



# TAMPINES MERIDIAN JUNIOR COLLEGE

## JC2 PRELIMINARY EXAMINATION

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**H2 CHEMISTRY**

**9729/01**

Paper 1 Multiple Choice

**25 September 2025**

**1 hour**

Additional materials: Multiple Choice Answer Sheet  
Data Booklet

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### READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

There are **thirty** questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

**Read the instructions on the use of the Answer Sheet very carefully.**

You are advised to fill in the Answer Sheet as you go along. No additional time will be given for the transfer of answers once the examination has ended.

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.

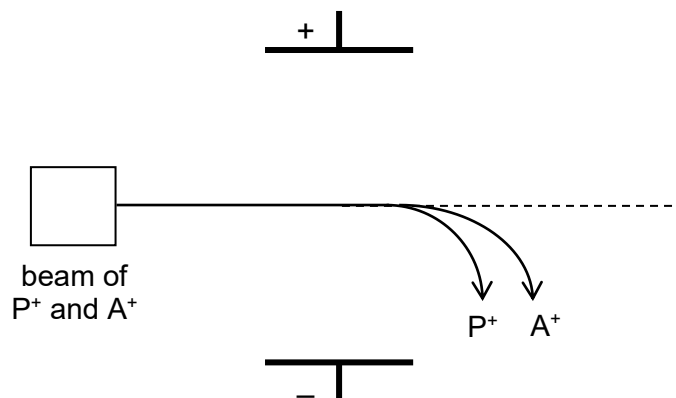
#### **Use of the Answer Sheet**

Ensure you have written your name, class, date and subject on the Answer Sheet. Shade the last four digits of your centre/index number on the Multiple Choice Answer Sheet. (e.g. if your centre/index number is 3054**1234**, shade 1234).

Use a **2B** pencil to shade your answers on the Answer Sheet; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

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

In an experiment, a sample containing phosphorus and an unknown element A is vapourised, ionised and passed through an electric field as shown below.



Given that the extent of deflection for  $A^+$  is smaller than  $P^+$ , which could be the identity of element A?

- A** sulfur                      **B** silicon                      **C** sodium                      **D** nitrogen

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

Which particle contains the largest number of unpaired electrons?

- A** O                      **B**  $Cl^-$                       **C**  $K^+$                       **D** Fe

- 3 In a microwave oven, the microwave produced is absorbed by polar molecules.

Which molecules would absorb microwave energy?

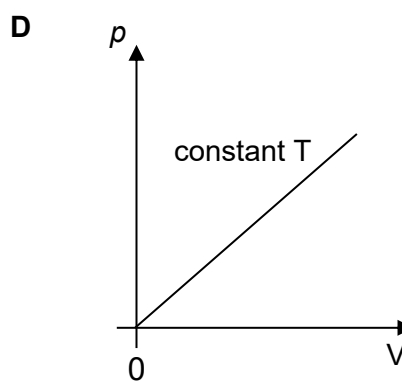
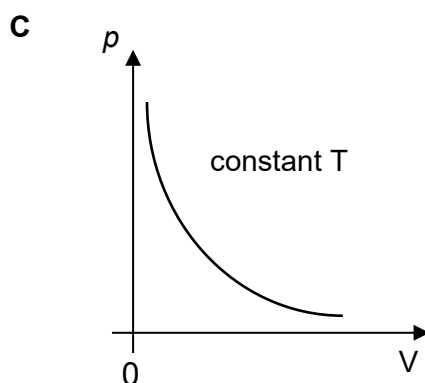
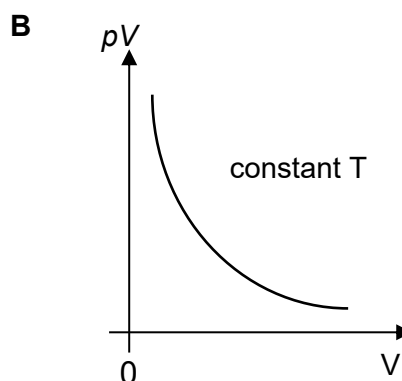
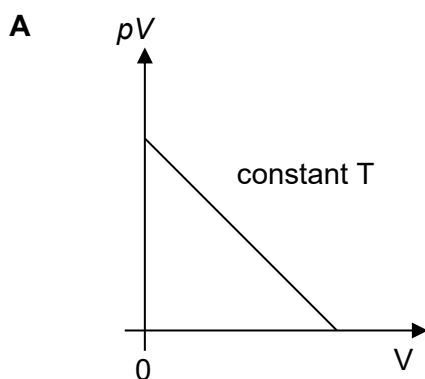
- 1  $SO_3$   
2  $CH_2F_2$   
3  $CH_3CH_2OH$

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

- 4 The melting point of potassium is lower than the melting point of magnesium.  
Which statement is most relevant in explaining the difference?
- A Potassium ion has a smaller radius than magnesium ion.  
B Potassium ion has a lower charge than magnesium ion.  
C Potassium atom contains fewer electrons than magnesium atom.  
D Potassium atom is heavier than magnesium atom.
- 5 Which of the following cannot be explained by hydrogen bonding?
- A The existence of hydrogen–difluoride anion,  $\text{HF}_2^-$ .  
B The difference in volatility between pentan–1–ol and hexan–1–ol.  
C The difference in melting point between 2–nitrophenol and 4–nitrophenol.  
D The relative molecular mass of ethanoic acid in organic solvent is higher than expected.



- 6 Which diagram correctly describes the behaviour of a fixed mass of an ideal gas?



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

Sodium percarbonate,  $(\text{Na}_2\text{CO}_3)_x \cdot y(\text{H}_2\text{O}_2)$ , is an oxidising agent used in laundry cleaning products.

On acidification,  $10.0 \text{ cm}^3$  of  $0.100 \text{ mol dm}^{-3}$  sodium percarbonate releases  $48.0 \text{ cm}^3$  of carbon dioxide at room temperature and pressure.

An identical sample, on titration with  $0.0500 \text{ mol dm}^{-3} \text{ KMnO}_4$ , requires  $24.0 \text{ cm}^3$  before the first pink colour appears. 2 moles of  $\text{KMnO}_4$  reacts with 5 moles of  $\text{H}_2\text{O}_2$ .

What is the ratio of  $y/x$ ?

**A**  $\frac{1}{3}$

**B**  $\frac{2}{3}$

**C**  $\frac{3}{2}$

**D** 3

- 8 **G, H** and **J** are three elements found in Period 3 of the Periodic Table.

Among the elements in Period 3,

- the melting point of **G** is the highest.
- the electrical conductivity of **H** is the highest.
- the melting point of the oxides of **J** is the highest.

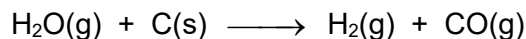
Which of the following elements is **not** represented by **G, H** or **J**?

- A** Na                      **B** Mg                      **C** Al                      **D** Si

- 9 Which equation defines standard enthalpy change of formation correctly?

- A**  $\text{Na(s)} + \text{Cl(g)} \rightarrow \text{NaCl(s)}$   
**B**  $2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{H}_2\text{O(g)}$   
**C**  $\text{Mg}^{2+}\text{(g)} + \text{O}^{2-}\text{(g)} \rightarrow \text{MgO(s)}$   
**D**  $\text{H}_2\text{(g)} + \text{S(s)} + 2\text{O}_2\text{(g)} \rightarrow \text{H}_2\text{SO}_4\text{(l)}$

- 10 Hydrogen can be made from steam.



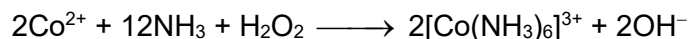
The Gibbs free energy change of reaction at two different temperatures are shown.

At 378 K,  $\Delta G_1 = +78 \text{ kJ mol}^{-1}$   
 At 1300 K,  $\Delta G_2 = -58 \text{ kJ mol}^{-1}$

Which row gives the correct signs of  $\Delta H$  and  $\Delta S$  for this reaction?

	$\Delta H$	$\Delta S$
<b>A</b>	—	+
<b>B</b>	—	—
<b>C</b>	+	—
<b>D</b>	+	+

- 11 The equation for the formation of hexaamminecobalt(III),  $[\text{Co}(\text{NH}_3)_6]^{3+}$  complex ion is shown below.



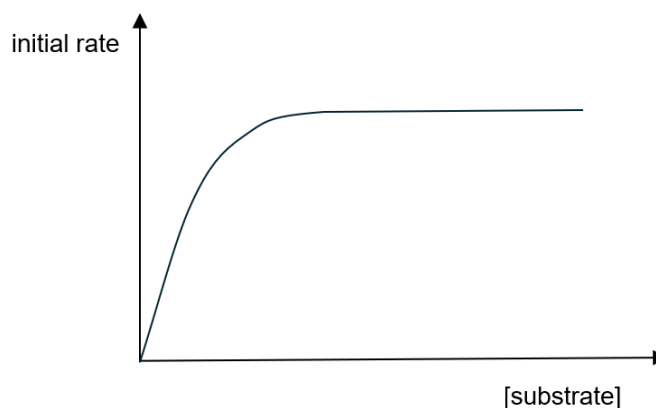
The rate equation is  $\text{rate} = k [\text{Co}^{2+}][\text{NH}_3]^3[\text{H}_2\text{O}_2]$ .

When the concentration of each reactant is  $x \text{ mol dm}^{-3}$ , the initial rate was found to be  $y \text{ mol dm}^{-3} \text{ s}^{-1}$ .

What will be the initial rate of the reaction if  $[\text{Co}^{2+}]$  is  $2x$ ,  $[\text{NH}_3]$  is  $\frac{1}{2}x$  and  $[\text{H}_2\text{O}_2]$  is  $2x$ ?

- A  $\frac{1}{8}y$                       B  $\frac{1}{2}y$                       C  $2y$                       D  $8y$

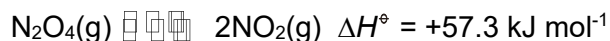
- 12 The Michaelis-Menten graph shows how the initial rate of reaction vary as the concentration of the substrate changes for an enzyme-catalysed reaction.



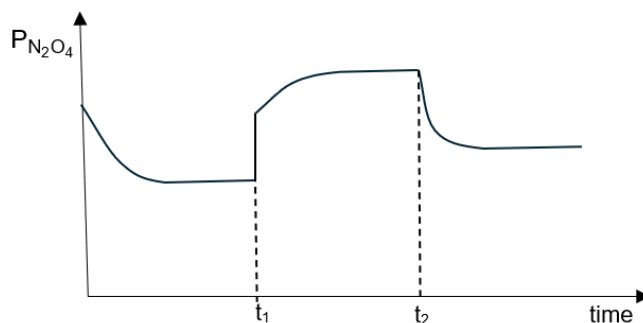
Which statement could explain the shape of the graph?

- A The enzyme is acting as a limiting reagent and is being used up in the reaction.  
 B Substrate molecules inhibit the enzyme at high concentrations which resulted in a constant rate.  
 C The reaction will reach a constant rate when all active sites of the enzyme are occupied.  
 D At high substrate concentration, the order of reaction with respect to substrate is 1

- 13 A sample of  $\text{N}_2\text{O}_4$  was placed in a closed vessel and allowed to reach equilibrium as shown below.



When the partial pressure of a sample of  $\text{N}_2\text{O}_4$  in a closed vessel was investigated, the following graph was obtained.



Which row correctly describes the changes applied to the reaction vessel at times  $t_1$  and  $t_2$ ?

	$t_1$	$t_2$
<b>A</b>	Volume decreased	Temperature increased
<b>B</b>	Volume decreased	Temperature decreased
<b>C</b>	Volume increased	Temperature increased
<b>D</b>	Volume increased	Temperature decreased

- 14  $10.0 \text{ cm}^3$  of  $8.00 \times 10^{-3} \text{ mol dm}^{-3} \text{ HCl(aq)}$  is added to  $10.0 \text{ cm}^3$  of  $6.00 \times 10^{-3} \text{ mol dm}^{-3} \text{ Ba(OH)}_2(\text{aq})$ .

What is the pH of the resulting solution?

- A** 3.0                      **B** 4.7                      **C** 9.6                      **D** 11.3

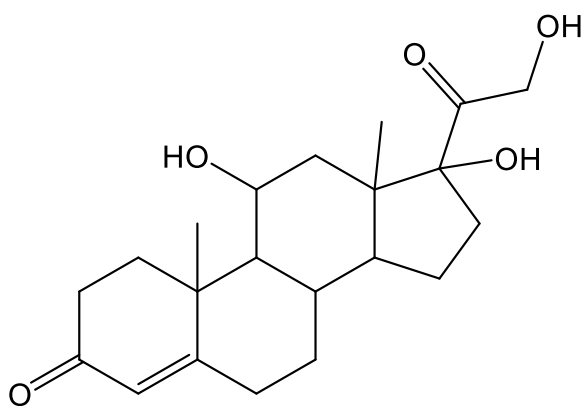
- 15 A saturated solution of  $\text{Ca(OH)}_2$  is found to have a pH of 12.4 at  $25^\circ\text{C}$ .



Which statements are correct?

- 1 The  $K_{sp}$  of  $\text{Ca}(\text{OH})_2$  is  $7.92 \times 10^{-6} \text{ mol}^3 \text{ dm}^{-9}$ .
  - 2 The solubility of  $\text{Ca}(\text{OH})_2$  will increase when aqueous  $\text{HCl}$  is added.
  - 3 The solubility of  $\text{Ca}(\text{OH})_2$  would increase when temperature is raised to  $40^\circ\text{C}$ .
  - 4 The pH of the solution would increase when solid  $\text{Ca}(\text{NO}_3)_2$  is added.
- A** 1 and 2 only    **B** 2 and 3 only    **C** 3 and 4 only    **D** 1, 2 and 3 only

- 16 Cortisol is a hormone that plays a critical role in regulating glucose metabolism.



cortisol

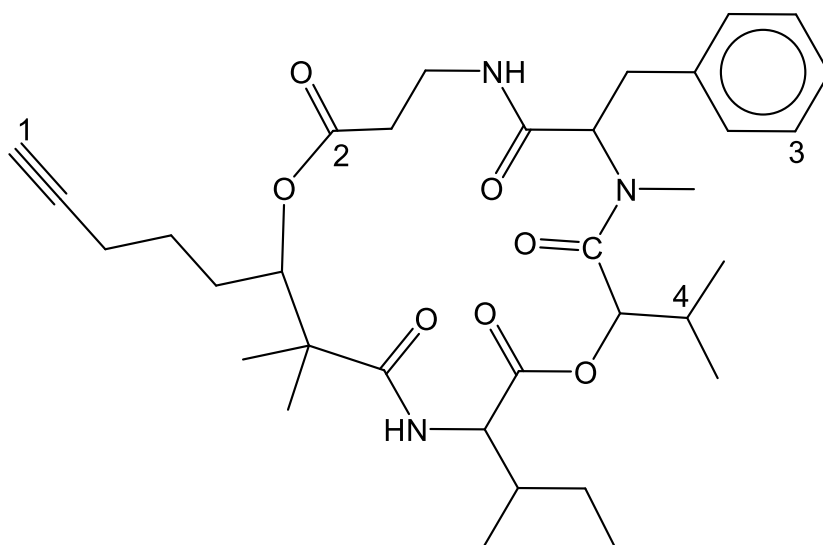
After cortisol is reacted with an excess of hydrogen gas in the presence of platinum catalyst, how many chiral carbon atoms would there be in the product?

- A** 8                      **B** 9                      **C** 10                      **D** 11

- 17 Yanucamide B can be extracted from a marine sponge.





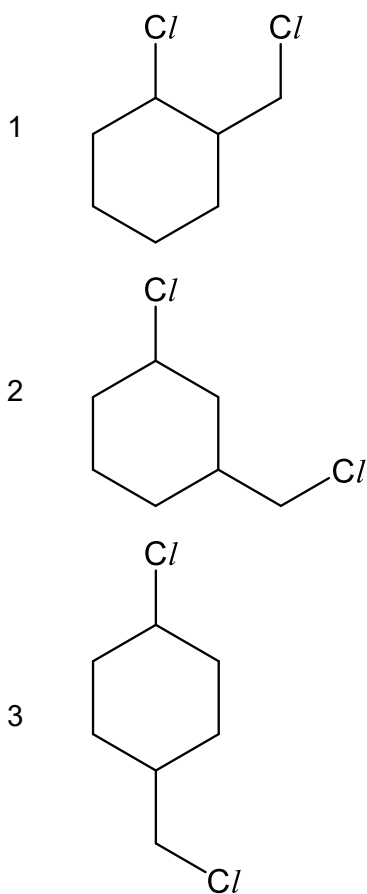


yanucamide B

What is the hybridisation of each of the carbon atoms, C-1 to C-4?

	C-1	C-2	C-3	C-4
A	$sp^2$	$sp^2$	$sp$	$sp^3$
B	$sp$	$sp^2$	$sp^2$	$sp^3$
C	$sp^2$	$sp^3$	$sp^2$	$sp^2$
D	$sp$	$sp^2$	$sp$	$sp^2$

- 18 Which compounds, on heating with ethanolic sodium hydroxide, produce **only one** product with molecular formula  $C_7H_{10}$ ?



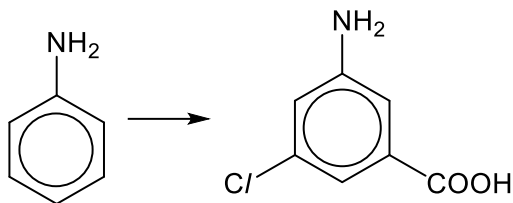
- A** 1 and 2 only    **B** 1 and 3 only    **C** 2 and 3 only    **D** 1, 2 and 3

**19** A catalytic converter is part of the exhaust system of many modern cars.  
Which reaction does **not** occur in a catalytic converter?

- A**  $\text{CO}_2 + \text{NO} \longrightarrow \text{CO} + \text{NO}_2$   
**B**  $2\text{CO} + 2\text{NO} \longrightarrow 2\text{CO}_2 + \text{N}_2$   
**C**  $2\text{CO} + \text{O}_2 \longrightarrow 2\text{CO}_2$   
**D**  $2\text{C}_8\text{H}_{18} + 25\text{O}_2 \longrightarrow 16\text{CO}_2 + 18\text{H}_2\text{O}$

**20** Use of the Data Booklet is relevant to this question.

Which of the following routes is most suitable to synthesise 3-amino-5-chlorobenzoic acid from phenylamine?



- A** neutralisation → chlorination → alkylation → oxidation → neutralisation
- B** neutralisation → alkylation → oxidation → chlorination → neutralisation
- C** reduction → alkylation → chlorination → oxidation → neutralisation
- D** reduction → alkylation → oxidation → chlorination → neutralisation

**21** The molecular formula of compound **X** is  $C_5H_{12}O$ . The following shows the reactions compound **X** undergoes:

- reacts with alkaline aqueous iodine
- can be dehydrated to form two alkenes only

What could be the identity of compound **X**?

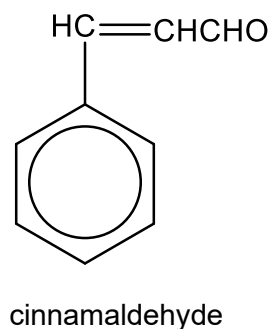
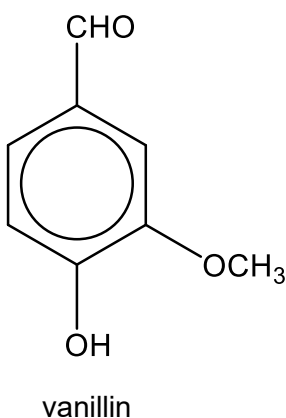
- A**  $(CH_3)_2CHCH(OH)CH_3$
- B**  $(CH_3)_2C(OH)CH_2CH_3$
- C**  $CH_3CH_2CH(CH_3)CH_2OH$
- D**  $CH_3CH_2CH_2CH(OH)CH_3$

- 22** A sample of bromoethane was warmed with ethanolic silver nitrate, and a cream precipitate was observed after about 4 minutes.

Under similar reaction conditions, which of the following compounds will result in precipitate formation only after 8 minutes?

- A** chlorobenzene
- B** chloroethane
- C** iodoethane
- D** ethanoyl bromide

- 23** Vanillin and cinnamaldehyde are found in natural products and have very pleasant fragrances.

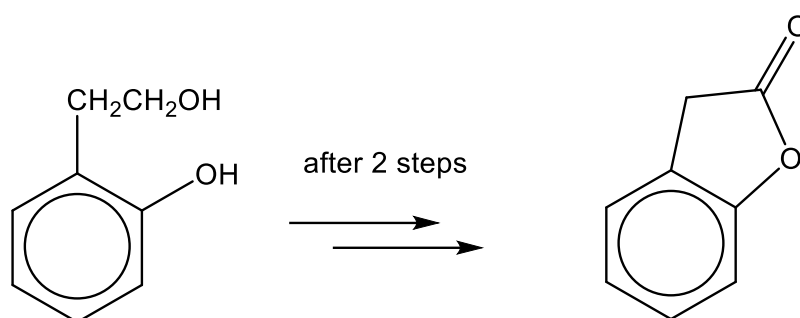


Which reagents could be used to distinguish between the two compounds? You may assume that the  $\text{-OCH}_3$  group in vanillin is inert.

- 1** 2,4-dinitrophenylhydrazine
- 2** Fehling's solution
- 3** Tollen's reagent

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

24 Compound **B** can be converted to compound **C** as shown below.

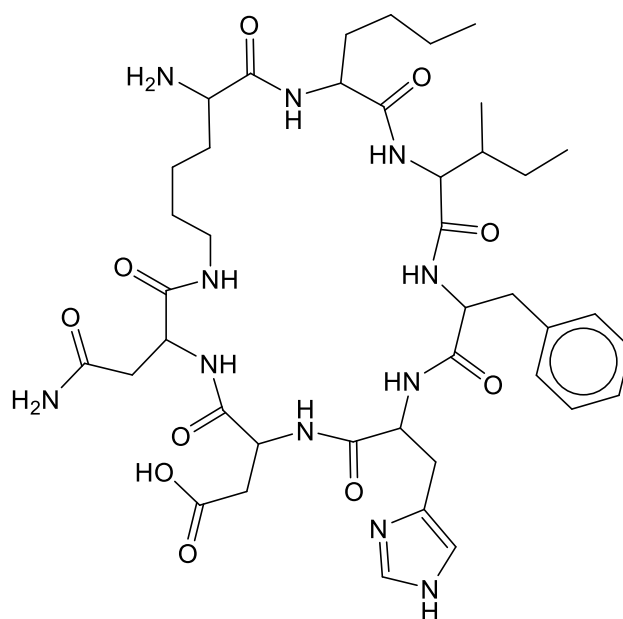


Which reagents are involved in the 2-steps synthesis?

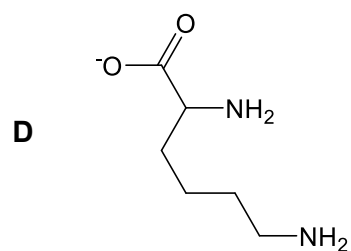
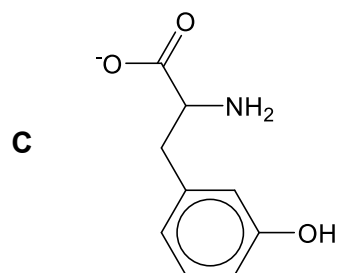
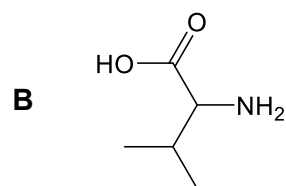
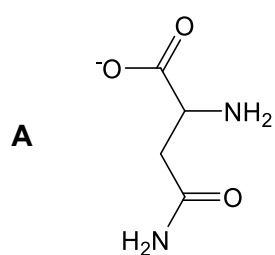
- 1 hot acidified  $\text{KMnO}_4$
- 2 hot acidified  $\text{K}_2\text{Cr}_2\text{O}_7$
- 3  $\text{PCl}_5$
- 4 concentrated  $\text{H}_2\text{SO}_4$

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

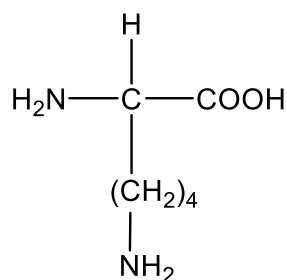
25 Consider the structure of the following cyclic polypeptide.



Which one of the following is a product of hydrolysis with hot NaOH(aq)?



- 26 Lysine is an amino acid. The structure of lysine is shown below.

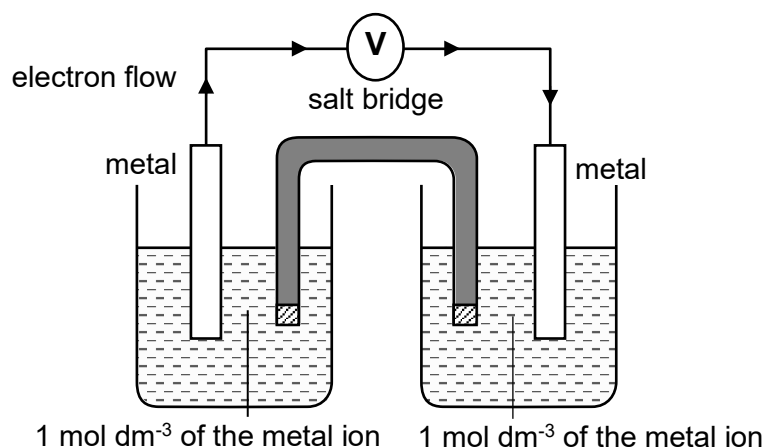


The pK<sub>a</sub> values of lysine are 2.18, 8.25 and 10.53.

Which of the following pH would result in a zwitterion to be predominantly formed?

- A pH 1                      B pH 5                      C pH 9                      D pH 13
- 27 Use of the Data Booklet is relevant to this question.

The half-cells for three metals: Ag, X and Y were in turn connected in pairs and the value of the potential difference was recorded at 298 K.



The results obtained are as shown in the table below.

negative electrode	positive electrode	e.m.f /V
X	Ag	+ 0.46
Y	X	+ 0.47

What is the identity of metal Y?

- A Co                      B Ni                      C Pb                      D Zn

**28** *Use of the Data Booklet is relevant to this question.*

A current of 8 A is passed for 100 minutes through molten aluminium oxide using inert electrodes.

What is the approximate volume of gas liberated, measured at s.t.p.?

- A**    2.8 dm<sup>3</sup>                      **B**    3.0 dm<sup>3</sup>                      **C**    8.4 dm<sup>3</sup>                      **D**    11.2 dm<sup>3</sup>

**29** Copper is a typical transition element and calcium is an s-block element.

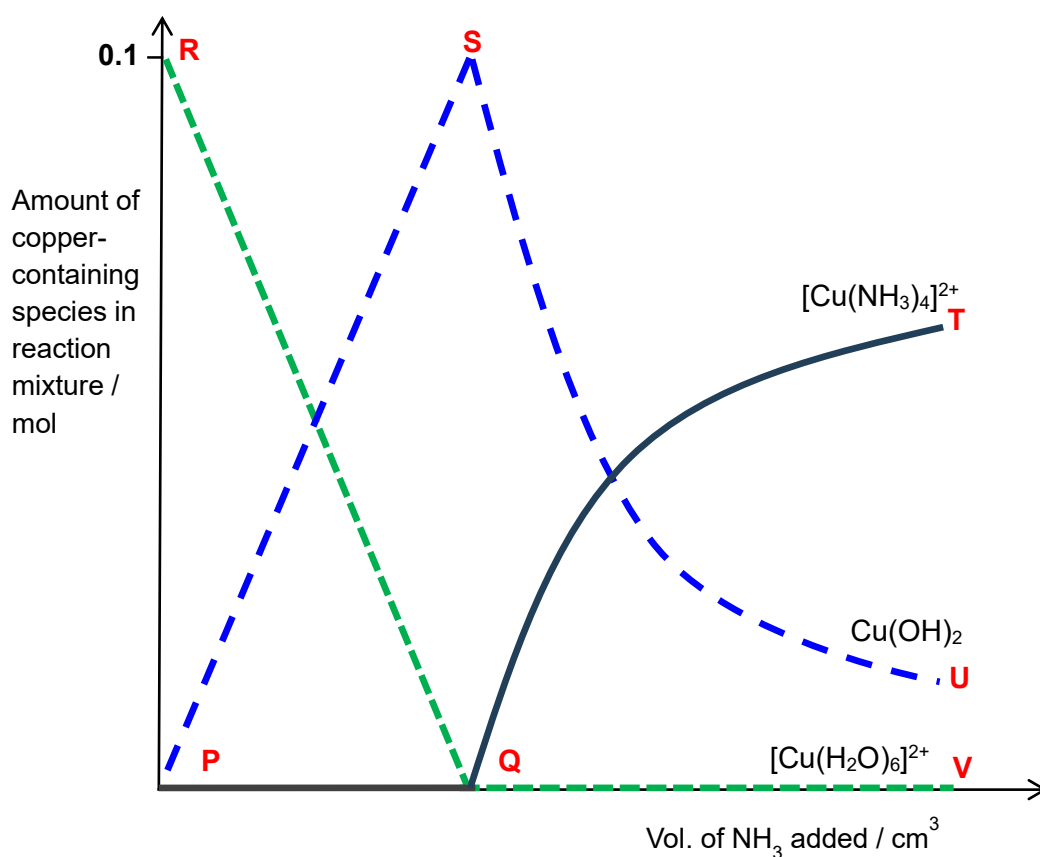
Which property is greater for calcium than for copper?

- A**    density  
**B**    melting point  
**C**    reducing power  
**D**    electrical conductivity





- 30 An experiment was conducted by adding  $\text{NH}_3(\text{aq})$  gradually to  $\text{CuSO}_4(\text{aq})$  in a beaker. The amounts of three major copper-containing species,  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ ,  $\text{Cu}(\text{OH})_2$  and  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  were determined and plotted against the volume of  $\text{NH}_3(\text{aq})$  added.



Which portion of the graph best represents each of the processes described?

	precipitation	dissolution	complex formation
<b>A</b>	QT	SU	QT
<b>B</b>	PS	RQ	SU
<b>C</b>	QT	RQ	SU
<b>D</b>	PS	SU	QT

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