



General Certificate of Secondary Education
2025–2026

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1

Foundation Tier



[GDW21]

GDW21

TUESDAY 11 NOVEMBER 2025, AFTERNOON

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 questions in black ink and use a dark HB pencil for drawings and graphs.

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.

You may use a scientific calculator.

Quality of written communication will be assessed in Question **2(a)**.

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

14878



20GDW2101

- 1 Calcium reacts with hydrochloric acid to produce calcium chloride and hydrogen. This reaction is shown in the equation below.

calcium + hydrochloric acid $\longrightarrow$ calcium chloride + hydrogen

- (a) (i) **Circle** the correct formula of the salt product in the equation above.

CaCL

CaCl

CaCl₂

[1]

- (ii) Using the following terms, complete the sentences below about the reaction between calcium and hydrochloric acid.

gas

solution

solid

liquid

A piece of _____ calcium is added to dilute hydrochloric acid.

Hydrogen _____ and calcium chloride _____ are produced.

[3]



(b) The table below gives the formulae of some compounds and an element.

HF	CH ₃ COOH	CuCO ₃
NaOH	O ₂	NH ₃
CuCl ₂	H ₂ O	CO ₂

Use the formulae in the table above to answer the following:

state the number of compounds which contain carbon atoms _____

state the formula of a coloured compound _____

state the formula of sodium hydroxide _____

state the formula of the element _____

[4]

[Turn over



- 2 (a) Sodium is a reactive Group 1 metal. When sodium is added to water, fizzing occurs.

Describe the reaction of sodium with water, using the headings below:

- name the two products formed in the reaction between sodium and water
- apart from fizzing, state three other observations which take place when sodium reacts with water
- other than wearing safety glasses, state two safety precautions that must be followed when adding sodium to water

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

name the two products formed in the reaction between sodium and water

apart from fizzing, state three other observations which take place when sodium reacts with water

other than wearing safety glasses, state two safety precautions that must be followed when adding sodium to water

[6]



(b) In the table below tick (✓) **two** physical properties which are typical of metals.

Property	Tick (✓)
does not conduct electricity	
dull	
brittle	
conductor of electricity	
ductile	

[2]



3 This question is about pure substances and mixtures.

- (a) Using words from the list below, complete the following sentence that describes a pure substance.

solution

compound

separated

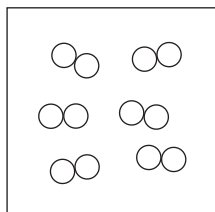
mixed

A pure substance is a single element or _____ not

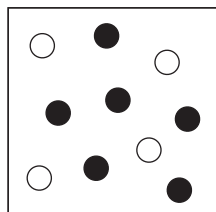
_____ with any other substance.

[2]

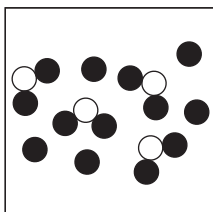
- (b) The following diagrams **A**, **B**, **C**, **D** and **E** represent elements, compounds, mixtures and pure substances.



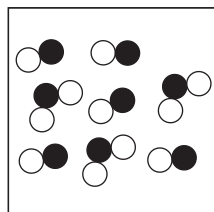
A



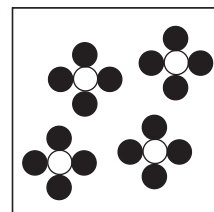
B



C



D



E

Select the diagram **A**, **B**, **C**, **D** or **E** which best describes the following:

a mixture of two elements

a compound containing molecules with 5 atoms

a mixture of an element and a compound

[3]

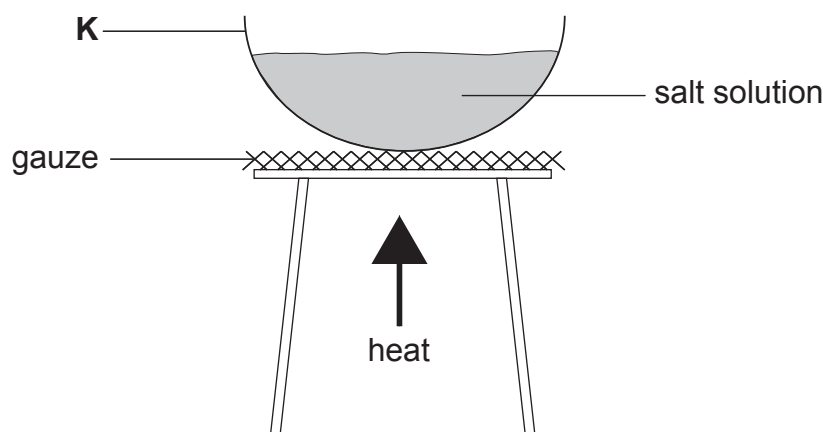


- (c) (i) A mixture of sand and salt can be separated by dissolving the salt in water. The sand is insoluble.

Name the separation technique used to separate the sand from the salt solution.

_____ [1]

- (ii) Evaporation can be used to separate the salt from the salt solution. The apparatus used for evaporation is shown below.



Name the piece of apparatus labelled K.

_____ [1]

- (iii) Name the piece of apparatus that would be used to heat the salt solution in the diagram above.

_____ [1]

- (iv) The salt collected is sodium chloride.

A flame test can be carried out to show that the salt contains the sodium ion.

What is the colour of the flame observed?

_____ [1]

[Turn over]



- 4 (a) (i) Complete the following table to give the correct colour of litmus paper in each of the following substances.

Substance	Blue Litmus	Red Litmus
hydrochloric acid	red	red
water	blue	
sodium hydroxide	blue	

[2]

- (ii) Name the **indicator** which can be used to test the pH of a substance.

[1]

- (b) (i) All alkalis produce the same ion when dissolved in water.

Give the formula of this ion.

[1]

- (ii) **Circle** the name of a strong acid below.

sodium hydroxide

hydrochloric acid

ethanoic acid

sodium chloride

[1]



- (c) (i) Calcium carbonate reacts with nitric acid to give calcium nitrate, water and carbon dioxide.

The balanced symbol equation for this reaction is given below.



Give **two** observations for this reaction.

1. _____
2. _____ [2]

- (ii) State the name of the reagent used to test for carbon dioxide and give the result for a positive test.

_____ [2]



- 5 (a) (i) Complete the table below to give the number of protons, electrons and neutrons in atoms of carbon-12 and carbon-14.

	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
carbon-12	6	12			
carbon-14	6	14			

[2]

- (ii) State the name given to atoms which have the same atomic number but different mass numbers.

[1]

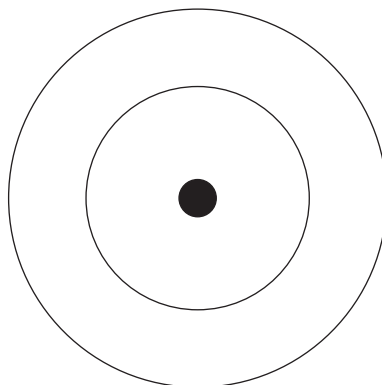
- (iii) Atoms are neutral. Tick (✓) the correct explanation below, which explains why atoms are neutral.

Explanation	Tick (✓)
there are unequal numbers of protons and neutrons	
there are equal numbers of protons and neutrons	
there are equal numbers of protons and electrons	

[1]



- (b) (i) Complete the diagram below to show the electronic configuration of a fluorine atom.
Show all the electrons.



[1]

- (ii) Which period in the Periodic Table contains fluorine?
Circle the correct answer below.

seven

one

three

two

[1]

[Turn over



- 6 (a) (i) Draw a dot and cross diagram to show the bonding in a molecule of hydrogen chloride, HCl.
Show outer electrons only.

[3]

- (ii) Cl_2 , HCl and O_2 are all examples of diatomic molecules. Complete the sentence below which gives the correct definition of a diatomic molecule.

Diatomic molecules are made of _____ atoms which
are _____ bonded.

[2]

- (b) (i) Calcium and oxygen react to form calcium oxide, CaO. The electronic configurations of the calcium atom and the oxygen atom are shown below.

calcium: 2,8,8,2
oxygen: 2,6

State how the electronic configurations of the calcium atom and the oxygen atom change when they react to form calcium oxide.

[2]

- (ii) State the type of bonding found in calcium oxide.

[1]





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(Questions continue overleaf)



- 7 (a) Iron(II) sulfate, FeSO_4 , reacts with barium nitrate, $\text{Ba}(\text{NO}_3)_2$, to produce iron(II) nitrate, $\text{Fe}(\text{NO}_3)_2$, and barium sulfate, BaSO_4 .



(Relative atomic mass: N = 14; O = 16; S = 32; Fe = 56; Ba = 137)

Calculate the relative formula mass of iron(II) sulfate.

relative formula mass = _____

Calculate the relative formula mass of barium nitrate.

relative formula mass = _____ [2]

- (b) (i) Calculate the number of moles in 46.6 g of barium sulfate.

(Relative formula mass of BaSO_4 = 233)

moles = _____ [1]

- (ii) Calculate the mass of 0.5 moles of iron(II) nitrate.

(Relative formula mass of $\text{Fe}(\text{NO}_3)_2$ = 180)

mass = _____ g [1]



- (c) Calculate the percentage of iron, by mass, in iron(II) nitrate, using the following equation.

(Relative formula mass of $\text{Fe}(\text{NO}_3)_2 = 180$)

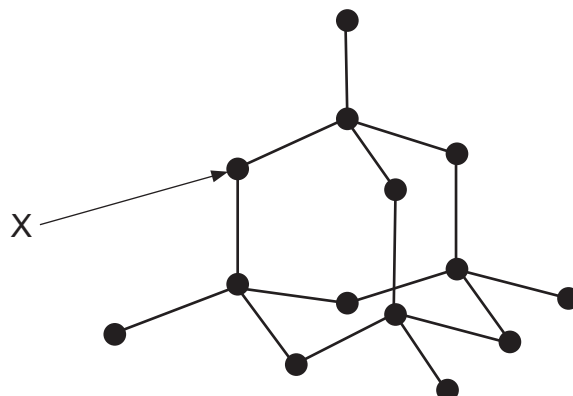
$$\text{percentage of iron} = \frac{\text{total mass of iron in iron(II) nitrate}}{\text{total mass of iron(II) nitrate}} \times 100$$

Show your working out.

percentage of iron = _____ % [2]



- 8 The diagram below shows an allotrope of carbon. This allotrope is diamond. The label X represents a carbon atom.



- (a) Place one tick (✓) in each column to show the type of bonding and type of structure found in diamond.

Type of bonding	Tick (✓)	Type of structure	Tick (✓)
covalent		giant covalent	
ionic		ionic lattice	
metallic		molecular covalent	

[2]

- (b) Name one other allotrope of carbon.

[1]

- (c) For each of the following options, **circle** the word or phrase that makes the statement true regarding the electrical conduction of diamond.

Diamond **can / cannot** conduct electricity as it does not have any

delocalised electrons / ions that can move and carry **charge / electricity**.

[3]





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Sources:

Question 3(b) *Principal Examiner*

Question 3(c)(ii) *Principal Examiner*

Question 8 *Principal Examiner*

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Question Number	Marks
1	
2	
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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

[illegible]

* 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