



General Certificate of Secondary Education
2024–2025

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1

Foundation Tier



[GDW21]

GDW21

MONDAY 19 MAY 2025, 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 **2(b)**.

You may use a scientific calculator.

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

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20GDW2101

- (c) Sodium, Na, reacts vigorously with water. Tick (✓) **three** safety measures that should be undertaken when carrying out this reaction.

Safety Measure	Tick (✓)
use a large piece of sodium	
use a safety screen	
use tongs to handle the sodium	
use a large volume of water	
use a small volume of water	

[3]

[Turn over



- 2 The mass number and atomic number can be used to work out the number of subatomic particles in an atom.

You may find your Data Leaflet useful when answering this question.

- (a) (i) Define the term **atomic number**.

[1]

- (ii) The electronic configuration of an atom or ion gives the number of electrons found in each shell. Select the correct electronic configuration to complete the sentences below.

Circle the correct answer.

The sodium atom has an atomic number of 11 and an electronic

configuration of

2,1
2,8,8,1
2,8,1

The oxide ion, with formula O^{2-} , has an electronic configuration

of

2,6
2,8,8
2,8

[2]



(b) Chlorine has two isotopes, chlorine-35 and chlorine-37. Define the term isotopes and describe the atoms of these isotopes. In your answer you should:

- define the term isotopes
- state the position of protons, neutrons and electrons in an atom of chlorine
- state the number of protons, neutrons and electrons in an atom of chlorine-35 and in an atom of chlorine-37

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

define the term isotopes

state the position of protons, neutrons and electrons in an atom of chlorine

state the number of protons, neutrons and electrons in an atom of chlorine-35 and in an atom of chlorine-37

[6]

[Turn over



- 3 (a) The table below shows the symbols or formulae of some elements and compounds.

$\text{Mg}(\text{HCO}_3)_2$	SO_3	F_2
HCl	NaCl	CaCO_3
SO_2	Na	O_2

Use the table to answer the following:

Give the **formula** of a diatomic gas.

Give the total **number** of atoms present in magnesium hydrogencarbonate.

What is the **formula** of sulfur dioxide?

_____ [3]

- (b) State the **name** of the compound with the formula CaCO_3 .

_____ [1]

- (c) Insert **numbers** to balance the equation below.



[2]





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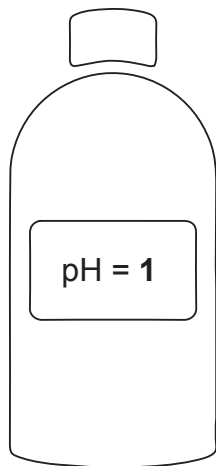
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(Questions continue overleaf)

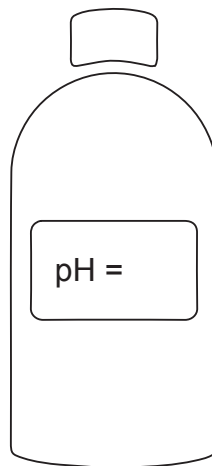


- 4 (a) Universal indicator is used to test the pH of substances. The diagram below shows four labelled bottles. Three pH values are missing.

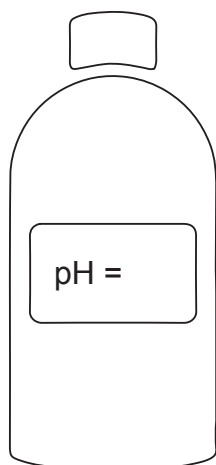
Write an appropriate pH value in the **space** provided on each of the three labels.



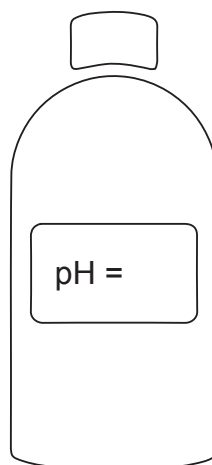
Hydrochloric acid



Ethanoic acid



Water



Sodium hydroxide

[3]



- (b) Universal indicator is used to test the pH of several household substances. Complete the table below by inserting the correct colour of universal indicator in each substance.

Substance	pH	Colour of universal indicator
drain cleaner	14	
battery acid	2	
toothpaste	10	

[3]

- (c) The base magnesium oxide reacts with hydrochloric acid in a neutralisation reaction.

Complete the following word equation for the reaction between magnesium oxide and hydrochloric acid.

magnesium oxide + hydrochloric acid $\longrightarrow$ _____ + _____

[2]

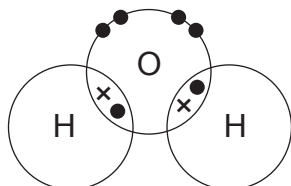
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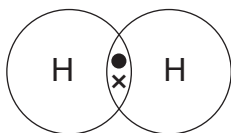
- 5 (a) Below are **four** dot and cross diagrams representing covalent molecules. Use **lines** to match each diagram to the correct description. One description will not be used.

Dot and cross diagram

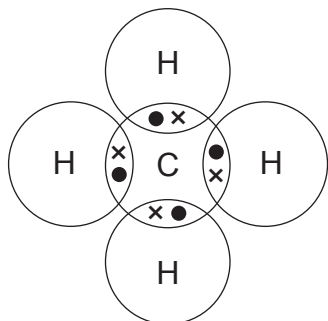
Description



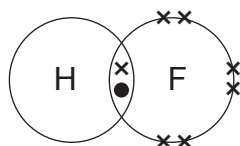
has four covalent bonds



has three lone pairs of electrons



is hydrogen



has three atoms bonded together

contains a metal

[4]



- (b) Molecules contain covalent bonds. Complete the following sentence about the **strength** of covalent bonds.

Covalent bonds are _____ and substantial _____ is
required to _____ them. [3]

[Turn over



- 6 The compound silver oxide, Ag_2O , breaks down on heating to form silver, Ag, and oxygen, O_2 , as shown in the following balanced symbol equation.



- (a) (i) Calculate the relative formula mass (M_r) of silver oxide, Ag_2O .

(Relative atomic masses (A_r): O = 16; Ag = 108)

relative formula mass = _____ [1]

- (ii) Silver nitrate, AgNO_3 , breaks down on heating to form silver, Ag, oxygen, O_2 , and nitrogen dioxide, NO_2 , as shown in the following balanced symbol equation.



Calculate the number of moles in 17.0 g of silver nitrate.

(Relative formula mass (M_r): AgNO_3 = 170)

moles = _____ [1]



- (iii) Use your answer to (a)(ii) and the balanced symbol equation in (a)(ii) to give the number of moles of silver that would be produced from 17.0 g of silver nitrate.

moles = _____ [1]

- (b) A ring has a mass of 12.5 g and contains 90% silver. Calculate the mass of silver in the ring to **one decimal place**. Use the following equation:

$$\frac{\text{mass of ring}}{100} \times 90 = \text{mass of silver in the ring}$$

mass = _____ g [2]

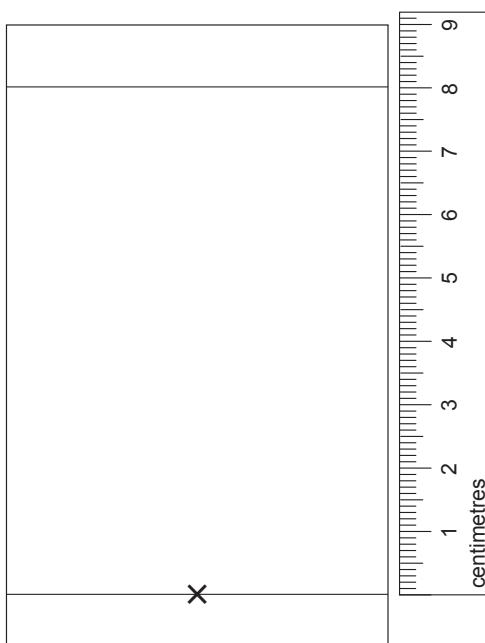
[Turn over



- 7 The values in the table below show the distance moved by four dyes **D1**, **D2**, **D3** and **D4** when placed in a solvent during a paper chromatography experiment.

Dye	Distance moved /cm
D1	2
D2	3
D3	6
D4	7

- (a) Use the information in the table to place a **spot** at the correct distance moved by dye **D2** on the chromatogram below.



[1]

- (b) Label the base line on the chromatogram above.

[1]



(c) State and explain which dye is the most soluble in the solvent used.

[2]

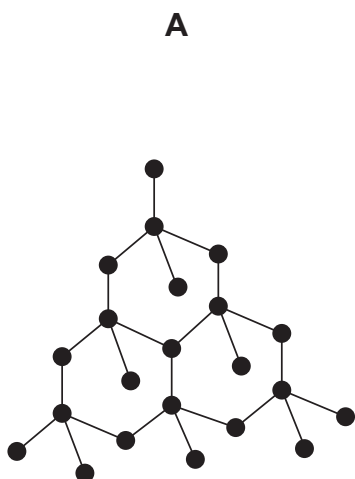
(d) What name is given to the line at 8 cm on the chromatogram?

[1]

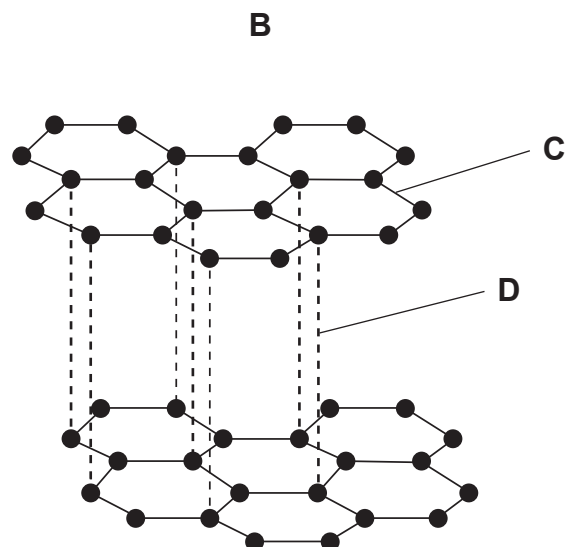
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8 (a) (i) Name the structures **A** and **B** below.



A _____



B _____

[2]

(ii) Name the element that both structures are made from.

_____ [1]

(iii) What is represented by the line labelled **C** in structure **B**?

_____ [1]

(iv) What name is given to the weak forces of attraction, labelled **D**, in structure **B**?

_____ [1]



- (b) The table below lists some physical properties. Using ticks (✓), select two properties of carbon dioxide, CO₂, and two properties of graphene.

Physical property	Carbon dioxide	Graphene
low boiling point		
does not conduct electricity		
strong		
high melting point		

[4]

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Sources:

Question 4(a)©AdobeStock

Question 5(a)Principal Examiner

Question 7(a)Principal Examiner

Question 8(a)(i). . . .Principal Examiner

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Question Number	Marks
1	
2	
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8	

Total Marks	
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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		2																																		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																												

* 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