



YISHUN INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 2

CANDIDATE
NAME

CG

INDEX NO

CHEMISTRY

9729/01

Paper 1 Multiple Choice

15 September 2023

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and class 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.

This document consists of **16** printed pages.

- 1 A medal has a total surface area of 150 cm^2 . It is evenly coated with silver by electrolysis. Its mass increases by 0.216 g .

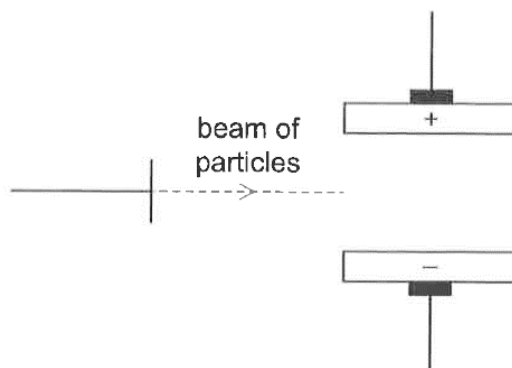
How many atoms of silver are deposited per cm^2 on the surface of the medal?

- A 8.0×10^{18} B 1.8×10^{19} C 8.7×10^{20} D 1.2×10^{21}

- 2 Which gas would behave most like an ideal gas under room conditions?

- A ammonia
B helium
C krypton
D nitrogen

- 3 In two separate experiments a beam of protons and a beam of ${}^4_2\text{He}^{2+}$ particles, travelling at the same velocity, pass through an electric field as shown.



Which statements are correct?

- 1 Both beams are deflected in the same direction.
- 2 The proton beam travels in a straight path towards the negatively charged plate.
- 3 The protons are deflected to a larger extent than the ${}^4_2\text{He}^{2+}$ particles.

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

- 4 The table shows some properties of four substances.

Which substance could be potassium iodide?

	Melting point of solid / °C	Electrical conductivity when molten
A	−66	poor
B	−39	good
C	680	good
D	1600	poor

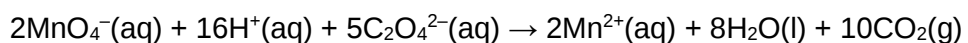
- 5 A carbon monoxide molecule, CO, has three bonds between the carbon atom and the oxygen atom.

Which features are present in one CO molecule?

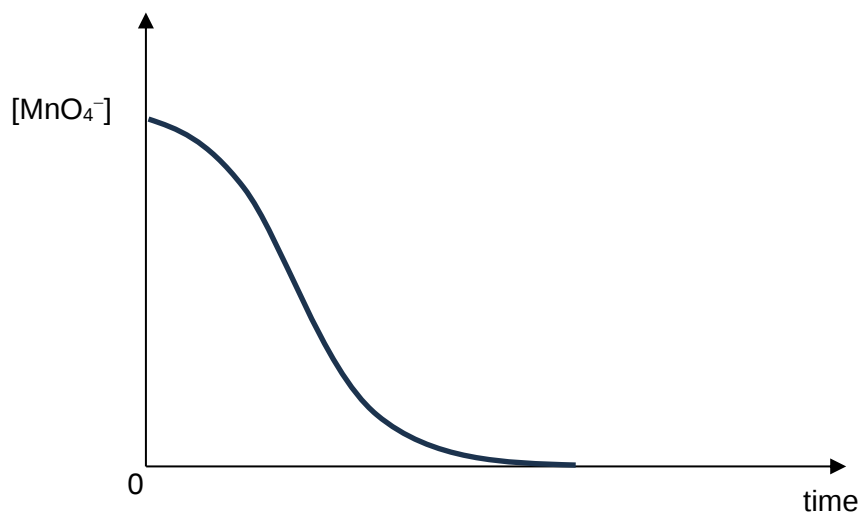
- 1 Three lone pairs of electrons
- 2 A co-ordinate bond from oxygen to carbon
- 3 Two π bonds

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

- 6 The reaction of manganate(VII) ions with ethanedioate ions in acid solution may be represented by the following equation.



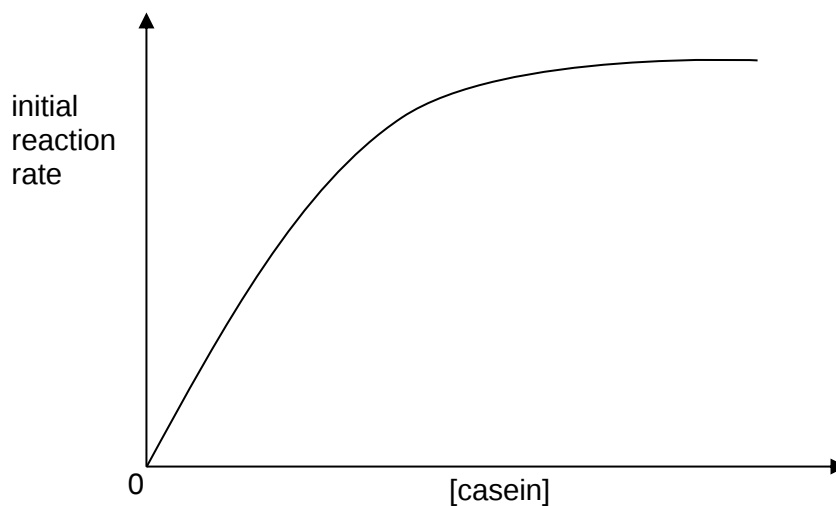
The graph shows concentration of manganate(VII) ions against time for this reaction.



What does the shape of the graph suggest about this reaction?

- A The rate of reaction decreases with time.
- B The reaction is endothermic.
- C The reaction shows first order kinetics.
- D The reaction is catalysed by a product.

- 7 The graph shows the results of an investigation of the initial rate of hydrolysis of casein by the enzyme trypsin. In the experiments, the initial concentration of casein was varied but that of trypsin was kept constant.



Which conclusions can be deduced from these results?

- 1 When [casein] is high, the rate is independent of [trypsin].
- 2 When [casein] is high, the rate is independent of [casein].
- 3 When [casein] is low, the rate is first order with respect to [casein].

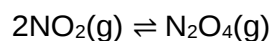
A 1, 2 and 3

B 1 and 2

C 2 and 3

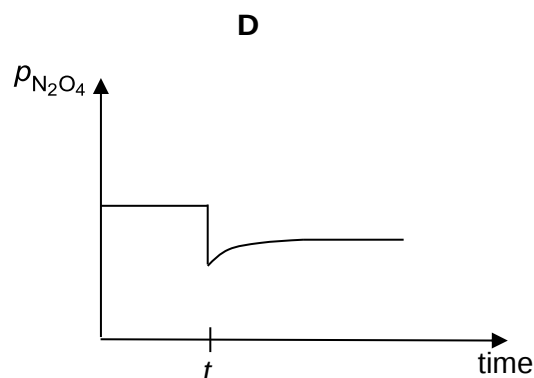
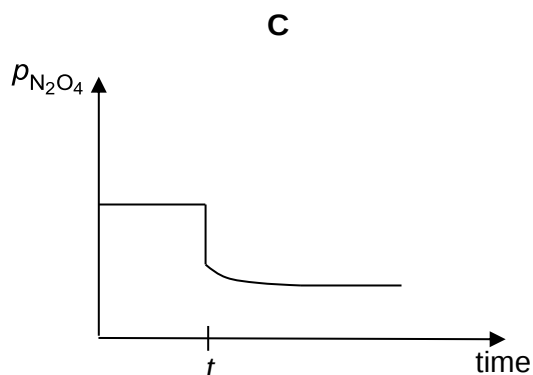
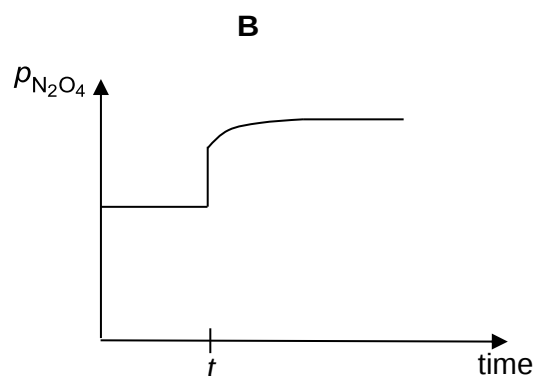
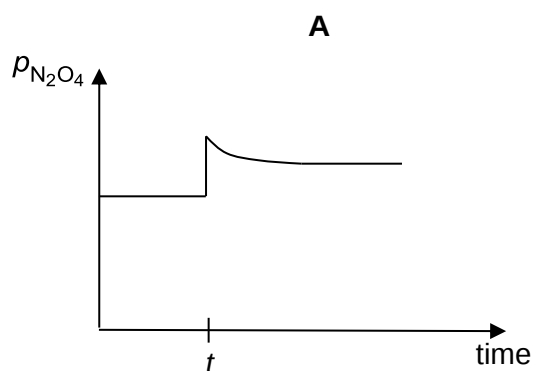
D 1 only

- 8 An equilibrium is set up, in a vessel at constant temperature and atmospheric pressure, according to the following reaction.

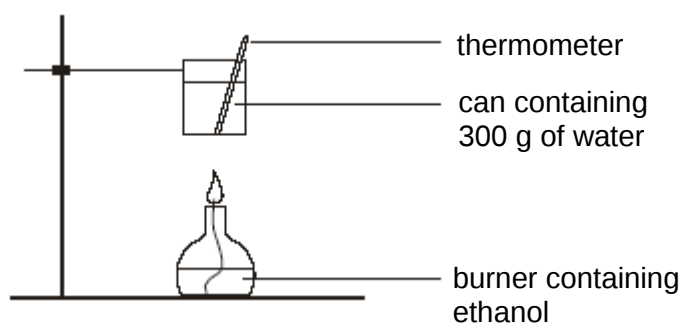


The vessel is attached to a plunger which can alter the pressure inside the vessel. At a time t , the plunger is pushed in quickly to increase the pressure and a new equilibrium is established. The temperature is maintained constant throughout.

Which graph shows the change in partial pressure of N_2O_4 , $p_{\text{N}_2\text{O}_4}$, during this process?



- 9 An experiment was conducted to determine the efficiency of the heating of a can of water using a spirit burner.



The following data were recorded:

Mass of ethanol burnt $= m \text{ g}$
 Change in temperature of water $= \Delta T \text{ }^{\circ}\text{C}$

You are also given that:

Relative molecular mass of ethanol $= 46.0$
 Enthalpy change of combustion of ethanol $= -1371 \text{ kJ mol}^{-1}$
 Specific heat capacity of water $= c \text{ J g}^{-1} \text{ K}^{-1}$

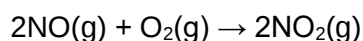
Which expression below gives the efficiency of this heating process?

- A $\frac{300 \times c \times \Delta T \times 46.0}{m \times 1371 \times 1000} \times 100\%$
- B $\frac{m \times c \times \Delta T \times 46.0}{300 \times 1371 \times 1000} \times 100\%$
- C $\frac{300 \times c \times \Delta T \times 46.0}{m \times 1371} \times 100\%$
- D $\frac{m \times 1371 \times 1000}{300 \times c \times \Delta T \times 46.0} \times 100\%$

- 10 The enthalpy changes involving some oxides of nitrogen are given below:

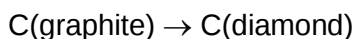
	enthalpy change / kJ mol^{-1}
$\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$	+180
$\text{N}_2(\text{g}) + \frac{5}{2}\text{O}_2(\text{g}) \rightarrow \text{N}_2\text{O}_5(\text{g})$	+11
$2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{N}_2\text{O}_5(\text{g})$	-55

What is the enthalpy change, in kJ mol^{-1} , of the following reaction?



- A -114 B +114 C -136 D +136

- 11 The conversion of graphite into diamond is a non-spontaneous reaction at 298 K. The entropy change of this reaction is negative at 298 K.



$$\Delta G = +3.08 \text{ kJ mol}^{-1}, \Delta S = -3.3 \text{ J mol}^{-1} \text{ K}^{-1}$$

With reference to the enthalpy change, ΔH , of the reaction above, which statements are correct?

- 1 Enthalpy change of atomisation of diamond is less endothermic than that of graphite.
- 2 Enthalpy change of atomisation of diamond is more endothermic than that of graphite.
- 3 Enthalpy change of combustion of diamond is less exothermic than that of graphite.
- 4 Enthalpy change of combustion of diamond is more exothermic than that of graphite.

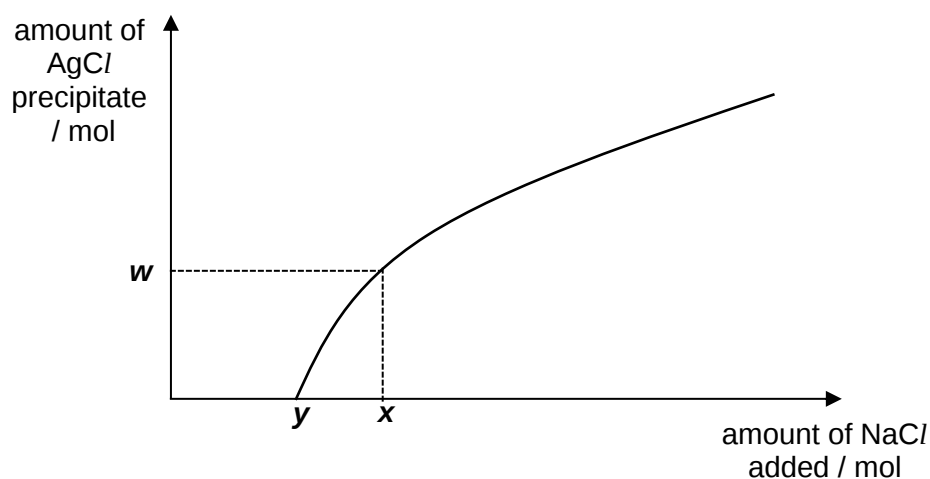
A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

- 12 Solid NaCl was continuously added to a 1 dm³ solution containing z mol of Ag⁺ ions and the amount of AgCl precipitated was found to change, as shown in the graph below.



When x mol of NaCl was added, w mole of AgCl precipitate was formed.

Which of the following gives the correct expression for the solubility product of AgCl?

A $(z)(y)$

B $(w)(x)$

C $(z)(x)$

D $(y)(y)$

- 13** Two experiments were conducted.

In the first set-up, 0.1 mol dm^{-3} of sodium ethanoate and 0.1 mol dm^{-3} silver nitrate was mixed and a white precipitate was obtained. On adding potassium bromide, the precipitate turns cream.

In the second set-up, 0.1 mol dm^{-3} of silver nitrate was added to potassium bromide and a cream precipitate was obtained. On adding sodium ethanoate, there is no further change.

What can be deduced from these observations?

- A** The cream precipitate is due to the silver ethanoate.
- B** Silver bromide is more soluble than silver ethanoate.
- C** The white precipitate in the first set-up is silver ethanoate.
- D** Ethanoate ions can oxidise bromide.

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

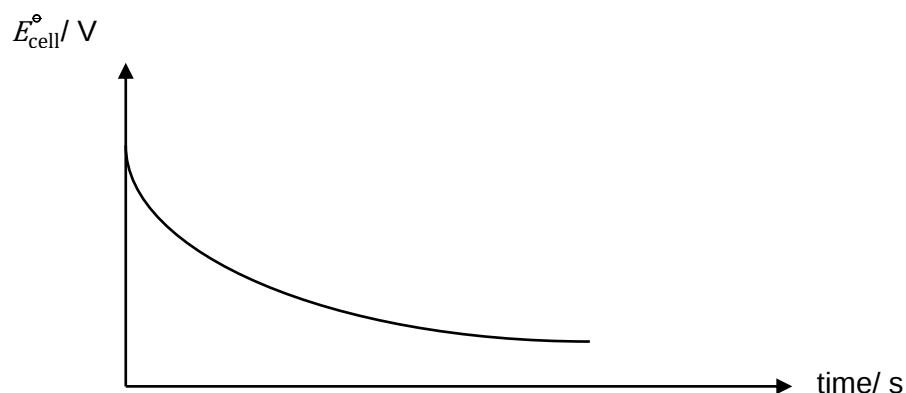
In the electrolysis of molten aluminium oxide, 0.27 g of aluminium is liberated when 0.8 A of current is passed through the molten aluminium oxide for 1 hour.

Which is the value of Avogadro's constant derived from this experiment?

- A** 1.00×10^{22}
 - B** 6.00×10^{23}
 - C** 6.05×10^{23}
 - D** 5.40×10^{24}
- 15** *Use of the Data Booklet is relevant to this question.*

An experiment is carried out between the Fe^{2+}/Fe and Co^{2+}/Co half cells.

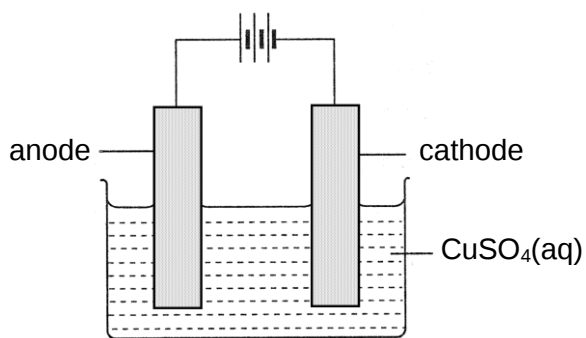
The following graph of cell potential against time was obtained when a change was continuously made to the half-cell.



Which of the following can explain the graph?

- A** Adding $\text{Co}^{2+}(\text{aq})$ to the Co^{2+}/Co half cell.
- B** Adding $\text{NaOH}(\text{aq})$ to the Co^{2+}/Co half cell.
- C** Adding water to the Fe^{2+}/Fe half cell.
- D** Increasing the mass of iron electrode used

- 16 In an experiment, a cell was set up to obtain pure copper from a copper-silver alloy as shown below. Pure copper is used as the cathode and the copper-silver alloy is used as the anode.

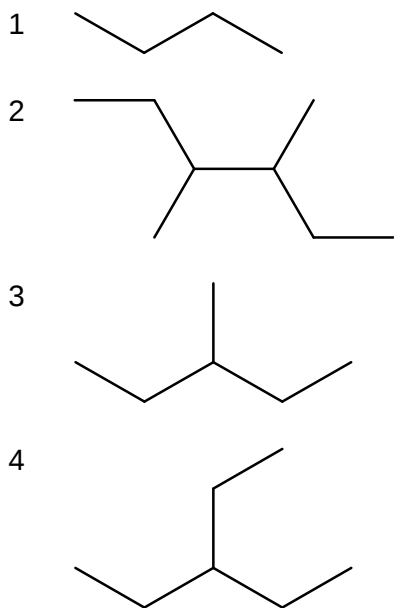


When a current of 30.0 A flows through the electrolyte for 31.4 minutes, silver deposit underneath the anode was collected and weighed. During this time, the mass of the anode changes by 26.47 g.

What is the mass of the silver collected underneath the anode?

- A 7.874 g B 18.60 g C 37.20 g D 61.70 g
- 17 How many isomers, including stereoisomers, are there of $C_3H_5Br_3$?
- A 3 B 4 C 5 D 6
- 18 Ethane undergoes free radical substitution when mixed with chlorine and exposed to ultra-violet light.

Which compounds are possible products from this reaction?



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

- 19 Hydrogen iodide undergoes an addition reaction with propene forming 2-iodopropane. When propene is bubbled through iodine monobromide, IBr, dissolved in a suitable solvent, a similar reaction occurs.

Which product will be present in the greatest yield?



- 20 The molecule of benzene, C_6H_6 is a regular hexagon in which the π electrons are described as delocalised.

Which of the following statements are true for benzene?

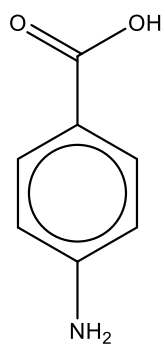
- 1 Benzene favours substitution reactions.
- 2 All C–C bonds lengths in benzene are intermediate between C–C bond in an alkane and C=C bond in an alkene.
- 3 The presence of π electrons enables benzene to be a good electrical conductor.

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

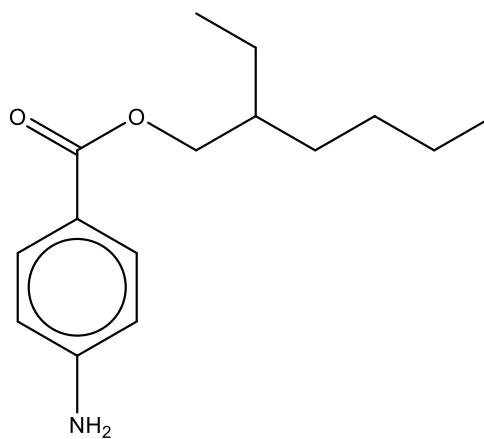
- 21 Which compound is least reactive with a few drops of ethanolic silver nitrate under the same conditions?

- A** benzoyl bromide
- B** 2-bromo-2-methylpropane
- C** bromobenzene
- D** 1-bromobutane

- 22 PABA and Padimate O are both effective sunscreen ingredients that absorb UVB light. What is the type of reaction occurring when PABA is converted to Padimate O?



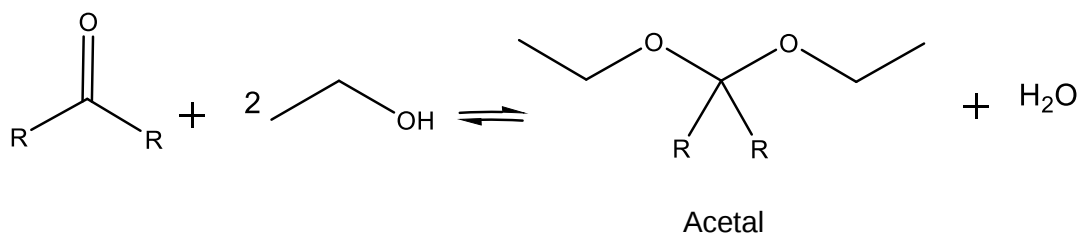
PABA



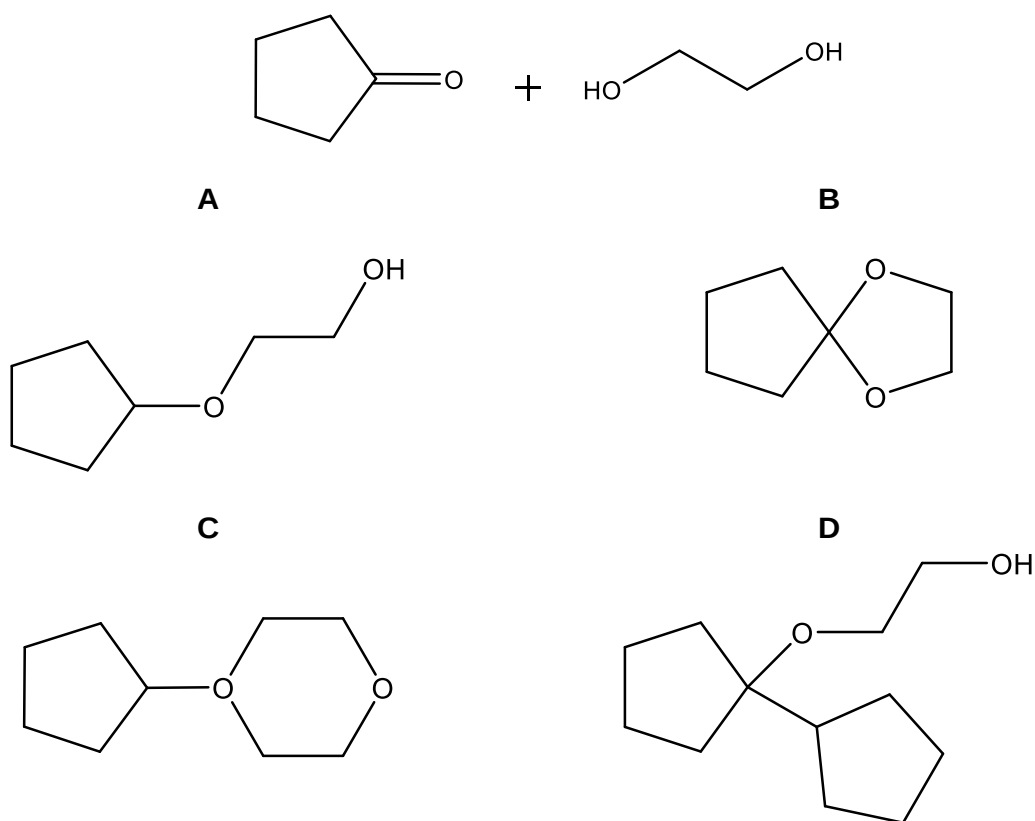
Padimate O

- A electrophilic addition
- B condensation
- C hydrolysis
- D electrophilic substitution

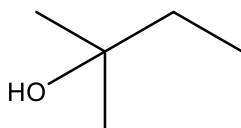
- 23** Acetals are formed by the reaction of aldehydes or ketones with alcohols in the presence of an acid catalyst. The resulting compound contains a carbon atom bonded to two alkoxy groups (OR) and two carbon atoms, forming a tetrahedral structure.



Which of the acetal is formed using the following reagents?

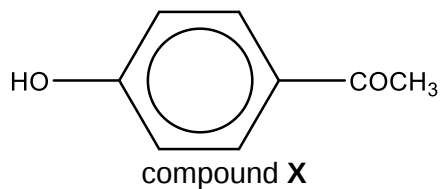


- 24** What is the total number of isomers that can be obtained when the alcohol as shown below is dehydrated?



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

25 The diagram shows the structure of a compound **X**.



Which statements are correct?

- 1 **X** undergoes nucleophilic addition with HCN in the presence of NaOH(aq).
- 2 **X** undergoes electrophilic addition with Br₂(aq).
- 3 **X** undergoes nucleophilic substitution with PCl₅(s).

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

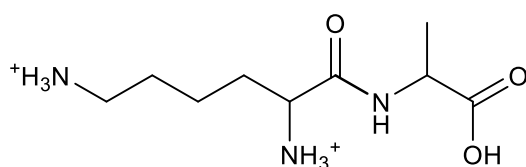
26 Consider the following four compounds.

- 1 phenol
- 2 propan-1-ol
- 3 2-chloropropanoic acid
- 4 3-chloropropanoic acid

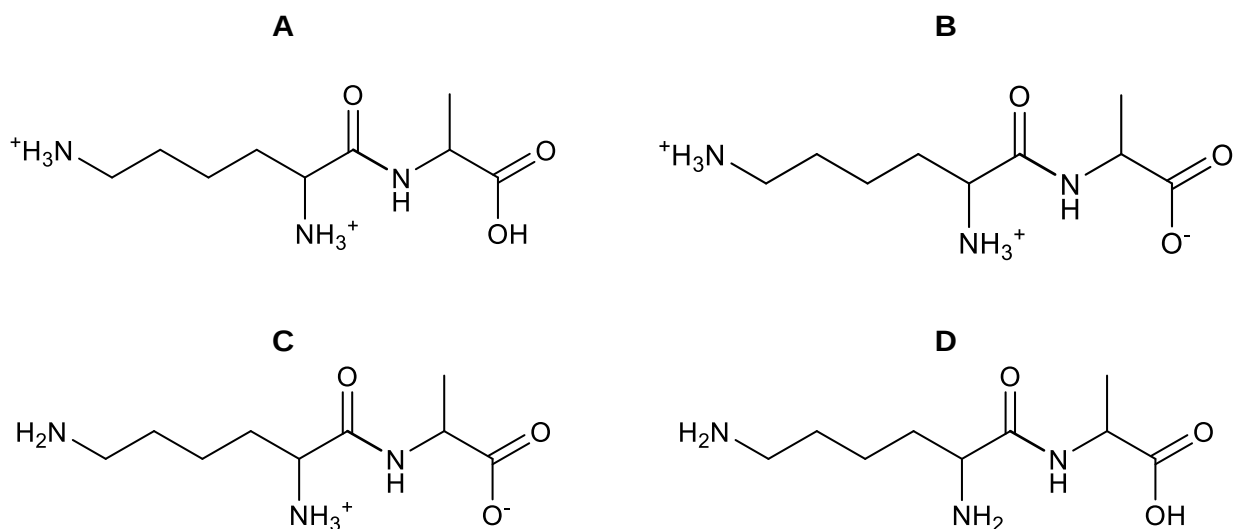
What is the relative order of **decreasing** acidity of these compounds?

- A** 3, 4, 1, 2
- B** 4, 3, 1, 2
- C** 2, 1, 4, 3
- D** 4, 3, 2, 1

- 27 A dipeptide lys–ala has pK_a values of 2.35, 8.95 and 10.53.



What is the structure of the major species in a solution of lys–ala at pH 7?



- 28 Which statements on boiling point and thermal stability of hydrogen halides down group 17 are correct?

- 1 Boiling point of hydrogen halides decreases due to weaker hydrogen-halogen bonds.
- 2 Boiling point of hydrogen halides increases due to stronger intermolecular forces of attraction.
- 3 Thermal stability decreases due to weaker hydrogen-halogen bonds.
- 4 Thermal stability increases due to stronger intermolecular forces of attraction.

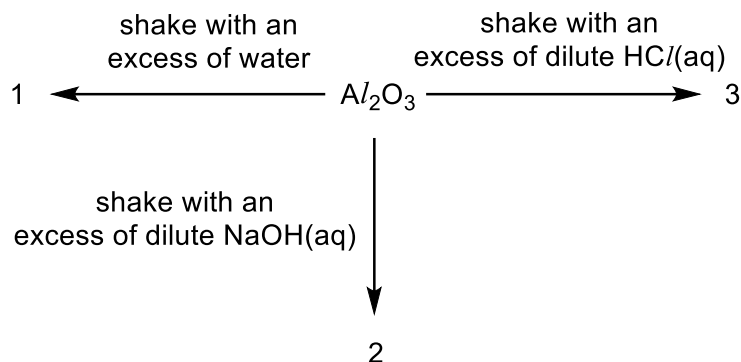
A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

- 29 A student carries out an investigation using aluminium oxide. All experiments are carried out at room temperature.



Which observations would the student make of the results of these experiments?

- A No solid remains in any experiment.
 - B A solid remains in one experiment only.
 - C A solid remains in two experiments only.
 - D Solid remains in all three experiments.
- 30 *Use of the Data Booklet is relevant to this question.*

The table shows some physical properties of metals.

One row of the table shows two properties of calcium. Another row shows two properties of chromium. The other two rows of the table each show one property of calcium and one property of chromium.

Which row shows two properties of chromium?

	density / g cm ⁻³	melting point / °C
A	1.6	842
B	1.6	1910
C	7.2	842
D	7.2	1910