

Pearson Edexcel International Advanced Level

Wednesday 6 May 2026

Afternoon (Time: 1 hour 30 minutes)

**Paper
reference**

WCH11/01A

Chemistry

International Advanced Subsidiary/Advanced Level

UNIT 1: Structure, Bonding and Introduction to

Organic Chemistry

Question Paper

You must have:

Scientific calculator, ruler and Answer Book (sent separately)

Turn over ►

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SECTION A

Answer ALL the questions in this section in the Answer Book.

You should aim to spend no more than 20 minutes on this section.

For each question, select one answer from A to D and put a cross ☐ in the Answer Book. If you change your mind, put a line through the box ☒ and then mark your new answer with a cross ☐.

- 1 An atom has electrons in two s orbitals and three p orbitals.

What is the **maximum** number of electrons that this atom can have?

- A 2
- B 5
- C 7
- D 10

(Total for Question 1 = 1 mark)

- 2 What is meant by the term **carbon neutrality** when referring to fuels?

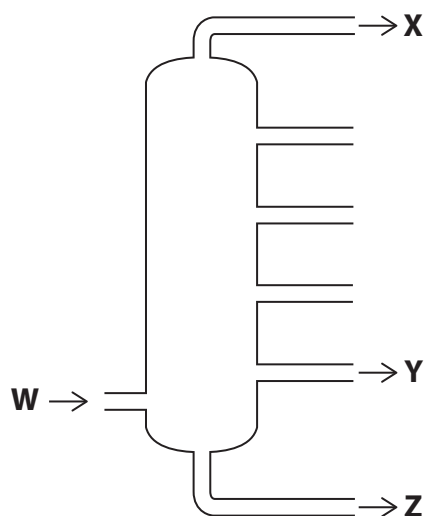
- A all combustion products of the fuel are neutral
- B on combustion the fuel releases zero carbon and carbon dioxide
- C equal amounts of carbon are emitted to and absorbed from the atmosphere
- D equal amounts of carbon dioxide are emitted to and absorbed from the atmosphere

(Total for Question 2 = 1 mark)

Use this space for any rough working. Anything you write in this space will gain no credit.

3 Alkanes are used as fuels.

A simplified diagram of a fractionating column is shown.



Which fraction contains molecules with the shortest average chain length?

- A** W
- B** X
- C** Y
- D** Z

(Total for Question 3 = 1 mark)

Use this space for any rough working. Anything you write in this space will gain no credit.

4 (a) Which condition is essential for cracking?

(1)

- A oxygen
- B phosphoric(V) acid catalyst
- C ultraviolet radiation
- D zeolite catalyst

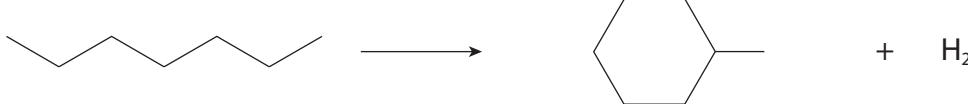
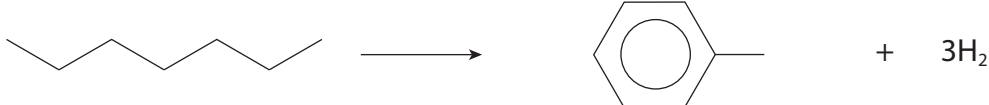
4 (b) Why is cracking used for the processing of some crude oil fractions?

(1)

- A to produce fuels that burn more efficiently
- B to remove impurities from the fractions
- C to convert long chain alkanes into shorter, more useful alkenes
- D to increase the chain length of the alkanes

4 (c) Which reaction does **not** occur in the reforming of heptane?

(1)

- A 
- B 
- C 
- D 

4 (d) Which reaction is **not** involved in the formation of acid rain?

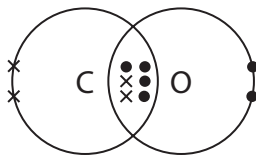
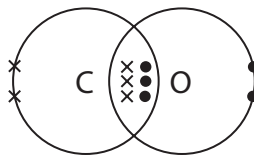
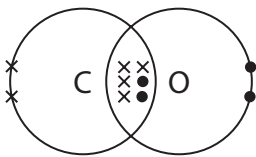
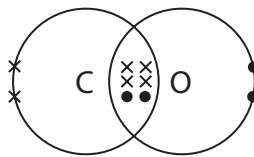
(1)

- A $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
- B $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$
- C $\text{C}_8\text{H}_{18} + 12\frac{1}{2}\text{O}_2 \rightarrow 9\text{H}_2\text{O} + 8\text{CO}_2$
- D $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$

- 4 (e) Carbon monoxide is a product of the incomplete combustion of alkane fuels.

Which is the dot-and-cross diagram for carbon monoxide?

(1)

A		B	
C		D	

(Total for Question 4 = 5 marks)

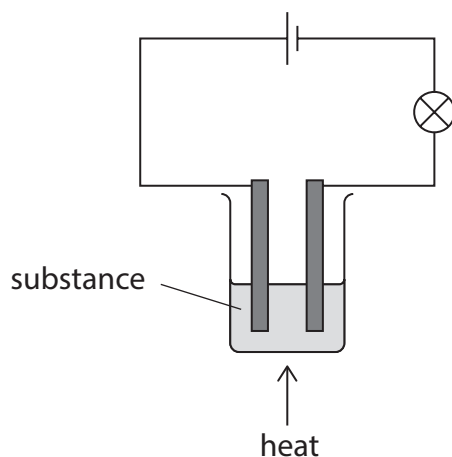
- 5 Methane reacts with chlorine in the presence of ultraviolet radiation.

Which equation shows a propagation step in this reaction?

- A** $\text{CH}_3\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$
- B** $\text{Cl}\cdot + \text{CH}_3\cdot \rightarrow \text{CH}_3\text{Cl}$
- C** $\text{Cl}\cdot + \text{CH}_2\text{Cl}\cdot \rightarrow \text{CH}_2\text{Cl}_2$
- D** $\text{H}\cdot + \text{Cl}_2 \rightarrow \text{HCl} + \text{Cl}\cdot$

(Total for Question 5 = 1 mark)

6 Electrical conductivity is investigated using the apparatus shown.



Which substance, **only** when molten, causes the bulb to light?

- A S
- B $\text{C}_6\text{H}_{12}\text{O}_6$
- C Na
- D NaCl

(Total for Question 6 = 1 mark)

7 Hydrogen chloride, HCl, is a covalently bonded molecule.

Which is the electron density map for HCl?

(1)

- A
- B
- C
- D

(Total for Question 7 = 1 mark)

8 The ionic radii of some ions are shown.

Ion	Li ⁺	Mg ²⁺	F ⁻	O ²⁻
Ionic radius / nm	0.060	0.065	0.136	0.140

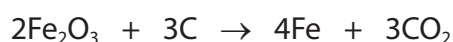
Which compound has the strongest ionic bonds?

(1)

- A LiF
- B Li₂O
- C MgF₂
- D MgO

(Total for Question 8 = 1 mark)

9 Iron metal can be extracted from iron(III) oxide by the reaction shown.



9 (a) What is the atom economy by mass of this process?

[Data: A_r values: C = 12.0 O = 16.0 Fe = 55.8]

(1)

- A 29.7%
- B 55.9%
- C 62.8%
- D 83.5%

9 (b) A sample of the iron ore haematite contains 68% by mass of iron(III) oxide.

What is the maximum mass of iron that can be obtained from 100 tonnes of haematite?

(1)

- A 23.8 tonnes
- B 35.0 tonnes
- C 47.5 tonnes
- D 69.9 tonnes

(Total for Question 9 = 2 marks)

- 10** A mass of 4.76 g of magnesium chloride was dissolved in deionised water to make 20.0 cm³ of solution.

What is the concentration, in mol dm⁻³, of **chloride ions** in this solution?

[Data: Molar mass of MgCl₂ = 95.3 g mol⁻¹]

- A** 4.99
- B** 2.50
- C** 1.25
- D** 1.00

(Total for Question 10 = 1 mark)

- 11** Which cation has the greatest polarising power?

- A** Na⁺
- B** K⁺
- C** Mg²⁺
- D** Ca²⁺

(Total for Question 11 = 1 mark)

- 12** Which reagent and condition are used to convert ethene into ethane-1,2-diol?

- A** hydrogen peroxide and a manganese(IV) oxide catalyst
- B** oxygen gas and high pressure
- C** potassium manganate(VII) and sulfuric acid
- D** steam and a phosphoric(V) acid catalyst

(Total for Question 12 = 1 mark)

- 13** When carrying out chemical experiments, the hazards and risks must be considered.

For a 2.0 mol dm⁻³ solution of hydrochloric acid

- A** the hazard varies but the risk is fixed
- B** the hazard is fixed but the risk varies
- C** both hazard and risk vary
- D** both hazard and risk are fixed

(Total for Question 13 = 1 mark)



14 Which statement is **not** correct about graphene?

- A** it is an excellent electrical conductor
- B** it can be rolled into a cylinder to form nanotubes
- C** it has a giant structure
- D** it has a multi-layered structure

(Total for Question 14 = 1 mark)

15 A 0.500 g sample of toothpaste contains 1.45×10^{-5} mol of sodium fluoride.

What is the concentration, in ppm by mass, of fluoride ions in this toothpaste?

- A** 276
- B** 551
- C** 609
- D** 1220

(Total for Question 15 = 1 mark)

TOTAL FOR SECTION A = 20 MARKS

SECTION B

Answer ALL the questions. Write your answers in the spaces provided in the Answer Book.

16 Periodicity is the repeating pattern of properties across different periods.

(a) Period **4** contains elements in the s, p and d blocks.

Give the symbols of **two** elements from Period **4** that are in each of these blocks.

(2)

16 (b) First ionisation energies generally increase across Period **2** but there is a decrease from beryllium (Be) to boron (B).

16 (b) (i) Explain the general increase in first ionisation energy across Period **2**.

(2)

16 (b) (ii) Explain the decrease in first ionisation energy from Be to B.

(2)

16 (c) The boiling temperatures for some Period **3** elements are shown.

Element	Na	Mg	Al	Si	P	S	Cl
Boiling temperature / °C	883	1107	2467	2355	280	445	-35

16 (c) (i) Explain why the boiling temperature of aluminium is higher than that of sodium.

(3)

16 (c) (ii) The boiling temperature of silicon is much higher than that of chlorine.

Explain this difference with reference to the structure and bonding of these two elements.

(3)

(Total for Question 16 = 12 marks)

17 This question is about gases.

- (a) A gas cylinder has a volume of 250 dm^3 .

The gas cylinder holds 5.72 kg of gas at a pressure of $1.37 \times 10^7 \text{ Pa}$ at 15.0°C .

Determine the molar mass and the identity of the gas.

Use the ideal gas equation, $pV = nRT$.

You **must** show your working.

[Data: $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$]

(5)

- 17** (b) Zinc reacts with hydrochloric acid to produce hydrogen gas.



- 17** (b) (i) Write the **ionic** equation for this reaction. Include state symbols.

(1)

- 17** (b) (ii) 0.214 g of zinc is added to 25.0 cm^3 of $0.250 \text{ mol dm}^{-3}$ hydrochloric acid.

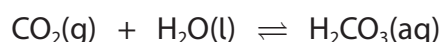
75 cm^3 of hydrogen gas is produced, measured at room temperature and pressure (r.t.p.).

Show by calculation which reagent is in excess.

[Data: 1 mol of any gas occupies $24\,000 \text{ cm}^3$ at r.t.p.]

(3)

- 17** (c) Carbon dioxide gas dissolves in water to form a solution of carbonic acid, as shown.



- 17** (c) (i) 1.98×10^{21} carbon dioxide molecules are dissolved in deionised water to form 100 cm^3 of solution.

Calculate the concentration, in g dm^{-3} , of carbon dioxide in this solution.

[Data: Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$]

(3)

- 17** (c) (ii) Molecules of ammonia and carbon dioxide both contain polar bonds. However, ammonia molecules are polar but carbon dioxide molecules are non-polar.

Explain these statements.

(4)

- 17** (d) Phosphorus(V) chloride, PCl_5 , exists as a gas above 167°C .

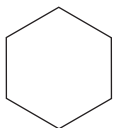
Draw a labelled three-dimensional diagram of a molecule of PCl_5 .

Include the name of the molecular shape and the bond angles in your answer.

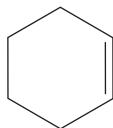
(3)

(Total for Question 17 = 19 marks)

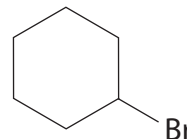
18 This question is about cyclohexane, cyclohexene and bromocyclohexane, which have the structures shown.



cyclohexane



cyclohexene



bromocyclohexane

18 (a) Identify, by name or formula, a catalyst used for the conversion of cyclohexene into cyclohexane. (1)

18 (b) The percentage by mass of hydrogen in cyclohexane is different from that in cyclohexene.

Calculate this **difference**.

Give your answer to **one** decimal place.

(3)

18 (c) Cyclohexene reacts with hydrogen bromide to form bromocyclohexane.

Draw the mechanism for this reaction.

Include curly arrows, and relevant dipoles and lone pairs.

(4)

18 (d) Bromocyclohexane can also be made by the reaction of cyclohexane with bromine.

18 (d) (i) Write an equation to show the homolytic fission of a bromine molecule. Include curly half-arrows. (2)

18 (d) (ii) A student stated that a bromine free radical is a species with one electron. Give **two** reasons why this statement is inaccurate. (2)

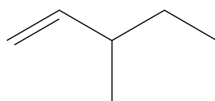
18 (d)(iii) Explain why this reaction is of limited use in the laboratory preparation of bromocyclohexane. (2)

18 (e) Draw the structure of poly(cyclohexene) showing **two** repeat units.

(1)

18 (f) Cyclohexane, cyclohexene and bromocyclohexane have isomers.

18 (f) (i) A branched-chain isomer of cyclohexane is shown.



Name this isomer according to IUPAC rules.

(1)

18 (f) (ii) Cyclohexene has three structural isomers in which the $C=C$ bond forms part of a five-carbon ring.

Draw the **skeletal** formulae of these isomers in the Answer Book boxes.

(2)

18 (f) (iii) There is a fourth structural isomer of cyclohexene that has a five-carbon ring.

Draw the structure of this isomer.

(1)

(Total for Question 18 = 19 marks)

19 Mass spectrometry is used to determine the masses of atoms and molecules.

19 (a) A very accurate mass spectrometer was used to analyse a sample of bromine.
The table shows some results of this analysis.

Isotope	Relative isotopic mass	Percentage abundance
^{79}Br	To be calculated	50.54
^{81}Br	80.9163	49.46

The relative atomic mass of bromine is 79.9065.

Calculate the relative isotopic mass of ^{79}Br .

Give your answer to **six** significant figures.

(3)

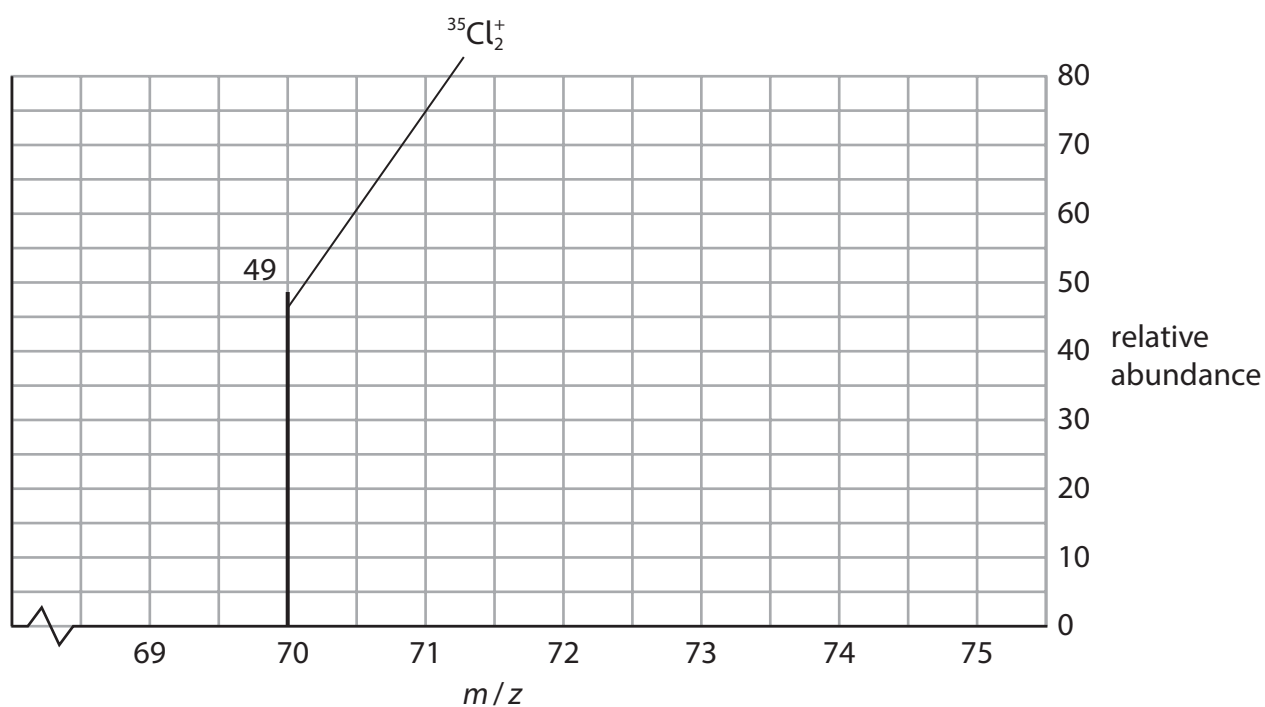
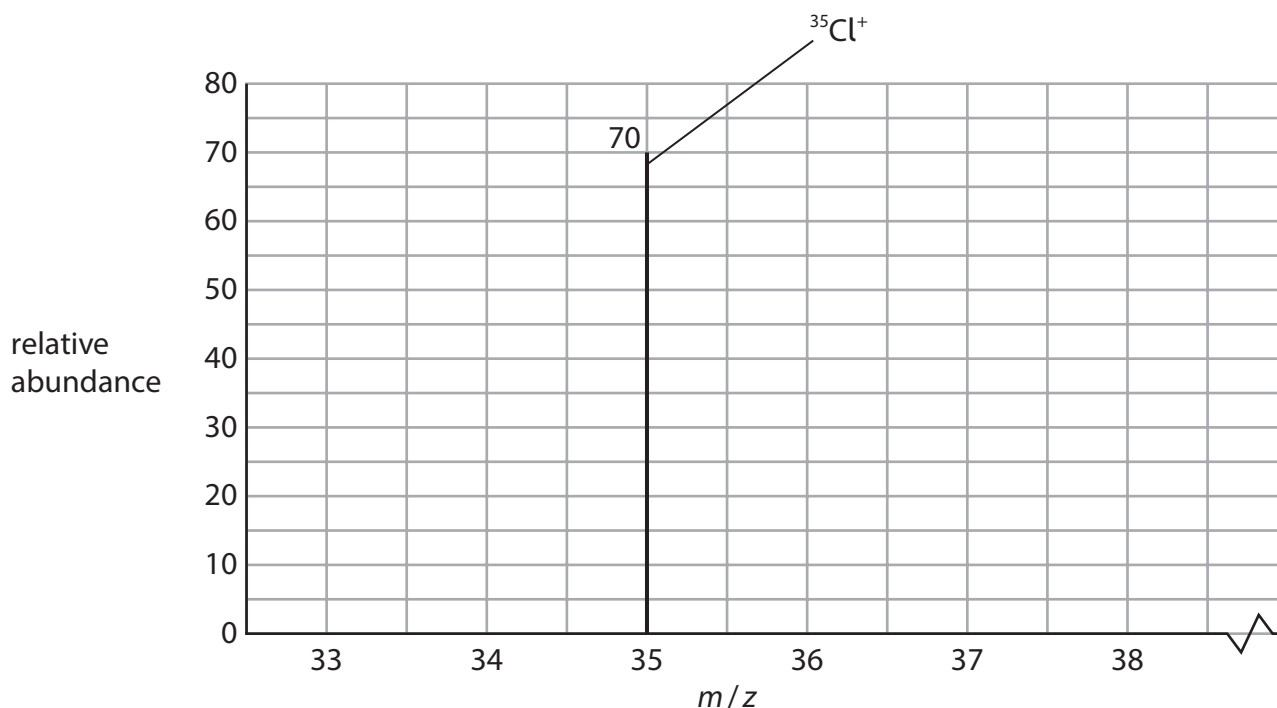
19 (b) Chlorine has two isotopes, ^{35}Cl and ^{37}Cl .

A sample of chlorine gas was found to contain these isotopes with the approximate abundances of 70% and 30% respectively.

An incomplete mass spectrum for a sample of chlorine gas is shown in two parts.

Complete the mass spectrum in the Answer Book by adding **all** the missing peaks. Include labels.

(4)



- 19 (c)** The mass spectrum of compound **R**, which contains **only** carbon and fluorine, has a peak at $m/z = 69$.

The peak is due to a molecular ion with a charge of $2+$.

Determine the molecular formula of **R**.

You **must** show your working.

(2)

- 19 (d)** The mass spectrum of a sample of hexane showed the presence of the molecular ion $C_6H_{14}^+$, and the fragment ions $C_4H_9^+$, $C_3H_7^+$ and $C_2H_5^+$.

Deduce which of these four ions was deflected the **most** in the mass spectrometer.

Justify your answer.

(1)

(Total for Question 19 = 10 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS



Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

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Wednesday 6 May 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WCH11/01A**

Chemistry

International Advanced Subsidiary/Advanced Level

UNIT 1: Structure, Bonding and Introduction to Organic Chemistry

Answer Book

You must have:
Scientific calculator, ruler and Question Paper (sent separately)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- A Periodic Table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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SECTION A

Answer ALL the questions in this section.

You should aim to spend no more than 20 minutes on this section.

For each question, select one answer from A to D and put a cross in the box ☒. If you change your mind, put a line through the box ☒ and then mark your new answer with a cross ☒.

1

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 1 = 1 mark)

2

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 2 = 1 mark)

3

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 3 = 1 mark)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



4 (a)

(1)

- ☐ A
☐ B
☐ C
☐ D

4 (b)

(1)

- ☐ A
☐ B
☐ C
☐ D

4 (c)

(1)

- ☐ A
☐ B
☐ C
☐ D

4 (d)

(1)

- ☐ A
☐ B
☐ C
☐ D



4 (e)

(1)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 4 = 5 marks)

5

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 5 = 1 mark)

6

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 6 = 1 mark)

7

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 7 = 1 mark)



8

☐ A☐ B☐ C☐ D

(Total for Question 8 = 1 mark)

9 (a)

(1)

☐ A☐ B☐ C☐ D

9 (b)

(1)

☐ A☐ B☐ C☐ D

(Total for Question 9 = 2 marks)

10

☐ A☐ B☐ C☐ D

(Total for Question 10 = 1 mark)



11

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 11 = 1 mark)

12

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 12 = 1 mark)

13

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 13 = 1 mark)

14

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 14 = 1 mark)



15

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(Total for Question 15 = 1 mark)

TOTAL FOR SECTION A = 20 MARKS



SECTION B

Answer ALL the questions. Write your answers in the spaces provided.

16 (a)

(2)

s block

p block

d block

16 (b) (i)

(2)

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.....

.....

16 (b) (ii)

(2)

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.....

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



16 (c) (i)

(3)

16 (c) (ii)

(3)

(Total for Question 16 = 12 marks)



17 (a)

(5)

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DO NOT WRITE IN THIS AREA

Molar mass of gas

Identity of gas



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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

17 (b) (i)

(1)

17 (b) (ii)

(3)



17 (c) (i)

(3)

17 (c) (ii)

(4)

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17 (d)

(3)

(Total for Question 17 = 19 marks)



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18 (a)

(1)

18 (b)

(3)

18 (c)

(4)



18 (d) (i)

(2)

18 (d) (ii)

(2)

18 (d) (iii)

(2)

18 (e)

(1)



18 (f) (i)

(1)

18 (f) (ii)

(2)

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18 (f) (iii)

(1)

(Total for Question 18 = 19 marks)



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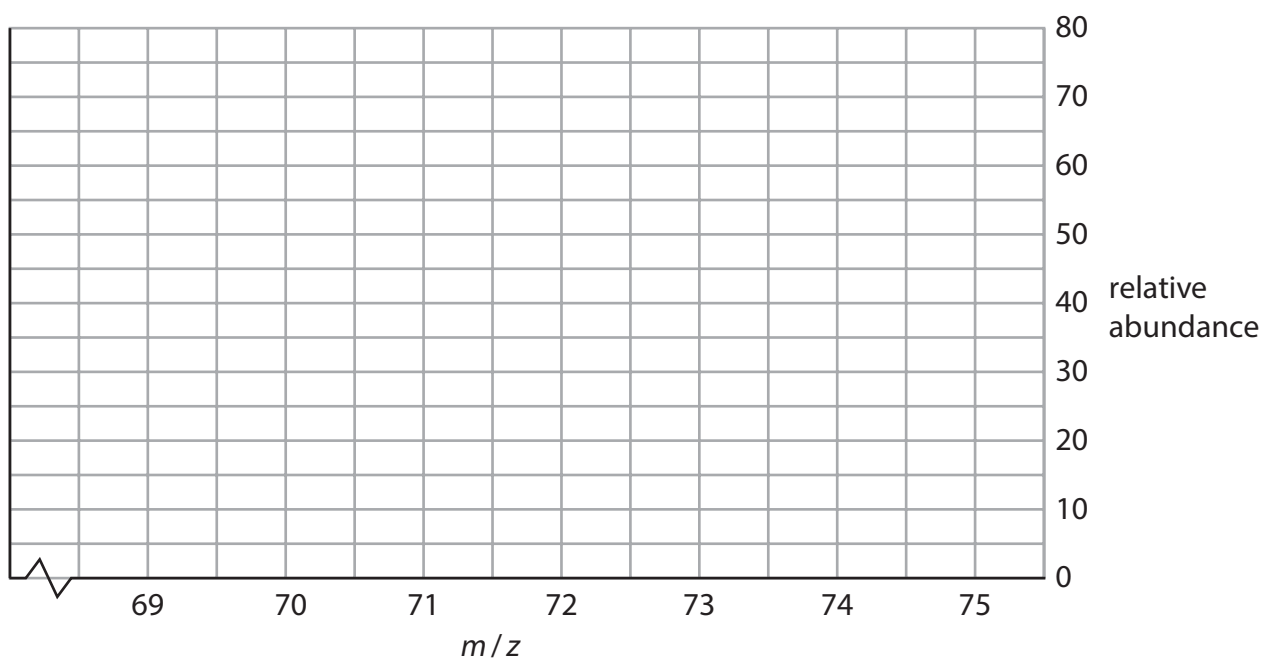
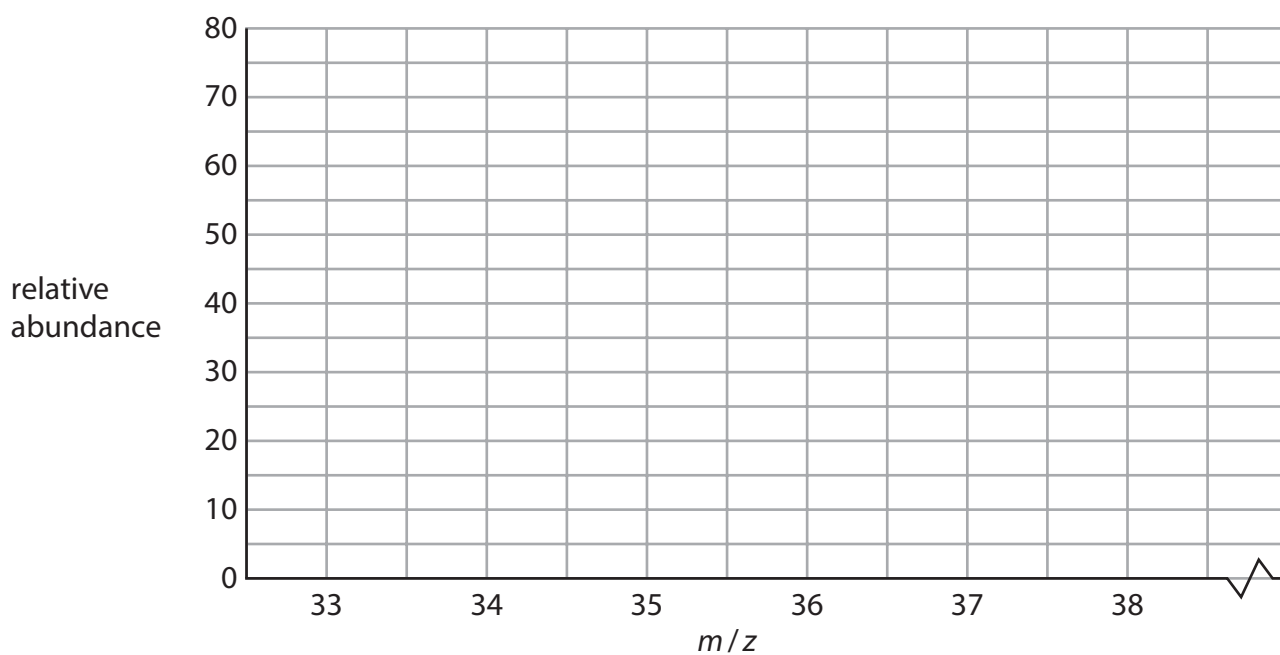
19 (a)

(3)



19 (b)

(4)



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DO NOT WRITE IN THIS AREA



19 (c)

(2)

.....

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.....

.....

19 (d)

(1)

.....

.....

(Total for Question 19 = 10 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS



20

* Lanthanide series

* Actinide series

Elements with atomic numbers 112-116 have been reported but not fully authenticated

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