



ST ANDREW'S JUNIOR COLLEGE
JC2 PRELIMINARY EXAMINATIONS
HIGHER 1
WORKED SOLUTIONS

CANDIDATE
NAME

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CLASS

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CHEMISTRY

8873/01

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

Answer

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

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 ^{12}C .

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 oxygen is given by the following expression.

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

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 are measured at room temperature and pressure.

What is the molecular formula of the hydrocarbon?

A C₄H₈

B C₄H₁₀

C C₅H₁₀

D C₅H₁₂

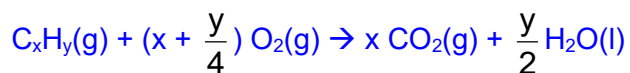
Ans: D

Volume of CO₂ = 50 cm³

Let the volume of reacted O₂ be V cm³

10 + V = 40 + 50

Volume of reacted O₂ = 80 cm³



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

$$x = 5$$

$$5 + y/4 = 8$$

$$y = 12$$

Molecular formula of the hydrocarbon is **C₅H₁₂**

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

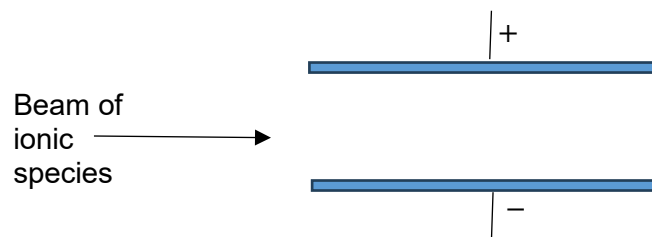
	X			Y		
	Number of electrons	charge	Nucleon number	Number of electrons	charge	Nucleon number
A	3	+3	12	9	−3	12
B	8	0	16	11	−1	19
C	10	+1	23	10	+1	24
D	18	−3	31	12	+3	31

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

- 4 Which particle will deflect the most when moving with the same speed through an electric field?



- A ${}^7\text{Li}^+$ B ${}^{11}\text{B}^{3+}$ C ${}^{19}\text{F}^-$ D ${}^{31}\text{P}^{3-}$

Ans: B

Angle of deflection is dependent on charge/mass ratio.

The charge/mass of the species are as shown below:

- A $\frac{+1}{7} = +0.14$ B $\frac{+3}{11} = +0.27$ C $\frac{-1}{19} = -0.053$ D $\frac{-3}{31} = -0.10$

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

The table shows the fifth, sixth, seventh, eighth and ninth ionisation energies (IE) of an element in the third period.

Element	5th	6th	7th	8th	9th
IE/ kJmol ⁻¹	13352	16611	20115	25491	28934

What element has these ionisation energy values?

- A P B S C Cl D Ar

Ans: C

There is a sharp increase from the 7th to 8th IE. Hence, the 8th electron is taken from the inner shell, that is closer to the nucleus, hence, having a stronger attraction with the nucleus and more energy is required to remove.

6 Which molecules are **not** polar?

1 H_2S 2 CS_2 3 SO_2 4 SF_6

A 1 and 2

B 2 and 4

C 3 and 4

D 4 only

Ans: B

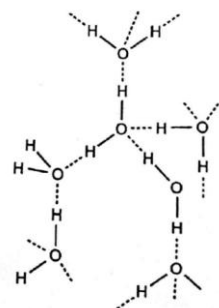
A: Bent/ polar (2 LP, 2 BP)

B: Linear/ non-polar (0 LP, 2 BP)

C: Bent/ polar (1 LP, 2 BP)

D: Octahedral/ non-polar (0 LP, 6 BP)

7 The diagram shows the structure of part of a crystal of ice.



Which statement is correct?

- A The hydrogen bonds, shown by the dotted lines, are stronger than the O–H covalent bonds.
- B The weaker covalent bonds in ice causes it to be less dense than water.
- C All the bond angles surrounding each oxygen atom are 120° .
- D Each oxygen can form 2 hydrogen bonds.

Ans: D

Option A: The hydrogen bonds are weaker than the O–H covalent bonds.

Option B: The open structure (due to hydrogen bonds) of ice causes ice to be less dense than water.

Option C: All the bond angles surrounding each oxygen atom are 109.5° .

Option D: 2 hydrogen bond per water molecule. Each hydrogen bond is formed from the interaction of a $\delta^+\text{H}$ atom and a lone pair of electrons on O.

- 8 Some information about some of the elements of Period 5 of the Periodic Table is shown:

element	Rb	Sr	In	Sn	Sb	Te	I	Xe
Electrical conductivity	high	high	high	high	high	semi-conductor	zero	zero
Boiling point / K	961	1650	2300	2540	1650	1260	457	165

Which statement about these elements is correct?

- A Both I and Xe have simple molecular structures.
- B Elements from Rb to Te have giant metallic structures.
- C There are less elements with metallic structures in Period 5 than in Period 3.
- D Sr has higher boiling point than Rb because of higher charge density.

Ans: D

Option A: Xe occurs as monoatomic as it is from Group 18 (noble gas- valence shell is complete) but I exists as I_2 molecules.

Option B: Te is a semi-conductor and in Group 16- likely to have covalent structure.

Option C: Rb→Sb are likely to have metallic structure as they have high electrical conductivity and boiling point. Hence there are more metals in Period 5 than Period 3

Option D: Bp of Rb (Group 1 metal) is lower because of its smaller charge and ionic radius (lower charge density) than Sr. It also implies that there is less electron delocalised, leading weaker metallic bonds than Sr.

- 9 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 T → S → V → U
 B U → V → S → T
 C S → T → V → U
 D V → U → S → T

Ans: A

The stronger the IMF, 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)

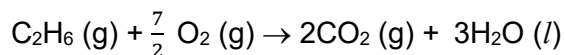
- 10 In a chlorine molecule, Cl_2 , the two chlorine atoms are held together by a single covalent bond. The bond energy is 244 kJ mol^{-1} . The bond length is 0.198 nm.

What do the terms *bond energy* and *bond length* mean?

	bond energy	bond length
A	the energy needed to make one mole of bonds	the distance between the outer shells of the two bonded atoms
B	the energy needed to make one mole of bonds	the distance between the nuclei of the two bonded atoms
C	the energy needed to break one mole of bonds	the distance between the outer shells of the two bonded atoms
D	the energy needed to break one mole of bonds	the distance between the nuclei of the two bonded atoms

Ans: D (by definition)

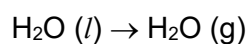
- 11** The standard enthalpy change of combustion of ethane is $-1560 \text{ kJ mol}^{-1}$.



Values of the relevant average bond energies are given in the table.

Bond	C–H	C–C	C=O	O–H	O=O
Average bond energy/ kJ mol ⁻¹	410	350	805	460	496

What is the value for the enthalpy change of vaporisation of water?



- A** -126
B -42
C $+42$
D $+126$

Ans: C

$\Delta H = [6(410) + 350 + 7/2 (496)] - [4(805) + 6(460)] = -1434 \text{ kJ mol}^{-1}$ (assuming gaseous water)

$3 \Delta H_{\text{vaporisation}} = -1434 \text{ kJ} - (-1560) = +126 \text{ kJ mol}^{-1}$

$\Delta H_{\text{vaporisation}} = +126/3 = +42 \text{ kJ mol}^{-1}$

- 12** Which of the following reactions are exothermic?

- 1** $\text{MgCO}_3 (\text{s}) \rightarrow \text{MgO} (\text{s}) + \text{CO}_2 (\text{g})$
 - 2** $\text{NaOH} (\text{aq}) + \text{HCl} (\text{aq}) \rightarrow \text{NaCl} (\text{aq}) + \text{H}_2\text{O} (\text{l})$
 - 3** $\text{C}_2\text{H}_4 (\text{g}) + 3\text{O}_2 (\text{g}) \rightarrow 2\text{CO}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l})$
- A** 1, 2 and 3
B 1 and 2 only
C 2 and 3 only
D 1 only

Ans: C

Option 1: thermal decomposition (endothermic)

Option 2: neutralization (exothermic)

Option 3: combustion (exothermic)

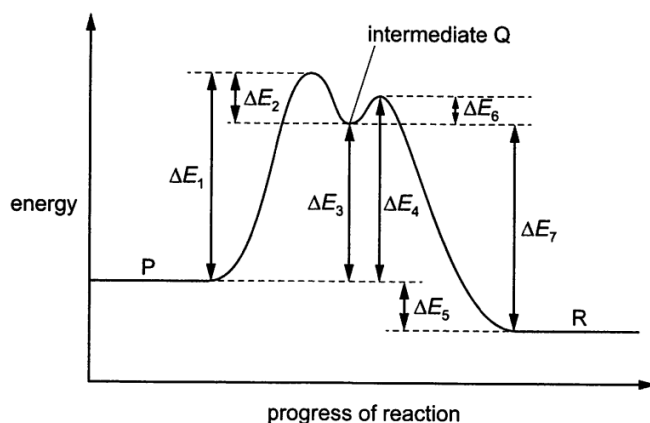
- 13 This question refers to 'reaction Z' in which compound P is converted into compound R.



This reaction can be broken down into two stages.



The energy profile of the reaction Z is shown.



Which rows about the magnitudes of activation energy and enthalpy change of reaction are correct?

		magnitude of activation energy	magnitude of enthalpy change of reaction
1	for reaction Z	ΔE_1	ΔE_5
2	for stage 1	ΔE_1	ΔE_3
3	for stage 2	ΔE_4	ΔE_7

A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 1 only

Ans: B

Activation energy = initial point to the highest point (w.r.t stages)

Enthalpy change = initial point (reactants) to the end point (products) (w.r.t stages)

Hence, all of them tally except for the magnitude of the activation energy for stage Y which should be ΔE_6 . When the transition state (peak) become the intermediate Q, ΔE_2 is released. This ΔE_2 provides the energy ΔE_6 for Q to overcome the activation energy to become R.

- 14** The half-life of the first-order gaseous reaction in which M_2 molecules become converted into M atoms is 30 minutes. 1 mol of M_2 is put into a sealed vessel at pressure p .

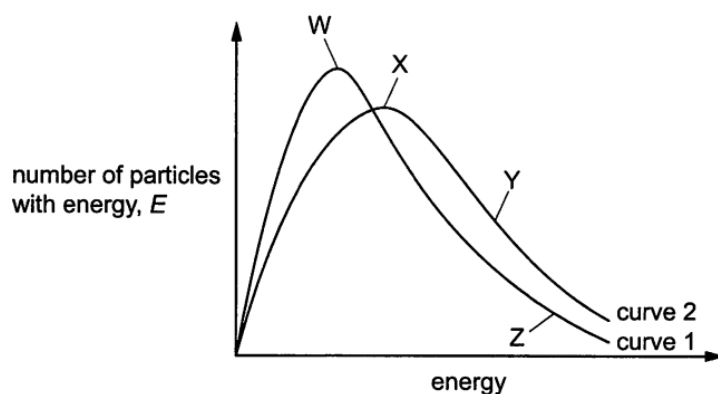
What will be true when 75% of M_2 has been converted into M atoms?

- 1 Three half-lives have passed.
 - 2 60 minutes have elapsed.
 - 3 1.5 mol of M have been formed.
- A** 1, 2 and 3
B 1 and 2 only
C 2 and 3 only
D 3 only

Ans: C

- 1 2 half-lives have passed (25 % of M_2 remains is equivalent to $1/4 = (1/2)^2$)
- 2 60 minutes have elapsed as two half-lives have passed.
- 3 After the first half-life, 0.5 mol of M_2 will produce 1 mol of M.
 After the second half-life, 0.25 mol of M_2 will produce 0.5 mol of M.
 Total no. of mol of M = 1 + 0.5 = 1.50 mol

- 15** 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.

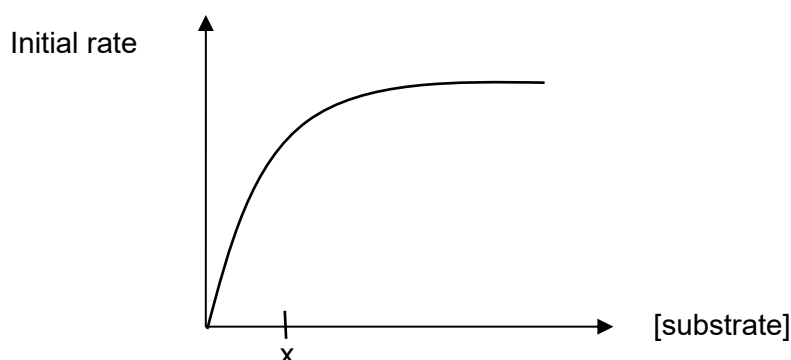
Ans: C

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.

- 16** 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 $[\text{substrate}] = x$?

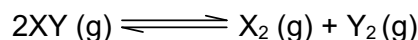
- 1 The initial rate of reaction is affected by increasing $[\text{substrate}]$.
- 2 The order of reaction with respect to $[\text{substrate}]$ is 1.
- 3 There are no more enzyme active sites available.

- 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 $[\text{substrate}]$.

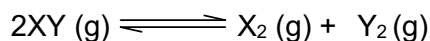
- 17 A sample of 1 mole of XY was placed in an empty 1 dm³ container and allowed to reach equilibrium according to the following equation.



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

- A $\left[\frac{x}{(1-x)}\right]^2$
 B $\left[\frac{(1-x)}{x}\right]^2$
 C $\left[\frac{x}{4(1-x)}\right]^2$
 D $\left[\frac{4(1-x)}{x}\right]^2$

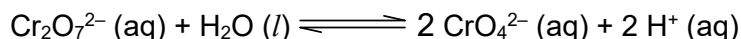
Ans: C



I	1	0	0
C	-x	$+\frac{1}{2}x$	$+\frac{1}{2}x$
E	$1-x$	$\frac{1}{2}x$	$\frac{1}{2}x$

$$K_c = \left[\left(\frac{1}{2}x\right)\left(\frac{1}{2}x\right)\right] / (1-x)^2 = \left[\frac{x}{4(1-x)}\right]^2$$

- 18 Orange dichromate(VI), $\text{Cr}_2\text{O}_7^{2-}$, and yellow chromate(VI) ions, CrO_4^{2-} , exist in equilibrium in aqueous solution.



Which statement about this equilibrium is correct?

- A In strong alkali, the solution appears yellow.
 B Addition of a catalyst will shift the position of equilibrium to the left.
 C Addition of $\text{Cr}_2\text{O}_7^{2-}$ will shift the position of equilibrium to the left.
 D Lowering the pH will increase concentration of CrO_4^{2-} ions.

Ans: A

Addition of strong alkali will shift the position of equilibrium to the right, resulting in more yellow CrO_4^{2-} ions formed.

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

Addition of $\text{Cr}_2\text{O}_7^{2-}$ will shift the position of equilibrium to the right to remove excess $\text{Cr}_2\text{O}_7^{2-}$.

Lowering the pH increases the H^+ and shift the position of equilibrium to the left, resulting in more $\text{Cr}_2\text{O}_7^{2-}$ ion.

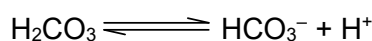
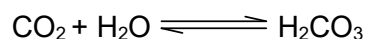
19 Which pair contains an Arrhenius acid and Arrhenius base?

	Acid	Base
A	KCl	NaOH
B	HCl	KOH
C	CH ₃ COOH	NH ₃
D	H ₂ SO ₄	NH ₃

Ans: B

Arrhenius acid is a substance that produces H⁺ while a Arrhenius base is a substance that produces OH⁻. NH₃ is not a Arrhenius base and KCl is salt and not acid.

20 The concentration of carbon dioxide in the blood is regulated by the following equilibria.



What statements about these equilibria are correct when the pH of the blood decreases?

- 1 Both equilibria move to the left.
- 2 HCO₃⁻ acts as an Bronsted Lowry acid.
- 3 More CO₂ is produced.

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

Ans: C

When pH decreases, the [H⁺] increases. The position of equilibrium 2 shifts to the left, resulting in more H₂CO₃ that shifts equilibrium 1 to the left to produce more CO₂. The HCO₃⁻ hence accepts protons and serves as a Bronsted Lowry base.

21 Which row describes the properties of oxides of aluminium and phosphorus?

	oxide of aluminium	oxide of phosphorus
A	exists as a solid at room temperature	exists as a gas at room temperature
B	conducts electricity in the solid state	does not conduct electricity at room temperature
C	dissolves in water to give a solution which has a pH greater than 7	reacts with water to give a solution which has a pH less than 7
D	reacts with aqueous sodium hydroxide	reacts with aqueous sodium hydroxide

Ans: D

Option A: Oxides of aluminium is a giant ionic compound which means it is expected to have a high melting point and exists as solid.

oxides of phosphorus (P_4O_{10}), it is a simple covalent molecule but due its large number of electrons, the id-id interactions is strong and hence it exists as solid at room temperature.

Option B: Aluminium oxide can only conduct electricity in molten or aq state. P_4O_{10} doesn't conduct electricity

Option C: Aluminium oxide doesn't dissolve in water due to its high lattice energy. Hence pH is 7 (of water). P_4O_{10} is an acidic oxide that gives an acidic solution of pH less than 7 when it reacts/dissolves in water

Option D: Aluminium oxide is amphoteric hence it can undergo neutralisation with aq NaOH. P_4O_{10} is an acidic oxide hence it can react with aq NaOH

- 22** A 4 g cube of sodium is added to an excess of water. The volume of hydrogen gas evolved is measured over time until the reaction is complete.

The experiment is repeated with a 4 g cube of lithium and an excess of water at the same temperature.

Which row is correct?

	time taken for the reaction to complete with lithium	total volume of hydrogen gas evolved with lithium
A	longer than with sodium	the same as with sodium
B	longer than with sodium	more than with sodium
C	shorter than with sodium	the same as with sodium
D	shorter than with sodium	more than with sodium

Ans: B

Lithium is the first element of group 1, with sodium below it. Since, the no. of moles = mass / A_r , when A_r decreases fr Na to Li, and with the same mass, the no. of moles should increase. Hence, the no. of moles of hydrogen gas evolved with Li should be more than with sodium.

Down the group, the reducing power of group 1 metals increases. Hence, the rate of (inversely proportional to time) reaction will be faster with Na than Li.

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

Table 1 shows the results of experiments in which the halogens, W_2 , X_2 and Y_2 , were added to separate aqueous solutions containing W^- , X^- and Y^- ions. The possible identities of the halogens are chlorine, bromine and iodine.

	W^- (aq)	X^- (aq)	Y^- (aq)
W_2	-	no reaction	no reaction
X_2	W_2 formed	-	no reaction
Y_2	W_2 formed	X_2 formed	-

Table 1

Which of the statements is correct?

- A** W_2 is a greenish yellow gas.
B The oxidising power of Y_2 is least.
C A brown solution is formed when X_2 is added to excess W^- .
D A purple layer is formed above the aqueous layer when Y_2 is added to X^- , followed by hexane.

Ans: C

Y_2 is chlorine, X_2 is bromine while W_2 is iodine.

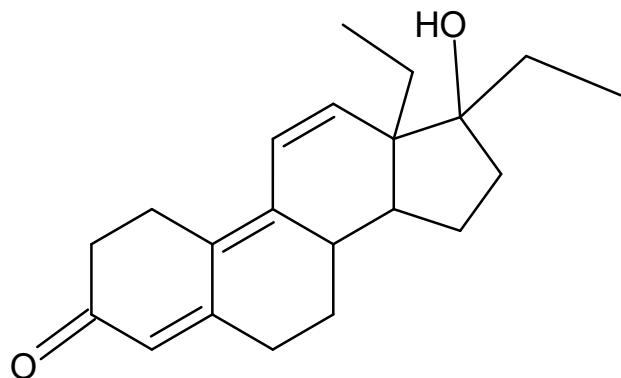
A: Incorrect. W_2 is a black solid which sublimes to be purple gas.

B: Incorrect. The oxidising powers increases from $W_2 > X_2 > Y_2$

C: Correct. Iodine formed in iodide solution is brown in colour.

D: An orange red layer is formed above the aqueous layer when Y_2 is added to X_2 , followed by hexane because the bromine formed will dissolve in hexane to form an orange layer.

- 24** THG is a steroid that mimics the effects of natural hormones and promotes muscle growth. It has the following structure.



THG

What is the molecular formula of THG?

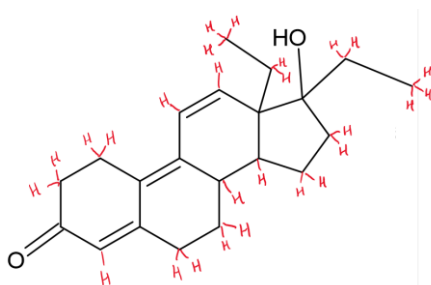
A $C_{21}H_{28}O_2$

B $C_{21}H_{26}O_2$

C $C_{19}H_{28}O_2$

D $C_{19}H_{23}O_2$

Ans: A

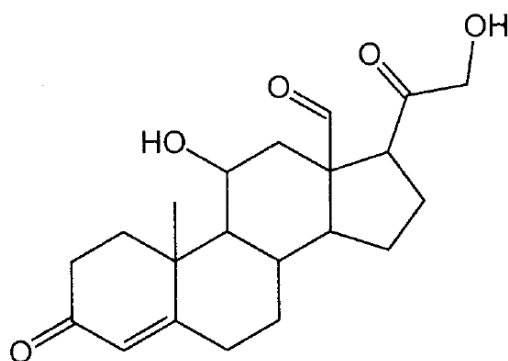


- 25** Which statement about constitutional isomers is correct?
- A** 3-methylbut-1-ene and pent-1-ene are constitutional isomers.
- B** All constitutional isomers have the same chemical properties.
- C** Constitutional isomers can have different empirical formula.
- D** C_4H_{10} has three constitutional isomers.

Ans: A

- A. Both compounds have the same molecular formula of C_5H_{10} and are chain isomers.
- B. False. Functional group isomers have different chemical properties.
- C. False. Having the same molecular formula means that constitutional isomers have the same empirical formula.
- D. C_4H_{10} has 2 isomers i.e. butane and methylpropane.

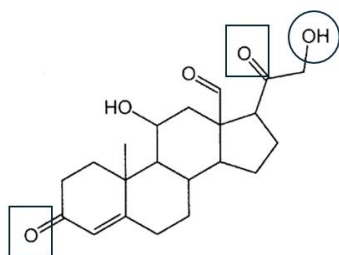
- 26** Aldosterone is a steroidal hormone in humans.
- Which row correctly describes the number of ketone and primary alcohol groups in aldosterone?



aldosterone

	Number of ketone groups	Number of primary alcohol groups
A	2	1
B	2	2
C	3	1
D	3	2

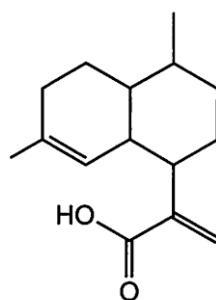
Ans:A



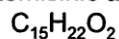
Primary alcohol is as circled while ketone are boxed.

2021/P1/26

- 27 Artemisinic acid is a useful intermediate for making the anti-malaria drug, artemisin.



artemisinic acid



Which statement about this compound is correct?

- A It does not decolourise liquid bromine in the dark.
- B It can exhibit cis-trans isomerism around the $\text{C}=\text{C}$.
- C 1 mol of artemisinic acid reacts with 3 mol of hydrogen in the presence of nickel catalyst.
- D It can react with aqueous sodium carbonate to form carbon dioxide.

Ans: D

A: alkenes can undergo addition of bromine in the dark and hence decolourise it.

B: Double bond in ring structure and terminal double bond cannot exhibit cis trans isomerism

C: each $\text{C}=\text{C}$ will react with 1 mol of hydrogen. Hence only requires 2 mol of hydrogen to react.

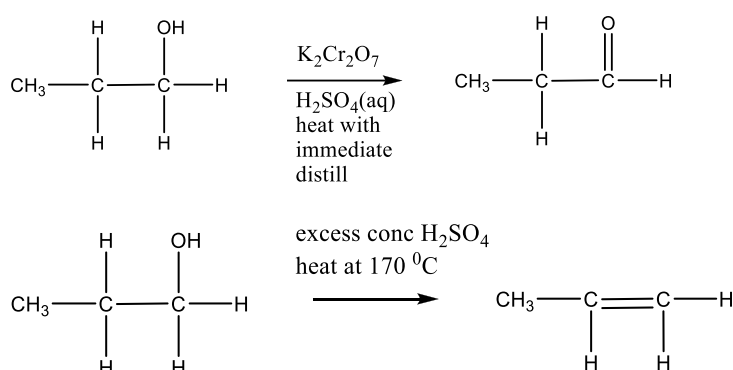
D: The carboxylic acid group can react with aqueous sodium carbonate to form carbon dioxide.

28 Which compounds could be a product of a single reaction of propan-1-ol?

- 1 propanal
- 2 propanone
- 3 propene
- A 1, 2 and 3
- B 1 and 3 only
- C 2 and 3 only
- D 1 only

Ans: B

Propan-1-ol can only be oxidized to give either propanoic acid or propanal. (To get propanone, propan-2-ol should be used instead)



29 Compound X and Y have the same functional group.

Compound X reacts with acidified potassium dichromate(VI) solution, giving compound Z after the mixture has been heated under reflux.

Compound Y reacts with compound Z, in the presence of a few drops of concentrated sulfuric acid, to give $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$.

What is compound X?

- A ethanol
- B ethanal
- C propan-1-ol
- D propanal

Ans: C

$\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3 \rightarrow$ Z is $\text{CH}_3\text{CH}_2\text{COOH}$ since it is formed from the oxidation of X with $\text{K}_2\text{Cr}_2\text{O}_7$. Y is $\text{CH}_3\text{CH}_2\text{OH}$.

Since X and Y have the same functional group, both are alcohol. Hence, X is $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$, a primary alcohol which is oxidized to a carboxylic acid.

- 30** Catalytic converters are used to convert the toxic gases produced from the internal combustion engines of vehicles into less harmful compounds.

Which equations represent reactions that will take place in the catalytic converter?

- 1 Oxides of nitrogen + carbon monoxide $\rightarrow$ nitrogen + carbon dioxide
- 2 Unburnt hydrocarbons + carbon monoxide $\rightarrow$ carbon dioxide + water
- 3 Carbon monoxide + oxygen $\rightarrow$ carbon dioxide

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

Ans: B

Possible reactions in the catalytic converter may involve the following redox reactions:

- $2\text{NO (g)} + 2\text{CO (g)} \rightarrow \text{N}_2 \text{(g)} + 2\text{CO}_2 \text{(g)}$
- $\text{CO (g)} + \frac{1}{2}\text{O}_2 \text{(g)} \rightarrow \text{CO}_2 \text{(g)}$
- $\text{C}_x\text{H}_y \text{(g)} + (x + y/4) \text{O}_2 \text{(g)} \rightarrow x \text{CO}_2 \text{(g)} + y/2 \text{H}_2\text{O (g)}$

END OF PAPER