



CANDIDATE
NAME

CG

INDEX NO

CHEMISTRY

9729/01

Paper 1 Multiple Choice

18 September 2025

1 hour

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 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** and **D**.

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

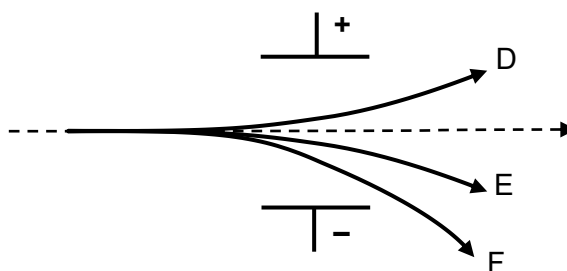
Read the instructions on the Answer Sheet very carefully.

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 Three different charged particles are fired with equal velocity into an electric field. The diagram below shows how each particle is deflected.

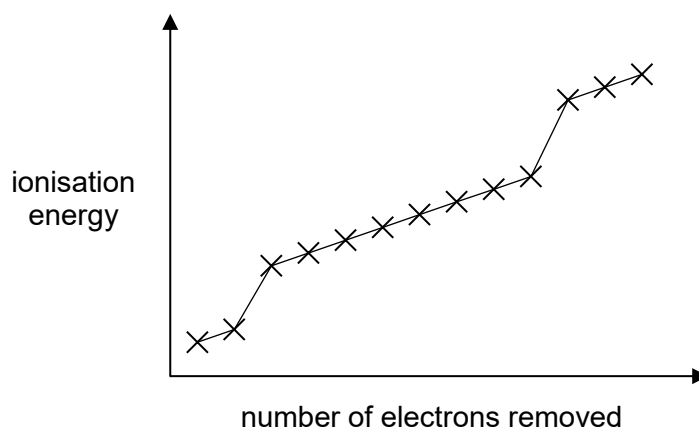


Which row gives the correct identities of D, E and F?

	D	E	F
A	$^{14}\text{N}^+$	$^{28}\text{Si}^{2-}$	$^{14}\text{C}^{2-}$
B	$^{14}\text{N}^-$	$^{28}\text{Si}^{2+}$	$^{14}\text{C}^{2+}$
C	$^{16}\text{O}^{2+}$	$^{16}\text{O}^{2-}$	$^{28}\text{Si}^-$
D	$^{16}\text{O}^{2-}$	$^{16}\text{O}^{2+}$	$^{28}\text{Si}^+$

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

The graph shows the first thirteen successive ionisation energies for element G.



What can be deduced about element G from the graph?

- A** It is aluminium.
- B** It is a d-block element.
- C** It is in Period 3 of the Periodic Table.
- D** The outermost electronic configuration is ns^2 .

- 3 Which statement describes a phenomenon caused by intermolecular hydrogen bonding?
- A The boiling point of an alcohol increases with increasing carbon chain length.
- B Hydrochloric acid forms H_3O^+ when dissolved in water.
- C CH_3CHO has a higher boiling point than $\text{CH}_3\text{CH}_2\text{CH}_3$.
- D Ice has a lower density than water at 0°C .
- 4 In certain microwave ovens, the wave energy produced is absorbed by polar molecules.

Which molecules would absorb microwave energy?

- 1 $\text{CH}_3\text{CH}_2\text{OH}$
- 2 AlCl_3
- 3 CO_2
- 4 CH_3F

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

- 5 Element J is in Period 3 of the Periodic Table. The four statements below describe the properties of element J or its compounds.

Three statements are correct descriptions. One of the statements is not correct because it does not fit with the other three.

Which statement is **not** correct?

- A Element J is a solid at room temperature which conducts electricity.
- B The oxide of element J dissolves in water to give an alkaline solution.
- C Element J forms a trichloride, JCl_3 , which reacts with water to give an acidic solution.
- D The oxide of element J reacts with both hydrochloric acid and sodium hydroxide solution.

- 6 The table below shows the observations when a hot wire is inserted into separate samples of hydrogen chloride, hydrogen bromide and hydrogen iodide gas.

hydrogen halide	observation
HCl	no observable change
HBr	reddish brown vapour only when wire is very hot
HI	purple vapour immediately forms

Which statements explain the observations?

- 1 Valence orbital size increases from Cl to Br to I.
- 2 Bond strength decreases from H–Cl to H–Br to H–I.
- 3 The electron cloud size of the hydrogen halide increases from HCl to HBr to HI.

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

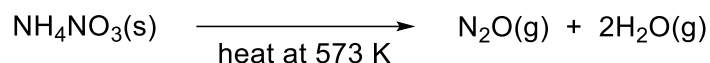
- 7 Which statements are correct?

- 1 The relative isotopic mass is the ratio of the mass of an atom of an isotope compared with $\frac{1}{12}$ of the mass of a carbon-12 atom.
- 2 The relative molecular mass is the ratio of the average mass of an atom in a molecule compared with $\frac{1}{12}$ of the mass of a carbon-12 atom.
- 3 One mole of a compound is the amount that contains the same number of atoms as there are atoms in 12.00 g of carbon-12.

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

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

Upon heating to 573 K, ammonium nitrate, NH_4NO_3 , decomposes into dinitrogen monoxide and water vapour.



0.2 g of NH_4NO_3 is heated to 573 K and then cooled. At room temperature and pressure, the amount of gas is 0.00208 mol.

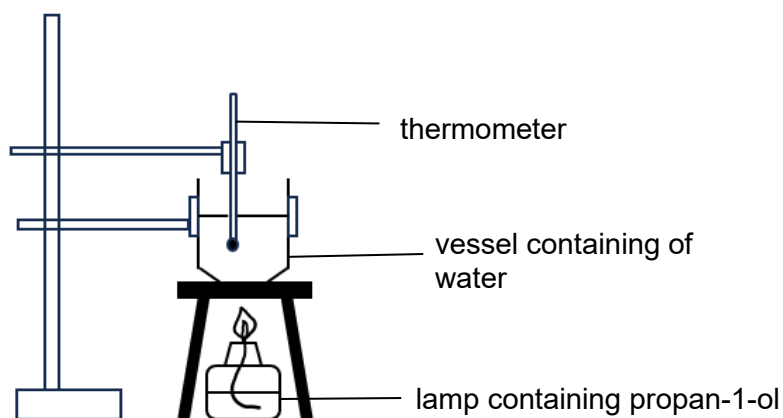
What percentage of NH_4NO_3 has decomposed?

- A** 27.8% **B** 29.4% **C** 83.3% **D** 88.1%

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

The experimental set-up below has a heat transfer efficiency of 90%.

In an experiment, 1.00 g of propan-1-ol ($M_r = 60.0$) was burnt under a vessel containing 200 g of water. It was found that the temperature of the water rose by 39.5 °C.



Which value for the enthalpy change of combustion of propan-1-ol is given by these results?

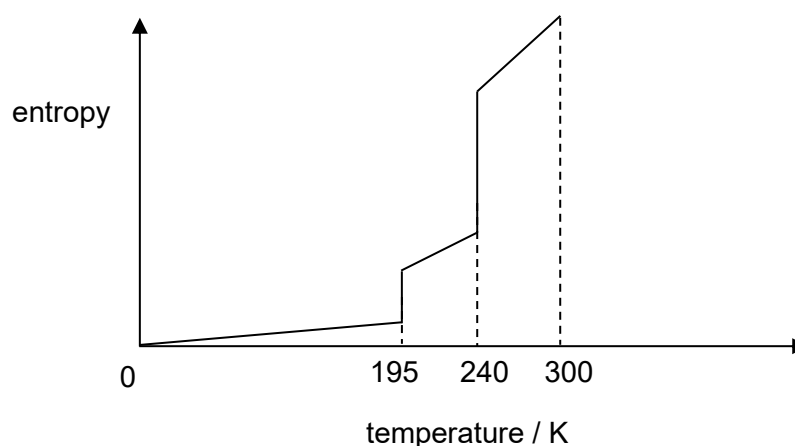
- A** -1780
B -2200
C -15700
D -17400

- 10 The nitride ion, N^{3-} , is usually found in compounds used for hard, heat-resistant materials, while the azide ion, N_3^- , is found in compounds that are used in airbags.

Which compound has the least negative value for lattice energy?

- A magnesium azide
 - B magnesium nitride
 - C sodium azide
 - D sodium nitride
- 11 The melting point of ammonia is 195 K and the boiling point of ammonia is 240 K.

The graph below shows how the entropy of NH_3 changes between 0 K and 300 K.

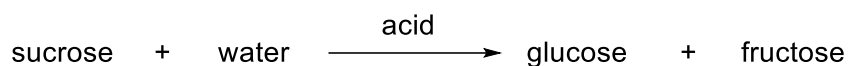


Which statements explain the shape of the graph?

- 1 Between 0 K and 195 K, entropy is low as the NH_3 molecules are held in their fixed positions in the solid state.
- 2 Between 195 K and 240 K, there is an increase in the number of ways to distribute energy among NH_3 molecules.
- 3 At 240 K, there is an increase in the number of NH_3 molecules and hence number of ways to arrange NH_3 molecules.

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

- 12 The hydrolysis of sucrose to glucose and fructose is catalysed by acid.



The reaction is first order with respect to sucrose and first order with respect to acid.

Which row correctly describes the effect on rate of reaction and half-life of sucrose when [acid] is doubled?

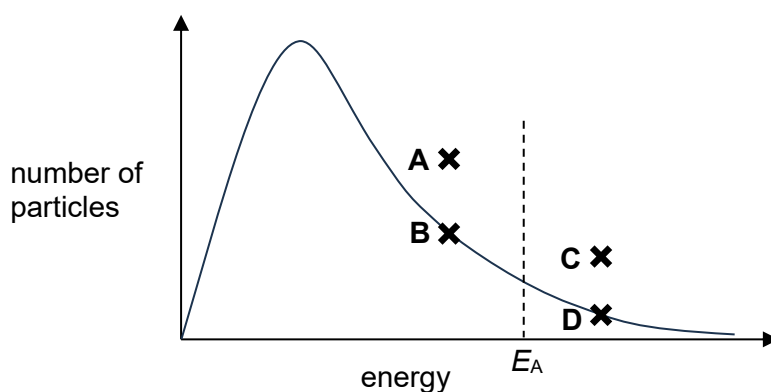
	rate of reaction	half-life of sucrose
A	remains the same	remains the same
B	remains the same	halves
C	doubles	remains the same
D	doubles	halves

- 13 The diagram shows the Boltzmann distribution for a sample of a reacting gas at a constant temperature.

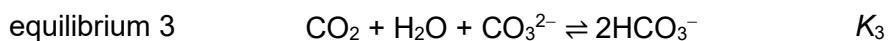
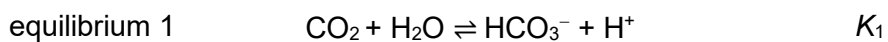
The activation energy, E_A , for the uncatalysed reaction is marked.

A catalyst is added to the sample of gas under constant temperature.

Which point could show the intercept of the Boltzmann distribution curve with the value of the activation energy of the reaction?



- 14 Consider the following three equilibria and their equilibrium constants, K_1 , K_2 and K_3 .



What is the correct expression for K_3 ?

- A** $K_1 \times K_2$ **B** K_2 / K_1 **C** K_1 / K_2 **D** $1 / (K_1 \times K_2)$
- 15 In this question, you should assume that all gases behave ideally.

Hydrogen and iodine react reversibly in the following reaction. The system is allowed to reach dynamic equilibrium.



Which row correctly describes how the equilibrium position and K_p are affected by an increase in temperature?

	equilibrium position	K_p
A	shifts left	increases
B	shifts left	decreases
C	shifts right	increases
D	shifts right	decreases

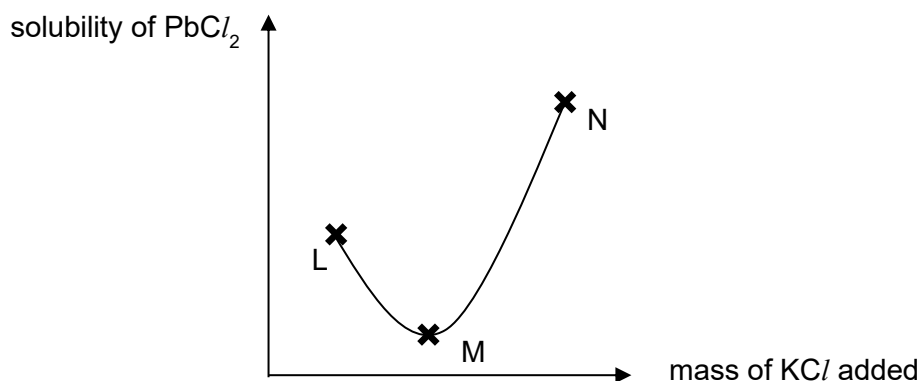
- 16 H_3PO_4 is a triprotic acid. At 25 °C, H_2PO_4^- has a K_a value of $6.3 \times 10^{-8} \text{ mol dm}^{-3}$.

What does the following expression represent?

$$\frac{1.00 \times 10^{-14}}{6.3 \times 10^{-8}}$$

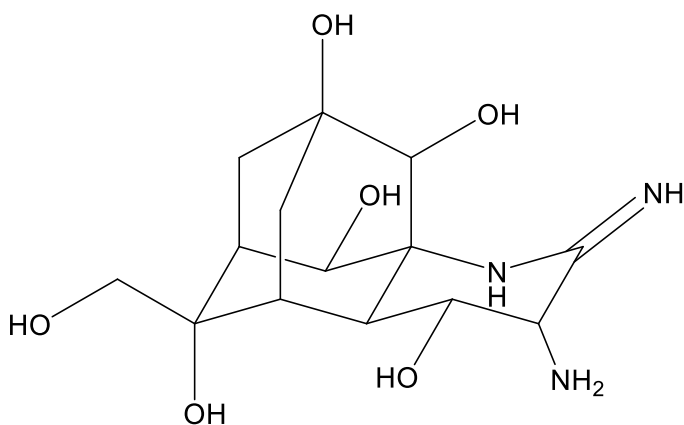
- A** K_a of H_3PO_4 **B** K_a of HPO_4^{2-} **C** K_b of H_2PO_4^- **D** K_b of HPO_4^{2-}

- 17 The graph shows how the solubility of a sparingly soluble salt lead(II) chloride, PbCl_2 , changes upon addition of solid potassium chloride, KCl , under constant temperature.



Which statement about the graph is **incorrect**?

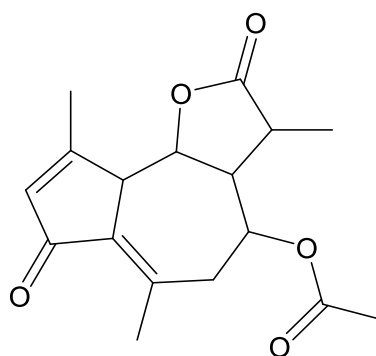
- A** K_{sp} remains constant along L to N.
B The change in solubility along L to M is due to increased chloride ion concentration.
C At M, the molar concentration of Cl^- ions in the solution is twice that of Pb^{2+} ions.
D The change in solubility along M to N is due to the formation of a complex ion.
- 18 The structure below shows a derivative of tetrodotoxin.



Which statements regarding this structure are correct?

- 1 It contains more secondary alcohol groups than tertiary alcohol groups.
 - 2 It contains only one primary alcohol group.
 - 3 It contains two primary amine groups.
- A** 1 and 2 only **B** 2 and 3 only **C** 1 only **D** 2 only

- 19 Matricarin occurs in oil of chamomile.

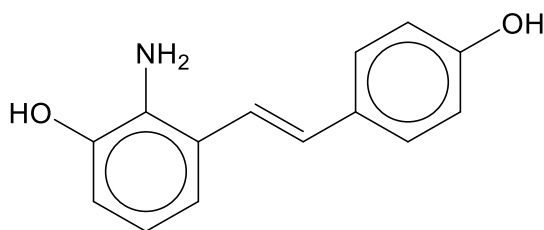


matricarin

When matricarin is treated with cold acidified KMnO_4 , compound P is formed.

How many chiral centres does P have?

- A 7 B 8 C 9 D 10
- 20 Compound Q is a resveratrol derivative that is being explored for its role in neurodegenerative diseases like Parkinson's.



Q

When treated with aqueous bromine, what is the maximum number of bromine atoms that can be incorporated into a molecule of compound Q?

- A 5 B 6 C 7 D 8

- 21** 2-Chlorobutane reacts with the :CH_3^- nucleophile to produce 2-methylbutane via nucleophilic substitution.

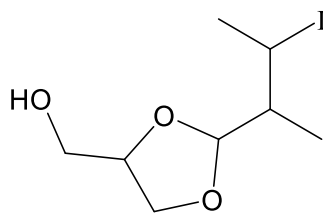
Before the reaction, the sample of 2-chlorobutane rotates plane-polarised light. After the reaction, the reaction mixture containing 2-methylbutane does not rotate plane-polarised light.

What can be concluded from the information given?

- 1 The reaction proceeds via $\text{S}_{\text{N}}1$.
- 2 The reaction proceeds via $\text{S}_{\text{N}}2$.
- 3 The rate of reaction is dependent on the concentration of 2-chlorobutane.

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

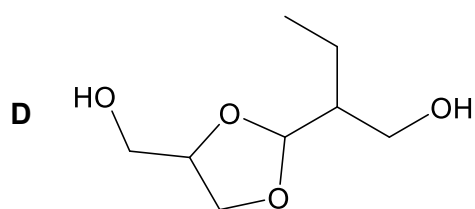
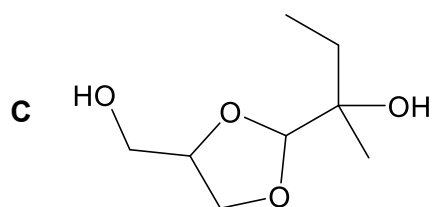
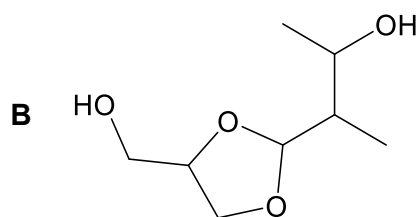
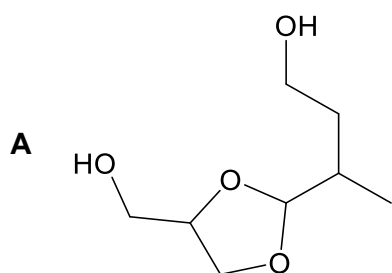
- 22** Iodinated glycerol is used in the symptomatic treatment of patients with chronic obstructive pulmonary disease.



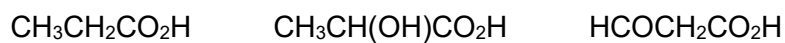
iodinated glycerol

What is the major product formed when iodinated glycerol is reacted with alcoholic KOH, followed by steam in the presence of concentrated phosphoric acid?

[The C–O–C bond in the structure is inert to these reagents.]



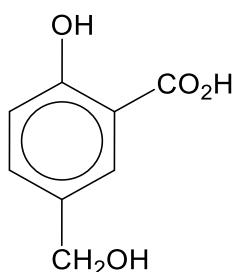
- 23 Three colourless liquids with the following formulae are contained in separate unlabelled bottles.



Which two tests, when carried out sequentially on separate samples of each liquid, will allow you to successfully identify all three liquids?

	Test 1	Test 2
A	warm alkaline aqueous iodine	PCl_5
B	Fehling's solution	NaHCO_3
C	PCl_5	warm acidified potassium dichromate(VI)
D	warm acidified potassium dichromate(VI)	Fehling's solution

- 24 2-hydroxy-5-(hydroxymethyl)benzoic acid is commonly used in biochemical systems as a buffer.



2-hydroxy-5-(hydroxymethyl)benzoic acid

Which statements are correct?

- 1 When the compound is reacted with PCl_5 , the product contains 3 chlorine atoms.
- 2 When the compound is reacted with NaOH , two moles of NaOH is needed to react with 1 mole of compound.
- 3 When the compound is reacted with an excess of ethanoyl chloride, the product contains 4 more carbon atoms.

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

- 25** Carbonyl compounds are reduced by LiAlH_4 but alkenes cannot be reduced by LiAlH_4 .

Which statements explain this observation?

- 1 Alkenes have an electron rich $\text{C}=\text{C}$ bond.
- 2 Carbonyl compounds have a polar $\text{C}=\text{O}$ bond.
- 3 Alkenes have greater steric hindrance than carbonyl compounds.

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

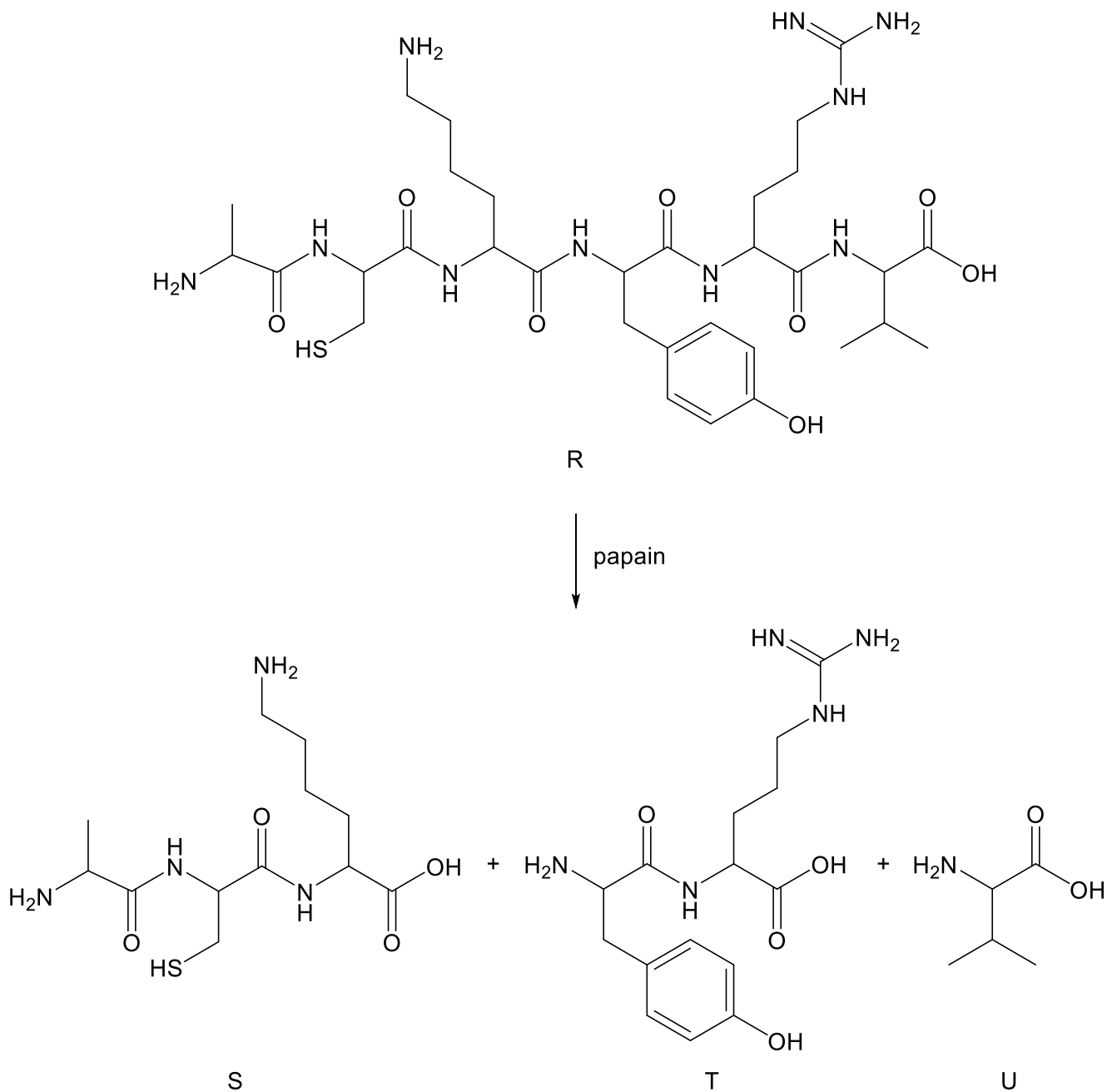
- 26** The compound $\text{C}_2\text{H}_5\text{CONH}_2$ is an amide.

Which statement about this amide is correct?

- A** It can react with $\text{H}_2\text{SO}_4(\text{aq})$ in an acid-base reaction.
- B** When heated with $\text{NaOH}(\text{aq})$, it will form sodium propanoate.
- C** When heated with $\text{H}_2\text{SO}_4(\text{aq})$, it will form ethanoic acid.
- D** It can be formed using propanoic acid and $\text{NH}_3(\text{aq})$ at room temperature.

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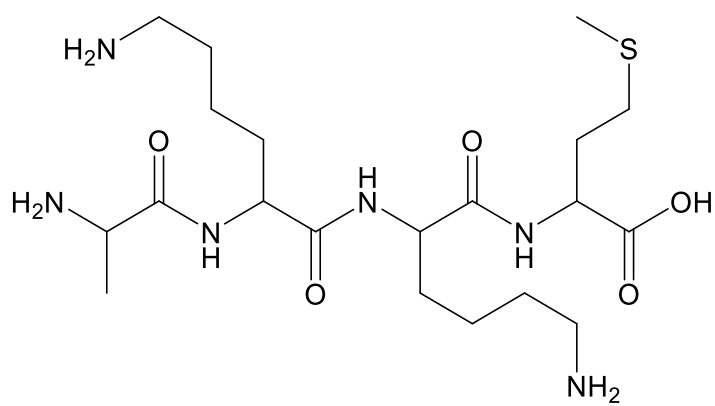
- 27 Papain is an enzyme that tenderises meats by hydrolysing proteins in meat into smaller polypeptides and amino acids. It specifically hydrolyses the peptide bond on the carboxyl side of a residue that contains a nitrogen in the side chain. For example, the polypeptide R is hydrolysed into S, T and U.



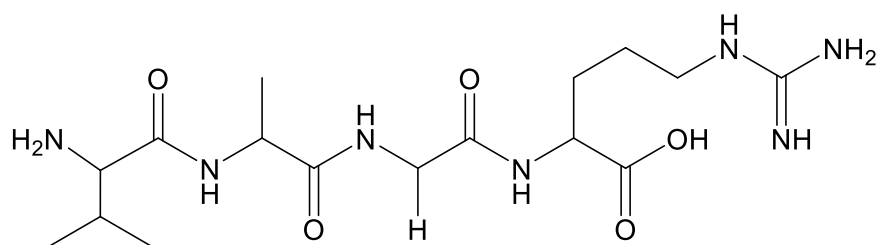
Which of the four tetrapeptides on the page 17 will form two different **dipeptides** when hydrolysed by papain?

17

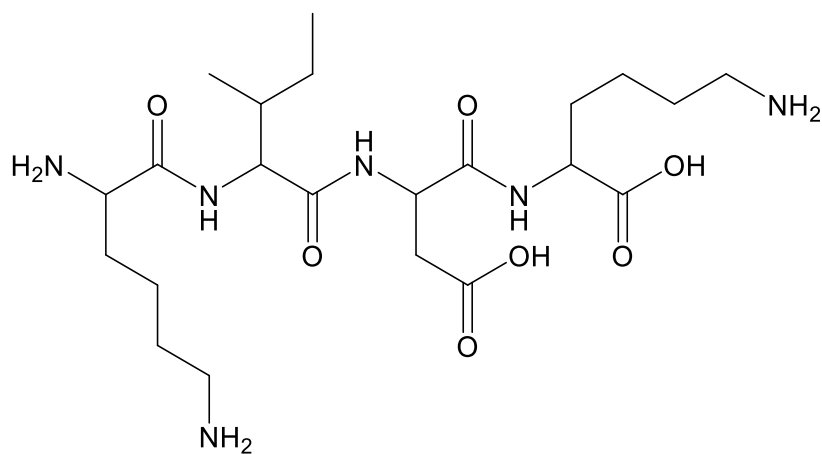
A



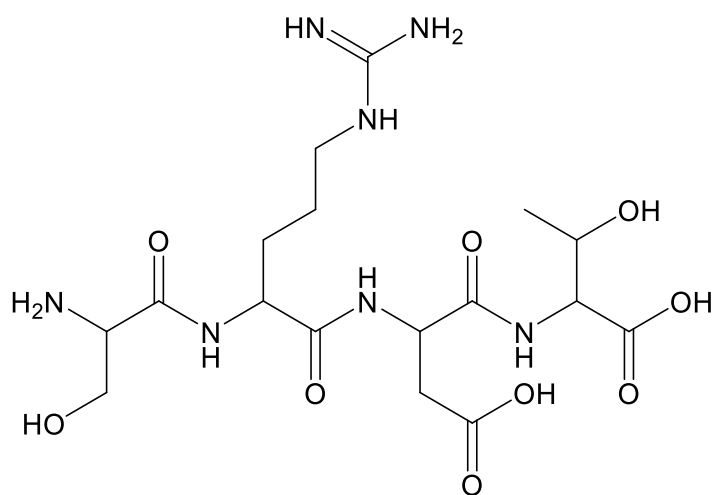
B



C



D



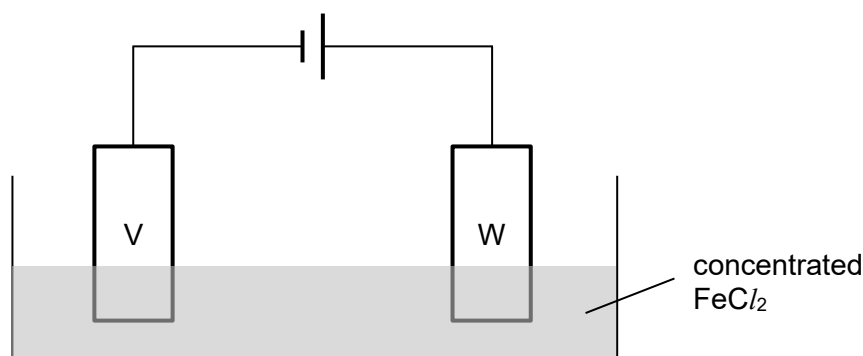
28 *Use of the Data Booklet is relevant to this question.*

Which pair of substances will react spontaneously?

- A** Ca^{2+} and MnO_4^- **B** Cl^- and Cu **C** Br_2 and Fe^{2+} **D** Al^{3+} and Cl^-

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

The diagram shows an electrolysis cell set-up of concentrated iron(II) chloride. V and W are platinum electrodes.



Which row identifies the products formed at electrodes V and W?

	product formed at V	product formed at W
A	Fe	Cl_2
B	Cl_2	Fe
C	Fe	O_2
D	O_2	Fe

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

When 0.95 g of a chromium compound is first dissolved in water and treated with an excess of aqueous silver nitrate solution, 0.50 g of white precipitate was collected.

Given that the general formula for the chromium compound is $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$, what is the formula of the chromium-containing ion?

- A** Cr^{3+} **B** $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ **C** $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]^{2+}$ **D** $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$

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