CBSE Board
Class XII Chemistry

Time: 3 Hrs Total Marks: 70

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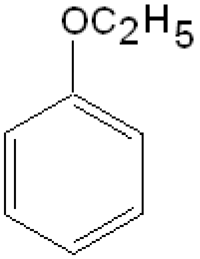
1. All questions are compulsory.
2. Question nos. 1 to 8 are very short answer questions and carry 1 mark each
3. Question nos. 9 to 18 are short answer questions and carry 2 marks each. Use of calculator is not permitted.
4. Question nos. 19 to 27 are also short answer questions and carry 3 marks each
5. Question nos. 28 to 30 are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

Q1: Which of the two: absorption or adsorption is a surface phenomenon?

Q2: Write the IUPAC name of isomer $[Co(NH_3)_5NO_2]Cl_2$.

Q3: Write the IUPAC name of the compound given below:



Q4: Give a chemical test to distinguish between benzaldehyde and benzoic acid.

Q5: Why do amines behave as nucleophiles?

Q6: Which type of linkage is responsible for the primary structure of proteins?

Q7: What are biodegradable polymers?

Q8:Name the sweetening agent used in the preparation of sweets for a diabetic Patient?

Q9: Calculate the boiling point of a solution containing 0.456 g of camphor (M.M. = 152) dissolved in 31.4 g of acetone (boiling point = 56.30°C) if molal elevation constant per 100 g of acetone is 17.2°C.

Q10: Write the cell reactions which occur in lead storage battery when the battery is in use.

Q11: Differentiate between lanthanoids and actinoids by giving two points of differences?

Q12: Explain hydrate isomerism. Give an example

Q13: An element E crystalllises in body centred cubic structure. If the edge length of the cell is 1.469 x 10^{-10} m and the density is 19.3 g cm^{-3}, calculate the atomic mass of this element.

OR

Q13. Potassium crystallizes in bcc lattice. What is the number of unit cells in 3.9 g of K? Atomic Mass of K = 39u

Q14: An element has bcc structure with cell edge of 288 pm. Density of the element is 7.2 g/cm^3. Calculate the number of atoms present in 208 g of element.

Q15:

(a) Write the name and the structure of the monomer of natural rubber?

(b) The presence of benzoquinone inhibits the free radical polymerization of vinyl derivative.

Q16: What are detergents? How are they classified?

Q17: Write the structures of

(a) 1-Chloro-4-ethylcyclohexane

(b) 4-tert-butyl-3-iodoheptane

Q18: Treatment of alkyl chlorides with aqueous KOH leads to formation of alcohols but in presence of alcoholic KOH, alkenes are formed as major products. Explain.

Q19: What are non – ideal solutions? Explain why non – ideal solution deviates from Raoult's law.

Q 20: When a certain conductivity cell was filled with 0.1 M KCl, it has a resistance of 85 Ω at 25° C. When the same cell was filled with an aqueous solution of 0.052 M unknown electrolyte, the resistance was 96 Ω. Calculate the molar conductivity of the unknown electrolyte at this concentration.

(Specific conductivity of 0.1 M KCl = $1.29 \times 10^{-2}\ \Omega^{-1}\ cm^{-1}$)

Q 21: An innovative washer woman while washing a copper miner's clothes found that sand and similar dirt particle fell to the bottom, while the ore particles stuck to the soapsuds and came to the top. The washer woman discussed this matter with a client who was a chemist.

(a) What is the reason for this observation?

(b) What value do you get from this episode?

Q 22:

(a) What are the two types of emulsions and how do they differ from one another? Give one example of each.

(b) Which one of the following electrolytes is most effective for the coagulation of $Fe(OH)_3$ sol and why?

$NaCl$, Na_2SO_4, Na_3PO_4

Q 23:

1. Bond dissociation energy of F_2 is less than that of Cl_2. Why?
2. Oxygen is a gas while sulphur is a solid. Why?
3. Which compound of Xe is isostructural with IF_5? What is the shape of the molecules?

Q 24:

1. What chemical change take place when:
   (a) MnO_2 is fused with KOH in air.
   (b) pH of a chromate solution is progressively lowered.
2. How would you account for increasing oxidizing power in series? $VO_2^+ < Cr_2O_7^+ < MnO_4^-$

OR

Q.24

1. Why are Mn^{2+} compounds more stable than Fe^{2+} towards oxidation into their +3 oxidation state?
2. Zn, Cd and Hg are normally not regarded as transition elements. Explain

Q25: Write equations to prepare XeF_2, XeF_4 and XeF_6

Q 26: What do you understand by replication by DNA? How does DNA differ from RNA structurally?

Q 27: Write the steps and conditions to carry out the following conversion: Phenol to benzoic acid.

Q 28:

Explain given reason each of the following:

1. Fluorine exhibits only -1 oxidation state whereas other halogens exhibit positive oxidation states also such as +1,+3,+5 and +7.
2. H_2S is less acidic than H_2Te.
3. Nitrogen does not form pentachloride but phosphorus forms.
4. SF_6 is well known but SCl_6 is not known.
5. HCl when reacts with finely divided iron to form ferrous chloride and not ferric chloride.

OR

Q 28:

Complete the reactions:

1. $(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}}$
2. $(NH_4)_2SO_4 + 2NaOH \rightarrow$
3. $3NO_2(g) + H_2O(l) \rightarrow$
4. $P_4 + 20HNO_3(\text{conc.}) \rightarrow$
5. $PbS(s) + 4O_3(g) \rightarrow$

Q29. The following rate date were obtained at 300 K for the reaction

$2A + B \rightarrow C + D$

Experiment No.	[A] mol L^{-1}	[B] mol L^{-1}	Rate of formation of D mol L^{-1} min^{-1}
1.	0.1	0.1	7.5×10^{-3}
2.	0.3	0.2	9.0×10^{-2}
3.	0.3	0.4	3.6×10^{-1}
4.	0.4	0.1	3.0×10^{-2}

Calculate the rate of formation of D when [A] = 0.8 mol L^{-1} and [B] = 0.5 mol L^{-1}.

OR

Q29.

(a) A first order reaction is 15% completed in 23 minutes. How long will it take to complete 60%?

(b) What is the significance of rate constant in a rate law?

Q30.Give reasons for the following:

1. Aliphatic aldehydes do not show position isomers. Why?
2. Why do you expect benzaldehyde to be less or more reactive in nucleophilic addition reactions than propanal? Explain
3. Why do aldyhydes and ketones have high dipole moment?
4. Boiling points of aldehydes and ketones are higher than those of hydrocarbons of comparable molecular mass?
5. The order of reactivity in nucleophilic addition reaction for some aldehydes and ketones is given below. Explain why such an order is observed? Ethanal> Propanal >Propanone >Butanone

OR

Q30.

(a) How are the following conversions carried out? (Write reactions and reaction conditions only).

1. Propanoic acid to 1 – propanol
2. Propanone to 4-Methyl-3-en-2-one
3. Benzyl alcohol to phenylethanoic acid

(b) Describe the following with an example for each:

1. Aldol condensation
2. Decarboxylation reaction

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Solution

1. Adsorption (1)
2. Pentamminenitrocobalt(III)chloride (1)
3. Ethoxy benzene (1)
4. There will be no reaction of benzaldehyde with sodium bicarbonate. Benzoic acid will react with sodium bicarbonate producing effervescence. $(\frac{1}{2})$

$$C_6H_5COOH + NaHCO_3 \longrightarrow C_6H_5COONa + H_2O + CO_2 \qquad (\frac{1}{2})$$

5. Amines behave as nucleophiles due to the presence of an unshared electron pair on nitrogen. (1)
6. Peptide linkage is primarily responsible for primary structure of proteins. (1)
7. Biodegradable polymers are those polymers which are degraded by micro organisms within suitable period of time due to their degradable property. Such polymers cause less pollution. (1)
8. Any artificial sweetening agent such as aspartame, saccharin or alitame may be used in the preparation of sweets for a diabetic patient. (1)

9.

$$\Delta T_b = \frac{K_b \text{ x } 1000 \text{ x } w_B}{M_B \text{ x } w_A} \qquad (\frac{1}{2})$$

$$K_b = 17.2\,K/mol \ \text{ per } 100g$$

$$= 1.72 \ \ K\,mol^{-1}\,kg$$

$$\Delta T_b = \frac{1.72 \text{ x } 1000 \text{ x } 0.456}{152 \text{ x } 31.4} \qquad (\frac{1}{2})$$

$$\Delta T_b = 0.16 \qquad (\frac{1}{2})$$

$$\text{Boiling point of solution} = 56.3 + 0.16 = 56.46^{\circ}C \qquad (\frac{1}{2})$$

10.

The cell reactions in lead storage battery when the battery is in use are :
At anode :

$Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$ $(\frac{1}{2})$

At cathode :

$PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$ $(\frac{1}{2})$

Net equation :

$Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$ (1)

11.

No.	a. Lanthanoids	b. Actinoids
1	General outer electronic configuration is $4f^{1-14}\ 5d^{0-1}\ 6s^2$	General outer electronic configuration is $5f^{1-14}\ 6d^{0-1}\ 7s^2$
2	Lanthanoids show the oxidation states +2,+3 and +4	c. Actinoids show a variable oxidation states from +3 to +7

(1 mark for each difference)

12. The compounds which has the same molecular formula but differ in the number of water molecules present as ligands or as molecules of hydration are called hydrate isomers and this type of isomerism is called hydrate isomerism. (1)

Example : $CrCl_3.6H_2O$ has three hydrate isomers (1)

$[Cr(H_2O)_6]Cl_3, [Cr(H_2O)_5Cl]Cl_2.H_2O$ and $[Cr(H_2O)_4Cl_2]Cl.2H_2O$

13.

$$d = \frac{z\,M}{a^3 \times N_A} \qquad (\tfrac{1}{2})$$

$z = 2$

$a = 1.469 \times 10^{-8}$ cm

$d = 19.3$ g cm^{-3}

$N_A = 6.023 \times 10^{23}$

$$19.3 = \frac{2\,M}{(1.469 \times 10^{-8})^3 \times 6.023 \times 10^{23}} \qquad (\tfrac{1}{2})$$

$M = 18.42$ g mol^{-1} (1)

OR

For bcc, number of atoms per unit cell = 2

No. of atoms in 3.9g of K $= 3.9 \times \dfrac{6.022 \times 10^{23}}{39} = 6.022 \times 10^{22}$ (1)

No. of unit cells in 3.9 g of K $= \dfrac{6.022 \times 10^{22}}{2} = 3.011 \times 10^{22}$ (1)

14.

Since the element forms body centered cubic structure,

Number of atoms in unit cell z = 1 + 1 = 2

$d = 7.2\, g / cm^3$

Volume of cube = a^3

$$= (288\, pm)^3$$

$$= (288 \times 10^{-12}\, m)^3$$

$$= (288 \times 10^{-10})^3\, cm^3$$

$$d = \frac{z \times M}{N_A \times a^3} \qquad (\frac{1}{2})$$

$$7.2 = \frac{2 \times M}{6.023 \times 10^{23} \times (288 \times 10^{-10})^3}$$

M = 51.79 $(\frac{1}{2})$

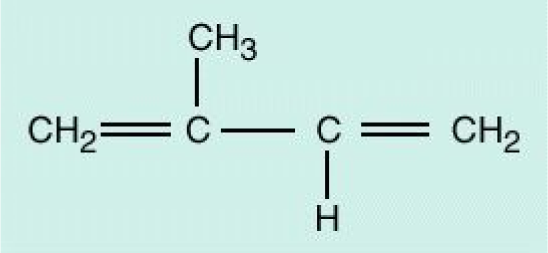
1 mole of element will have 6.023×10^{23} atoms $(\frac{1}{2})$

51.79 g of element will have 6.023×10^{23} atoms

208 g of element will have $\frac{6.023 \times 10^{23}}{51.79} \times 208 = 24.18 \times 10^{23}$ atoms $(\frac{1}{2})$

15.

(a) Natural rubber: Isoprene $(\frac{1}{2})$



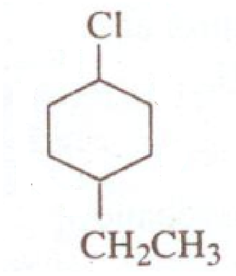
$(\frac{1}{2})$

(b) Benzoquinone traps the radical intermediate to form a non-reactive radical which is highly stabilized by resonance. Because of lack of reactivity of this intermediate, further progress of chain reaction is interrupted and reaction stops. (1)

16. Detergents are sodium salts of long chain alkyl hydrogen sulphates or long chai benzene sulphonic acid. They are cleansing agents and help in removing dirt and dust. (1)

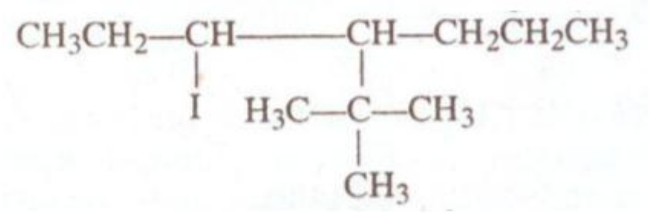
Detergents are classified into three categories namely cationic, anionic and non-ionic detergents. (1)

17. (a)



(1)

(b)



(1)

18. In aqueous solution, KOH is almost completely ionized to give OH^- ions which being a strong nucleophile brings about a substitution reaction on alkyl halides to form alcohols. Further in the aqueous solutions OH^- are highly hydrated. This solvation reduces the basic character of OH^- ions which therefore fails to abstract hydrogen from beta carbon of alkyl halide to form alkene. (1)

In contrast ,an alcoholic solution of KOH contains alkoxide (RO^-)which being a much stronger base than OH^- ions preferentially eliminates a molecule of HCl from an alkyl chloride to form alkene. (1)

19. The solutions which do not obey Raoult's law over the entire range of concentrations and are accompanied by a change in enthalpy and change in volume during their formation are called non – ideal solutions. (1)

(a) The liquid pairs for which solute-solvent (B—A) interactions are weaker than solute-solute (B—B) or solvent-solvent (A—A) interactions, the escaping tendency of solute or solvent molecules will be more. Hence vapour pressure is greater than that for ideal solution. Thus, such solutions show positive deviations from Raoult's law. (1)

(b) The liquid pairs for which solute-solvent (B—A) interactions are stronger than solute-solute (B—B) or solvent-solvent (A—A) interactions, the escaping tendency of solute or solvent molecules will be less. Hence vapour pressure is less than that for ideal solution. Thus such solutions show negative deviations from Raoult's law. (1)

20.

Resistance of KCl solution, $R = 85\ \Omega$

Specific conductivity $\kappa = 1.29 \times 10^{-2}\ \Omega^{-1}\ \text{cm}^{-1}$

$$\text{Cell constant} = \kappa \times R$$
$$= 1.29 \times 10^{-2}\ \Omega^{-1}\ \text{cm}^{-1} \times 85\ \Omega$$
$$= 1.1\ \text{cm}^{-1} \quad \text{(1 mark)}$$

Resistance of unknown electrolyte solution, $R = 96\ \Omega$

$$\text{Specific conductivity} = \frac{\text{Cell constant}}{R}$$
$$= \frac{1.1\ \text{cm}^{-1}}{96\,\Omega}$$
$$= 0.0114\,\Omega^{-1}\ \text{cm}^{-1} \quad (1)$$

Concentration, $C = 0.052\ \text{mol/L}$

$$\text{Molar conductivity } \Lambda_m = \frac{1000\,\kappa}{C} = \frac{1000(\text{cm}^3/\text{L}) \times 0.0114(\text{S cm}^{-1})}{0.052\ \text{mol/L}}$$
$$= 219.2\ \text{S cm}^2\ \text{mol}^{-1} \quad (1)$$

21.

(a) The miner's clothes had particles of CuS / Cu2S on it. This adhered to the froth and came up. (2)

(b) Keen observation can lead to great discoveries. (1)

22.

(a) Two types of emulsions:

i. Oil – in – water emulsions: In these emulsions, oil is the dispersed phase and water is the dispersion medium. For example, milk is an emulsion of fat in water. (1)

ii. Water – in – oil emulsion: In these emulsions, water is the dispersed phase and oil is the dispersion medium, For example, butter, etc. (1)

(b) Na_3PO_4 is most effective for the coagulation of $Fe(OH)_3$ sol.
Generally the greater the valence of the flocculating ion added; greater is its power to cause precipitation. Coagulating powers decrease in the order in the order given below:

$PO_4^{3-} > SO_4^{2-} > Cl^-$ (1)

23.

1. Due to small size of fluorine, bond length of F-F bond is less than Cl-Cl bond which leads to high interelectronic repulsions between the lone pairs of electrons. Thus, the bond dissociation energy of F_2 is less than Cl_2. (1)

2. O because of its small size is capable of forming $p\pi - p\pi$ bond and forms O_2 .The intermolecular forces in oxygen are weak van der Waals forces and hence it is a gas. S being large in size is not able to form $p\pi - p\pi$ bond and thus does not form S_2 molecule. It is linked by single bonds and form polyatomic complex molecules having eight atoms per molecule and form puckered ring structure. Therefore, sulphur atoms are strongly held and exist as solid. (1)

3. $XeOF_4$ is isostructural with IF_5. The shape of the molecules is square pyramidal. (1)

24.

1.

(a) a.MnO_2 is fused with KOH in the presence of atmospheric oxygen or an oxidizing agent like potassium nitrate or potassium chlorate to give potassium manganate, K_2MnO_4. $(\frac{1}{2})$

(b) $2MnO_2 + 4KOH + O_2 \xrightarrow{\text{Heat}} 2K_2MnO_4 + 2H_2O$ $(\frac{1}{2})$

(c) Chromate (yellow) changes to dichromate (orange) on lowering the pH by adding acid. $(\frac{1}{2})$

$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ $(\frac{1}{2})$

2. The order is due to increasing stability of the lower species to which they are reduced. (1)

OR

24.

1.
Electronic configuration of Mn^{2+} is $[Ar]3d^5$

Electronic configuration of Fe^{2+} is $[Ar]3d^6$

Mn^{2+} has exactly half filled electronic configuration which is extremely stable. Mn^{2+} has no tendency to lose an extra electron to undergo oxidation as compared to Fe^{2+} which has one extra electron (than the exactly half filled electronic configuration)which it can lose to undergo oxidation to Fe^{3+}. (1)

2. Generally those elements which contain partially filled d-orbitals are considered as transition elements.

Electronic configuration of $Zn\,(Z = 30)$ is $[Ar]3d^{10}4s^2$

Electronic configuration of $Cd\,(Z = 48)$ is $[Kr]4d^{10}5s^2$ (1)

Electronic configuration of $Hg\,(Z = 80)$ is $[Xe]4f^{14}5d^{10}6s^2$

Since Zn, Cd and Hg do not contain partially filled d-orbitals they are normally not considered as transition elements. (1)

25. Preparation of xenon difluoride:

$$\underset{\text{(xenon in excess)}}{Xe\,(g) + F_2\,(g)} \xrightarrow{673\text{K}, 1\text{bar}} XeF_2(s)$$

(1)

Preparation of xenon tetrafluoride:

$$\underset{\text{(1:5 ratio)}}{Xe\,(g) + 2F_2\,(g)} \xrightarrow{873\text{ K}, 7\text{ bar}} XeF_4(s)$$

(1)

Preparation of xenon hexafluoride:

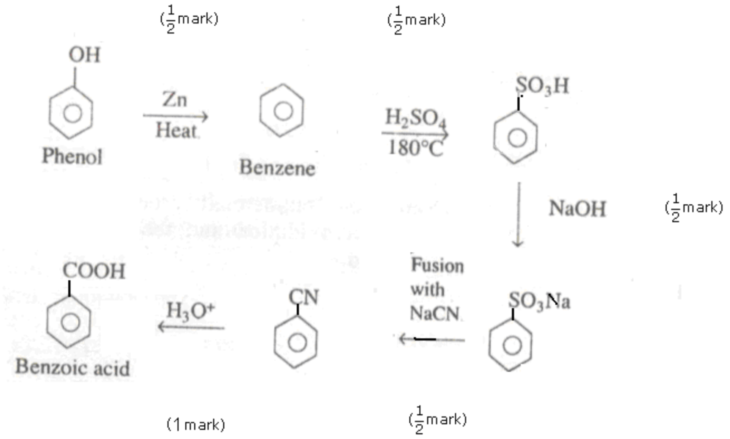
$$\underset{\text{(1:20 ratio)}}{Xe\,(g) + 3F_2\,(g)} \xrightarrow{573\text{ K}, 60\text{–}70\text{bar}} XeF_6(s)$$

(1)

26. DNA molecule can synthesize another DNA molecule identical with the original; this process of duplication is called replication. (1)

S.No.	DNA	RNA
1	It has double stranded structure in which two strands are coiled spirally in opposite directions.	It has single stranded structure (1)
2	The sugar molecule is β -D-2-deoxyribose.	The sugar molecule is β- D-ribose. (1/2)
3	Nitrogenous base uracil is not present.	Nitrogenous base thymine is not present. (1/2)

27.



28

1. Fluorine is the most electronegative element and cannot exhibit positive oxidation state. (1)
2. Due to decrease in bond dissociation enthalpy of (E - H) bond, acidic character increases down the group. (1)
3. Nitrogen does not possess d–subshell. Whereas, phosphorus contains d – subshell and can expand its octet to form PCl_5. (1)
4. Due to small size of S, it cannot easily accommodate six large Cl atoms around it. But six F atoms being small can be easily accommodated. Moreover because of low electronegativity of Cl it cannot cause promotion of electrons in S to form S(VI). (1)
5. HCl reacts with finely divided iron and produces H_2 gas.

$$Fe + 2\,HCl \rightarrow FeCl_3 + H_2 \qquad (\frac{1}{2})$$

Liberation of hydrogen prevents the formation of ferric chloride. $(\frac{1}{2})$

OR

28.

1. $(NH_4)_2Cr_2O_7 \xrightarrow{Heat} N_2 + 4H_2O + Cr_2O_3$ (1)
2. $(NH_4)_2SO_4 + 2NaOH \rightarrow 2NH_3 + 2H_2O + Na_2SO_4$ (1)
3. $3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO(g)$ (1)
4. $P_4 + 20HNO_3(conc.) \rightarrow 4H_3PO_4 + 20NO_2 + 4H_2O$ (1)
5. $PbS(s) + 4O_3(g) \rightarrow PbSO_4(s) + 4O_2(g)$ (1)

29. In experiment 2 and 3 the concentration of A in same. Therefore,

Rate = k $[A]^x [B]^y$

From the experiment 2, $9 \times 10^{-2} = k [0.3]^x [0.2]^y$ .....eqn 1

From the experiment 3, $3.6 \times 10^{-1} = k [0.3]^x [0.4]^y$ ......eqn 2

Dividing equation 2 by equation 1

$$\Rightarrow \frac{3.6 \times 10^{-1}}{9 \times 10^{-2}} = \left[\frac{0.4}{0.2}\right]^y$$

$$\Rightarrow (2)^2 = (2)^y$$

$$\Rightarrow y = 2$$ (1)

Similarly from the experiment 1 and 4,

$$\frac{3 \times 10^{-2}}{7.5 \times 10^{-3}} = \left[\frac{0.4}{0.1}\right]^x$$

$$\therefore \quad 4 = (4)^x$$

$$\therefore \quad (4)^1 = (4)^x$$

$$\therefore \quad x = 1$$ (1)

So, the rate law for the reaction is,

Rate of formation of D = k [A] $[B]^2$ $(\frac{1}{2})$

Substituting the value of experiment 1 in the rate law, we get,

$7.5 \times 10^{-3}\ mol\,L^{-1}\,min^{-1} = k\,[0.1]\ mol\,L^{-1} \times [0.1]^2\ mol^2L^{-2}$

$$\Rightarrow \quad k = \frac{7.5 \times 10^{-3}\ mol\,L^{-1}\,min^{-1}}{0.001\ mol^3L^{-3}}$$

$\Rightarrow \quad k = 7.5\ mol^{-2}\,L^2\ min^{-1}$ (1)

So, the rate of formation of D, when [A] = 0.8 mol /L
and [B] = 0.5 mol /L is

$= k[A]^x[B]^y$

$= 7.5\,mol^{-2} \times L^2 \times min^{-1} \times 0.8\,mol/L \times [0.5\,mol/L]^2$ $(\frac{1}{2})$

$= 1.5\,mol\,L^{-1}\,min^{-1}$ (1)

OR

29.

(a)

For a first order rate equation

$$k = \frac{2.303}{t}\log\frac{a}{a-x}$$ (1)

$$t_{15\%} = \frac{2.303}{k}\log\frac{a}{a-x}$$

$$\therefore\ 20\,min = \frac{2.303}{k}\log\frac{100}{100-15}$$

$$\therefore\quad k = \frac{2.303}{20\,min}\log\frac{20}{17}$$ $(1\frac{1}{2})$

$$\therefore\quad k = 8.12 \times 10^{-3}\ min^{-1}$$

$$t_{60\%} = \frac{2.303}{k}\log\frac{a}{a-x}$$

$$\therefore\quad = \frac{2.303}{k}\log\frac{100}{100-60}$$

$$\therefore\quad = \frac{2.303}{8.12 \times 10^{-3}\ min^{-1}}\log\frac{10}{4}$$

$$\therefore\quad = 112.86\,min$$ $(1\frac{1}{2})$

(b) Rate constant is the rate of the reaction when the concentration of each reaction is unity. Greater is the value of the rate constant, faster is the reaction. (1)

30.

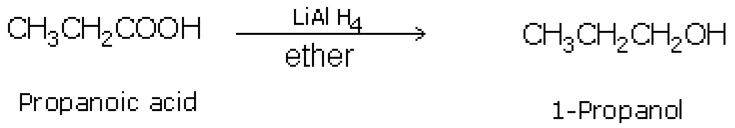
1. In case of aliphatic aldehydes the –CHO group is always present at the end. Therefore they do not show position isomers. (1)
2. The carbon atom of the carbonyl group of benzaldehyde is less electrophilic than carbon atom of the carbonyl group in propanal. This is because the polarity of carbonyl group is decreases in benzaldehyde due to resonance. Therefore benzaldehyde is less reactive than propanal. (1)
3. The carbonyl group in aldehydes and ketones contains a double bond between carbon and oxygen. Since O is more electronegative than C,>C=O group is polarized with O having considerable negative charge and C having considerable positive charge. Hence aldehydes and ketones have dipole moment. (1)
4. Boiling points of aldehydes and ketones are higher than those of hydrocarbons of comparable molecular mass because of dipole-dipole interactions between their respective molecules which are stronger than the dispersion forces existing between molecules of hydrocarbons. (1)
5. Reactivity of aldehydes and ketones towards nucleophilic addition reaction depends on inductive effect and steric effect. As the number of alkyl group increases, due to their electron releasing inductive effect, the positive charge on C of the carbonyl group decreases and hence the tendency of nucleophile to attack the C decreases which eventually decreases reactivity. By steric effect as the number and size of alkyl group increases, hindrance to nucleophilic addition increases which decreases reactivity. So, aldehydes are more reactive towards nucleophillic addition reaction than ketones. (1)

OR

30.

(a)

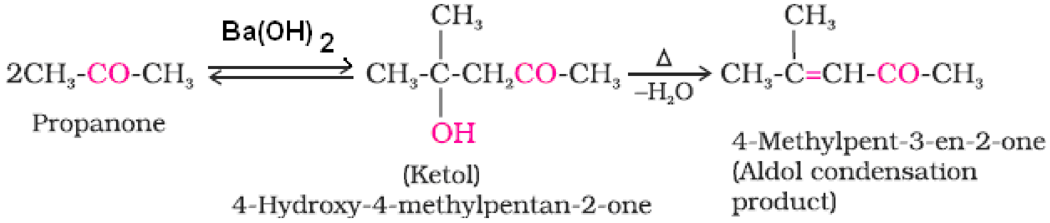
1. Propanoic acid to 1 – propanol



$$CH_3CH_2COOH \xrightarrow[\text{ether}]{LiAlH_4} CH_3CH_2CH_2OH$$

(1)

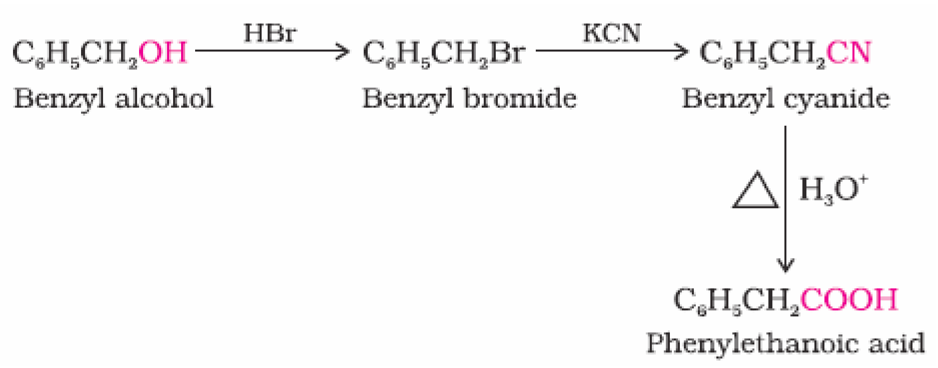
2. Propanone to 4-Methylpent-3-en-2-one



$$2CH_3\text{-}CO\text{-}CH_3 \overset{Ba(OH)_2}{\rightleftharpoons} CH_3\text{-}\overset{CH_3}{\underset{OH}{C}}\text{-}CH_2CO\text{-}CH_3 \xrightarrow[-H_2O]{\Delta} CH_3\text{-}\overset{CH_3}{C}\text{=}CH\text{-}CO\text{-}CH_3$$

(1)

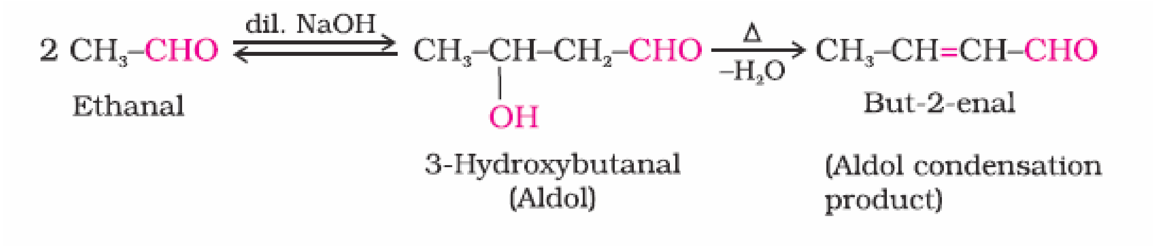
3. Benzyl alcohol to phenylethanoic acid



(1)

(b)

1. Aldehydes and ketones having at least one α -hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form α -hydroxy aldehydes (aldol) or α -hydroxy ketones (ketol), respectively. This is known as **Aldol reaction.** $(\frac{1}{2})$



$$2\,CH_3{-}CHO \underset{}{\overset{\text{dil. NaOH}}{\rightleftharpoons}} CH_3{-}\underset{\substack{|\\ OH}}{CH}{-}CH_2{-}CHO \xrightarrow[-H_2O]{\Delta} CH_3{-}CH{=}CH{-}CHO$$

$(\frac{1}{2})$

2. Carboxylic acids lose carbon dioxide to form hydrocarbons when their sodium salts are heated with sodalime (NaOH and CaO in the ratio of (3 : 1). The reaction is known as decarboxylation reaction. $(\frac{1}{2})$

$$R\text{-}COONa \xrightarrow[\text{Heat}]{\text{NaOH \& CaO}} R\text{-}H + Na_2CO_3$$

$(\frac{1}{2})$