

2: What volume of sulfur dioxide gas reacts completely with 50 cm³ of 0.12 mol dm⁻³ sodium hydroxide solution?

[molar volume of a gas = 24 dm³ at room temperature and pressure]



- A 0.072 dm³
- B 0.144 dm³
- C 0.288 dm³
- D 72 dm³

(Total for Question 2 = 1 mark)

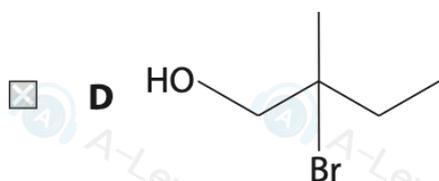
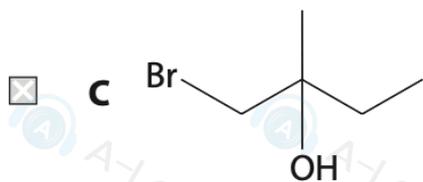
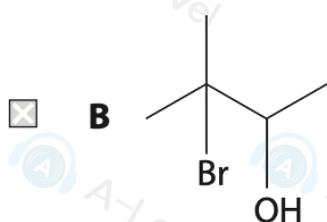
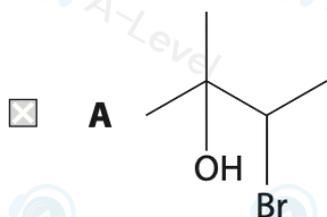
15 What is the number of structural isomers with the molecular formula C₅H₁₂?

- A six
- B five
- C four
- D three

(Total for Question 15 = 1 mark)

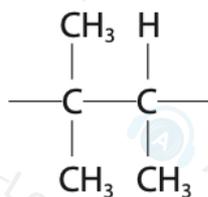
17 Bromine and bromine water can be used to test for a carbon-carbon double bond. When **bromine water** reacts with 2-methylbut-2-ene, there is one major organic product.

Which is the skeletal formula of the **major** product?



(Total for Question 17 = 1 mark)

16 The repeat unit of a polymer is shown.



Which is the name of the monomer that forms this polymer?

- A 1,1,2-trimethylethene
- B 1,1-dimethylpropene
- C 2-methylbut-2-ene
- D 3-methylbut-2-ene

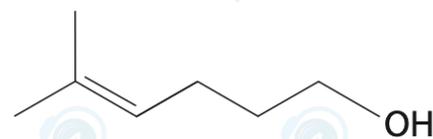
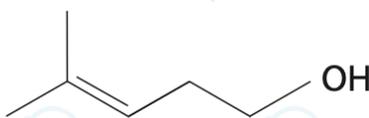
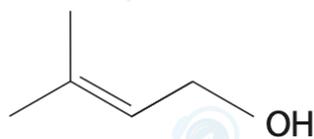
(Total for Question 16 = 1 mark)

1: Which row shows the numbers of neutrons and electrons in a bromide ion $^{79}\text{Br}^-$?

	Number of neutrons	Number of electrons
<input type="checkbox"/> A	44	35
<input type="checkbox"/> B	44	36
<input type="checkbox"/> C	46	35
<input type="checkbox"/> D	46	36

(Total for Question 1 = 1 mark)

17 What is the name of a series such as the one shown?



- A addition
- B heterolytic
- C homologous
- D homolytic

(Total for Question 17 = 1 mark)

13: Which type of reaction occurs when an alkane is cracked?

- A** combustion
- B** hydrolysis
- C** neutralisation
- D** thermal decomposition

(Total for Question 13 = 1 mark)

18 Which is **not** a step in the reaction of chlorine with propane in ultraviolet radiation?

- A** $\text{C}_3\text{H}_7\cdot + \text{Cl}\cdot \rightarrow \text{C}_3\text{H}_7\text{Cl}$
- B** $\text{C}_3\text{H}_7\cdot + \text{C}_3\text{H}_7\cdot \rightarrow \text{C}_6\text{H}_{14}$
- C** $\text{C}_3\text{H}_7\cdot + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{Cl}\cdot$
- D** $\text{C}_3\text{H}_7\cdot + \text{HCl} \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{H}\cdot$

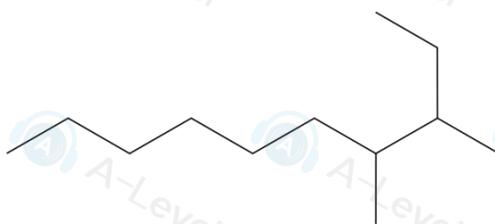
(Total for Question 18 = 1 mark)

1 Which compound has the greatest covalent character?

- A** MgBr_2
- B** MgF_2
- C** NaBr
- D** NaF

(Total for Question 1 = 1 mark)

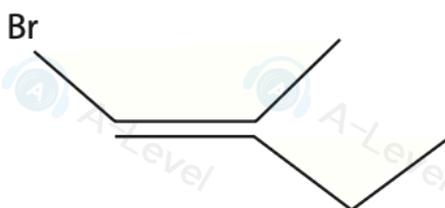
15 What is the IUPAC name for the hydrocarbon shown?



- A 2-ethyl-3-methylnonane
- B 3,4-dimethyldecane
- C 8-ethyl-7-methylnonane
- D 7,8-dimethyldecane

(Total for Question 15 = 1 mark)

17 What is the IUPAC name for the compound shown?



- A E-1-bromo-2-methylbut-1-ene
- B Z-1-bromo-2-methylbut-1-ene
- C E-1-bromo-2-ethyl-2-methylethene
- D Z-1-bromo-2-ethylpropene

(Total for Question 17 = 1 mark)

4 N_xO_4 is an oxide of nitrogen.

The percentage by mass of oxygen in this oxide is 69.57%.

What is the relative molecular mass of this oxide?

- A 78
- B 92
- C 106
- D 109

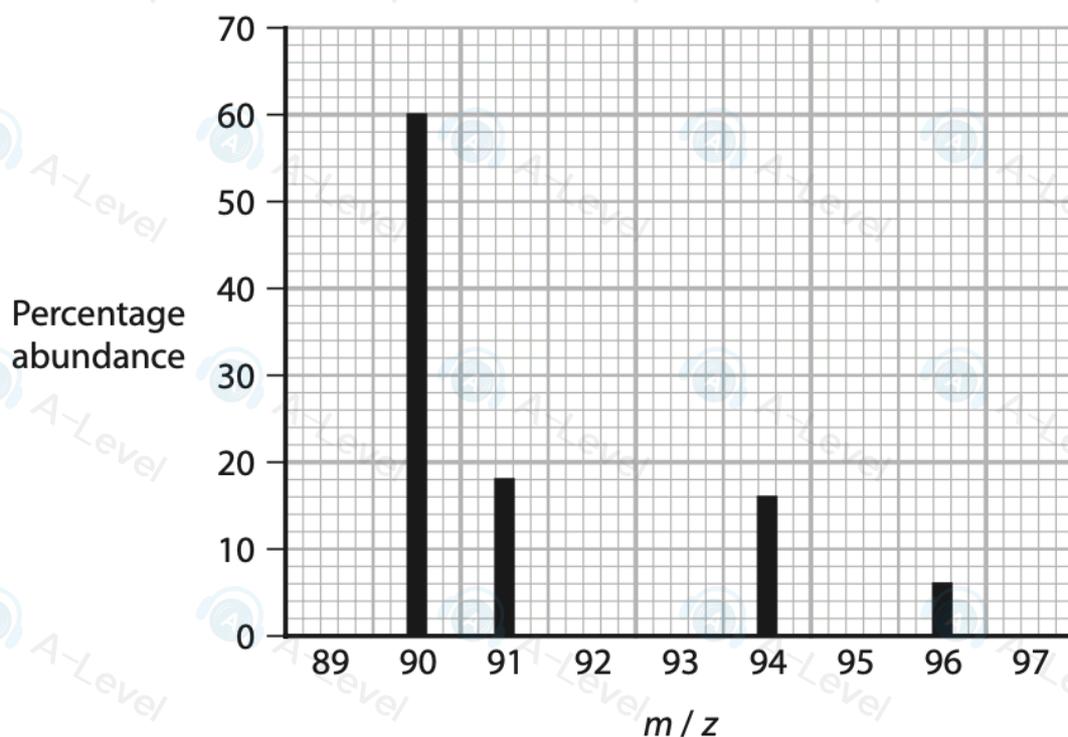
(Total for Question 4 = 1 mark)

9: Which method for the preparation of hydrogen has the highest atom economy by mass?

- A $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- B $\text{CH}_4 + \text{H}_2\text{O} \rightarrow 3\text{H}_2 + \text{CO}$
- C $\text{CO} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{CO}_2$
- D $\text{CH}_3\text{OH} + \text{H}_2\text{O} \rightarrow 3\text{H}_2 + \text{CO}_2$

(Total for Question 9 = 1 mark)

7 The mass spectrum of an element is shown.



What is the relative atomic mass of this element?

- A 90.0
- B 90.9
- C 91.2
- D 92.8

(Total for Question 7 = 1 mark)

7 A sample of hydrated magnesium sulfate contains 43% by mass of water.

What is the formula of this magnesium sulfate?

- A $\text{MgSO}_4 \cdot 9\text{H}_2\text{O}$
- B $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$
- C $\text{MgSO}_4 \cdot 2.5\text{H}_2\text{O}$
- D $\text{MgSO}_4 \cdot 1.25\text{H}_2\text{O}$

(Total for Question 7 = 1 mark)

21 Boric acid is a white solid often used as an antiseptic.

- (a) Boric acid contains 17.48% by mass of boron, 77.67% of oxygen and the remainder is hydrogen. The molar mass of boric acid is 61.8 g mol^{-1} .

[A_r values: H = 1 B = 10.8 O = 16]

Show that the molecular formula of boric acid is H_3BO_3 .

You must show all your working.

(4)

- (b) The formula of boric acid can also be written as $\text{B}(\text{OH})_3$.

- (i) Draw a dot-and-cross diagram for this molecule.
Show outer electrons only.

(3)

- (ii) Suggest a value for the O—B—O bond angle. Justify your answer.

(2)

(Total for Question 21 = 9 marks)

23 Oxygen is vital in the treatment of respiratory diseases. Oxygen is traditionally produced by the fractional distillation of air.

(a) Suggest **one** difference between the fractional distillation of air and of crude oil.

(1)

(b) Hospital patients sometimes need to breathe air with a higher than normal concentration of oxygen.

The oxygen concentration can be increased to 90% by passing dry air through a tube filled with zeolite which adsorbs most of the nitrogen.

(i) Dry air contains 21.0% oxygen by volume.

The average human breath has a volume of 500 cm^3 .

Calculate the volume of air, in dm^3 , that would have to pass over the zeolite to obtain 500 cm^3 of gas containing 90% oxygen by volume.

(2)

(ii) Nitrogen molecules bind to zeolite using their outer electrons.

Draw a dot-and-cross diagram of the bonding in a nitrogen molecule.
Show outer electrons only.

(2)

20 This question is about magnesium, magnesium oxide and magnesium sulfate.

- (a) A sample of magnesium contains three isotopes and has a relative atomic mass of 24.32.

The table gives the relative abundances of two of these isotopes.

Mass number	24	25
Relative abundance / %	78.99	10.00

- (i) Calculate the relative abundance and hence the mass number of the third isotope.

Give your answer to the appropriate number of significant figures.

You must show all your working.

(4)

- (ii) State **one** similarity and **one** difference between these isotopes.

(1)

- (iii) State which of these isotopes would be deflected most in a mass spectrometer. Justify your answer.

(1)

(c) The table gives some data about the electrical conductivity of magnesium and magnesium oxide.

State	Electrical conductivity	
	Magnesium	Magnesium oxide
solid	high	low
liquid	high	high

Explain the similarities and differences in the electrical conductivity of the two substances.

(2)

(d) Magnesium sulfate can be made by reacting magnesium with dilute sulfuric acid.

(i) Write an equation for the reaction that occurs.

Include state symbols in your answer.

(2)

(ii) Give **two** observations you would make when the reaction is taking place.

(2)
