TAMPINES MERIDIAN JUNIOR COLLEGE

JC2 PRELIMINARY EXAMINATION

H2 CHEMISTRY **9729/01**

Paper 1 Multiple Choice **25 September 2025**

1 hour

Additional materials: Multiple Choice Answer Sheet
Data Booklet

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.

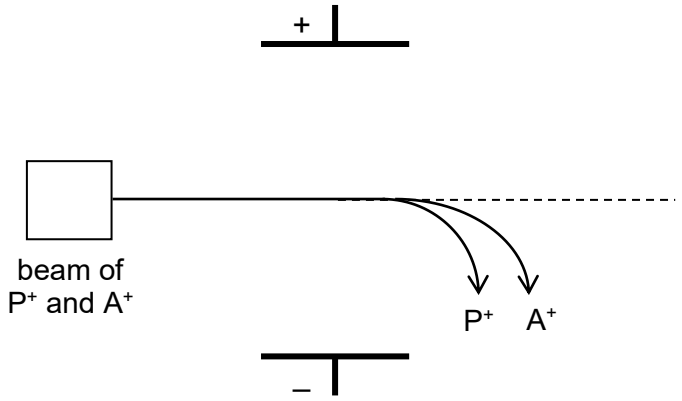
Use of the Answer Sheet

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

Answer: A

Angle of deflection $\propto \left|\frac{\text{charge}}{\text{mass}}\right|$

Since the extent of deflection of X^+ is smaller, this implies that X^+ has a larger mass than P^+.

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

Answer: D

$_{8}O$: $1s^2 2s^2 2p^4$ (2 unpaired electrons)

$_{17}Cl^-$: $1s^2 2s^2 2p^6 3s^2 3p^6$ (0 unpaired electrons)

$_{19}K^+$: $1s^2 2s^2 2p^6 3s^2 3p^6$ (0 unpaired electrons)

$_{26}Fe$: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$ (4 unpaired electrons)

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

Answer: C

SO_3 ⇒ trigonal planar, non–polar
CH_3F ⇒ tetrahedral, polar C–F bond
CH_3CH_2OH ⇒ tetrahedral, polar O–H bond

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.

Answer: B

Both potassium and magnesium contain giant metallic structures.

Strength of metallic bond is affected by:
(i) no. of valence electrons delocalised (K < Mg)
(ii) charge density (K^+ < Mg^{2+})

5 Which of the following cannot be explained by hydrogen bonding?

A The existence of hydrogen–difluoride anion, HF_2^-.

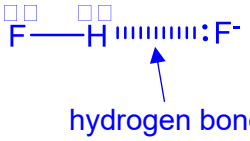
B The difference in volatility between pentan–1–ol and hexan–1–ol.

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.

Answer: B

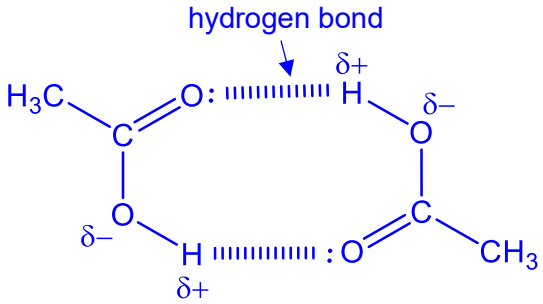
Option A:



Option B: Pentan–1–ol is more volatile (or has a lower boiling point) because it has a smaller electron cloud size than hexan–1–ol. Hence there is a smaller extent of distortion of electron cloud, resulting in weaker instantaneous dipole–induced dipole attraction between pentan–1–ol molecules.

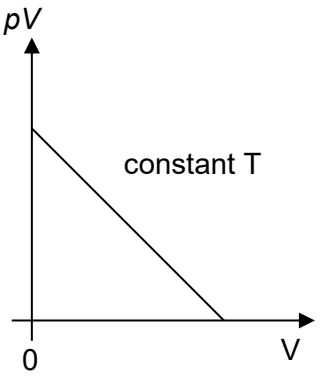
Option C: Due to the proximity of $–NO_2$ and –OH group in 2–nitrophenol, intramolecular hydrogen bonding will occur. Hence less extensive intermolecular hydrogen bonding will be formed between 2–nitrophenol molecules, resulting in lower melting point compared to 4–nitrophenol.

Option D: Ethanoic acid molecules can form a dimer via hydrogen bond in organic solvent.

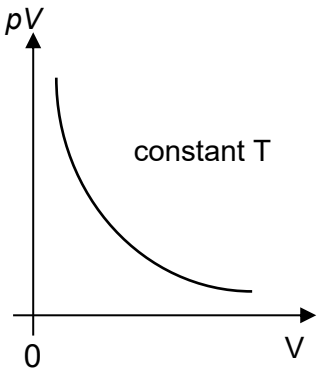


6 Which diagram correctly describes the behaviour of a fixed mass of an ideal gas?

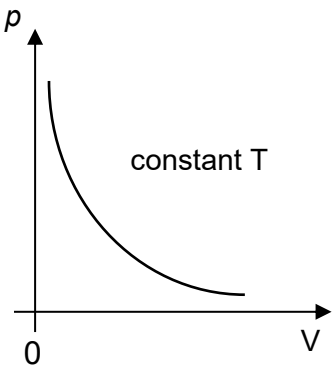
A



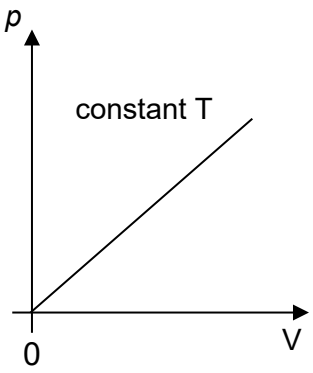
B



C

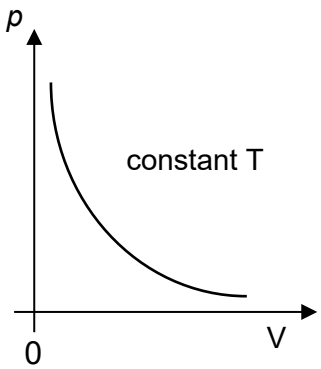


D



Answer: C

Option C is correct



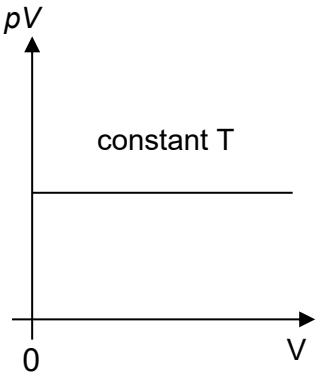
pV = nRT

$p = nRT\left(\frac{1}{V}\right)$

since nRT is constant

$\Rightarrow p = k\left(\frac{1}{V}\right)$, where k is a constant

Option A and B is incorrect



since nRT is constant

⇒ pV = k, where k is a constant

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

Sodium percarbonate, $(Na_2CO_3)_x \cdot y(H_2O_2)$, is an oxidising agent used in laundry cleaning products.

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

An identical sample, on titration with 0.0500 mol dm^{-3} $KMnO_4$, requires 24.0 cm^3 before the first pink colour appears. 2 moles of $KMnO_4$ reacts with 5 moles of H_2O_2.

What is the ratio of y/x?

A $\frac{1}{3}$ **B** $\frac{2}{3}$ **C** $\frac{3}{2}$ **D** 3

Answer: C

$(Na_2CO_3)_x.y(H_2O_2) \equiv xNa_2CO_3 \equiv xCO_2$

$\eta Na_2CO_3 = \frac{10.0}{1000} \times 0.100 = 0.001$

$\eta CO_2 = \frac{48.0}{1000} \div 24 = 0.002$

$\Rightarrow x = 2$

$2KMnO_4 \equiv 5H_2O_2$

$(Na_2CO_3)_x.y(H_2O_2) \equiv yH_2O_2$

$\eta KMnO_4 = \frac{24.0}{1000} \times 0.0500 = 0.0012$

$\eta H_2O_2 = \frac{5}{2} \times 0.0012 = 0.003$

$\Rightarrow y = 3$

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** A*l* **D** Si

Answer: A

Among the Period 3 elements:
- Silicon has the highest melting point. Hence, **G** is silicon.
- Aluminium has the highest electrical conductivity. Hence, **H** is aluminium.
- Magnesium oxide has the highest melting point. Hence, **J** is magnesium.

9 Which equation defines standard enthalpy change of formation correctly?

A $Na(s) + Cl(g) \rightarrow NaCl(s)$

B $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

C $Mg^{2+}(g) + O^{2-}(g) \rightarrow MgO(s)$

D $H_2(g) + S(s) + 2O_2(g) \rightarrow H_2SO_4(l)$

Answer: D

Standard enthalpy change of formation of a substance is the energy change when 1 mole of the substance is formed from its elements under standard conditions of 298K and 1bar.

10 Hydrogen can be made from steam.

$$H_2O(g) + C(s) \longrightarrow H_2(g) + CO(g)$$

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

At 378 K, ΔG_1 = +78 kJ mol^{-1}
At 1300 K, ΔG_2 = –58 kJ mol^{-1}

Which row gives the correct signs of ΔH and ΔS for this reaction?

	ΔH	ΔS
A	–	+
B	–	–
C	+	–
D	+	+

Answer: D

When T is increased from 378K to 1300K, ΔG is changed from positive to negative.
$\Delta G = \Delta H - T\Delta S$
When ΔH is positive, ΔS is positive such that $-T\Delta S$ is negative,
(i) At lower T, $|\Delta H| > |T\Delta S|$, so ΔG will be positive.
(ii) At higher T, $|\Delta H| < |T\Delta S|$, so ΔG will be negative.

11 The equation for the formation of hexaamminecobalt(III), $[Co(NH_3)_6]^{3+}$ complex ion is shown below.

$$2Co^{2+} + 12NH_3 + H_2O_2 \longrightarrow 2[Co(NH_3)_6]^{3+} + 2OH^-$$

The rate equation is rate = $k\,[Co^{2+}][NH_3]^3[H_2O_2]$.

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

What will be the initial rate of the reaction if $[Co^{2+}]$ is 2x, $[NH_3]$ is $\frac{1}{2}$x and $[H_2O_2]$ is 2x?

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

Answer: B

Rate = k $[Co^{2+}][NH_3]^3[H_2O_2]$

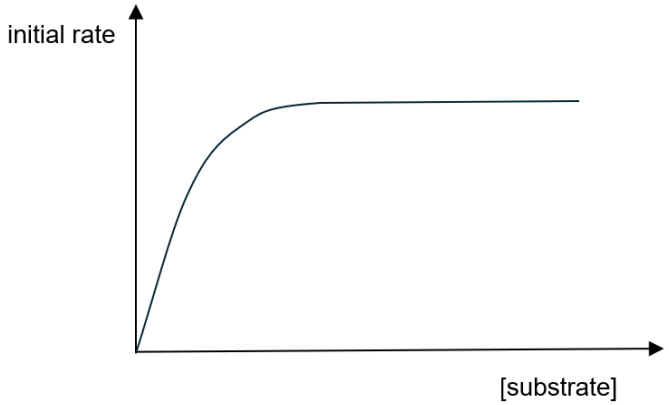
k= $\frac{rate}{[Co2+]\,[NH3]^3\,[H2O2]}$

=$\frac{y}{[x]\,[x]^3\,[x]}$

=$\frac{y}{x^5}$

Rate= $\frac{y}{x^5}$ (2x)($\frac{1}{2}$x)^3(2x) = $\frac{1}{2}$

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

Answer: C

Option A (incorrect): Enzyme is a catalyst so it is not been used up in the reaction.

Option B (incorrect): substrate inhibition does occur in some systems, but that's not the usual explanation for a plateau in Michaelis-Menten kinetics.

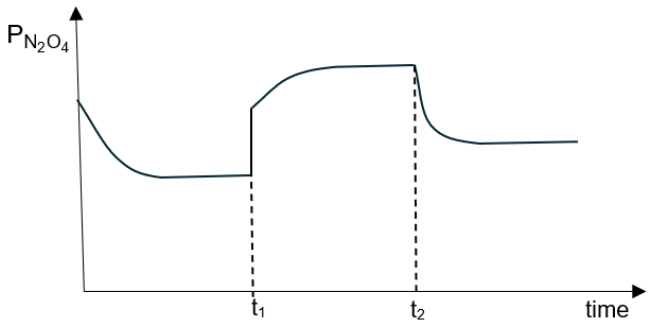
Option C (correct): when all active sites are occupied, the enzyme is saturated, and increasing [S] further does not increase the rate

Option D (incorrect): Order of reaction at high substrate concentration is 0.

13 A sample of N_2O_4 was placed in a closed vessel and allowed to reach equilibrium as shown below.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \quad \Delta H^{\ominus} = +57.3 \text{ kJ mol}^{-1}$$

When the partial pressure of a sample of N_2O_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
A	Volume decreased	Temperature increased
B	Volume decreased	Temperature decreased
C	Volume increased	Temperature increased
D	Volume increased	Temperature decreased

Answer: A

At t_1, there is a sharp increase in partial pressure of N_2O_4 followed by further increase in partial pressure of N_2O_4. With an decrease in volume, it will leads to formation of less moles of gaseous molecules and thus backward reaction is favoured.

At t_2, gradual decrease in partial pressure of N_2O_4 implies that the forward reaction is favoured. Since the forward reaction is given to be endothermic, increase in temperature will favour the forward endothermic reaction.

14 10.0 cm^3 of 8.00 x 10^{-3} mol dm^{-3} HC*l*(aq) is added to 10.0 cm^3 of 6.00 x 10^{-3} mol dm^{-3} $Ba(OH)_2$(aq).

What is the pH of the resulting solution?

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

Answer: D

Amt of HCl = 8.00 x 10^{-5} mol Amt of $Ba(OH)_2$ = 6.0 x 10^{-5} mol

$2HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2H_2O$
Limiting reagent: HCl

Amt of $Ba(OH)_2$ used = 8.00 x 10^{-5} /2 = 4.00 x 10^{-5} mol
Amt of $Ba(OH)_2$ left = 6.00 x 10^{-5} – 4.00 x 10^{-5} = 2.00 x 10^{-5}
$Ba(OH)_2 \rightarrow Ba^{2+} + 2OH^-$
$[OH^-] = [2.00 \times 10^{-5} \times 2] / 0.02 = 2.00 \times 10^{-3}$ mol

pOH = -lg $[OH^-]$ = 2.70
pH = 14 – 2.70 = 11.3

15 A saturated solution of $Ca(OH)_2$ is found to have a pH of 12.4 at 25 °C.

Which statements are correct?

1 The K_{sp} of $Ca(OH)_2$ is 7.92×10^{-6} mol^3 dm^{-9}.

2 The solubility of $Ca(OH)_2$ will increase when aqueous HCl is added.

3 The solubility of $Ca(OH)_2$ would increase when temperature is raised to 40 °C.

4 The pH of the solution would increase when solid $Ca(NO_3)_2$ is added.

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

Answer: D

A saturated solution of $Ca(OH)_2$ is found to have a pH of 12.4 at 25 °C.
$Ca(OH)_2 \rightleftharpoons Ca^{2+} + 2OH^-$ ——— (1)

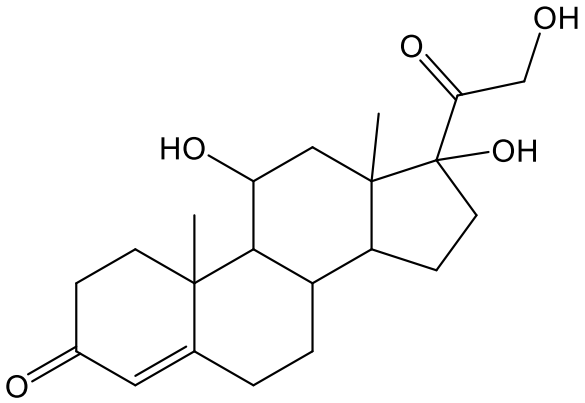
Option A is correct:
K_{sp} of $Ca(OH)_2 = [Ca^{2+}][OH^-]^2 = (\frac{1}{2} \times 10^{-1.6})(10^{-1.6})^2 = 7.92 \times 10^{-6}$ mol^3 dm^{-9}.

Option B is correct: When HCl is added, $[OH^-]$ decreases. As such, eqm position of (1) above will shift to the right to increase $[OH^-]$. The solubility of $Ca(OH)_2$ will increase.

Option C is correct: The solubility of $Ca(OH)_2$ would increase when temperature is increased.

Option D is incorrect: When $Ca(NO_3)_2$ is added, $[Ca^{2+}]$ increases. As such, eqm position of (1) will shift to the left, hence $[OH^-]$ decrease. The pH of the solution would decrease.

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

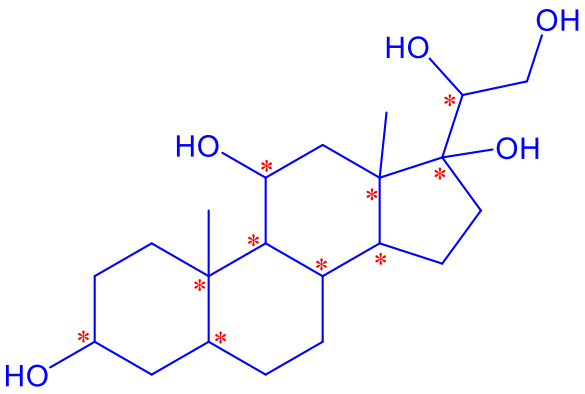


cortisol

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?

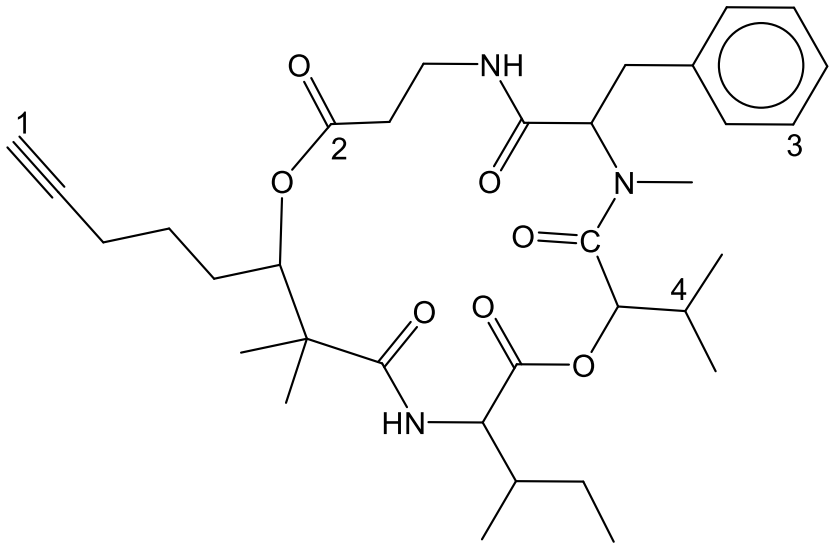
A 8 **B** 9 **C** 10 **D** 11

Answer: C



(10 chiral carbons)

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?

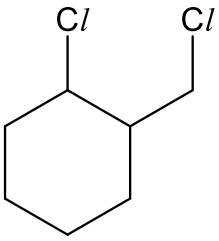
	C-1	C-2	C-3	C-4
A	sp^2	sp^2	sp	sp^3
B	sp	sp^2	sp^2	sp^3
C	sp^2	sp^3	sp^2	sp^2
D	sp	sp^2	sp	sp^2

Answer: B

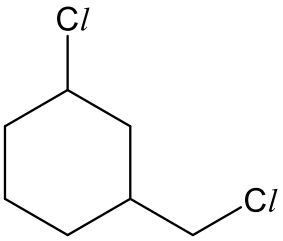
C-1 (alkyne carbon / ≡C—H) forms 2 σ bonds ⇒ sp hybridisation
C-2 (carbonyl C atom) forms 3 σ bonds ⇒ sp^2 hybridisation
C-3 (C on benzene ring) forms 3 σ bonds ⇒ sp^2 hybridisation
C-4 forms 4 σ bonds ⇒ sp^3 hybridisation

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

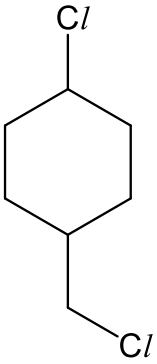
1



2



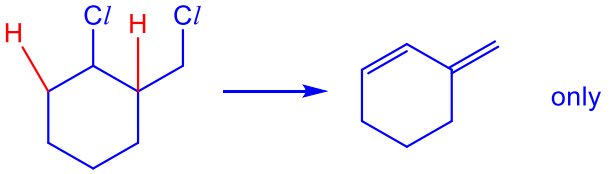
3



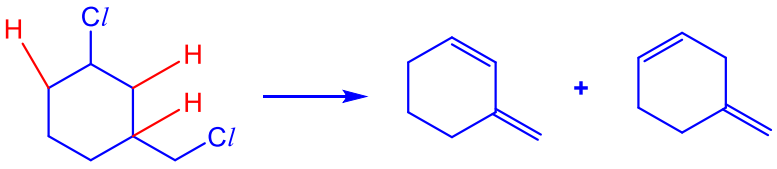
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1,2 and 3

Answer: B (1 and 3 only)

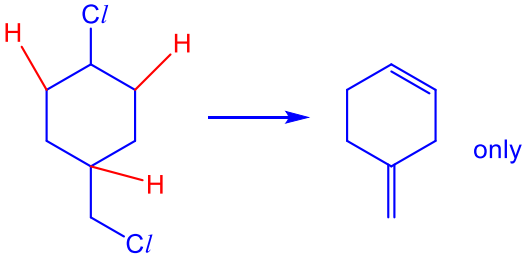
1



2



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 $CO_2 + NO \longrightarrow CO + NO_2$

B $2CO + 2NO \longrightarrow 2CO_2 + N_2$

C $2CO + O_2 \longrightarrow 2CO_2$

D $2C_8H_{18} + 25O_2 \longrightarrow 16CO_2 + 18H_2O$

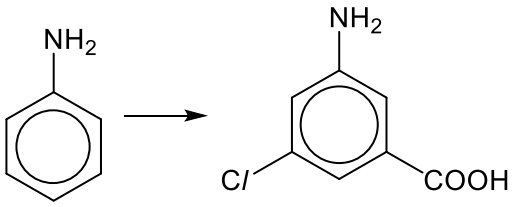
Answer: A

A catalytic converter in the exhaust system of motor vehicles speeds up the conversion of harmful pollutants such as CO, NO_x and unburnt hydrocarbons (C_xH_y) into harmless products such as H_2O, CO_2 and N_2.

Option A is incorrect as CO is formed as one of the products.

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?



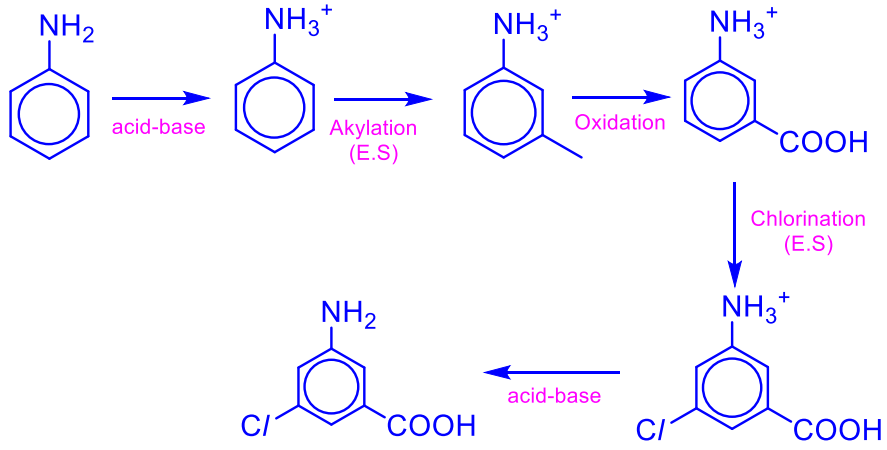
A neutralisation → chlorination → alkylation → oxidation → neutralisation

B neutralisation → alkylation → oxidation → chlorination → neutralisation

C reduction → alkylation → chlorination → oxidation → neutralisation

D reduction → alkylation → oxidation → chlorination → neutralisation

Answer: B



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**?

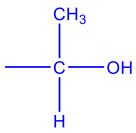
A $(CH_3)_2CHCH(OH)CH_3$

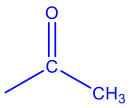
B $(CH_3)_2C(OH)CH_2CH_3$

C $CH_3CH_2CH(CH_3)CH_2OH$

D $CH_3CH_2CH_2CH(OH)CH_3$

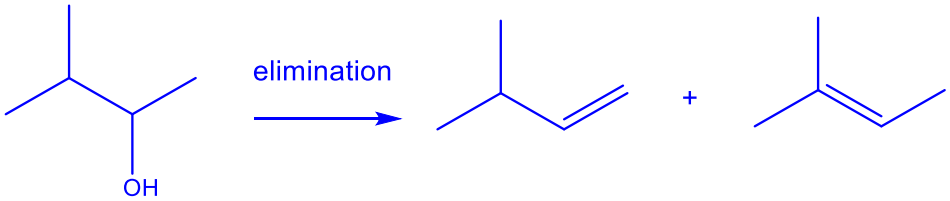
Answer: A



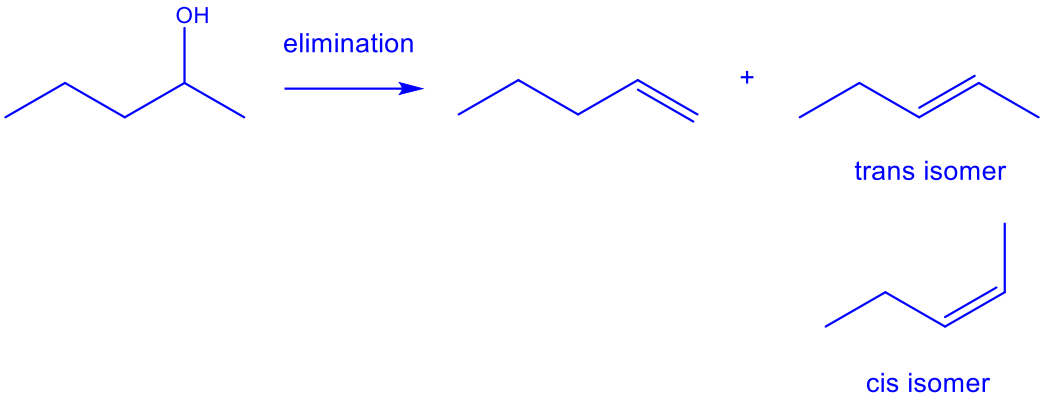
or


Options B and C does not contain the group that undergoes iodoform test / oxidation with alkaline aqueous iodine.

Alkenes formed after elimination for option A:



Alkenes formed after elimination for option D:


OH
elimination
+
trans isomer
cis isomer

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

Answer: B

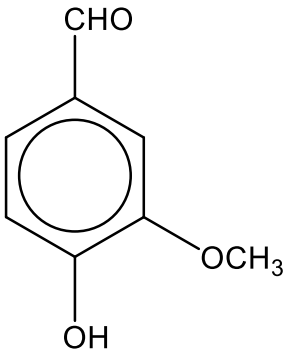
Chlorobenzene would not release chloride ions as the lone pair of electrons on the chlorine atom is delocalized into the benzene ring, resulting in the strengthening of the carbon-chlorine bond. Hence no precipitation would occur.

Iodoethane has a weaker carbon-halogen bond than bromoethane, hence it will result in nucleophilic substitution more readily and precipitation occurs in less than 4 minutes.

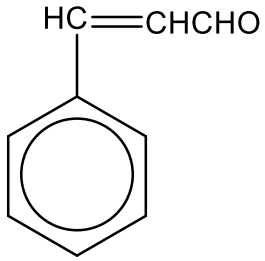
Ethanoyl bromide has the carbonyl bonded to two electronegative atoms O and Br. This makes the carbonyl C highly electron deficient, and is hence very susceptible to nucleophilic substitution, releasing Br^- readily. Hence precipitation will occur in less than 4 minutes.

Chloroethane has a stronger carbon-halogen bond than bromoethane, hence it will result in nucleophilic substitution les readily and precipitation occurs in more than 4 minutes.

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



vanillin



cinnamaldehyde

Which reagents could be used to distinguish between the two compounds? You may assume that the $-OCH_3$ group in vanillin is inert.

1 2,4-dinitrophenylhydrazine

2 Fehling's solution

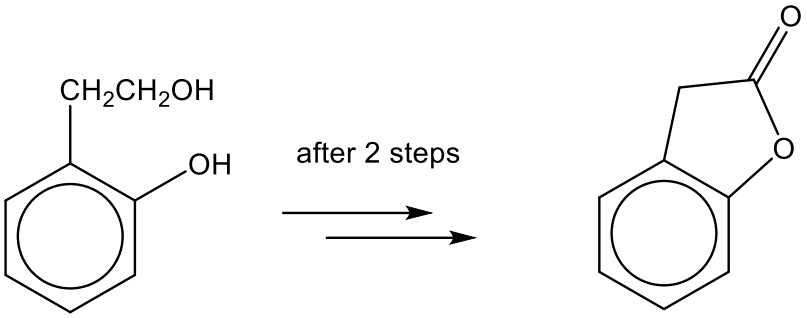
3 Tollen's reagent

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

Answer: B

	Vanillin	Cinnamaldehyde
2,4-dinitrophenylhydrazine	✓	✓
Fehling's solution	×	✓
Tollen's solution	✓	✓

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



Which reagents are involved in the 2-steps synthesis?

1 hot acidified $KMnO_4$

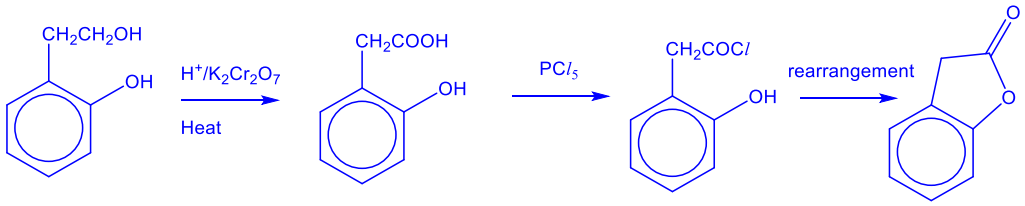
2 hot acidified $K_2Cr_2O_7$

3 PCl_5

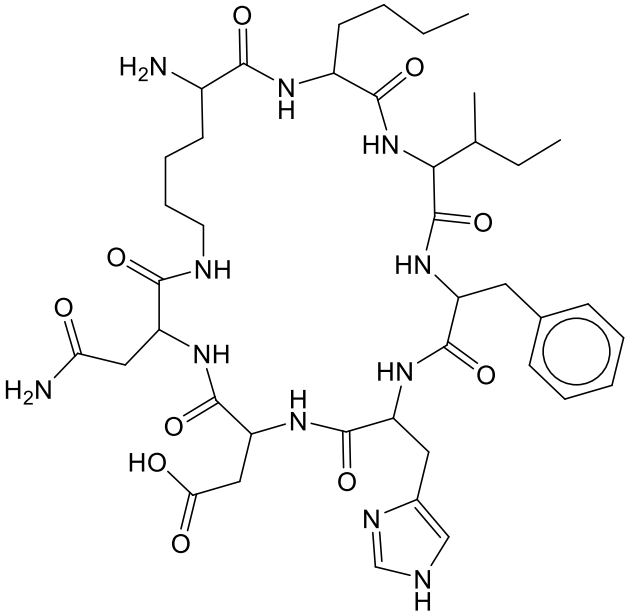
4 concentrated H_2SO_4

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

Answer: C

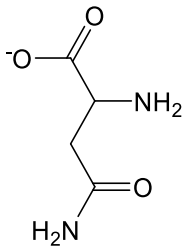


25 Consider the structure of the following cyclic polypeptide.

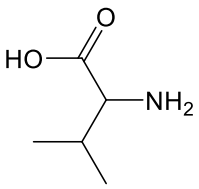


Which one of the following is a product of hydrolysis with hot NaOH(aq)?

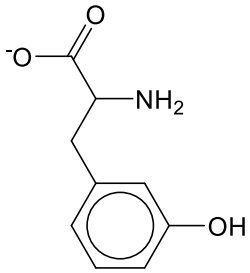
A



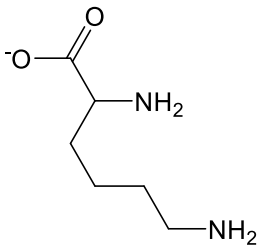
B



C



D



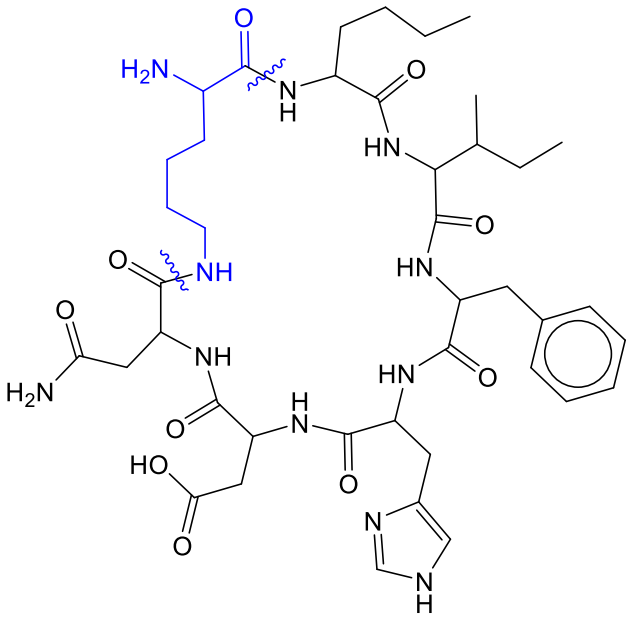
Answer: D

Option A is wrong as amide functional group would undergo basic hydrolysis to form a carboxylate salt.

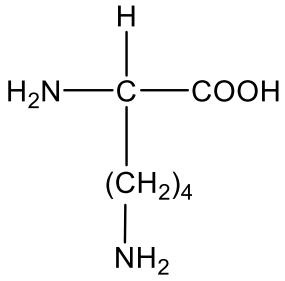
Option B is wrong as carboxylic acid group would undergo neutralisation to form a carboxylate salt.

Option C is wrong as no such amino acid would be formed upon hydrolysis of all amide bonds. Additionally phenol would undergo neutralisation to form phenoxide.

Option D is formed from this amino acid fragment.


O
H2N
N
H
O
HN
O
HN
O
NH
O
NH
H2N
HN
O
H
N
O
HO
O
O
N
N
H

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

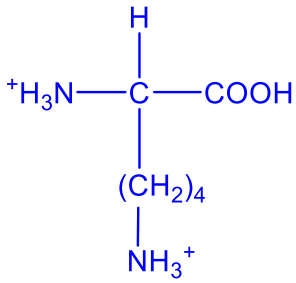
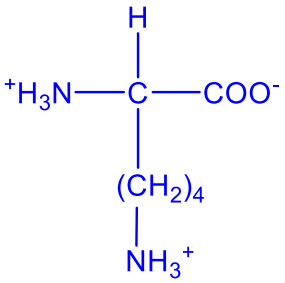
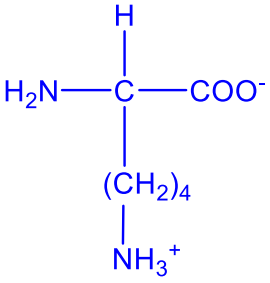
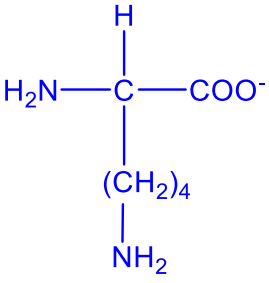


The pKa values of lysine are 2.18, 8.25 and 10.53.

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

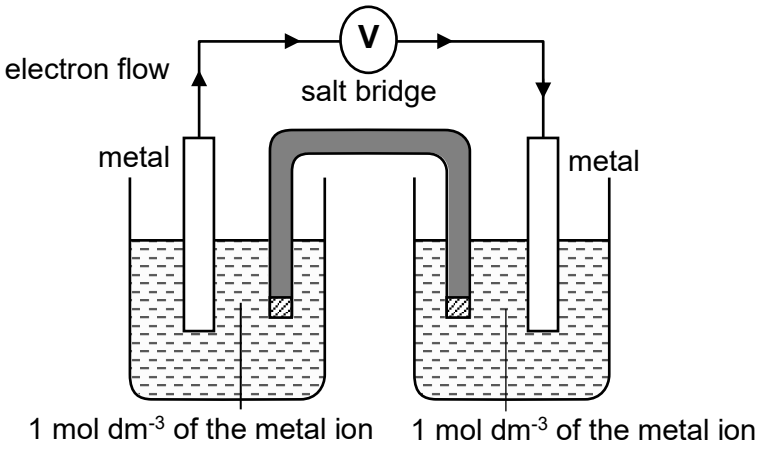
A pH 1 **B** pH 5 **C** pH 9 **D** pH 13

Answer: C

pH 1	pH 5
 Overall: 2+ charge	 Overall: 1+ charge
pH 9	**pH 13**
 Overall: 0 charge	 Overall: 1- charge

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

Answer: C

Negative electrode is anode (oxidation) while positive electrode is cathode (reduction).

In the reaction between metal X and Ag half-cells,
Since $E^{\ominus}_{red} = E^{\ominus}_{Ag+/Ag}$,
$E^{\ominus}_{cell} = E^{\ominus}_{red} - E^{\ominus}_{oxid}$

$+0.46 = +0.80 - E_{oxid}$
$E^{\ominus}_{oxid} = +0.34$ V

In the reaction between metal Y and X, $E_{red} = +0.34$ V
$+0.47 = +0.34 - E^{\ominus}_{oxid}$
Hence, $E^{\ominus}_{oxid} = -0.13$ V

Hence metal Y is Pb since $E^{\ominus}_{Pb2+/Pb} = -0.13$ V from Data Booklet

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^3 **B** 3.0 dm^3 **C** 8.4 dm^3 **D** 11.2 dm^3

Answer: A

$2O^{2-} \rightarrow O_2 + 4e^-$
Amount of O_2 = (8 x 100 x 60) / (4 x 96500) = 0.124
Volume of O_2 = 0.124 x 22.7 = 2.8 dm^3

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

Answer: C

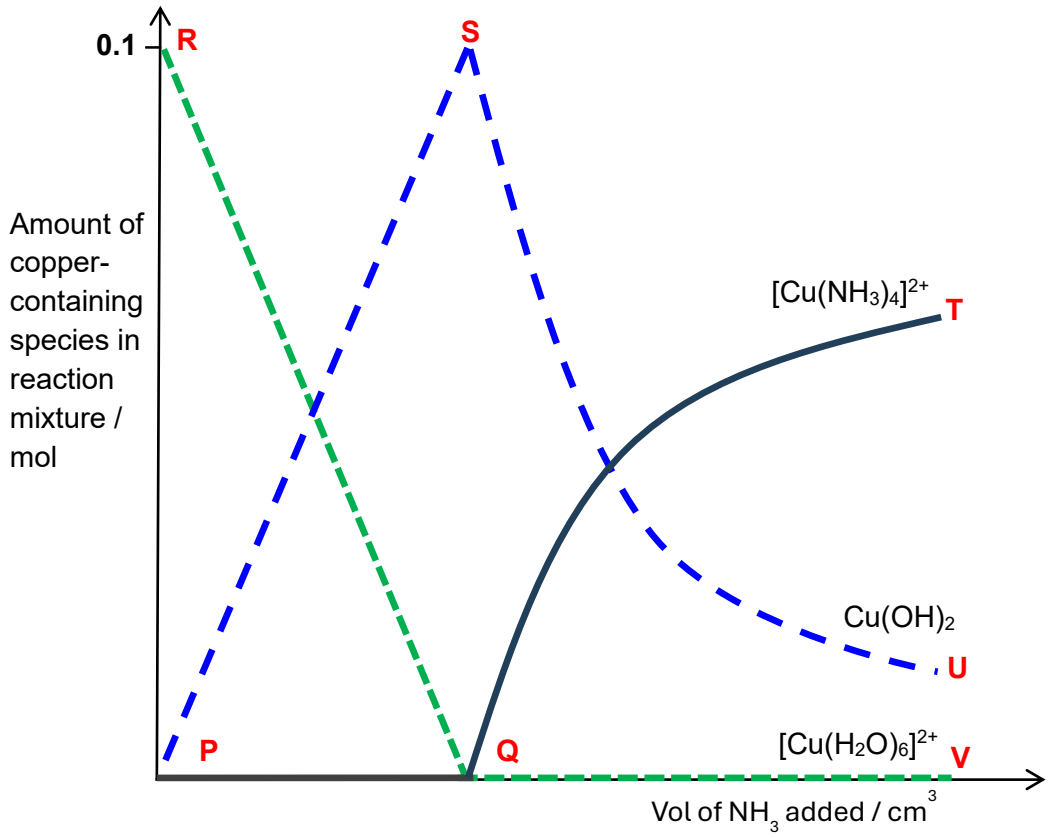
Density: Due to its greater nuclear charge, Cu has a higher atomic mass and smaller atomic volume. Hence, its density is higher than Ca.

Melting point: Metallic bond for Cu is stronger since both 3d and 4s electrons are delocalised compared to the 4s electrons only for Ca. Hence, more energy is needed during melting accounting for its higher melting point.

Reducing power:
$E^{\ominus}_{Cu2+/Cu}$ = + 0.34 V while $E^{\ominus}_{Ca2+/Ca}$ = -2.87 V
The more negative the $E^{\ominus}$ value, the more tendency for the metal to undergo oxidation (while it reduces others). Ca will have greater reducing power while itself undergoes oxidation.
OR
The sum of first and second IE for Cu is higher than that for Ca. It is harder for Cu to lose 2 e^- to form Cu^{2+} than that for Cu^{2+}. Hence, Cu has a lower reducing power than Ca.

Electrical conductivity: Cu has higher electrical conductivity since it has a greater number of delocalised electrons (both 3d and 4s) to conduct electricity compared to the 4s electrons only for Ca.

30 An experiment was conducted by adding $NH_3(aq)$ gradually to $CuSO_4(aq)$ in a beaker. The amounts of three major copper-containing species, $[Cu(H_2O)_6]^{2+}$, $Cu(OH)_2$ and $[Cu(NH_3)_4]^{2+}$ were determined and plotted against the volume of $NH_3(aq)$ added.



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

	precipitation	dissolution	complex formation
A	QT	SU	QT
B	PS	RQ	SU
C	QT	RQ	SU
D	PS	SU	QT

Answer: D

$NH_3(aq)$ is a weak base which contains $OH^-(aq)$.$Cu(OH)_2$ will be precipitated according to the following equation: $Cu^{2+}(aq) + 2OH^-(aq) \longrightarrow Cu(OH)_2(s)$. Therefore, $Cu^{2+}(aq)$ amount will decrease and the $Cu(OH)_2(s)$ amount will increase. **RQ**, would refer to $Cu^{2+}(aq)$ decreasing. **PS** would refer to precipitation of $Cu(OH)_2(s)$.

Beyond point **Q**, further addition of $NH_3(aq)$ result in formation of the $[Cu(NH_3)_4(H_2O)_2]^{2+}$ complex (blue ppt soluble in excess aq. NH_3 to give dark blue solution according to the QA Notes). More NH_3 added means more complex formed, so **QT** would refer to complex formation. The formation of the complex also results in the dissolution of $Cu(OH)_2(s)$ which would be represented by **SU**.

Answers:

1	2	3	4	5	6	7	8	9	10
A	D	C	B	B	C	C	A	D	D
11	12	13	14	15	16	17	18	19	20
B	C	A	D	D	C	B	B	A	B
21	22	23	24	25	26	27	28	29	30
A	B	B	C	D	C	C	A	C	D

6A 8B 9C 7D