Catholic Junior College

JC 2 Preliminary Examinations

Higher 1

CHEMISTRY

8873/01

Paper 1 Multiple Choice

12 September 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, HT group and NRIC/FIN number on the Answer Sheet in the spaces provided.
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 Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

WORKED SOLUTIONS

This document consists of **11** printed pages

For each question there are ***four*** possible answers, ***A***, ***B***, ***C*** and ***D***. Choose the **one** you consider to be correct.

1 A sample of bromine contains a mixture of two isotopes, ^{79}Br and ^{81}Br. The relative atomic mass of Br in this sample is 79.92.

What is the percentage abundance of each isotope?

	^{79}Br	^{81}Br
A	46.0%	54.0%
B	41.2%	58.8%
C	54.0%	46.0%
D	58.8%	41.2%

Concept: Mole Concept and Stoichiometry, percentage abundance
Answer: C

The relative atomic mass of Br is given as 79.92. As the weighted average is closer to 79 than 81, clearly there is a greater abundance of ^{79}Br. Hence A and B are wrong.
Let *x* be the percentage abundance of ^{79}Br. Hence (100-*x*) is the abundance of ^{81}Br.
$\left(\frac{x}{100}\right) 79 + \left(\frac{100-x}{100}\right) 81 = 79.92$
x = 54.0%

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

How many atoms of silver (proton number 47) are there in a pure silver ring with a mass of 2.88 g?

A 1.20×10^{21} **C** 1.20×10^{22}

B 2.00×10^{21} **D** 1.61×10^{22}

Concept: Mole Concept and Stoichiometry, Use of Avogadro's number
Answer: D

From the Data Booklet, A_r of silver = 107.9 and Avogadro's number = 6.02×10^{23}
Hence number of atoms of silver = $2.88 \div 107.9 \times 6.02 \times 10^{23} = 1.61 \times 10^{22}$

3 In an experiment, 100 cm^3 of a 0.2 mol dm^{-3} solution of a metallic salt reacts exactly with 50 cm^3 of 0.2 mol dm^{-3} aqueous sodium sulfite, Na_2SO_3. The half-equation for the oxidation of the sulfite ion is shown below:

$$SO_3^{2-}(aq) + H_2O(l) \rightarrow SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$$

If the original oxidation number of the metal ion for the metallic salt is +3, what is the new oxidation number of the metal ion?

A +1 **B** +2 **C** +4 **D** +5

Concept: Mole Concept and Stoichiometry, Oxidation numbers
Answer: B

Amt of SO_3^{2-} = $\frac{50}{1000} \times 0.20 = 1.0 \times 10^{-2}$ mol
Amt of e^- lost = 2 × 1.0 x 10^{-2} = 2.00 × 10^{-2} mol
Amt of metallic salt = $\frac{100}{1000} \times 0.20 = 0.0200$ mol = 2.0 × 10^{-2} mol
Hence mole ratio of metallic salt: e^- gained is 1:1
Since original oxidation number of the metal in the salt is +3, after gaining 1 e^-, the new oxidation number will be +2.

4 **A** and **B** represent two consecutive elements in the periodic table.

$\mathbf{A}^{2+}$ contains *n* protons while the cation of **B** contains (*n*+1) protons and is isoelectronic with **A**.

What is the formula of the chloride formed by **B**?

A BCl **B** BCl_2 **C** BCl_3 **D** BCl_4

Concept: Atomic Structure, Number of protons and charges on ions
Answer: C

Elements	No. of protons	No. of electrons	Charge
A	n	n-2	+2
B	n+1	(n+1)-3 Since **A** and **B** are isoelectronic	+3 (since there is a loss of $3e^-$)

Hence, chloride of **B** will have the formula of **B**Cl_3.

5 Which of the following is the correct electronic configuration of a copper(II), Cu^{2+} ion in the ground state?

A $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9\ 4s^2$

B $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$

C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$

D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$

Concept: Atomic Structure, electronic configuration
Answer: D

Electronic configuration of Cu element: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^1$
Electronic configuration of Cu^{2+} ion: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$
(remove one 4s electron first followed by one 3d electron)

6 Which of the following gives the symbols of elements in the order of decreasing first ionisation energy?

A C*l*, Br, I

B F, Ne, Na

C A*l*, Mg, Na

D C*l*, S, P

Concept: Atomic Structure, ionisation energy
Answer: A

A is correct. Ionisation energy decreases down the group as the distance between the nucleus and the valence electrons increases.
B is incorrect. Ionisation energy increases from F to Ne (period 2) but decreases for Na as Na is from period 3. The distance between the nucleus and the valence electrons of Na is further than that of F and Ne, thus smaller electrostatic forces of attraction between the nucleus and valence electrons of Na
C is incorrect. There is an anomaly between A*l* and Mg.
Ionisation energy increases from A*l* to Mg and decreases to Na.
A*l*: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ Mg: $1s^2\ 2s^2\ 2p^6\ 3s^2$
The 3p electrons of Al is at a higher energy level than the 3s electrons of Mg hence less energy needed to remove the 3p electron is Al.
D is incorrect. There is an anomaly between P and S.
Ionisation energy decreases from C*l* to S and increases to P
P : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p_x^1 3p_y^1 3p_z^1$ S : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p_x^2 3p_y^1 3p_z^1$
Due to inter-electronic repulsion between paired electrons in the same orbital of S, less energy is required to remove the 3p electron from S.
Students can also check the *Data Booklet* to confirm their choices.

7 Which of the following have giant lattice structures under standard conditions at 298 K?

1 magnesium
2 buckminsterfullerene, C_{60}
3 beryllium chloride
4 sodium fluoride

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

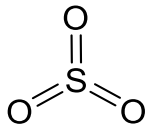
Concept: Chemical Bonding, Giant Lattice Structure
Answer: B
Option 1: Magnesium is a metal and has a giant metallic lattice structure.
Option 2: Buckminsterfullerene exists as simple molecular structure with covalent bonds between the C atoms.
Option 3: Beryllium chloride exist as simple molecular structure with covalent bonds between the Be and Cl atoms.
Option 4: Sodium fluoride is an ionic compound which has a giant ionic lattice.

8 Which of the following species has the smallest bond angle?

A SO_3 **B** BrF_2^+ **C** SF_6 **D** IF_2^-

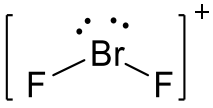
Concept: Chemical Bonding, bond angles
Answer: C

A



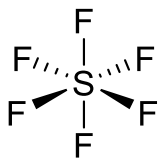
trigonal planar 120°

B



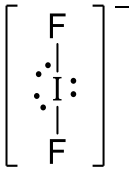
bent 105°

C



octahedral 90°

D



linear 180°

9 Which one of the following statements about aluminium chloride is **incorrect**?

A $AlCl_3$ has a simple molecular structure.

B $AlCl_3$ has a lower melting point than Al_2O_3.

C The Al_2Cl_6 dimer contains intermolecular hydrogen bonding.

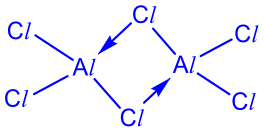
D The reaction $AlCl_3 + Cl^- \rightarrow AlCl_4^-$ involves the formation of a dative bond.

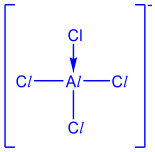
Concept: Chemical Bonding
Answer: C

A **$AlCl_3$ has simple molecular structure due to high charge density of Al^{3+} which polarizes the Cl^- electron cloud to an extent where it forms a covalent bond.**

B **$AlCl_3$ is simple molecular and is held together by intermolecular instantaneous dipole-induced dipole forces and hence will have a lower melting point than Al_2O_3 which is giant ionic.**

C **The Al_2Cl_6 dimer contains two co-ordinate bonds, not intermolecular hydrogen bonds.**



D  **The Al is electron deficient and hence will accept a lone pair from Cl^- to achieve the octet configuration.**

10 The table shows the boiling points of some halogenoalkanes.

compound	boiling point/ °C
CH_3Cl	−24.2
CH_3Br	3.6
CH_3I	42.4

Which of the following correctly explains the difference in the boiling points?

A the bond energy of C−X bond decreases from C−Cl to C−I.

B the strength of permanent dipole-permanent dipole attractions increases from C−Cl to C−I.

C the strength of instantaneous dipole-induced dipole attraction increases from CH_3Cl to CH_3I.

D the electronegativity difference between the halogen and carbon increases from C−Cl to C−I.

Concept: Chemical Bonding, Intermolecular Forces
Answer: C

The increasing trend in boiling point from chloromethane to bromomethane to iodoethane can be explained by the increasing strength of the intermolecular instantaneous dipole-induced dipole attraction which require more energy to overcome. This is due to the increasing number of electrons in the molecule, leading to a more polarisable electron cloud.

11 Use of Data Booklet is relevant to this question.

Which solid has the least exothermic lattice energy?

A NaF **B** MgO **C** CaO **D** LiC*l*

Concept: Chemical Energetics – Lattice Energy
Answer: A

$|\Delta H_{latt}| \propto \frac{q_+ q_-}{r_+ + r_-}$ for ionic compound

Comparing the ionic charges, NaF and LiC*l* has the lower ionic charges. However, the summation of the ionic radii in NaF is (0.095+0.136=0.231) is smaller than that of ionic radii in LiC*l* is (0.060+0.181=0.241). Thus, lattice energy of LiCl is the least exothermic lattice energy.

12 Which equation correctly describes the standard enthalpy change of formation of water at 298K?

A $2H(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$

B $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$

C $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$

D $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Concept: Chemical Energetics – Definition of standard enthalpy change of formation
Answer: C

Standard enthalpy change of water is the enthalpy change when one mole of the substance is formed from its elements under standard conditions of 298 K and 1 bar.
Option B is incorrect because H_2O is a liquid at 298K.

13 The gas-phase reaction of carbon monoxide with hydrogen forming methanol is as follows:

$$2H_2(g) + CO(g) \rightleftharpoons CH_3OH(g)$$

The reaction was investigated by mixing 4.0 mol of $H_2(g)$ with 2.0 mol of CO(g) in a 2.0 dm^3 flask and allowing equilibrium to be established. At equilibrium, y mol dm^{-3} of H_2 has reacted with CO(g).

What is the equilibrium concentration of CO(g) in mol dm^{-3}?

A 1 - y

B $1 - \frac{y}{2}$

C $4 - \frac{y}{2}$

D 4 - y

Concept: Chemical Equilibria – Calculation of equilibrium concentrations
Answer: B

	$2H_2(g)$	+	$CO(g)$	$\rightleftharpoons$	CH_3OH
Initial moles /mol	**4**		**2**		**0**
Initial concentration/ mol dm^{-3}	$\frac{4}{2}$ **=2**		$\frac{2}{2}$ **=1**		**0**
Change in concentration/ mol dm^{-3}	**-y**		$-\frac{y}{2}$		$+\frac{y}{2}$
Equilibrium concentration/ mol dm^{-3}	**2-y**		**1-** $\frac{y}{2}$		$\frac{y}{2}$

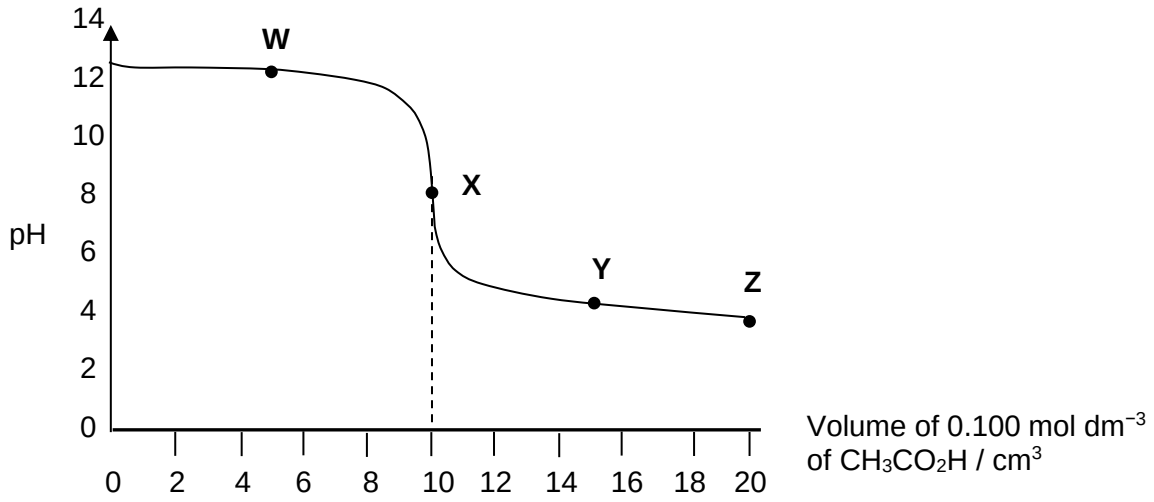
Thus, equilibrium concentration of CO is 1 - $\frac{y}{2}$.

14 For a reversible reaction, what is the effect of a catalyst on the rate constant, k_f for the forward reaction, the rate constant, k_r, for the reverse reaction, and the equilibrium constant K_c?

	k_f	k_r	K_c
A	increase	increase	increase
B	no effect	no effect	increase
C	increase	decrease	no effect
D	increase	increase	no effect

Concept: Chemical equilibria and Reaction kinetics – rate constant and equilibrium constant
Answer: D
Rate constant for both forward and reverse reactions will increase in the presence of catalyst. Equilibrium constant is only affected by temperature and hence no effect in the presence of catalyst.

15 When 10.00 cm^3 of a 0.100 mol dm^{-3} NaOH is titrated against 0.100 mol dm^{-3} of aqueous CH_3CO_2H, the following titration curve is obtained.



Which of the following points on the curve shows that it is functioning as a buffer?

1 Point W
2 Point X
3 Point Y
4 Point Z

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

Concept: Theories of Acids and Bases- identification of buffer
Answer: C

$CH_3CO_2H + NaOH \rightarrow CH_3CO_2Na + H_2O$
Point W: The predominant species present are $CH_3CO_2^-Na^+$ and excess NaOH.
Point X: The predominant species present is $CH_3CO_2^-Na^+$ as equivalence point is reached.
Point Y: The predominant species present are $CH_3CO_2^-Na^+$ and CH_3CO_2H which are conjugate acid-base pairs. Thus, it is functioning as a buffer.
Point Z: The predominant species present are $CH_3CO_2^-Na^+$ and excess CH_3CO_2H which are conjugate acid-base pairs. Thus, it is functioning as a buffer.

16 Carbon-14 is an isotope of carbon. It is unstable and undergoes radioactive decay to form nitrogen-14. This radioactive decay is a first-order reaction with a half life of 5700 years.

What is the molar proportion of carbon-14 to nitrogen-14 after a period of 17100 years?

A 1:1 **B** 1:3 **C** 1:7 **D** 1:15

Concept: Chemical Kinetics
Answer: C

Number of half-lives = 17100 / 5700 = 3 half lives

Carbon-14 is reacted so it will be 1(0.5)(0.5)(0.5) = 0.125 after 3 half-lives.
Nitrogen-14 is produced so it will be 1 – 0.125 = 0.875 after 3 half-lives.
Molar proportion = 0.125/0.875 = 1: 7

17 Hydrogen peroxide reacts with acidified iodide to form iodine. The following results were obtained.

Expt No	Initial concentration of reactants / mol dm^{-3}			Initial rate of formation of iodine / mol dm^{-3} s^{-1}
	$[H_2O_2]$	$[I^-]$	$[H^+]$	
1	0.010	0.010	0.10	2×10^{-6}
2	0.010	0.010	0.20	2×10^{-6}
3	0.020	0.010	0.10	4×10^{-6}
4	0.020	0.030	0.10	1.2×10^{-5}

Which of the following correctly explains the results?

A The reaction is dependent on the concentration of the acid.

B The reaction is overall first order.

C The rate constant is 2.0×10^{-1} mol^{-1} dm^3 s^{-1}.

D The rate equation for the reaction is rate = $k[H_2O_2][I^-]$.

Concept: Reaction Kinetics – Order of reaction and rate equations
Answer: D

Rate = $k[H_2O_2]^p[I^-]^q[H^+]^r$

For experiments 1 and 2, keeping $[H_2O_2]$ and $[I^-]$ constant, when the $[H^+]$ is doubled, there is no change to the initial rate of the reaction. Thus, the order of reaction wrt $[H^+]$ is 0.

For experiments 2 and 3, keeping $[I^-]$ constant and disregarding $[H^+]$ since it does not affect rate,

$$(\frac{0.10}{0.20})^p = \frac{2\times10^{-6}}{4\times10^{-6}}$$ **=> p = 1. Thus, the order of reaction wrt $[H_2O_2]$ is 1.**

For experiments 3 and 4, keeping $[H_2O_2]$ and $[H^+]$ = constant,

$$(\frac{0.010}{0.030})^q = \frac{4\times10^{-6}}{1.2\times10^{-5}}$$ **=> q = 1. Thus, the order of reaction wrt $[I^-]$ is 1.**

In experiment 1: k = $\frac{2\times10^{-6}}{0.010\times0.010}$ **= 2.0 × 10^{-2} mol^{-1} dm^3 s^{-1}**

18 Some data on two acid-base indicators are shown in the table below:

indicator	Approximate pH working range	colour change	
		acid	alkali
bromophenol blue	3.0 – 4.6	yellow	violet
bromothymol blue	6.0 – 7.6	yellow	blue

What conclusion can be drawn about a solution in which bromophenol blue is violet and bromothymol blue is yellow at 25 ºC?

A It is weakly acidic.

B It is strongly acidic.

C It is neutral.

D It is weakly basic.

Concept: Theories of Acids and Bases, Indicators
Answer: A

Since the solution turned violet in the presence of bromophenol blue, the pH of solution is greater than 4.6
Since the solution turned yellow in the presence bromothymol blue, pH of the solution is less than 6.0.
Colour of bromothymol blue between 6.0 to 7.0 is green.
Therefore, pH of the solution is between 4.6 – 6.0, which is a weakly acidic solution.

19 Silicon is an element in the third period, Na to Ar, of the Periodic Table.

Which statement is true for silicon?

A The oxide of silicon reacts with water to give a basic solution.

B Silicon has the highest melting point of the elements in this period.

C Silicon is the only element in this period whose chloride react with water to form acidic solution.

D Silicon is the only element in this period which can exist, at room temperature and pressure, as a simple molecule.

Concept: The Periodic Table
Answer: B

A is incorrect. SiO_2 does not dissolve in water hence the solution is neutral.
B is correct. Silicon has the highest melting point in the third period as the silicon atoms are held together by strong and extensive covalent bonds.
C is incorrect. $MgCl_2$ and $AlCl_3$ dissolve in water to produce $[Mg(H_2O)_6]^{2+}$ and $[Al(H_2O)_6]^{3+}$ respectively. $[Mg(H_2O)_6]^{2+}$ and $[Al(H_2O)_6]^{3+}$ hydrolyse partially in water to form weakly acidic solutions (pH 6.5 and 3 respectively)
$SiCl_4$ and PCl_5 hydrolyses completely in water to form a strongly acidic solution at pH 2.
D is incorrect. Silicon has a giant molecular structure.

20 Which of the following properties of the Group 17 elements increases with increasing atomic number?

A First ionisation energy

B Electronegativity of the element

C Oxidising power of the elements

D Atomic radius

Concept: The Periodic Table, Group 17 elements
Answer: D

A/B First ionisation energy and electronegativity decrease due to increasing atomic size and shielding effect.

C Oxidising power of the elements decreases because the size of the atom increases and hence the ability for itself to be reduced (gain an electron) decreases.

D As principal quantum shell increases down the group, atomic radius increases.

21 **Y** and **Z** are 2 elements from Period 3 (Na to Cl) of the Periodic Table.

Element **Y** has the highest electrical conductivity in the period, and it has an oxide that does not dissolve in water.
Element **Z** has a chloride that reacts vigorously with water to form a colourless solution with white fumes of HCl.

What are the identities of **Y** and **Z**?

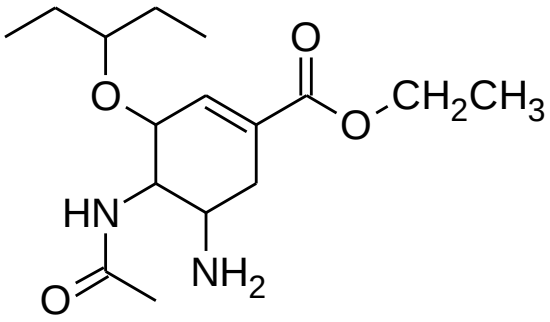
	Y	**Z**
A	aluminium	phosphorus
B	silicon	aluminium
C	magnesium	sulfur
D	phosphorus	silicon

Concept: The Periodic Table
Answer: A

Aluminium has the highest electrical conductivity due to its 'sea' of delocalised electrons where each aluminium atom in its giant lattice structure can donate three electrons.
Al_2O_3 has a giant ionic lattice structure and does not dissolve in water as large amounts of energy is required to break the crystal lattice.

Chlorides of Al, Si and P all reacts vigorously with water, forming white fumes of HCl as its product. However, chlorides of Al and Si would also form a while solid as a by-product in the reaction.

22 Which functional group(s) is present in Oseltamivir?



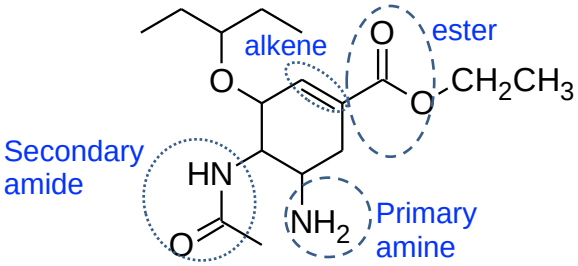
Oseltamivir

1 Alkene
2 Amide
3 Amine
4 Alcohol

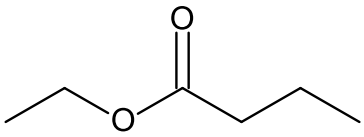
A 2 and 3 only
B 2 and 4 only
C 1, 3 and 4 only
D 1, 2 and 3 only

Concept: Polymers
Answer: D

The functional groups present in the molecule are shown below



23 Compound **A** below is used as a flavour enhancer in processed orange juice.



Compound **A**

What is the IUPAC name of compound **A**?

A ethyl butanoate

B propyl ethanoate

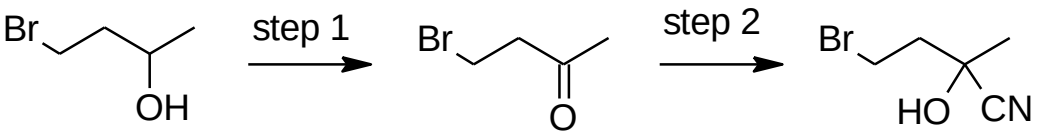
C ethyl propanoate

D butyl ethanoate

Concept: Polymer Chemistry (Naming Organic Compounds)
Answer: A

A is made from ethanol and butanoic acid hence its name is ethyl butanoate as the acidic group has a higher priority and hence form the suffix, while the alcohol group forms the prefix.

24 What types of reaction occur in steps 1 and 2?

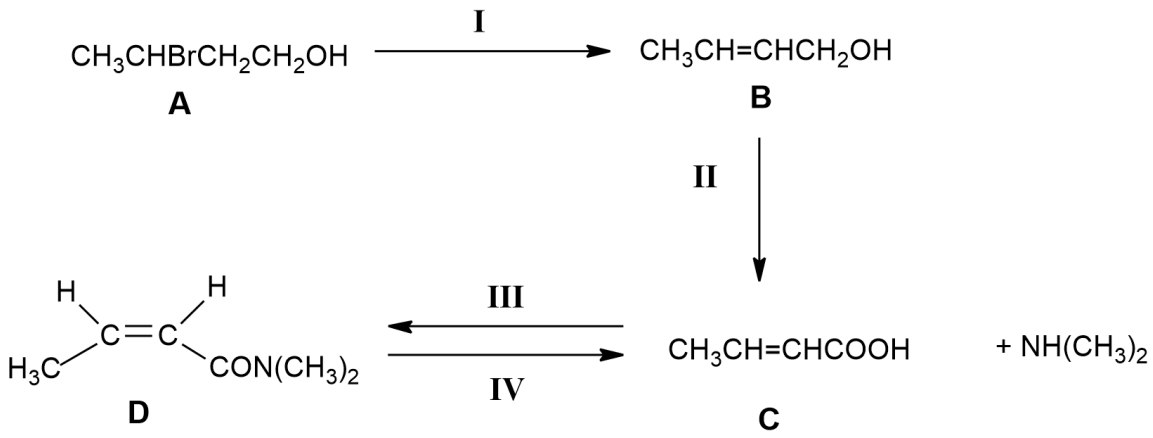


	Step 1	Step 2
A	oxidation	addition
B	oxidation	condensation
C	elimination	addition
D	elimination	condensation

Concept: Polymer Chemistry (Types of organic reactions)
Answer: A

Step 1: oxidation of secondary alcohol to ketone
Step 2: addition across C=O bond. A π bond breaks and new σ bonds are formed.

25 A student considered the following synthetic route to produce compound **D**.



Which steps show an **incorrect** type of reaction and/or reagent used?

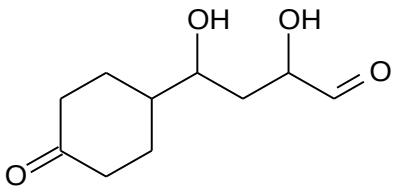
	step	type of reaction	reagent
1	**I**	substitution	excess concentrated sulfuric acid
2	**II**	oxidation	$K_2Cr_2O_7$ in dilute H_2SO_4
3	**III**	condensation	dicyclohexylcarbodiimide (DCC)
4	**IV**	elimination	ethanolic NaOH

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

Concept: Polymer Chemistry (Condensation Polymer)
Answer: D

	step	type of reaction	reagent
1	**I**	~~Substitution~~ elimination	~~excess concentrated sulfuric acid~~ ethanolic NaOH
2	**II**	oxidation	$K_2Cr_2O_7$ in dilute H_2SO_4
3	**III**	condensation	dicyclohexylcarbodiimide (DCC)
4	**IV**	elimination	~~ethanolic NaOH~~ excess concentrated sulfuric acid

26 Which one of the following statements is true about the compound chosen below?



A It reacts with H_2 gas to form a product with four alcohol groups.

B Effervescence is observed upon reacting the compound with sodium carbonate.

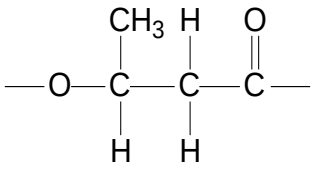
C The alcohol groups undergo elimination when reacted with hot dilute H_2SO_4.

D It can be oxidised under suitable conditions to form a compound with 4 ketone groups.

Concept: Polymer Chemistry (Reactions)
Answer: A

Option A is correct as the ketone and aldehyde group will be reduced to form alcohol groups.
Option B is wrong as sodium carbonate reacts with carboxylic acids, which is not present in the molecule.
Option C is wrong because elimination occurs with hot concentrated H_2SO_4.
Option D is incorrect because the 2 secondary alcohol groups are oxidised to 2 ketones. In addition, the aldehyde functional group is then oxidised to carboxylic acid. Hence, the compound has a total of 3 ketone groups present.

27 The repeat unit of a polymer is shown below.



What deductions about this polymer can be drawn from its structure?

1 It is a polyester.

2 It could be readily made from $HOCH_2CH_2CH_2CO_2H$.

3 There are intermolecular hydrogen bonds formed between two polymer chains.

A 1 only

B 1 and 3 only

C 2 and 3 only

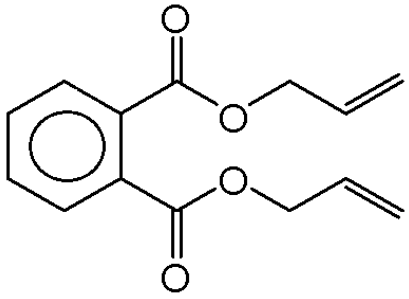
D 1 , 2 and 3

Concept: Polymer Chemistry (Condensation Polymer)
Answer: A

1 An ester linkage is formed when the repeat units are joined together
2 It should be made from $HOCH(CH_3)CH_2CO_2H$.
3 This repeat unit does not have a hydrogen atom that is directly bonded to fluorine, oxygen or nitrogen atom to form intermolecular hydrogen bonds.

28 Poly(diallyl phthalate) is a polymer which is commonly used for electronics and electrical parts.

The structure of its monomer, diallyl phthalate is shown below.



Diallyl phthalate

Which of the following statement is true of its polymer?

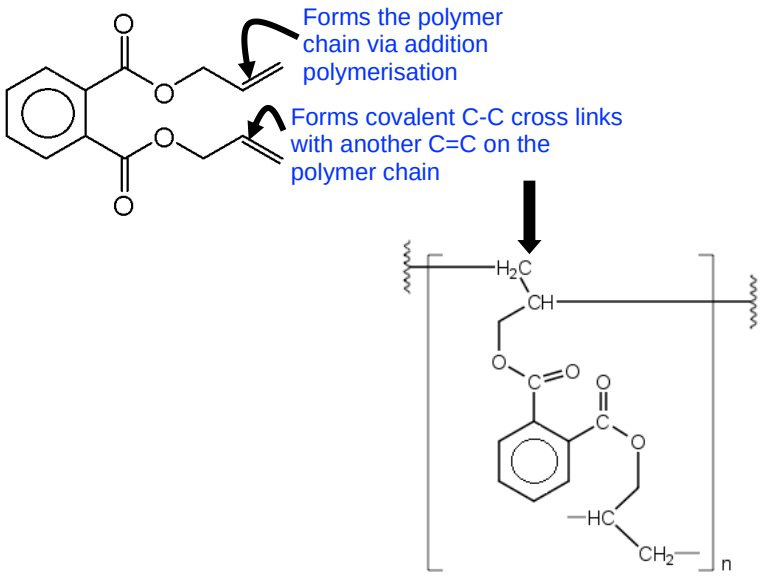
A It is a thermoplastic polymer.

B It is formed via condensation polymerisation.

C It can form cross–links through its ester bonds.

D It can be hydrolysed when heated using dilute H_2SO_4.

Concept: Polymer Chemistry (Thermoset Polymers)
Answer: D



Poly(diallyl phthalate) are thermosetting polymers due to the presence of cross links hence they are rigid and cannot be recycled. Hence A is incorrect.

Due to the presence of ester bonds, it can be hydrolysed when heated with dilute H_2SO_4.

29 Dishwasher pouches are small convenient packets that contain the detergent needed to be used in dishwashers. Such pouches are sturdy enough to be easily transported and safely handled by hand yet dissolve easily when it is time to wash dishes. What could be the polymer that is used for the pouches?

A bakelite
B poly(vinyl alcohol)
C poly(vinyl chloride)
D poly(ethylene terephthalate)

Concept: Polymer Chemistry (Application of Polymers)
Answer: B

It has to dissolve easily hence must possess hydrophilic groups that allows for intermolecular hydrogen bonding to form with water. This therefore rules out poly(ethylene terephthalate) as it is a hydrocarbon. Since it is a pouch, it needs to be flexible to contain varying quantities of liquids, thus a thermoplastic is required which rules out bakelite which is a thermoset polymer.

30 Which of the following statements are **incorrect**?

1 Graphene has low tensile strength.

2 Geckos can stick to walls as they form strong covalent bonds to the walls.

3 Catalytic converters have a honeycomb structure to maximise the surface area available for catalysis to take place.

A 1 and 2 only

B 1 and 3 only

C 1, 2 and 3

D 1 only

Concept: Nanomaterial
Answer: A

Option 1 is incorrect as it has high tensile strength as each carbon atom has strong covalent bonds with three other carbon atoms.
Option 2 is incorrect as they form instantaneous dipole- induced dipole interactions with the wall.
Option 3 is correct as a honeycombed structure for catalyst in the catalytic converter is used so as to maximise the surface area on which heterogeneous catalysed reactions take place as the metals are very expensive.