

Practice Paper 1

Question Paper

Course	DP IB Chemistry
Section	Set B
Topic	Practice Paper 1
Difficulty	Medium

Time allowed: 40

Score: /30

Percentage: /100

Question 1

Which equation below represents deposition?

- A** $2\text{Al(s)} + 3\text{Br}_2\text{(g)} \rightarrow 2\text{AlBr}_3\text{(s)}$
- B** $\text{MgCO}_3\text{(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$
- C** $\text{I}_2\text{(g)} \rightarrow \text{I}_2\text{(s)}$
- D** $\text{HgCl}_2\text{(s)} \rightarrow \text{HgCl}_2\text{(g)}$

[1 mark]

Question 2

A compound of molar mass 92 g mol^{-1} contains 12g of carbon, 2g of hydrogen and 32g of oxygen. What is the molecular formula of the compound?

- A** CH_2O_2
- B** CH_2O
- C** $\text{C}_2\text{H}_4\text{O}_2$
- D** $\text{C}_2\text{H}_4\text{O}_4$

[1 mark]

Question 3

A periodic table is needed for this question

A 2.27 dm^3 sample of nitrogen gas, measured under standard conditions, reacted with a large excess volume of hydrogen gas to produce ammonia. Only 20.0% of the nitrogen gas reacted to produce ammonia.

What mass of ammonia was made?

- A** 0.20 g
- B** 0.34 g
- C** 0.68 g
- D** 1.36 g

[1 mark]

Question 4

A periodic table is needed for this question

When a 1.00 g sample of carbon is burned in a limited supply of oxygen, 0.72 g of the carbon combusts to form CO_2 and 0.28 g of the carbon combusts to form CO.

These gases were passed through excess NaOH(aq) which absorbs the CO_2 , but not the CO. The remaining gas was then dried and collected.

Assuming that all gas volumes were taken at 25°C and 100 kPa pressure, what was the volume of gas at the end of the reaction? (Molar Volume of a gas at rtp = 24 dm^3)

- A** 0.01 dm^3
- B** 100 cm^3
- C** 2.40 dm^3
- D** 240 cm^3

[1 mark]

Question 5

The atomic number of an element gives the number of protons in the nucleus which is also equal to the number of electrons. Which statement explains why atoms are neutral?

- A** one proton has a mass 1840 times greater than one electron
- B** the charge on an electron is equal and opposite to the charge on a proton
- C** the difference in charge between electrons and protons is balanced by the neutrons
- D** electrons are spread out in shells around the nucleus while protons are concentrated inside the nucleus

[1 mark]

Question 6

Element X is in period 2 and has the first seven ionisation energies in kJ mol^{-1} as shown.

1300	3380	5330	7460	11 010	13 320	71 200
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What is the electronic configuration of element X?

- A** $1s^2 2s^2 2p^4$
- B** $1s^2 2s^2 2p^2$
- C** $1s^2 2s^2 2p^3$
- D** $1s^2 2s^2 2p^6$

[1 mark]

Question 7

A periodic table is needed for this question

Sodium sulfide, Na_2S , is a reactive yellow solid, produced when sodium and sulfur react together.

How do the ionic radius and atomic radius of sodium compare with those of sulfur?

	ionic radius	atomic radius
A	sodium < sulfur	sodium < sulfur
B	sodium < sulfur	sodium > sulfur
C	sodium > sulfur	sodium > sulfur
D	sodium > sulfur	sodium < sulfur

[1 mark]

Question 8

Which statement correctly describes the trend in metallic radius in group I elements Na to Rb?

- I. Increases moving down the group
- II. Increases moving down due to the addition of electron shells
- III. Decreases moving down due to increasing nuclear forces

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]

Question 9

Phosphine, PH_3 , can react with a hydrogen ion, H^+ , to form the phosphonium ion.

Which type of bond is formed in this reaction?

- A. dipole-dipole forces
- B. dative covalent bond
- C. ionic bond
- D. hydrogen bond

[1 mark]

Question 10

Which of the following statements about graphite are correct?

- I. The carbon atoms are joined together by three covalent bonds
- II. Graphite contains delocalised electrons
- III. The C-C-C bond angle is 109.5°

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]

Question 11

The properties of alloys can be explained in terms of metals having

- I. Non-directional bonding
- II. Delocalised electrons
- III. Ions of different size

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]

Question 12

A student mixed 30.0 cm^3 of $0.0250 \text{ mol dm}^{-3}$ potassium hydroxide solution with 30.0 cm^3 of $0.0250 \text{ mol dm}^{-3}$ nitric acid. The temperature rose by 0.50°C . Assume no heat was lost to the surroundings.

The mixture had a specific heat capacity of $4.18 \text{ J g}^{-1} \text{ K}^{-1}$.

What is the molar enthalpy change for the reaction?

A. $-\frac{30 \times 4.18 \times 0.5 \times 1000}{0.025 \times 30}$

B. $-\frac{60 \times 4.18 \times 0.5}{0.025 \times 30}$

C. $-\frac{0.025 \times 30}{60 \times 4.18 \times 0.5 \times 1000}$

D. $-\frac{60 \times 4.18 \times 0.5}{0.025 \times 30}$

[1 mark]

Question 13

The reaction of hydrochloric acid with sodium hydroxide produced an overall temperature increase of 24.4 K .

Given the following data, how much thermal energy was evolved during this reaction?

Initial temperature of 25.0 cm^3 hydrochloric acid = 17.6°C

Initial temperature of 25.0 cm^3 sodium hydroxide = 18.5°C

The specific heat capacity of water is $4.18 \text{ J g}^{-1} \text{ K}^{-1}$.

A. $(25.0 \times 4.18 \times 6.8) + (25.0 \times 4.18 \times 5.9)$

B. $\frac{(25.0 \times 4.18 \times 6.8) + (25.0 \times 4.18 \times 5.9)}{2}$

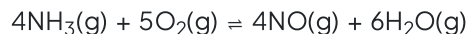
C. $50.0 \times 4.18 \times \left(\frac{6.8 + 5.9}{2}\right)$

D. $(50.0 \times 4.18 \times 6.8) + (50.0 \times 4.18 \times 5.9)$

[1 mark]

Question 14

The first stage in the industrial production of nitric acid from ammonia can be represented by the following equation.



Using the following standard enthalpy change of formation data, what is the value of the standard enthalpy change ΔH^\ominus for this reaction?

Compound	$\Delta H_f^\ominus / \text{kJ mol}^{-1}$
$\text{NH}_3(\text{g})$	-46.1
$\text{NO}(\text{g})$	+90.3
$\text{H}_2\text{O}(\text{g})$	-241.8

- A. $(4 \times (-46.1)) + ((4 \times 90.3) + (6 \times (-241.8)))$
- B. $((4 \times 90.3) + (6 \times (-241.8)) - (4 \times (-46.1)))$
- C. $(4 \times (-46.1)) - ((4 \times 90.3) + (6 \times (-241.8)))$
- D. $(-46.1) - (90.3) + (-241.8)$

[1 mark]

Question 15

Which equation correctly shows how the bond energy for the covalent bond Y-Z can be calculated by dividing ΔH by n?

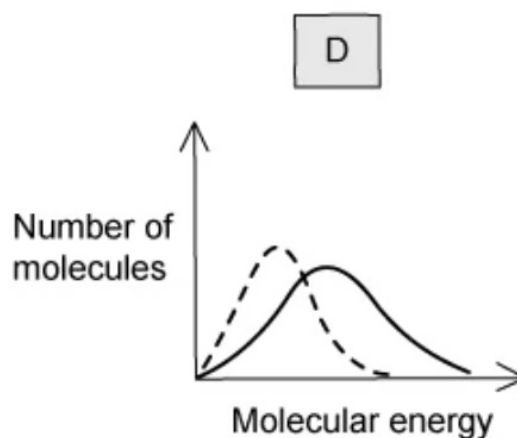
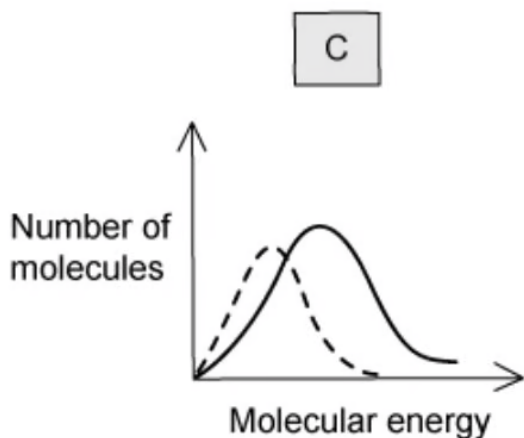
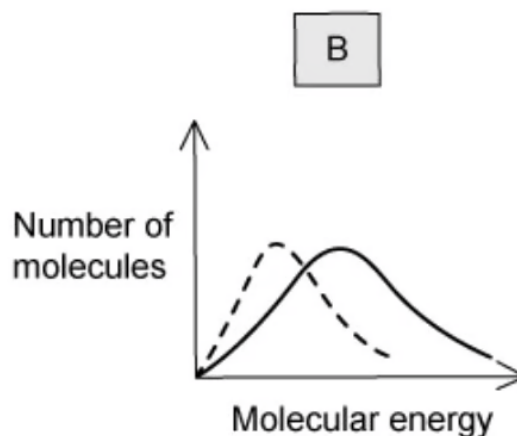
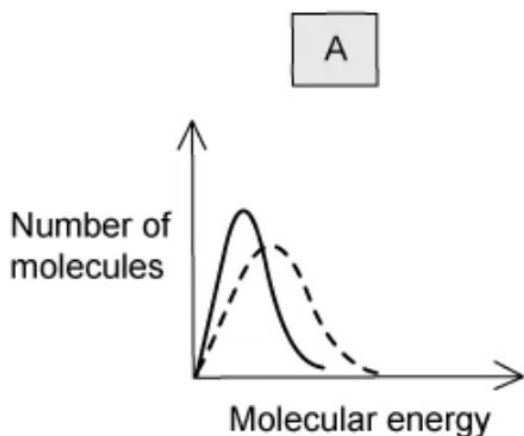
- A. $n\text{YZ}(\text{g}) \rightarrow n\text{Y}(\text{g}) + \frac{n}{2} \text{Z}_2(\text{g})$
- B. $\text{Z}(\text{g}) + \text{YZ}_{n-1}(\text{g}) \rightarrow \text{YZ}_n(\text{g})$
- C. $2\text{YZ}_n(\text{g}) \rightarrow 2\text{YZ}_{n-1}(\text{g}) + \text{Y}_2(\text{g})$
- D. $\text{YZ}_n(\text{g}) \rightarrow \text{Y}(\text{g}) + n\text{Z}(\text{g})$

[1 mark]

Question 16

The dotted-line curve on each graph below represents the corresponding distribution for a gas at 300 K.

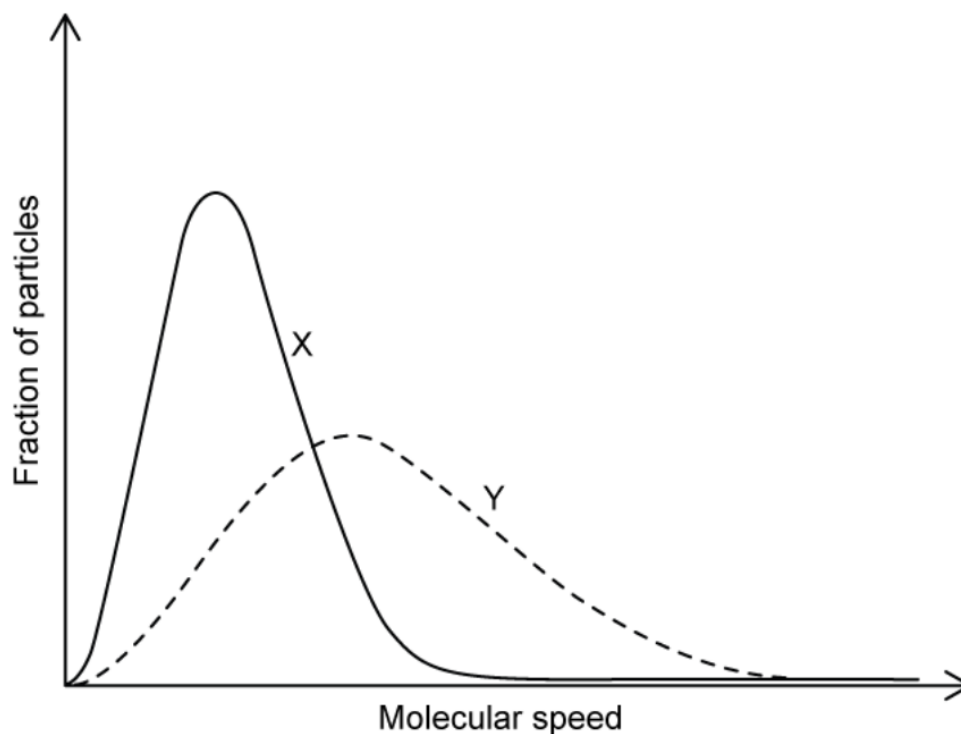
Which solid-line curve most accurately represents the distribution of molecular energies in the same gas at 500 K?



[1 mark]

Question 17

1 dm³ of gas **X** and 1 dm³ of gas **Y** are kept at the same temperature and pressure. The speed of the molecules is plotted against the fraction of molecules with that speed. From the graph what can be said about the two gases?

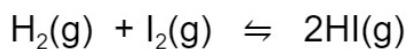


- A** The molar mass of **X** is larger than the molar mass of **Y**
- B** The molar mass of **Y** is larger than the molar mass of **X**
- C** The average kinetic energy of **X** is higher than that of **Y**
- D** The average kinetic energy of **Y** is higher than that of **X**

[1 mark]

Question 18

Hydrogen reacts with iodine according to the following equation



The value of K_c for this reaction has been measured at different temperatures

$$K_c = 60 \text{ at } 355^\circ\text{C}$$

$$K_c = 47 \text{ at } 450^\circ\text{C}$$

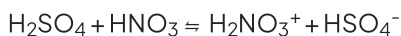
From the information given which of the following must be true?

- A The reaction is exothermic
- B The reaction is endothermic
- C The reaction barely proceeds at 355°C
- D The reaction almost goes to completion at 450°C

[1 mark]

Question 19

The following reaction occurs between concentrated sulfuric and nitric acids.



Identify the two species which are acting as Brønsted–Lowry bases.

- A. H_2NO_3^+ and HSO_4^-
- B. HNO_3 and H_2NO_3^+
- C. H_2SO_4 and HSO_4^-
- D. HNO_3 and HSO_4^-

[1 mark]

Question 20

Calculate the pH of a solution of NaOH of concentration $0.001 \text{ mol dm}^{-3}$

- A. 1
- B. 3
- C. 11
- D. 13

[1 mark]

Question 21

Acid rain can be up to 50 times more acidic than normal rain, which has a pH around 5.5. What is the approximate concentration of H^+ in acid rain?

- A. $2.50 \times 10^{-3} \text{ mol dm}^{-3}$
- B. $2.50 \times 10^{-4} \text{ mol dm}^{-3}$
- C. $2.50 \times 10^{-5} \text{ mol dm}^{-3}$
- D. $50.0 \times 10^{-4} \text{ mol dm}^{-3}$

[1 mark]

Question 22

The chemistry of the Group VII elements often involves redox processes. Which of the following statements is correct?

- A** Bromine can oxidise chloride ions
- B** Iodide ions are the weakest reducing agent of the first four Group VII ions
- C** In reactions with water, chlorine is oxidised and reduced
- D** Fluorine is a weaker oxidising agent than chlorine

[1 mark]

Question 23

Below are four descriptions about the movements of electrons in voltaic cells.

Which is the correct statement?

- A** Electrons flow through the external wire from the cathode (positive electrode) to the anode (negative electrode)
- B** Electrons flow through the external wire from the anode (negative electrode) to the cathode (positive electrode)
- C** Electrons flow through the salt bridge from the oxidizing agent to the reducing agent
- D** Electrons flow through the salt bridge from the reducing agent to the oxidizing agent

[1 mark]

Question 24

How many isomeric esters have the molecular formula $C_5H_{10}O_2$?

- A** 4 **B** 5 **C** 9 **D** 7

[1 mark]

Question 25

What is the correct condensed structural formula for 2,2-dibromo-4-methylhexane?

- A** $\text{CH}_3\text{CBr}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$
- B** $\text{CH}_3\text{CHBrCBr}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$
- C** $\text{CH}_3\text{CBr}_2\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- D** $\text{CH}_3\text{CHBrCH}(\text{CH}_3)\text{CHBrCH}_2\text{CH}_3$

[1 mark]

Question 26

In the presence of ultraviolet light, ethane and chlorine react to give a mixture of products.

Which compound could be present in the mixture of products?

- A** CH_3Cl
- B** $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$
- C** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- D** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

[1 mark]

Question 27

Dichlorodifluoromethane, CCl_2F_2 , has been used in aerosol propellants and as a refrigerant.

Which statement helps to explain why dichlorodifluoromethane is chemically inert?

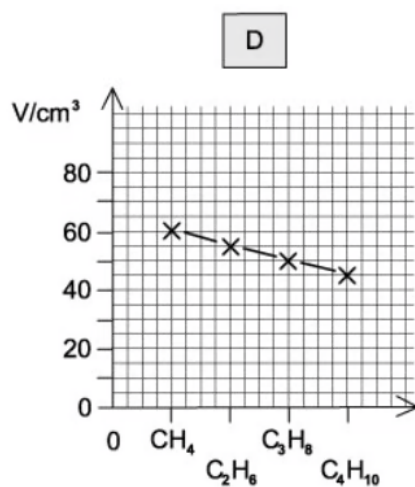
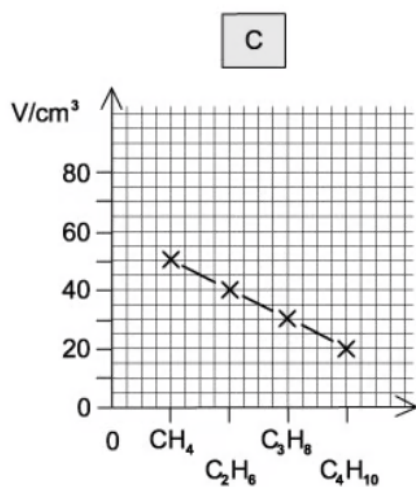
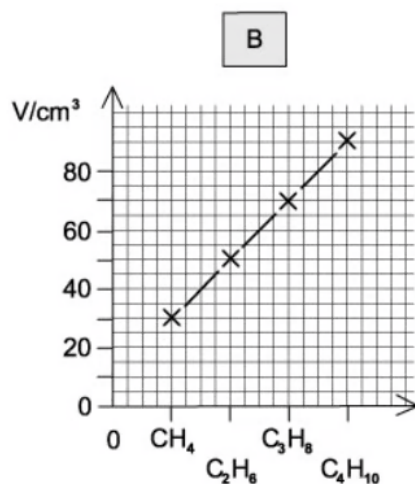
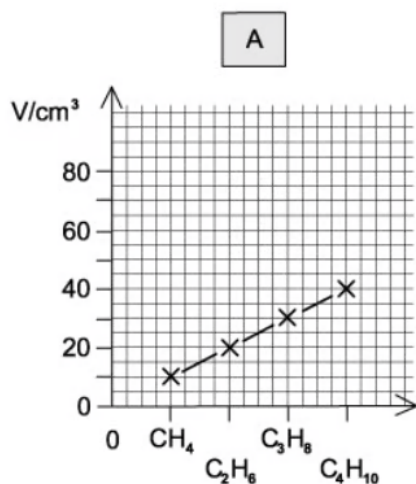
- A** the carbon-fluorine bond energy is large
- B** the carbon-fluorine bond has a low polarity
- C** fluorine is highly electronegative
- D** fluorine compounds are non-flammable

[1 mark]

Question 28

Samples of 10 cm^3 of each of the first four members of the alkane series are separately mixed with 70 cm^3 of oxygen. Each is then burned and the total volume, V , of residual gas measured again at room temperature and pressure.

Which graph represents the results that would be obtained?



[1 mark]

Question 29

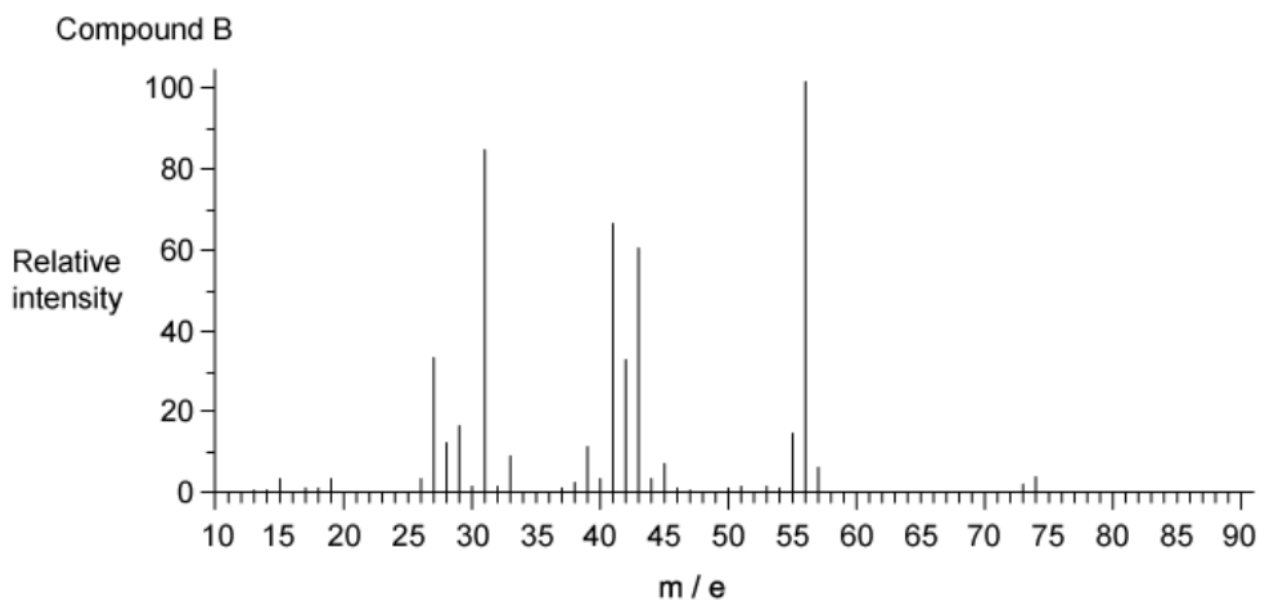
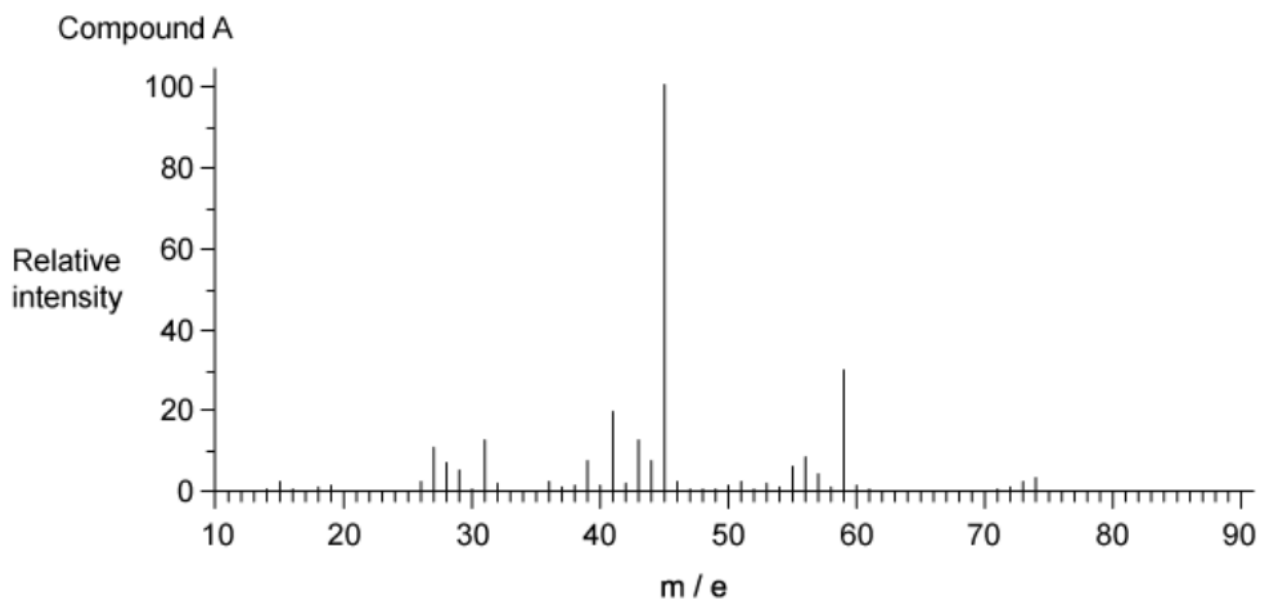
Chlorine has two isotopes ^{35}Cl and ^{37}Cl . Assuming in the molecule $\text{C}_4\text{H}_6\text{Cl}_4$ there is only one hydrogen and one carbon isotope, how many molecular ion peaks will be seen in its mass spectrum?

- A** 5
- B** 4
- C** 3
- D** 2

[1 mark]

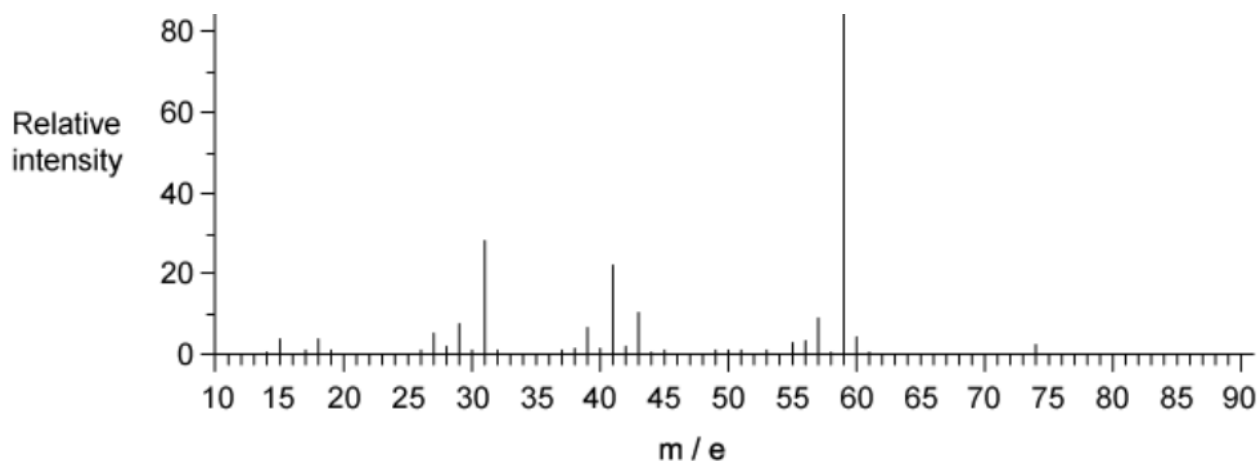
Question 30

The mass spectra of three compounds A, B and C are shown below.



Compound C





What evidence from the spectra of the three compounds A, B and C, suggests they could be isomers?

- A** all show a molecular ion peak at 74
- B** all show a molecular ion peak at 13
- C** all show a molecular ion peak at 73
- D** all show a molecular ion peak at 33

[1 mark]