



ST. ANDREW'S JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATIONS
HIGHER 2

CANDIDATE

NAME

CLASS

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CHEMISTRY

9729/01

Paper 1 Multiple Choice

18 September 2025

Candidate answer on the Optical Answer Sheet.

1 hour

Additional Materials: Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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 Optical Answer Sheet.

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 **XX** printed pages (including this cover page).

[Turn Over

Answer

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

[Turn Over]

1 Which statement is correct?

A One mole of a compound is the amount that contains the same number of atoms as there are in 12.0 g of carbon-12.

B The relative isotopic mass of beryllium-9 is given by the following expression.

$$\frac{\text{average mass of all isotopes of beryllium}}{\frac{1}{12} \text{ the mass of one atom of } ^{12}\text{C}}$$

C The relative atomic mass of nitrogen is given by the following expression.

$$\frac{\text{average mass of one atom of nitrogen}}{\frac{1}{12} \text{ the mass of one atom of } ^{12}\text{C}}$$

D The relative molecular mass of Q is given by the following expression.

$$\frac{\text{average mass of one atom of Q}}{\frac{1}{12} \text{ the mass of one atom of } ^{12}\text{C}}$$

Ans: C

A: Incorrect. The number of moles of a compound is not the same as the number of moles of atoms in a compound.

B: Incorrect. It should be "*the mass of the isotope of Be*"

C: Correct as defined.

D: Incorrect. It should be "*average mass of one molecule of the substance*"

2 10 cm³ of a gaseous hydrocarbon, C_xH_y, was exploded with an excess of oxygen. There was a contraction of 40 cm³. When the products were treated with aqueous sodium hydroxide, there was a further contraction of 50 cm³. All gas volumes were measured at room temperature and pressure.

What is the molecular formula of the hydrocarbon?

A C₄H₈

B C₄H₁₀

C C₅H₁₀

D C₅H₁₂

Ans: D

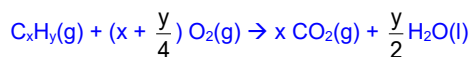
Volume of CO₂ = 50 cm³

Let the volume of reacted O₂ be V cm³

10 + V = 40 + 50

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Volume of reacted $O_2 = 80 \text{ cm}^3$



$$\begin{array}{ccc} 10 & 80 & 50 \\ 1 & 8 & 5 \end{array}$$

$$x = 5$$

$$5 + y/4 = 8$$

$$y = 12$$

Molecular formula of the hydrocarbon is C_5H_{12} .

- 3 In which row are X and Y atoms or ions of different isotopes of the same element?

	X			Y		
	Number of electrons	Charge	Nucleon number	Number of electrons	Charge	Nucleon number
A	3	+3	12	9	-3	12
B	8	0	16	11	-1	19
C	10	+1	23	10	+1	24
D	18	-3	31	12	+3	31

Commented [SXF(1): Need table outline

Ans: C

Isotopes are elements with the same number of protons but different number of neutrons.

	X		Y		Conclusion
	protons	neutrons	protons	neutrons	
A	6	6	6	6	Same element and isotope
B	8	8	10	9	Different element
C	11	12	11	13	Same element, different isotope
D	15	16	15	16	Same element and isotope

[Turn Over

5 Which molecules are **not** polar?



The charge/mass of the species are shown below:

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

- 1: Bent/ polar (2 LP, 2 BP)
- 2: Linear/ non-polar (0 LP, 2 BP)
- 3: Bent/ polar (1 LP, 2 BP)
- 4: Octahedral/ non-polar (0 LP, 6 BP)

- 6 A mixture consisting of gaseous compounds, S, T, U and V, is slowly cooled.

Gaseous Compound	M_r	Compound
S	72	$\text{CH}_3\text{CH}_2\text{COCH}_3$
T	74	$\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
U	72	$(\text{CH}_3)_4\text{C}$
V	72	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

In which order, from first to last, will the compounds condense to form their liquids?

- A $\text{T} \rightarrow \text{S} \rightarrow \text{V} \rightarrow \text{U}$
 B $\text{U} \rightarrow \text{V} \rightarrow \text{S} \rightarrow \text{T}$
 C $\text{S} \rightarrow \text{T} \rightarrow \text{V} \rightarrow \text{U}$
 D $\text{V} \rightarrow \text{U} \rightarrow \text{S} \rightarrow \text{T}$

Ans: A

The stronger the intermolecular forces of attraction, the first the compound will condense, given M_r is similar.

Hydrogen bonding > pd-pd > id-id of straight-chained molecule > id-id of branched

Gaseous Compound	M_r	Compound	Intermolecular forces of attraction
S	72	$\text{CH}_3\text{CH}_2\text{COCH}_3$	Pd-pd
T	74	$\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$	Hydrogen Bonding
U	72	$(\text{CH}_3)_4\text{C}$	Id-id (weaker)
V	72	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	Id-id (stronger)

- 7 Which equation corresponds to the enthalpy change stated?

- A $\text{S}_8(\text{s}) + 12\text{O}_2(\text{g}) \rightarrow 8\text{SO}_3(\text{l})$ $\Delta H^\ominus_{\text{formation}}(\text{SO}_3(\text{l}))$
 B $\text{CaCl}_2(\text{s}) + \text{aq} \rightarrow \text{Ca}^{2+}(\text{g}) + 2\text{Cl}^-(\text{g})$ $\Delta H^\ominus_{\text{solution}}(\text{CaCl}_2(\text{s}))$
 C $2\text{Fe}^{3+}(\text{g}) + 3\text{O}^{2-}(\text{g}) \rightarrow \text{Fe}_2\text{O}_3(\text{s})$ $H^\ominus_{\text{lattice energy}}(\text{Fe}_2\text{O}_3(\text{s}))$
 D $\text{H}_2\text{SO}_4(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow \text{CaSO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ $\Delta H^\ominus_{\text{neutralisation}}$

Ans: C

A: $8 \times \Delta H^\ominus_{\text{formation}}(\text{SO}_3(\text{l}))$

B: $\text{CaCl}_2(\text{s}) + \text{aq} \rightarrow \text{Ca}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq})$

C: $1 \times H^\ominus_{\text{lattice energy}}(\text{Fe}_2\text{O}_3(\text{s}))$

D: $2 \times \Delta H^\ominus_{\text{neutralisation}}$

[Turn Over

Commented [SXF(2)]: I added comma

Commented [SXF(3)]: Which equation corresponds to

Commented [SXF(4)]: Alignment

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

A student mixes 20.0 cm^3 of 5.00 mol dm^{-3} sulfuric acid with an equal volume of 6.00 mol dm^{-3} sodium hydroxide. The initial temperature of both solutions is 25.0°C . The maximum temperature reached after the reaction is 55.0°C . Assume the density of both solutions is 1 g cm^{-3} .

What is the value of the enthalpy change of neutralisation, in kJ mol^{-1} , calculated using these values?

- A -41.8
- B -50.2
- C -83.6
- D -100.3

Ans: A

$$Q = mc\Delta T = (40)(4.18)(30) = 5016 \text{ J}$$

$$\text{No. of moles of } \text{H}_2\text{SO}_4 = 20/1000 \times 5 = 0.1 \text{ mol}$$

$$\text{No of moles of } \text{H}^+ = 0.2 \text{ mol}$$

$$\text{No. of moles of NaOH} = 20/1000 \times 6 = 0.12 \text{ mol}$$

The limiting agent is NaOH.

$$\text{No. of moles of } \text{H}_2\text{O} = 0.12 \text{ mol}$$

$$\Delta H = -(5016) / 0.12 = -41800 \text{ J mol}^{-1} = -41.8 \text{ kJ mol}^{-1}$$

Commented [SXF(5): Neutralisation and I included the units cos the A level qns has the units in the options

9 The half-life of the first-order gaseous reaction in which M_2 molecules become converted into M atoms is 40 minutes. 1 mol of M_2 is put into a sealed vessel at pressure p .

What will be true when 87.5% of M_2 has been converted into M atoms?

- 1 80 minutes have elapsed.
 - 2 1.5 mol of M have been formed.
 - 3 The total pressure is $\frac{15}{8}p$ (at constant pressure).
- A 1, 2 and 3
 - B 1 and 2 only
 - C 2 and 3 only
 - D 3 only

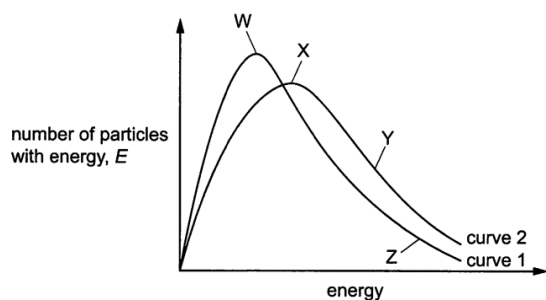
Ans: D

1	120 minutes have elapsed as three half-lives have passed (12.5% of M_2 remains is equivalent to $1/8 = (1/2)^3$)
2	After the first half-life, 0.5 mol of M_2 will produce 1 mol of M.

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	<p>After the second half-life, 0.25 mol of M_2 will produce 0.5 mol of M.</p> <p>After the third half-life, 0.125 mol of M_2 will produce 0.25 mol of M.</p> <p>Total no. of moles of M = $1 + 0.5 + 0.25 = 1.75$ mol</p>
3	<p>True.</p> <p>The initial pressure is p, containing only M_2. The change in the p is $-0.875p$ for M_2 while $+1.75p$ for M. Hence, The final pressure is $0.125p + 1.75p = 1.875p$.</p>

- 10 Curves 1 and 2 show the Boltzmann distributions for identical compositions of a reaction mixture which occur at different temperatures.



Which statement is correct?

- A Curve 1 applies to the faster reaction and point W indicates particles with lower energy than point Z.
- B Curve 1 applies to the faster reaction and point W indicates particles with higher energy than point Z.
- C Curve 2 applies to the faster reaction and point X indicates particles with lower energy than point Y.
- D Curve 2 applies to the faster reaction and point X indicates particles with higher energy than point Y.

Ans: C

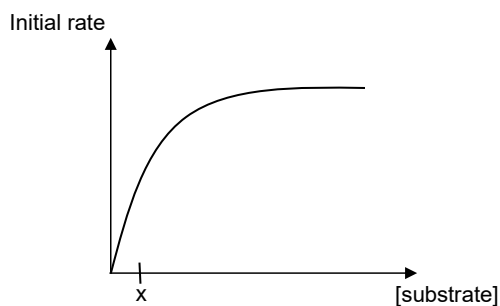
A faster reaction is due to the reaction being conducted at a higher temperature. When temperature of a reaction increases, the molecules would gain kinetic energy and move faster. This would result in its Boltzmann distribution curve to shift to the right with a lower peak.

Hence curve 2 is the one at a higher temperature with a faster rate.

Also, since the x-axis represents energy, point X would thus indicate particles with lower energy when compared with point Y.

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- 11 The graph shows how the initial rate of reaction varies for an enzyme catalysed reaction as the substrate concentration changes.



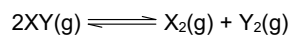
Which of the statements correctly describe the situation when $[\text{substrate}] = x$?

- 1 The initial rate of reaction is affected by increasing $[\text{substrate}]$.
 - 2 The order of reaction with respect to $[\text{substrate}]$ is 1.
 - 3 There are no more enzyme active sites available.
- A 1, 2 and 3
 B 1 and 2 only
 C 2 and 3 only
 D 3 only

Ans: B

At low $[\text{substrate}] = x$, the active sites are not fully filled, and the rate is directly proportional to $[\text{substrate}]$. The reaction is first-order with respect to $[\text{substrate}]$.

- 12 A sample of 1 mol of XY was placed in an empty 1 dm^3 container and allowed to reach equilibrium with a total pressure, p , according to the following equation.



At equilibrium, x mol of XY had dissociated. What is the value of the equilibrium constant, K_p , at the temperature of the experiment?

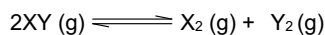
- A $\frac{x^2}{(1-x)^2}$
 B $\frac{(1-x)^2}{x^2}$

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C $\frac{4(1-x)^2}{x^2}$

D $\frac{x^2}{4(1-x)^2}$

Ans: D



I 1 0 0

C -x + $\frac{1}{2}$ x + $\frac{1}{2}$ x

E 1 - x $\frac{1}{2}$ x $\frac{1}{2}$ x

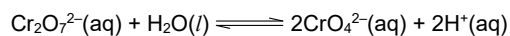
Total number of moles = $1 - x + \frac{1}{2}x + \frac{1}{2}x = 1$

Partial pressure of XY = $\left(\frac{1-x}{1}\right)p = (1-x)p$

Partial pressure of X_2 and partial pressure of $Y_2 = \left(\frac{\frac{1}{2}x}{1}\right)p = \frac{1}{2}xp$

$$K_p = \frac{\left(\frac{1}{2}xp\right)^2}{[(1-x)p]^2} = \frac{\left(\frac{1}{2}x\right)^2}{(1-x)^2} = \frac{x^2}{4(1-x)^2}$$

- 13 Orange dichromate(VI), $Cr_2O_7^{2-}$, and yellow chromate(VI) ions, CrO_4^{2-} , exist in equilibrium in aqueous solution.



Which statement about this equilibrium is correct?

- A Lowering the pH will increase concentration of CrO_4^{2-} ions.
 B Addition of a catalyst will shift the position of equilibrium to the left.
 C Addition of water will shift the position of equilibrium to the left.
 D In strong alkali, the solution appears yellow.

Ans: D

Lowering the pH increases the concentration of H^+ . This will shift the position of equilibrium to the left, resulting in more $Cr_2O_7^{2-}$ ion formed.

The addition of catalyst has no effect on the position of equilibrium.

Adding water will shift the position of equilibrium to the right as there is a greater lowering of concentration of the ions on the right, so the position of equilibrium shifts to replenish the loss of concentration.

Addition of strong alkali neutralises H^+ , causing the concentration of H^+ to decrease. This will shift the position of equilibrium to the right, resulting in more yellow CrO_4^{2-} ions formed.

Commented [NHs(6): Changed this from full stop to question mark

- 14 The table shows the fifth ionisation energies of four consecutive elements in the Periodic Table.

Element	E	F	G	H
Fifth IE / kJmol^{-1}	37832	9445	10989	13327

What is the formula of the chloride of E?

- A ECl_2 B ECl_3 C ECl_4 D ECl_5

Ans: C

There is a sharp drop from the fifth IE from E to F, which indicates that F^{4+} is removed from $(n+1)$ quantum shell from E^{4+} . This means that the valence electronic configuration for F^{4+} is $(n+1)s^1$ while E^{4+} has ns^2np^6 . This implies that the valence electronic configuration of F is $(n+1)s^2p^3$. This means that the valence electronic configuration for E has $(n+1)s^2p^2$, having 4 valence electrons. Hence, with Cl, the formula should be ECl_4 .

- 15 Which pair contains an Arrhenius acid and Arrhenius base?

	Acid	Base
A	KCl	NaOH
B	HCl	KOH
C	CH_3COOH	NH_3
D	H_2SO_4	NH_3

Ans: B

Arrhenius acid is a substance that produces H^+ while a Arrhenius base is a substance that produces OH^- . NH_3 is not an Arrhenius base and KCl is salt and not acid.

- 16 An excess of silver bromide is added to water and the mixture is shaken until equilibrium is reached.

How is the solubility of silver bromide, in this equilibrium mixture, affected by the addition of either

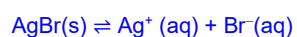
- aqueous ammonia or
- aqueous potassium bromide?

	addition of aqueous ammonia	addition of aqueous potassium bromide
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A	decreases	decreases
B	decreases	increases
C	increases	increases
D	increases	decreases

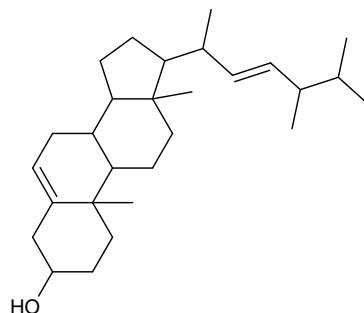
Ans: D



Addition of aqueous NH_3 will result in formation of complex, $[\text{Ag}(\text{NH}_3)_2]^+$ which decreases the $[\text{Ag}^+]$. Hence POE shift right, increasing the solubility of AgBr

Addition of aqueous KBr increase $[\text{Br}^-]$. Hence POE shift left, decreasing the solubility of AgBr.

- 17 Brassicasterol is a plant sterol found in sources like rapeseed oil and marine algae.

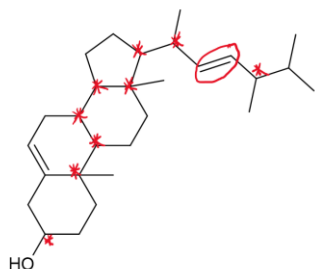


brassicasterol

How many stereoisomers does brassicasterol have?

- A** 2^9
- B** 2^{10}
- C** 2^{11}
- D** 2^{12}

Ans: B



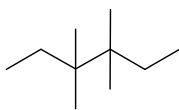
- 18 In the free radical substitution of 2-methylbutane with chlorine, a mixture of mono-chlorinated compounds was obtained.

Assuming the rate of reaction at all the carbon atoms are the same, which statements are correct?

- 1 The ratio for the two compounds with the highest yields is 2:1.
- 2 Homolytic fission only occurs in the initiation step.

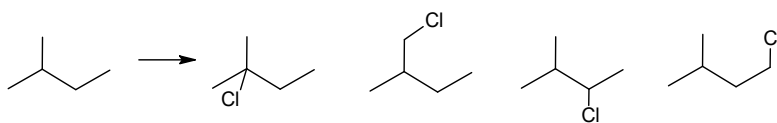
3

One of the products formed in this reaction is



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

Ans: B



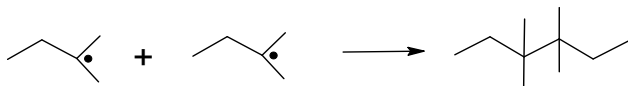
Ratio is 1:6:2:3 (thus ratio of highest yield is 6:3 = 2:1)

Option 1 is correct.

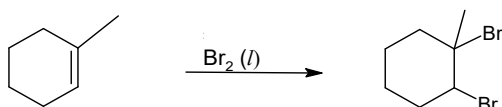
Option 2 is incorrect as homolytic fission occurs in both the initiation and propagation steps.

The product in option 3 (i.e. side product) is formed in the termination step.

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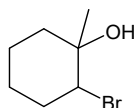


19 Which statement about this reaction is correct?



- A The product as shown above is the major product when $\text{Br}_2(aq)$ is used instead.
 B Electrons in the carbon-carbon σ bond are donated to an electrophile.
 C The carbocation has the same hybridisation state as the C in the $\text{C}=\text{C}$.
 D A primary carbocation is formed in this reaction.

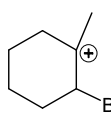
Ans: C

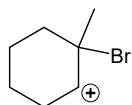


Option A is wrong because the major product is

Option B is wrong because electrons in $\text{C}-\text{C}$ π bond is donated to an electrophile and not electrons from the σ bond.

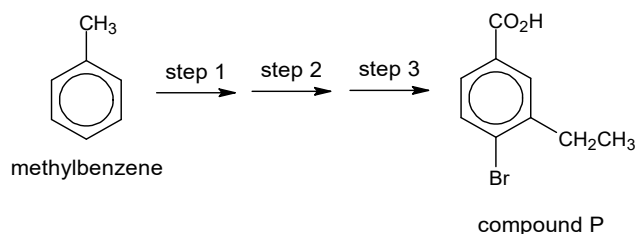
Option C is correct. Both are sp^2 .

Option D is wrong:  formed is a tertiary carbocation with 3 R groups and



formed is a secondary carbocation with 2 R groups.

20 Compound P can be synthesised from methylbenzene as shown below.



[Turn Over

Which of the following could be a possible sequence for converting methylbenzene to compound P?

	Step 1	Step 2	Step 3
A	$\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3	Br_2 , AlBr_3 , dark	Hot acidified KMnO_4
B	Br_2 , AlBr_3 , dark	Hot acidified KMnO_4	$\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3 , heat
C	Br_2 , AlBr_3 , dark	$\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3	Hot acidified KMnO_4
D	Hot acidified KMnO_4	$\text{CH}_3\text{CH}_2\text{Cl}$, AlCl_3 , heat	Br_2 , AlBr_3 , dark

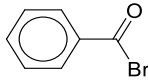
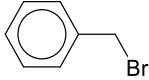
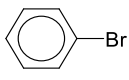
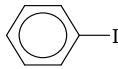
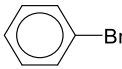
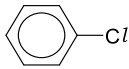
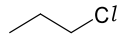
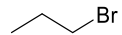
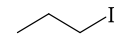
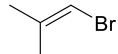
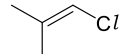
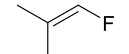
Ans: B

The methylbenzene first undergoes bromination to form 4-bromomethylbenzene. Then undergo oxidation to form benzoic acid. Benzoic acid is deactivating and 3-directing and Br is 2,4-directing hence Friedel-Crafts alkylation takes place in 2 position w.r.t bromine and 3 position w.r.t benzoic acid.



- 21 Equal amounts of compounds X, Y and Z were heated with ethanolic silver nitrate in three separate test-tubes. After some time, the precipitate formed in each test-tube, if any, was filtered, dried and weighed.

Compound X produced the largest mass of precipitate in the shortest time, while compound Z did not produce any precipitate.

Which of the following could be the identities of X, Y and Z?

	X	Y	Z
A			
B			
C			
D			

Ans: A

 and  are resistant to nucleophilic substitution as the lone pair of electrons on X is delocalised into the benzene ring and C=C respectively, imparting partial double bond in the C-X bond, making cleavage difficult.

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Among the $\text{CH}_3\text{CH}_2\text{X}$, the C–I bond being the weakest means that $\text{CH}_3\text{CH}_2\text{I}$ react the fastest.



22 Compound W has the empirical formula CH_2O and has the following properties.

- It gives a yellow precipitate when warmed with alkaline aqueous iodine.
- White fumes are produced when it is heated with PCl_3 .

What could W be?

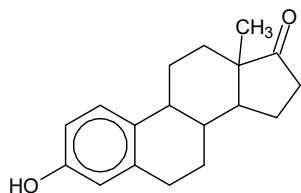
- A $\text{CH}_3\text{CO}_2\text{H}$
 B $\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{H}$
 C $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CO}_2\text{H}$
 D $\text{HO}_2\text{CCH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$

Ans: B

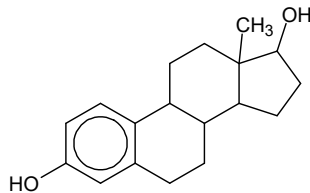
(C has the wrong empirical formula)

		M.F.	E.F.	Alkaline aqueous iodine	white fumes with PCl_3
A	$\text{CH}_3\text{CO}_2\text{H}$	$\text{C}_2\text{H}_4\text{O}_2$	CH_2O	×	✓
B	$\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{H}$	$\text{C}_3\text{H}_6\text{O}_3$	CH_2O	✓	✓
C	$\text{CH}_3\text{COCH}_2\text{CH}_2\text{CO}_2\text{H}$	$\text{C}_5\text{H}_8\text{O}_3$	$\text{C}_5\text{H}_8\text{O}_3$	✓	✓
D	$\text{CH}_3\text{COOCH}(\text{OH})\text{CH}_2\text{OH}$	$\text{C}_4\text{H}_8\text{O}_4$	CH_2O	×	✓

23 Two female sex hormones are oestrone and oestradiol.



oestrone



oestradiol

Which of the following reagents could be used to distinguish between the two hormones?

- 1 | Acidified aqueous $K_2Cr_2O_7$
- 2 | Acidified aqueous $KMnO_4$
- 3 | Aqueous alkaline iodine

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

Ans: D

Option 1: PCl_5 will react with oestradiol to produce white fumes of HCl but not with oestrone.

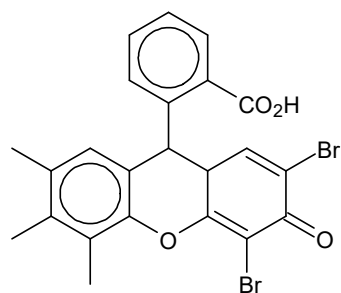
Option 2: Side chain oxidation will take place for both compounds with $KMnO_4/H^+$

Option 3: $LiAlH_4$ in dry ether can reduce ketone in oestrone but there is no observable change

Commented [SXF(8)]: I don't think it is in the syllabus that they need to know $SOCl_2$. Change to PCl_5

[Turn Over

- 24 The classic red colour from many lipsticks are obtained from pigments and dyes, such as the compound, eosin. Eosin reacts with proteins of the skin to produce a deep red colour.



Eosin

Eosin was reduced separately by NaBH_4 and by H_2 with Pt.

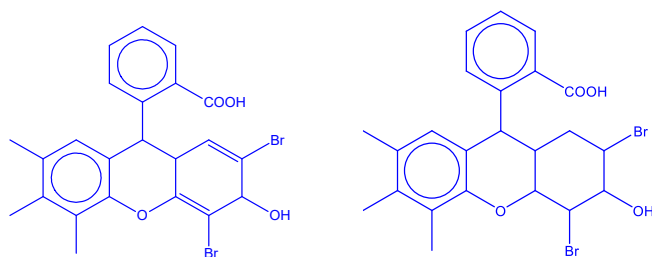
What is the number of hydrogen atoms added to each molecule of eosin?

	NaBH_4	H_2 with Pt
A	2	4
B	2	6
C	4	4
D	4	6

Commented [JY9]: Rephrase. Should not use + in prose.

Ans: B

NaBH_4 can reduce carbonyl compounds only whereas by H_2 with Pt will reduce the alkenes and carbonyl group in the compound. The product formed are shown below:

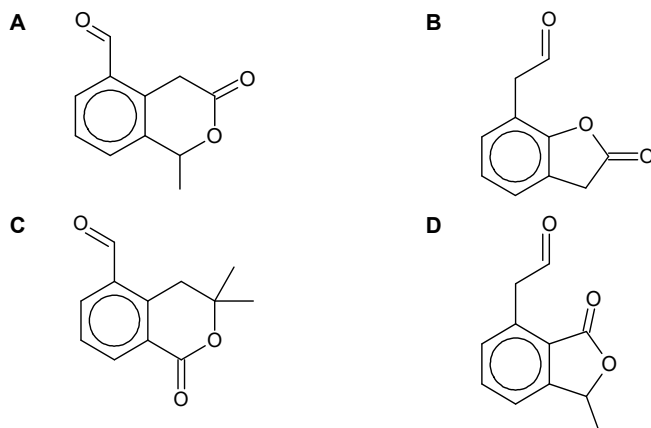


[Turn Over

- 25 Compound X reacts with $[\text{Ag}(\text{NH}_3)_2]^+$, but not with alkaline Cu^{2+} .

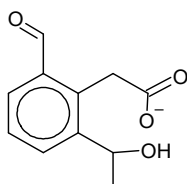
Upon warming X with alkaline aqueous iodine, a yellow precipitate is observed.

What could X be?



Ans: A

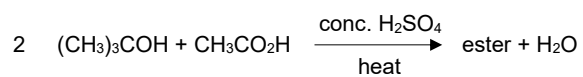
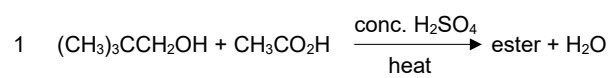
- $[\text{Ag}(\text{NH}_3)_2]^+$ is Tollens' reagent. It will react with both aromatic and aliphatic aldehydes.
- Alkaline Cu^{2+} is Fehling's solution and it will react with only aliphatic aldehydes.
- Thus A and C are possible answers given the presence of an aromatic aldehyde.
- When undergone alkaline hydrolysis, A has $-\text{CH}_3\text{CH}(\text{OH})$ structure (as shown in diagram) unlike C. As such, A can form yellow ppt with alkaline aqueous iodine.



- 26 The ester 2,2-dimethylpropyl ethanoate is found in rare flowers and has a very strong scent.

How may this ester be made in the laboratory?

[Turn Over



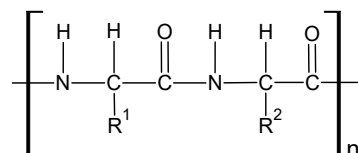
- A** 1, 2, and 3
B 1 and 3
C 1 only
D 2 only

Ans: B

The ester has the structure, $(\text{CH}_3)_3\text{CCH}_2\text{OCOCH}_3$.

Hence the alcohol used must be $(\text{CH}_3)_3\text{CCH}_2\text{OH}$, which will react with the acid chloride, $\text{CH}_3\text{COC/}$, or carboxylic acid, $\text{CH}_3\text{CO}_2\text{H}$, to form 2,2-dimethylpropyl ethanoate.

- 27 The diagram below shows the general structure of a protein.



Chymotrypsin is an enzyme that hydrolyses protein into smaller peptides and amino acids. It specifically hydrolyses the peptide bond on the carboxylic end of phenylalanine (Phe).

The structure of hexapeptide Y and the M_r of selected amino acids are given below.

Hexapeptide Y: Val-Ala-Lys-Phe-Ser-Arg

Amino acid	M_r
Valine (Val)	117
Alanine (Ala)	89
Lysine (Lys)	146
Phenylalanine (Phe)	165
Ser (Serine)	105
Arginine (Arg)	174

What are the M_r of the two fragments obtained when hexapeptide Y is hydrolysed by chymotrypsin?

	M_r of fragment 1	M_r of fragment 2
A	517	279
B	463	261
C	316	408
D	352	444

[Turn Over

Ans: B

Val-Ala-Lys-Phe-Ser-Arg will be hydrolysed into 2 peptides:

Val-Ala-Lys-Phe and Ser-Arg

When the peptide bond is formed, -OH from the carboxylic acid end of one amino acid and the -H from the amino end of the neighboring amino acid will be removed as water.

M_r of Val-Ala-Lys-Phe = $117 + 89 + 146 + 165 - (18 \times 3) = 463$

M_r of Ser-Arg = $105 + 174 - 18 = 261$

- 28** Which factors determine the number of atoms of nickel deposited on the cathode of an electrolytic cell?

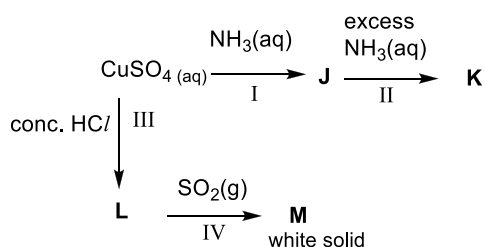
	$[\text{Ni}^{2+}(\text{aq})]$	current	time
A	✓	✓	✓
B	✓	✓	x
C	x	✓	x
D	x	✓	✓

Ans: D

The number of atoms of Ni deposited is dependent on the charge supplied.

$Q = I \times t$, which is affected by current and time.

- 29** Copper(II) sulfate solution reacted as shown in the scheme below.



Which of the following statements is correct?

- A** NH_3 functions as a ligand in reaction I.
- B** The coordination number of complex **L** is 6.
- C** The oxidation number of Cu in **L** and **M** is the same.
- D** Ligand exchange has taken place in reaction II.

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Ans: D

Option A is incorrect as NH_3 acts as a base.

Option B is incorrect. L is $[\text{CuCl}_4]^{2-}$, coordination number 4.

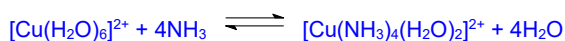
Option C is incorrect.



White solid is CuCl . Cu in $[\text{CuCl}_4]^{2-}$ is reduced from +2 to +1 in CuCl .

Option D is correct.

When excess aqueous NH_3 is added, ligand exchange occurs to form a deep blue solution.



30 Which of the following statements about manganese are correct?

- 1 Manganese have a greater number of oxidation states than titanium.
- 2 Aqueous solution of Mn^{3+} is acidic.
- 3 Mn^{3+} can catalyse the reaction between $\text{S}_2\text{O}_8^{2-}(\text{aq})$ and $\text{I}^-(\text{aq})$.

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

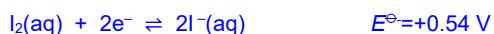
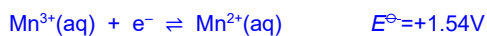
Ans: A

Option 1: Correct. Number of oxidation states for the element increases from Sc to Mn.

O.S of Ti : +2, +3, +4

O.S of Mn: +1, +2, +3, +4, +5, +6, +7

Option 2: Correct. To catalyse the reaction, E^\ominus of the catalyst must be between + 0.54 and +2.01.



Option 3: Correct. Mn^{3+} is very polarising due to its high charge density, hence it can be hydrolysed to give H^+ .

Commented [NHs(10)]: Mn^{3+}

END OF PAPER

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