1]



- (d) Wasp stings are alkaline, and can be neutralised by a weak acid. What is the pH of a weak acid?

_____ [1]

- (e) Define the term **alkali**.

_____ [1]

The reaction between an acid and an alkali is called neutralisation.

- (f) Complete the table below to give the names and formulae of the ions present in acidic solutions and alkaline solutions.

	Name	Formula
Ion present in all acidic solutions		
Ion present in all alkaline solutions	hydroxide	

[3]

[Turn over



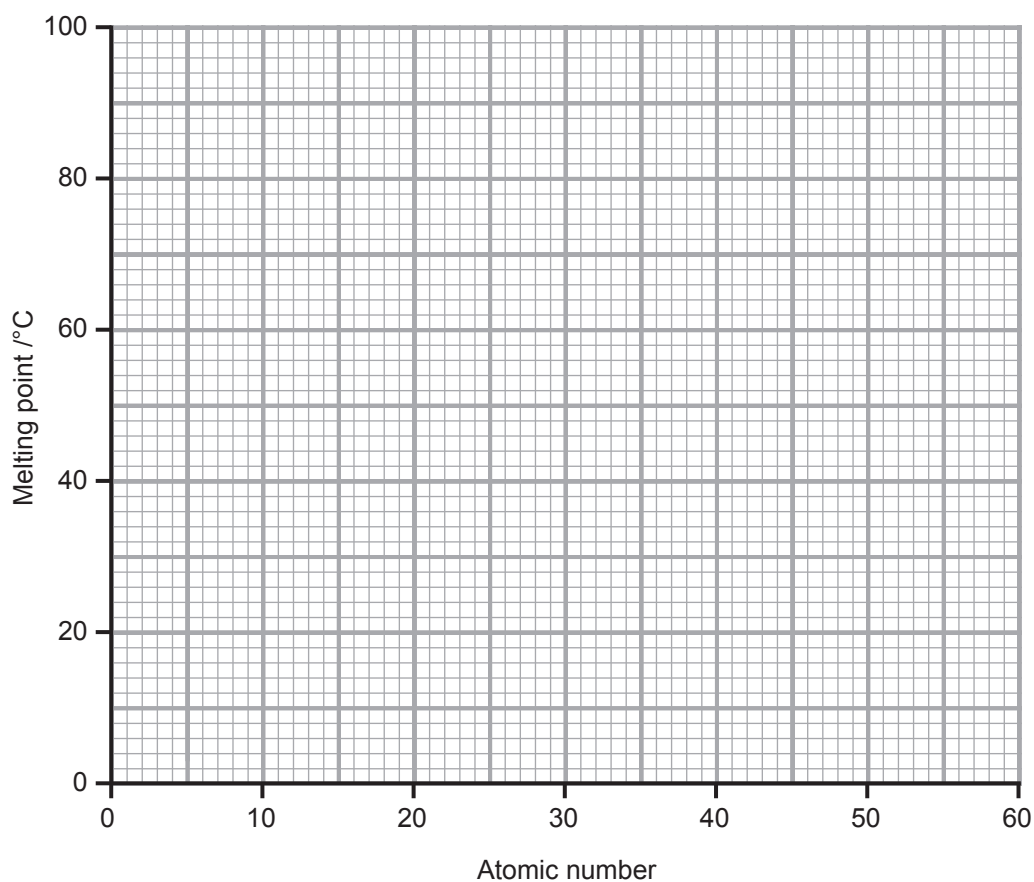
- 2 The table below shows the atomic number, melting point and boiling point of some of the Group 1 elements.

Group 1 element	Atomic number	Melting point /°C	Boiling point /°C
Na	11	98	883
K	19	64	760
Rb	37	39	686
Cs	55	28	671

- (a) Name the change in state which occurs when caesium (Cs) is heated from 20 °C to 35 °C.

_____ [1]

- (b) Using the melting points given in the table, plot a graph of melting point against atomic number for the Group 1 elements on the grid below. Draw a line of best fit.



(c) Sodium chloride is a compound of the Group 1 element sodium. Sodium chloride dissolves in water to form sodium chloride solution.

(i) What term describes the water in sodium chloride solution?

Circle the correct answer.

solvent

residue

solute

filtrate

distillate

[1]

(ii) What colour is sodium chloride solution?

Circle the correct answer.

colourless

white

clear

blue

pink

[1]

(iii) What is the formula of sodium chloride?

Circle the correct answer.

Na_2Cl

NaCl_2

NaCl

NaCL

Na^2Cl^2

[1]

[Turn over



- 3 (a) Draw a dot and cross diagram to show the arrangement of the outer shell electrons in a chlorine molecule, Cl_2 .

[3]

- (b) Complete the following definition.

A molecule is a particle that consists of _____ or more
_____ covalently bonded together.

[2]

- (c) Chlorine (Cl_2) is an example of a diatomic molecule. Choose **two** substances from the table below which also exist as diatomic molecules.

Tick (✓) the **two** correct boxes.

hydrogen (H_2)	
carbon dioxide (CO_2)	
iron (Fe)	
helium (He)	
hydrogen chloride (HCl)	

[2]

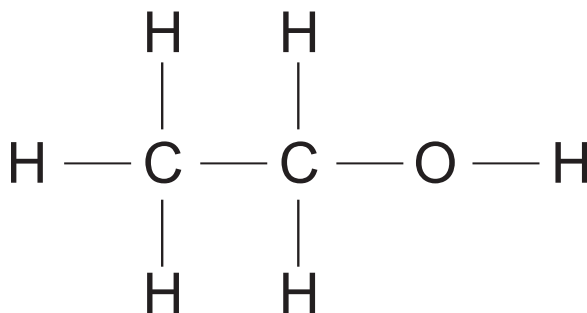


(d) Methane (CH_4) is a gas. Circle the correct answer which indicates the strongest attraction **between** molecules of methane.

covalent molecular covalent giant covalent van der Waals' forces

[1]

(e) Ethanol ($\text{C}_2\text{H}_5\text{OH}$) can be represented by the diagram below. How many covalent bonds are present in ethanol?



[1]

[Turn over



4 In 1869, Mendeleev, a Russian scientist, produced a Periodic Table containing 63 elements. The modern Periodic Table in your Data Leaflet contains 112 elements.

(a) Compare Mendeleev's Periodic Table with the modern Periodic Table using the following bullet points.

- State three features of Mendeleev's Periodic Table.
- State how the modern Periodic Table is different from Mendeleev's Periodic Table.

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

State three features of Mendeleev's Periodic Table.

State how the modern Periodic Table is different from Mendeleev's Periodic Table.



[6]

- (b) Potassium is found in Mendeleev's Periodic Table. Potassium reacts vigorously with water.

Complete a word equation for the reaction of potassium with water.

potassium + water → +

[2]

- (c) Describe how potassium is stored in the laboratory.

[1]

- (d) Before potassium is placed in water it must be cut into small pieces. Describe the appearance of potassium immediately after being freshly cut and then after two minutes.

appearance immediately after being cut: _____

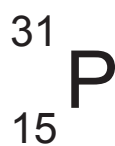
appearance after two minutes: _____

[2]

[Turn over



- 5 (a) The symbol below represents the phosphorus atom.



- (i) State the number of protons, electrons and neutrons in an atom of phosphorus.

number of protons: _____

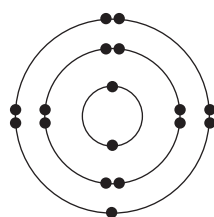
number of electrons: _____

number of neutrons: _____

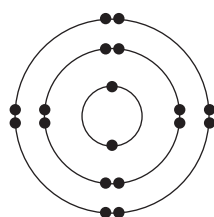
[3]

- (ii) When phosphorus reacts it becomes a phosphide ion with the formula, P^{3-} . Which one of the diagrams below represents the electronic configuration of the **phosphide ion**, P^{3-} ?

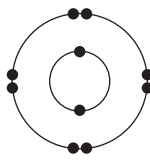
Circle the correct letter below.



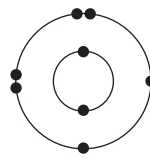
A



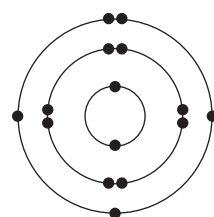
B



C



D



E

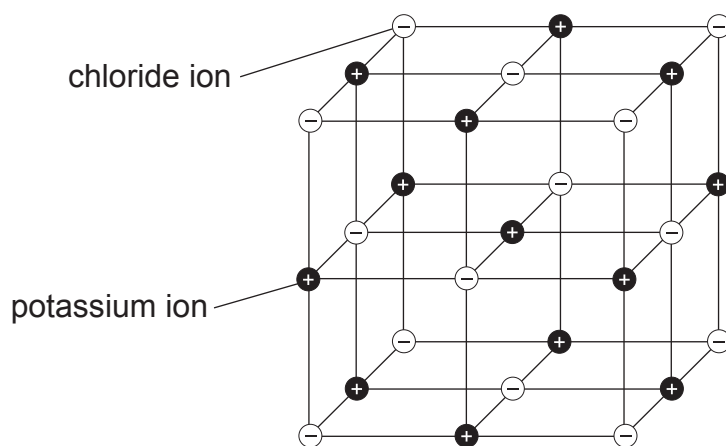
[1]

- (b) Explain why the phosphide **ion** has a negative charge.

[1]



- (c) Phosphorus can form ionic compounds when it reacts with Group 1 metals. These compounds have a giant ionic lattice similar to that of potassium chloride shown below.



Complete the sentences below about potassium chloride.

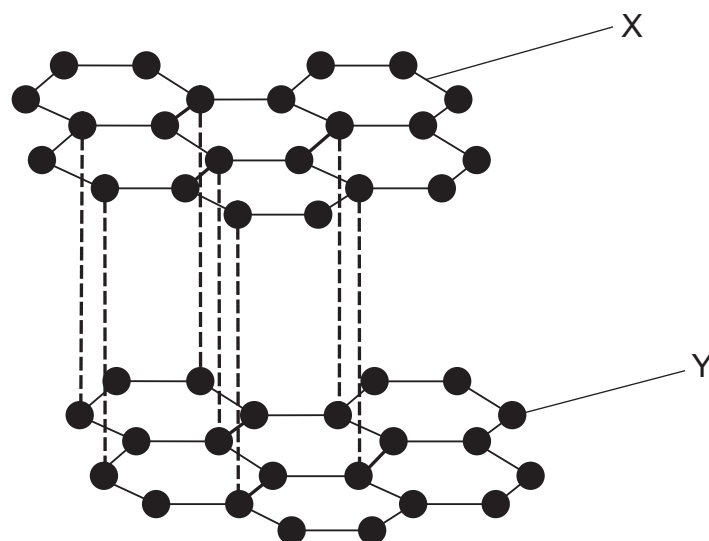
- (i) Potassium chloride has a _____ melting point due to the strong _____ between _____ charged ions. [3]

- (ii) **Solid** potassium chloride cannot conduct electricity because the _____ cannot move and carry charge. [1]

[Turn over



- 6 Carbon is a non-metallic element which exists as allotropes. The diagram below shows the structure of graphite, one of the allotropes of carbon.



- (a) What do the letters X and Y represent?

X: _____

Y: _____

[2]

- (b) Explain why graphite can be used in pencils.

[1]

- (c) Name one other allotrope of carbon.

[1]



- 7 A balanced symbol equation for a chemical reaction is given below with state symbols.



- (a) How many **reactants** are in the equation for this chemical reaction?

_____ [1]

- (b) Colourless bubbles are given off during this reaction. Which compound is responsible for these bubbles?

_____ [1]

- (c) State the name of the substance with the formula CuSO_4 .

_____ [1]

- (d) Complete the table below.

Formula	Total number of atoms in the formula	Number of different elements in the formula
I_2		
$(\text{NH}_4)_2\text{SO}_4$		

[4]

[Turn over



8 (a) Calculate the relative formula mass (M_r) of the following compounds:

(Relative atomic masses (A_r): C = 12; O = 16; S = 32; Fe = 56; Zn = 65)

zinc sulfate, ZnSO_4

relative formula mass (M_r) _____

iron(III) carbonate, $\text{Fe}_2(\text{CO}_3)_3$

relative formula mass (M_r) _____

[2]



- (b) Using the formula given below, calculate the percentage of magnesium by mass in magnesium dichromate, MgCr_2O_7 .

(Relative atomic masses (A_r): O = 16; Mg = 24; Cr = 52)

(Relative formula mass (M_r): MgCr_2O_7 = 240)

$$\% \text{ of magnesium in } \text{MgCr}_2\text{O}_7 = \frac{\text{total mass of magnesium in magnesium dichromate}}{\text{relative formula mass of magnesium dichromate}} \times 100$$

Show your working out.

percentage of magnesium _____ % [2]

- (c) Complete the table below:

Chemical	Relative formula mass (M_r)	Mass /g	Moles
BaSO_4	233	69.9	
Na_2S	78		0.15

[2]

THIS IS THE END OF THE QUESTION PAPER



Sources:

Q1(a) . . . © Getty Images
Q5(a)(ii) . . . Principal Examiner
Q5(c) . . . Principal Examiner
Q6 . . . Principal Examiner

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
----------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA
will be happy to rectify any omissions of acknowledgement in future if notified.

14375/7



16GDW2116

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

																0					
1		2																		0	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																		2	
1		2																			

* 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