

**JURONG PIONEER JUNIOR COLLEGE**
JC2 PRELIMINARY EXAMINATION 2025**CHEMISTRY****9729/01****Higher 2****18 September 2025**

Paper 1 Multiple Choice Questions

1 hour

Candidates answer on the Question paper.

Additional Materials: Multiple Choice Answer Sheet
 Data Booklet**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and exam index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** or **D**.Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

- 1 A vessel, at standard temperature and pressure, contains a mixture of $^{35}\text{Cl}_2$ and $^{37}\text{Cl}_2$. The gaseous mixture occupies a volume of 5.7 dm^3 , and has a mass of 18.0 g . What is the percentage by mass of $^{35}\text{Cl}_2$ in the mixture?

A 25 % B 40 % C 60 % D 75 %

- 2 A stable ion of **E** has the following properties:
- has a noble gas configuration
 - was obtained by removing electrons from the same orbital
- Which of the following could be **E**?

A Al B Ca C Cu D S

- 3 Trifluorooxonium has the formula OF_3^{n+} and its shape is trigonal pyramidal. What is the value of n in trifluorooxonium?

A 1 B 2 C 3 D 4

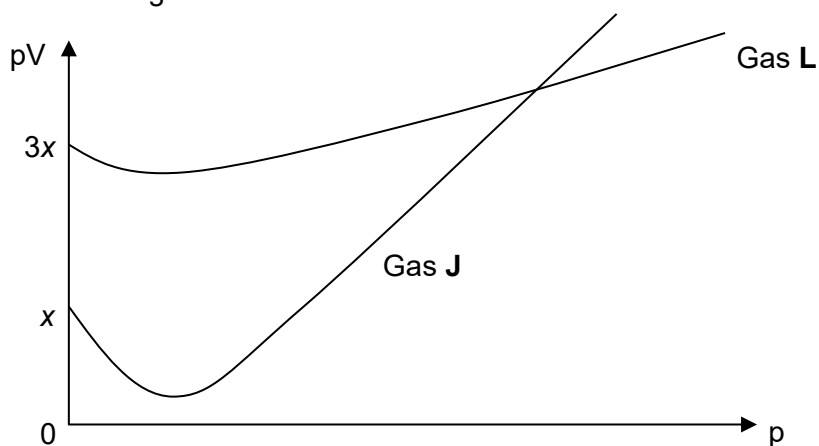
- 4 A mixture of 10 cm^3 of methane and 20 cm^3 of ethane was sparked with an excess of oxygen. After cooling, the residual gas was passed through aqueous potassium hydroxide. All gas volumes were measured at the same temperature and pressure. Which volume of gas was absorbed by the alkali?

A 20 cm^3 B 30 cm^3 C 50 cm^3 D 100 cm^3

- 5 An ion of metal **G** can be oxidised by potassium manganate(VII) in acid solution to form GO_3^- . In an experiment, $1.25 \times 10^{-3}\text{ mol}$ of the ion of **G** required 37.5 cm^3 of $0.0200\text{ mol dm}^{-3}$ potassium manganate(VII) for complete reaction. What is the initial oxidation state of the ion of **G** given that potassium manganate(VII) is reduced to Mn^{2+} ?

A +1 B +2 C +3 D +4

- 6 The value of pV is plotted against p for two gases, **J** and **L**, where p is the pressure and V is the volume of the gas.



Which of the following could be the identities of the gases?

	Gas J	Gas L
1	0.5 mol of N_2H_2 at $25^\circ C$	0.5 mol of H_2 at $75^\circ C$
2	0.5 mol of NH_3 at $25^\circ C$	1.5 mol of CH_4 at $25^\circ C$
3	0.25 mol of H_2 at $25^\circ C$	0.75 mol of SO_2 at $25^\circ C$

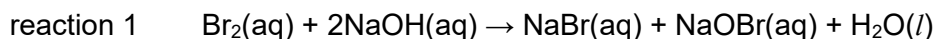
- A 1 only
 B 2 only
 C 1 and 2 only
 D 2 and 3 only
- 7 Three statements about potassium and chlorine and their ions are listed.
- 1 The atomic radius of a potassium atom is greater than the atomic radius of a chlorine atom.
 - 2 The first ionisation energy of potassium is greater than the first ionisation energy of chlorine.
 - 3 The ionic radius of a potassium ion is greater than the ionic radius of a chloride ion.

Which statements are correct?

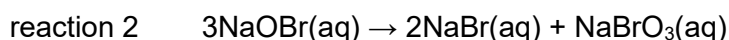
- A 1 only
 B 2 only
 C 1 and 3 only
 D 2 and 3 only

- 8 A disproportionation reaction is a reaction where a single compound is both oxidised and reduced simultaneously.

Bromine reacts with aqueous sodium hydroxide at 25 °C.



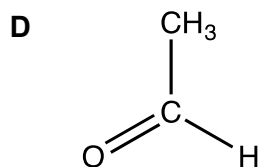
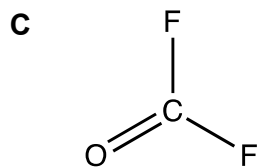
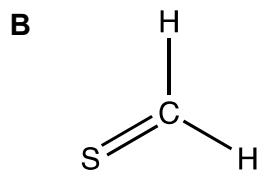
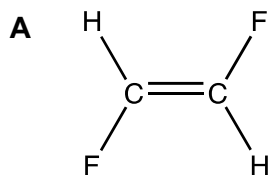
The NaOBr formed is unstable at 25 °C and reacts further.



In which reactions are disproportionation reactions?

- A reaction 1 only
 B reaction 2 only
 C neither reaction 1 nor reaction 2
 D both reaction 1 and reaction 2

- 9 Which molecule has the largest dipole?



- 10 Use of the Data Booklet is relevant to this question.

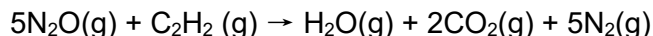
The lattice energies of the compounds, magnesium oxide, magnesium bromide, sodium oxide and sodium bromide, are given in the options below.

Which of the following values corresponds to the lattice energy of magnesium bromide?

- A -752 kJ mol^{-1}
 B $-2421 \text{ kJ mol}^{-1}$
 C $-2564 \text{ kJ mol}^{-1}$
 D $-3790 \text{ kJ mol}^{-1}$

11 *Use of Data Booklet is relevant to this question.*

Nitrous oxide, N_2O , commonly known as laughing gas, contains one $\text{N}=\text{N}$ and one $\text{N}=\text{O}$ bond per molecule. It burns in ethyne, $\text{HC}\equiv\text{CH}$, to produce water vapour, carbon dioxide and nitrogen gas as the only products.



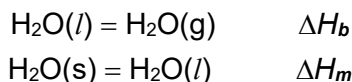
Given that the $\text{N}=\text{N}$ and $\text{N}=\text{O}$ bond energies in nitrous oxide are $+418 \text{ kJ mol}^{-1}$ and $+686 \text{ kJ mol}^{-1}$ respectively, what is the enthalpy change of the above reaction?

- A $+1930 \text{ kJ mol}^{-1}$
 B $+2260 \text{ kJ mol}^{-1}$
 C $-1680 \text{ kJ mol}^{-1}$
 D $-3980 \text{ kJ mol}^{-1}$

12 The average intermolecular forces in water are much stronger than the average intermolecular forces in steam.

The average intermolecular forces in ice are slightly stronger than the average intermolecular forces in water.

Enthalpy changes are associated with the equilibrium processes shown.



Which statements are correct?

- 1 The numerical value of ΔH_b is greater than ΔH_m .
- 2 ΔH_b and ΔH_m are both negative.
- 3 The intermolecular forces in ice and water are of the same type.

- A 1, 2 and 3
 B 1 and 2
 C 1 and 3
 D 3 only

13 The table below gives data for the reaction between **N** and **P** at constant temperature.

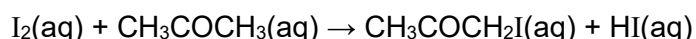
Experiment	[N] / mol dm^{-3}	[P] / mol dm^{-3}	Initial rate / $\text{mol dm}^{-3} \text{ min}^{-1}$
1	0.003	0.4	1.6×10^{-3}
2	0.006	0.4	1.6×10^{-3}

3	0.006	0.8	6.4×10^{-3}
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Which statement about the reaction is not correct?

- A The reaction is a one-step reaction.
- B The rate constant k has the units of $\text{mol}^{-1} \text{dm}^3 \text{min}^{-1}$.
- C The half-life of **N** is not constant.
- D The order of reaction with respect to **[P]** is 2.

- 14 Iodine and propanone react according to the following equation.

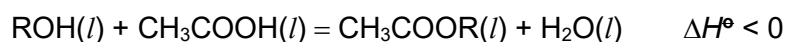


If the concentration of propanone is increased, keeping the total reaction volume constant, the initial rate of the reaction also increases.

Which of the following statements could be the reason for this?

- A A greater proportion of collisions are successful at the higher concentration.
- B The particles are further apart at the higher concentration.
- C The particles have more energy at the higher concentration.
- D There are more effective collisions per second between particles at the higher concentration.

- 15 An alcohol, ROH, reacts reversibly with ethanoic acid to produce an ester.

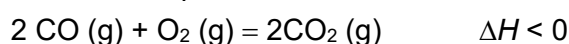


3.0 mol of ROH, 2.0 mol of CH_3COOH and 1.0 mol of water are mixed together and heated to a constant temperature. At this temperature, 1.5 mol of CH_3COOH is present in the equilibrium mixture.

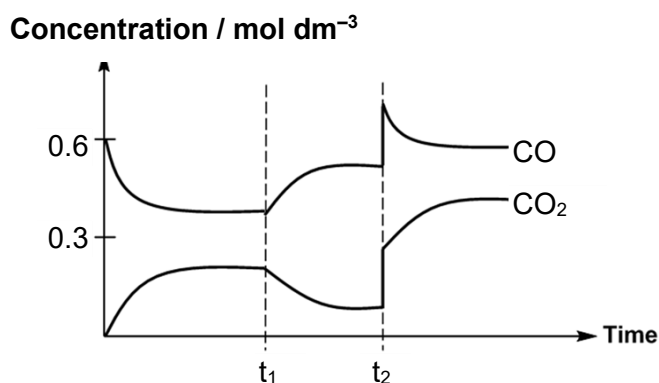
Which statement is correct?

- A The value of the equilibrium constant is 0.20.
- B At a lower temperature, the equilibrium amount of CH_3COOH is higher than 1.5 mol.
- C K_c has units of $\text{mol}^{-1} \text{dm}^3$.
- D The equilibrium amount of ester is the same as the equilibrium amount of water.

- 16 At a temperature $T \text{ K}$, 0.60 mol dm^{-3} of CO and 0.30 mol dm^{-3} of O_2 were introduced into a 5 dm^3 vessel and allowed to reach equilibrium.



The graph below shows the changes in the concentration of CO and CO₂ in the system with time. A change was made to the system at time, t_1 and t_2 .



What were the changes made at time, t_1 and t_2 ?

	t_1	t_2
A	A catalyst was added	Volume of the system is increased
B	The temperature was increased	Volume of the system is decreased
C	Some O ₂ was removed	An inert gas was added at constant volume
D	The temperature was increased	More O ₂ was added

- 17 What is the pH of the resultant solution when 100 cm³ of 0.10 mol dm⁻³ aqueous NH₄Cl and 40 cm³ of 0.15 mol dm⁻³ aqueous NaOH are mixed at 25 °C? (pK_b of NH₃ = 4.75)

A 4.57 **B** 4.93 **C** 9.07 **D** 9.43

- 18 The solubility of Group 2 metal hydroxides increases down the group. Given that the solubility product, K_{sp} , of magnesium hydroxide at 25 °C is **X** and the solubility of magnesium hydroxide at 25 °C is **S**. Which of the following statements is correct at 25 °C?

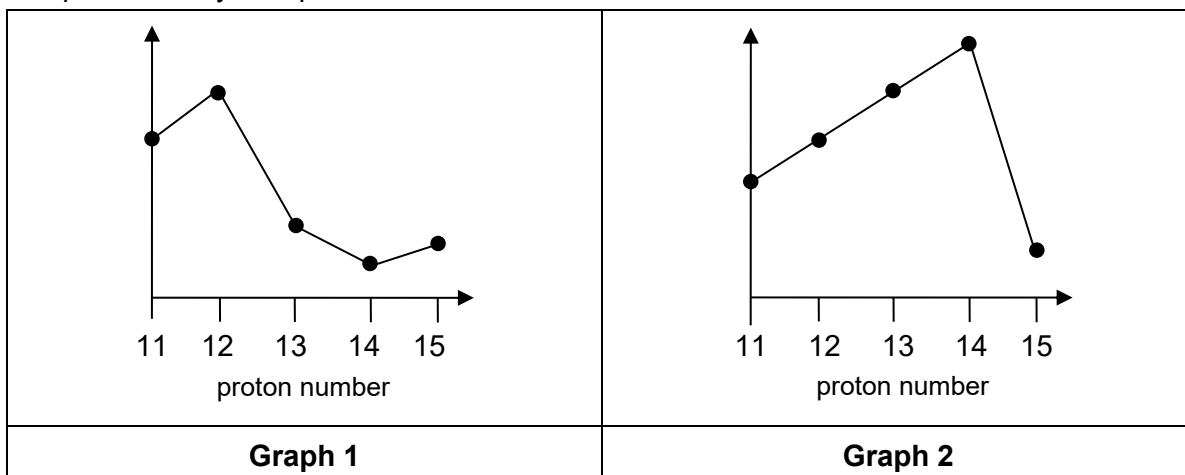
- A** The K_{sp} of barium hydroxides is smaller than **X**.
B The pH of a saturated solution of magnesium hydroxide is $14 + \lg(2X)^{1/3}$.
C The solubility of magnesium hydroxide in a solution of magnesium nitrate is larger than **S**.
D When solid sodium hydroxide is dissolved in a saturated solution of magnesium hydroxide, K_{sp} of magnesium hydroxide becomes smaller than **X**.

- 19 Which of the following changes does not affect the reduction potential measured for a Cl_2/Cl^- half-cell?

- A** Adding water into the half-cell.

- B** Increase the size of the platinum electrode in the half-cell.
C Placing the half-cell in an ice-water bath.
D Adding silver ions into the half-cell.

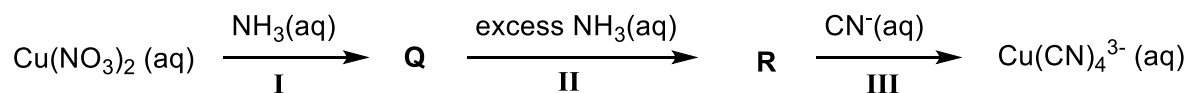
- 20** The following graphs show how three properties of the elements, Na to P, and their compounds, vary with proton number.



What properties are shown by the two graphs?

	Graph 1	Graph 2
A	Melting point of chloride	Melting point of element
B	Electrical conductivity of element	Melting point of chloride
C	Melting point of chloride	Electrical conductivity of element
D	Melting point of oxide	Melting point of element

- 21** A reaction scheme starting from aqueous copper(II) nitrate solution is shown below. Both **Q** and **R** are copper-containing species.



Which of the following statements are correct about the above reaction scheme?

- 1** One of the reactions involves a redox reaction.
2 CN^- is a stronger ligand than NH_3 .
3 Precipitation occurs in step I.

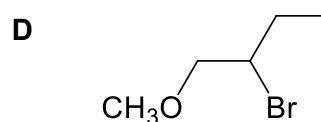
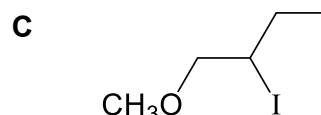
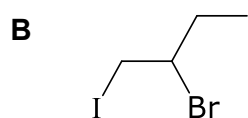
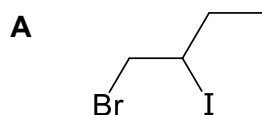
- A** 1, 2 and 3 **B** 2 and 3 only **C** 1 and 2 only **D** 2 only

- 22** A non-cyclic organic compound has the molecular formula $\text{C}_5\text{H}_9\text{O}_2\text{N}$. Which functional groups could be present in this molecule?

- 1 one ketone group and one amide group
 2 one ester group and one amine group
 3 one carboxylic acid group and one nitrile group

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 1 only

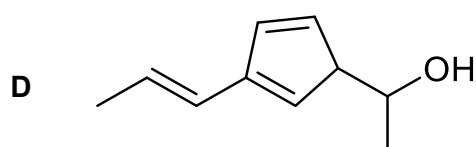
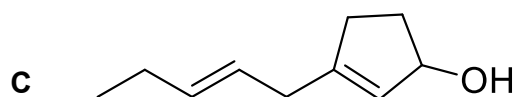
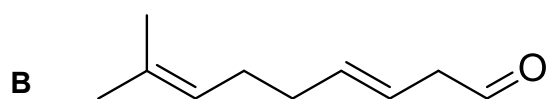
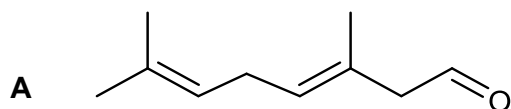
- 23** Which of the following cannot be formed when but-1-ene reacts with IBr, dissolved in methanol?



- 24** The reaction of compound **T** ($M_r = 152$) with hot acidified potassium manganate(VII) yields three products, **U**, **V** and **Y**.

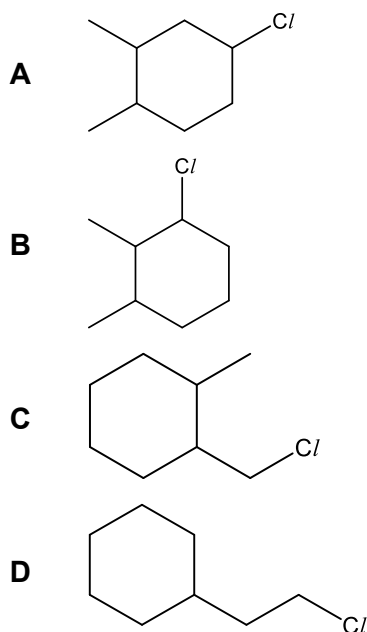
U can be converted to **V** with the use of alkaline aqueous iodine followed by acidification with aqueous sulfuric acid.

Which of the following shows the structure of compound **T**?



- 25** Compound **W** is able to rotate the plane of polarised light. When **W** is heated with ethanolic KOH, only **one** organic product is formed.

What is compound **W**?



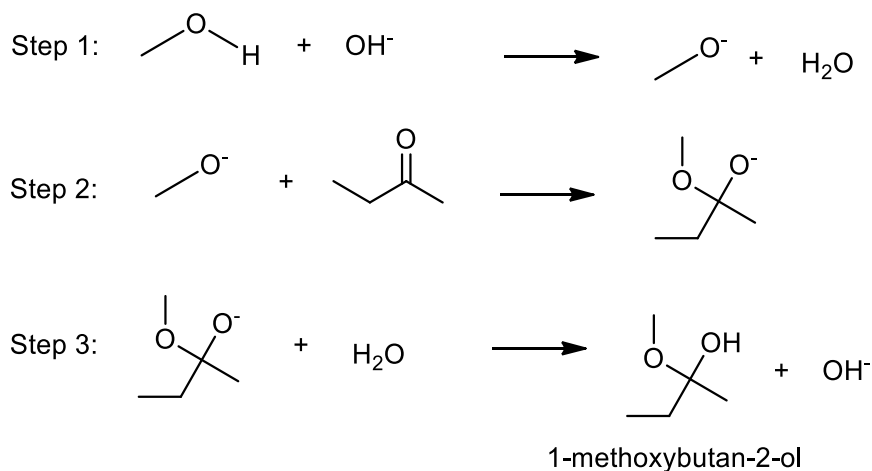
- 26** When ethyl ethanoate undergoes hydrolysis with dilute sulfuric acid in the presence of H_2^{18}O , a mixture of two products is formed.

Which of the following pairs correctly gives the structures of the two products?

- A** $\text{CH}_3\text{CO}^{18}\text{OH}$ and $\text{CH}_3\text{CH}_2^{18}\text{OH}$
- B** CH_3COOH and $\text{CH}_3\text{CH}_2^{18}\text{OH}$
- C** $\text{CH}_3\text{C}^{18}\text{OOH}$ and $\text{CH}_3\text{CH}_2\text{OH}$
- D** $\text{CH}_3\text{CO}^{18}\text{OH}$ and $\text{CH}_3\text{CH}_2\text{OH}$

- 27** 1-methoxybutan-2-ol is an organic compound which has an alcohol and an ether ($\text{R}-\text{O}-\text{R}$) attached to the same carbon atom. It is formed when butan-2-one reacts with methanol in the presence of a catalyst.

The reaction follows the mechanism below.

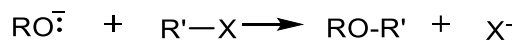


Which of the following statements about the reaction is correct?

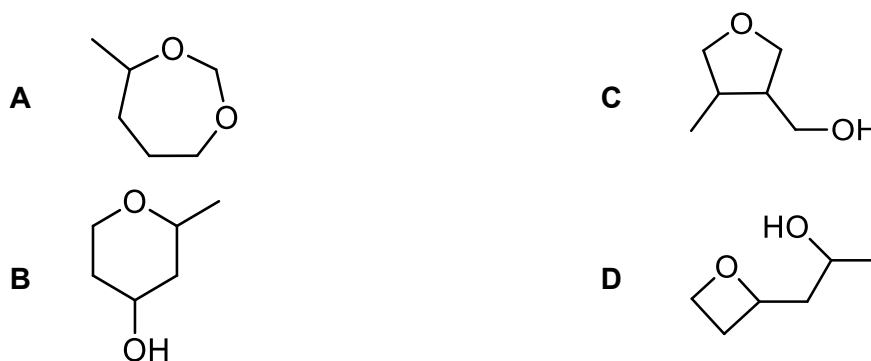
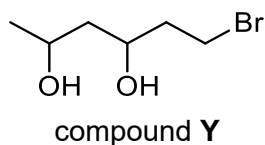
- 1 Methanol acts as a Lewis acid in step 1.
- 2 Step 2 is a nucleophilic addition reaction.
- 3 KOH can be used as a catalyst for this reaction.
- 4 Step 3 is a redox reaction.

A 1 and 2 **B** 2 and 4 **C** 2 and 3 **D** 1 and 4

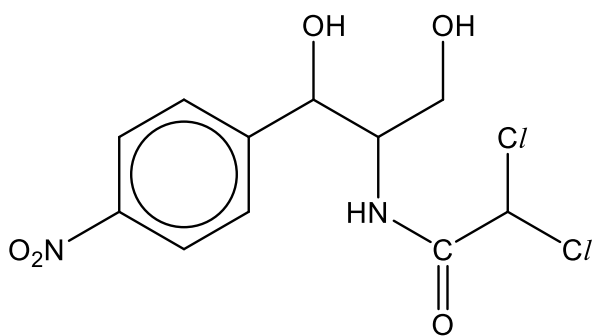
- 28** Williamson ether synthesis is a very useful reaction in the formation of ethers from halogenoalkanes, $R'-X$, via the S_N2 mechanism shown below.



Which of the following compounds will be formed as a major product when compound **Y** undergoes Williamson ether synthesis?



- 29** *Chloramphenicol* is an antibiotic useful for the treatment of a number of bacterial infections.



Chloramphenicol

Which of the following statements regarding *Chloramphenicol* is not correct?

- A** It has a total of 4 stereoisomers.
- B** Addition of lithium aluminium hydride causes two atoms of hydrogen to be incorporated into the molecule.
- C** On reacting with ethanoyl chloride, two mole of ethanoyl chloride are used up per mole of *Chloramphenicol*.
- D** On reacting with aqueous bromine, two mole of bromine is used up per mole of *chloramphenicol*.

- 30** **Z** is synthetic nonapeptide (contain 9 amino acids) that is resynthesised from the amino acids found in honey bee venom. To investigate the sequence of amino acids in **Z**, the nonapeptide was first hydrolysed by two enzymes. The protein fragments were then separated and their sequence determined.

The following protein fragments were obtained from the first enzyme which hydrolysed the peptide chain at the carboxylic end of the amino acid isoleucine, Ile.

Arg-Ile
Ser-Lys-Trp-Ile
Lys-Leu-Arg

The second enzyme, which hydrolysed the peptide chain at the carboxylic end of the amino acid lysine, Lys, yielded the following fragments

Trp-Ile-Lys
Arg-Ile-Ser-Lys
Leu-Arg

Which of the following is the correct primary structure of the nonapeptide **Z**?

- A** Lys-Leu-Arg-Ile-Ser-Lys-Trp-Ile-Lys
- B** Ser-Lys-Trp-Ile-Arg-Ile-Lys-Leu-Arg
- C** Arg-Ile-Ser-Lys-Trp-Ile-Lys-Leu-Arg
- D** Arg-Ile-Ser-Lys-Leu-Arg-Trp-Ile-Lys