



General Certificate of Secondary Education
2023–2024

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1

Foundation Tier



[GDW21]

GDW21

WEDNESDAY 22 MAY 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 **8(b)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included with this question paper.

You may use a scientific calculator.

14365.06R



16GDW2101

1 Group 7 in the Periodic Table is a group of reactive non-metal elements.

(a) (i) What name is given to Group 7 in the Periodic Table?

_____ [1]

(ii) The elements in Group 7 are diatomic. What is meant by the term diatomic?

_____ [2]

(iii) Complete the following table to give the correct colour and physical state of the Group 7 elements at room temperature (20 °C).

Element	Colour	Physical state
fluorine	yellow	
chlorine		gas
bromine	red-brown	
iodine		solid

[4]

(iv) State the trend in the reactivity of the Group 7 elements as you go down the group.

_____ [1]

(b) Solid iodine changes directly into a purple gas when heated.
Name this change of state.

_____ [1]



- (c) Chlorine is used in swimming pools to kill bacteria. Pool attendants often test for the levels of chlorine, in order to keep the water safe for swimmers.

Choose words from the list below to complete the sentence to give the correct positive test for chlorine.

blue white purple red green

Damp universal indicator paper changes to _____

and then bleaches _____. [2]



2 Atoms are made up of three types of subatomic particles, protons, electrons and neutrons.

(a) Complete the table below about three different atoms. (You may find the Data Leaflet useful.)

Atom	Number of protons	Number of electrons	Number of neutrons
nitrogen		7	
potassium	19		
	3		4

[3]

(b) Complete the sentences below by circling the correct answers.

(i) The total number of protons and neutrons in an atom

is the

atomic number.
group number.
mass number.

[1]

(ii) The number of protons in an atom is the

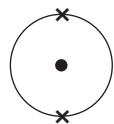
atomic number.
group number.
mass number.

[1]

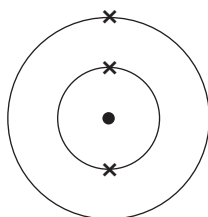


(c) The electronic configuration gives the arrangement of electrons in an atom.

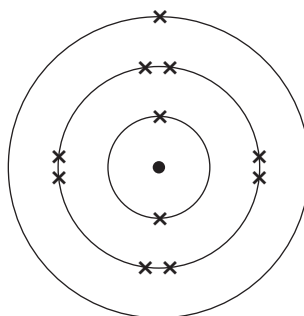
Look at the electronic configurations below and answer the following questions.



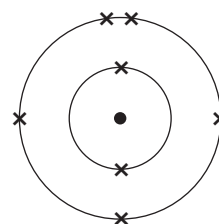
Atom A



Atom B



Atom C



Atom D

(i) How many electrons are in the first shell of **Atom B**? _____ [1]

(ii) Write the electronic configuration of **Atom C**. _____ [1]

(iii) Which atom has a full outer shell? _____ [1]

(iv) Which two atoms belong to the same group? _____ [1]

[Turn over



- 3 In the test for carbon dioxide gas, carbon dioxide is bubbled through limewater (calcium hydroxide solution). If carbon dioxide is present the limewater changes from colourless to milky.

The word equation for the reaction is given below.



- (a) How many products are in this reaction?

_____ [1]

- (b) Name the compound in the reaction that has a boiling point of 100 °C.

_____ [1]

- (c) Write the formula of calcium hydroxide.

_____ [1]

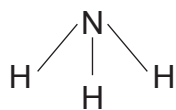
- (d) Complete the table below with the correct state symbols for the compounds given.

Compound	State symbol
carbon dioxide	
water	
calcium hydroxide	(aq)

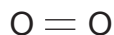
[1]



4 Below are the diagrams for five covalent molecules labelled **A**, **B**, **C**, **D** and **E**.



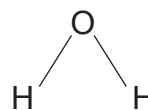
A



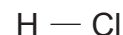
B



C



D



E

(a) Define the term **covalent bond**.

[1]

(b) Choose from the covalent molecules labelled **A**, **B**, **C**, **D** and **E**, the letter which matches the following statements.

An element

A molecule with 4 atoms

A molecule with four covalent bonds

[3]

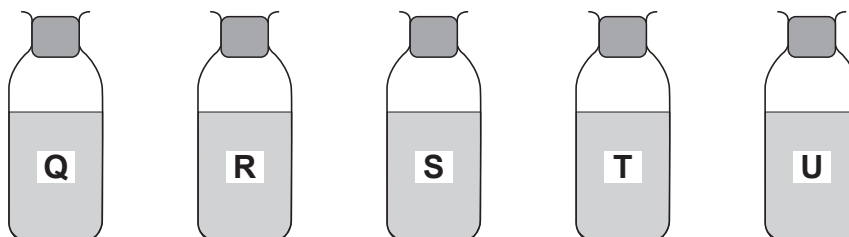
(c) Draw the dot and cross diagram for a molecule of chlorine (Cl_2) showing the outer electrons only.

[3]

[Turn over]



- 5 A pH meter was used to obtain pH readings for five solutions labelled **Q**, **R**, **S**, **T** and **U**. The results are shown in the table below.



- (a) (i) Use ticks (✓) to identify each solution as an acid, an alkali or neutral. One has been completed.

Solution	pH	Acid	Alkali	Neutral
Q	1.9	✓		
R	4.5			
S	7.0			
T	8.9			
U	12.6			

[4]

Use the table to answer the following:

- (ii) Which solution is a strong acid?

[1]



(b) Name the hazard symbol commonly seen on bottles of concentrated acid.

_____ [1]

(c) The table below gives information about three salts formed when three acids react with three alkalis. Complete the table by filling in all the gaps.

Acid	Alkali	Salt
hydrochloric acid	potassium hydroxide	
	sodium hydroxide	sodium sulfate
ethanoic acid		potassium ethanoate

[3]

[Turn over

14365.06R



16GDW2109

- 6 Silver nitrate solution reacts with sodium chloride solution to give a white precipitate of silver chloride and sodium nitrate solution.

8.50 g of silver nitrate was added to 0.05 moles of sodium chloride.

(Relative atomic masses (A_r): Ag = 108; Cl = 35.5; N = 14; O = 16)

- (a) (i) Calculate the relative formula mass (M_r) of silver nitrate, AgNO_3 .

_____ [1]

- (ii) Determine the number of moles of silver nitrate in 8.50 g.

_____ [1]

- (iii) The relative formula mass (M_r) of sodium chloride is 58.5. Calculate the mass of 0.05 moles of sodium chloride.
Give your answer to **2** decimal places.

_____ g [2]



- (b) Calculate the percentage by mass of **chlorine** in silver chloride, AgCl, using the equation below. The relative formula mass (M_r) of silver chloride is 143.5.

$$\% \text{ of element Cl in a compound} = \frac{(\text{number of atoms of Cl in a compound}) \times (A_r \text{ of Cl})}{M_r \text{ of compound}} \times 100$$

Show your working.

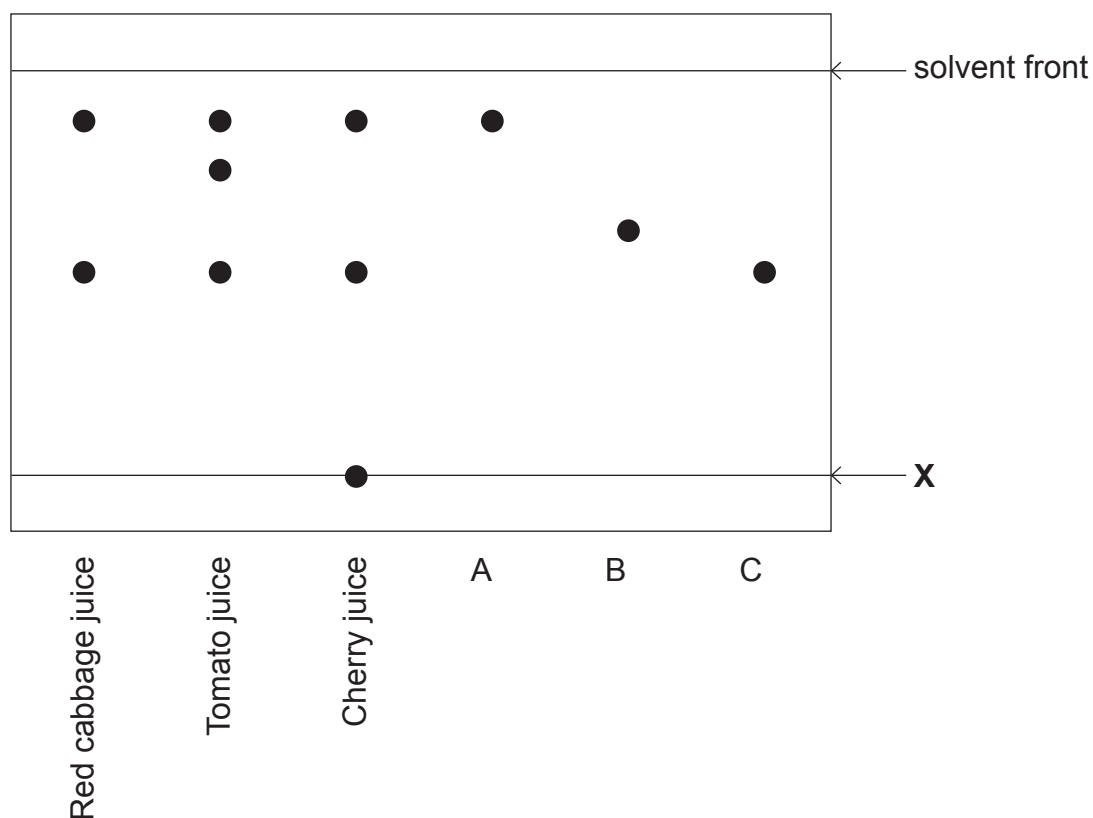
_____ % [2]



- 7 A student investigates the dyes in some different fruit and vegetable juices.

A spot of each juice is dotted onto chromatography paper, along with three dyes A, B and C.

The diagram shows the chromatogram at the end of the experiment.



- (a) Give the correct name for the line labelled X.

_____ [1]

- (b) Which one of the juices contains **only** two dyes?

_____ [1]

- (c) Which one of the dyes A, B or C is **not found** in any of the juices?

_____ [1]



(d) Which of the dyes A, B or C is **most soluble** in the solvent?

_____ [1]

(e) Which one of the juices contains a dye that is **insoluble** in the solvent?

_____ [1]

(f) What is the total number of **different** dyes in red cabbage juice and tomato juice?

_____ [1]

[Turn over

14365.06R

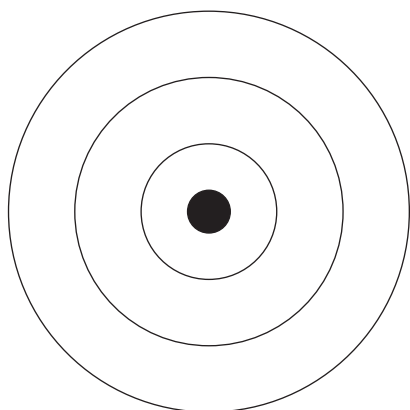


16GDW2113

- 8 Potassium chloride is an ionic compound used in medicine to treat and prevent low blood pressure.

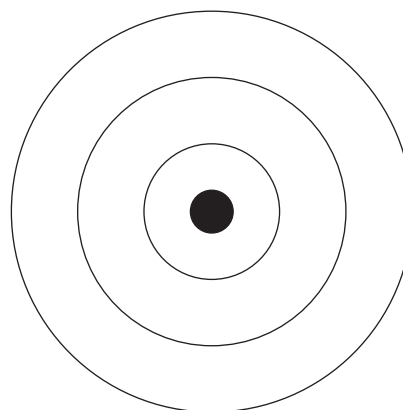
(a) Potassium chloride is formed when potassium atoms and chlorine atoms react to form ions. Complete the diagrams below to show the electronic configuration of the potassium ion and the chloride ion. Include the charges.

Potassium ion



Charge _____

Chloride ion



Charge _____

[2]



- (b) The physical properties of ionic compounds depend on their structure and bonding.

Discuss the bonding, structure and physical properties of potassium chloride using the following headings:

- Define the term ionic bond
- Name the type of structure found in potassium chloride
- Explain why potassium chloride has a high melting point
- State and explain the electrical conductivity of molten potassium chloride

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

Define the term ionic bond

Name the type of structure found in potassium chloride

Explain why potassium chloride has a high melting point

State and explain the electrical conductivity of molten potassium chloride

[6]

14365.06R



16GDW2115

Sources:

Question 2(c) . . . Principal Examiner

Question 5 Principal Examiner

Question 7 Principal Examiner

Question 8(a) . . . Principal Examiner

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

**For Examiner's
use only**

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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Examiner Number

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14365.06R



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