CBSE Board
Class XII Chemistry

Time: 3 Hrs | Total Marks: 70

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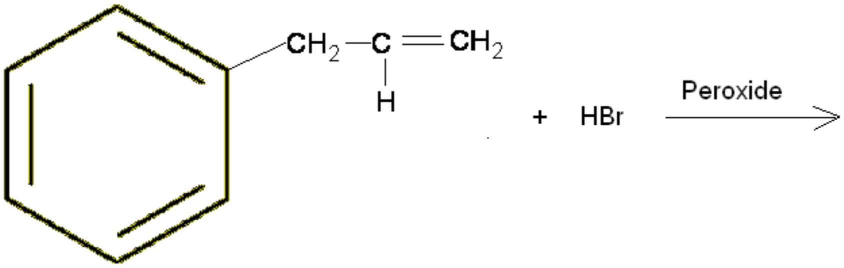
1. All questions are compulsory.
2. Question nos. **1 to 8** are very short answer questions and carry 1 mark each
3. Question nos. **9 to 18** are short answer questions and carry 2 marks each. Use of calculator is not permitted.
4. Question nos. **19 to 27** are also short answer questions and carry 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: What is the type of linkage responsible for the formation of primary structure of proteins?

Q2: Give a chemical test to distinguish between benzaldehyde and acetophenone.

Q3: Write the product of the following reaction:



Q4: A solid has a cubic structure in which X atoms are located at the corners of the cube, Y atoms are at the body centre and O atoms are at all the face centres. What is the formula of the compound?

Q5: Explain why amorphous solids are isotropic.

Q6: Identify the reaction order for the reaction having the rate constant
$k = 1.3 \times 10^{-5}\ Lmol^{-1}s^{-1}$

Q7: For a reaction, A+ B → Product; the rate law is given by
Rate = $k\,[A]^{1/2}\,[B]^{3/2}$. What is the order of the reaction?

Q8: Predict the shape of the compound ClF_3

Q9:If NaCl is doped with 10^{-3} mol% of $SrCl_2$, what is the concentration of cationic vacancies?

Q10: Calculate the equilibrium constant, K for the reaction at 298 K:

$3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$; $E^{\ominus} = 0.885$ V

Q11: Out of sodium chloride and barium chloride which will have a greater coagulation value for As_2S_3 sol? Why?

Q12: Give reasons:-

(a) True solutions do not exhibit Tyndall effect.
(b) Enthalpy of chemisorption is more than that of physisorption.

Q13: Give reasons: -

(a) PH_3 has lower boiling than NH_3. Why?
(b) H_3PO_2 acts as reducing agent.

Or

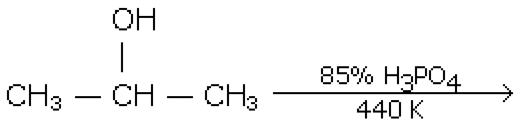
Give reasons: -

(a) Nitrogen exists as diatomic molecule, N_2, whereas phosphorus exists as a tetraatomic molecule P_4.
(b) Noble gases have low heat of vapourisation.

Q14: Complete the following chemical reactions: -

(a) $RCHO + H_2 \xrightarrow{Pd} ?$

(b)



$$CH_3-\overset{\overset{\large OH}{|}}{C}H-CH_3 \xrightarrow[440\ K]{85\%\ H_3PO_4}$$

Q15:Give equations involved in the following reactions: -

(a) Reimer – Tiemann reaction
(b) Kolbe's reaction

Q16: Convert –

(a) Propanoic acid to ethanamine
(b) Aniline to benzoic acid

Q17: Arrange the following in the increasing order of basic strength in gas phase:

$C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$, and NH_3

Give reason.

Q18:What happens when:

(a) White phosphorus is heated with concentrated NaOH solution in an inert atmosphere of CO_2

(b) PCl_5 is heated

Q19: The following data were obtained for the reaction:

$$2\ NO\ (g) + Br_2\ (g) \longrightarrow 2\ NOBr\ (g)$$

Experiment	[NO]	[Br_2]	Initial rate (mol L^{-1} min $^{-1}$)
I	0.10	0.10	1.3×10^{-6}
II	0.20	0.10	5.2×10^{-6}
III	0.20	0.30	1.56×10^{-5}

Determine (a) the order of reaction with respect to NO and Br_2

(b) the rate law and

(c) rate constant

Q20: The molar conductivity of 0.025 molL^{-1} methanoic acid is 46.1Scm^2 mol^{-1}. Calculate its degree of dissociation and dissociation constant. Given $\lambda^\circ_{(H^+)} = 349.6\ S\ cm^2\ mol^{-1}$ and

$\lambda^\circ_{(HCOO^-)} = 54.6\ S\ cm^2\ mol^{-1}$.

Q21:

(a) Name the method used for refining of

i. Nickel

ii. Titanium

(b) The extraction of Au by leaching with NaCN involves both oxidation and reduction. Justify giving equations.

Q 22:

(a) Out of the following which hydride has the largest bond angle? Why?

H_2O, H_2S, H_2Se and H_2Te

(b) Which oxide of sulphur acts as oxidising as well as reducing agent?

(c) SO_3 has zero dipole moment. Why?

Q23: Using valence bond theory, explain the geometry and magnetic behaviour of pentacarbonyliron (0).

Q24: Explain the following terms with suitable examples:

(a) cationic detergents
(b) anionic detergents and
(c) non-ionic detergents

Q25: Is $(—CH_2—CH(C_6H_5—)_n$ a homopolymer or a copolymer? Write the name and formula of its monomer/s. Is it an addition polymer or a condensation polymer?

Q26: What happens when D – glucose is treated with the following reagents?

(a) HI
(b) Bromine water
(c) HNO_3

Q27: How will you bring the following conversions?

(a) Toluene to benzyl alcohol
(b) Ethanol to ethyl fluoride
(c) Benzene to biphenyl

Or

(a) $C_6H_5O^-Na^+ + C_2H_5Cl \longrightarrow$
(b) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}}$
(c) $CH_3CH = C(CH_3)_2 + HBr \longrightarrow$

Q28: 45 g of ethylene glycol ($C_2H_6O_2$) is mixed with 600 g of water. Calculate

(a) Freezing point depression
(b) The freezing point of the solution
(K_f for water = 1.86 K kg mol^{-1})

Or

Calculate the osmotic pressure of a solution obtained by mixing 100mL of 3.4 percent solution of urea (mol mass = 60) and 100mL of 1.6 percent solution of cane sugar (mol mass = 342) at 293 K. R = 0.083 L bar mol^{-1} K^{-1}

Q29:

(a) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.
(b) Actinoid contraction is greater from element to element than lanthanoid contraction. Why?
(c) Which is the last element in the series of the actinoids? Write the electronic configuration of this element. Comment on the possible oxidation state of this element.
(d) Which out of $Lu(OH)_3$ and $La(OH)_3$ more basic and why?

Or

(a) Why do Zr and Hf exhibit similar properties?

(b) What is the basic difference between the electronic configuration of transition and inner transition elements?

(c) What is meant by ‘disproportionation’? Give one example.

Q30: An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but – 1 –ene. Write equations for the reactions involved.

Or

(a) Arrange the following compounds in increasing order of their property as indicated:

Benzoic acid, 4 – Nitro benzoic acid, 3, 4 – Dinitrobenzoic acid,
4 – Methoxybenzoic acid (acid strength)

(b) Give simple chemical tests to distinguish between the following pairs of compounds.

i. Propanal and Propanone
ii. Benzoic acid and Ethyl benzoate

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XII Chemistry
Solution

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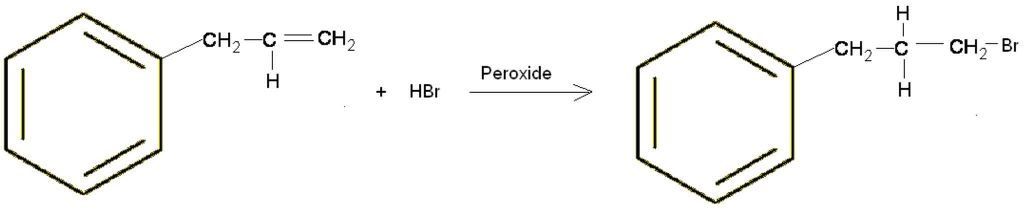
Solution

Ans 1. Primary structure of proteins arises due to peptide bonds (-CO-NH- bonds) between various constituent of amino acids. (1)

Ans 2. Iodoform test can be used to distinguish between benzaldehyde and acetophenone.
Benzaldehyde (C_6H_5CHO) will not give iodoform test.
Acetophenone on reacting with NaOI gives yellow ppt.

$$\underset{\text{Acetophenone}}{C_6H_5COCH_3} + 3I_2 + 4NaOH \rightarrow \underset{\text{Iodoform}}{CHI_3} + C_6H_5COONa + 3NaI + 3H_2O \quad \left(\frac{1}{2}\right)$$

Ans 3.



(1)

Ans 4. Number of X atoms per unit cell = $8 \times \frac{1}{8} = 1 \text{ atom}$

Number of Y atoms per unit cell = 1 x 1 = 1 atom

Number of O atoms per unit cell = $6 \times \frac{1}{2} = 3 \text{ atoms}$

Thus, the formula of the compound = XYO_3 (1)

Ans 5. Because the arrangement of particles is irregular in all directions. (1)

Ans 6. Second order reaction (1)

Ans 7. Order of reaction = $\frac{1}{2} + \frac{3}{2} = 2$ (1)

Ans 8. Bent T- shape (1)

Ans 9. Introduction of one Sr^{2+} introduces a cationic vacancy because one Sr^{2+} replaces two Na^+ ions.
Therefore, introduction of 10^{-3} moles of $SrCl_2$ per 100 moles of NaCl would introduce 10^{-3}
mole cation vacancies in 100 moles of NaCl. (1)

Number of vacancies per mole of NaCl

$= \frac{10^{-3}}{100} = 10^{-5}$ mole vacancies $(\frac{1}{2})$

$= 10^{-5} \times 6.02 \times 10^{23}$ vacancies

$= 6.02 \times 10^{18}$ vacancies $(\frac{1}{2})$

Ans 10.

$3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$

$E^{\theta} = 0.885$ V

$n = 6$ $(\frac{1}{2})$

$E^{\theta}_{cell} = \frac{0.059}{n} \log K_c$ $(\frac{1}{2})$

$0.885 = \frac{0.059}{6} \log K_c$

$\log K_c = 90$ $(\frac{1}{2})$

$K_c = \text{Antilog}(90)$

$= 1.0 \times 10^{90}$ $(\frac{1}{2})$

Ans 11.

Greater the valence of the flocculating ion added, the greater is its power to cause precipitation. (1)

As_2S_3 sol is negatively charged. $BaCl_2$ has Ba^{2+} cation and NaCl has Na^+ cation. So, $BaCl_2$ will have a higher coagulating value. (1)

Ans 12.

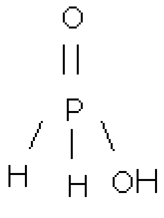
a. The size of the particles of a true solution is too small to cause scattering. (1)

b. Chemisorption involves formation of chemical bonds which are relatively stronger than van der Waals forces existing in physisorption. Hence, energy released during chemisorption is more than energy released during physisorption. (1)

Ans 13.

(a) In NH_3, nitrogen atom is small in size and has high electronegativity. So, it has hydrogen bonding. On the other hand, PH_3 molecules are not associated through H – bonding because of larger size of phosphorus. (1)

(b) H_3PO_2 has two P – H bond. Because of two P-H bonds, H_3PO_2 has reducing character. $(\frac{1}{2})$



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

OR

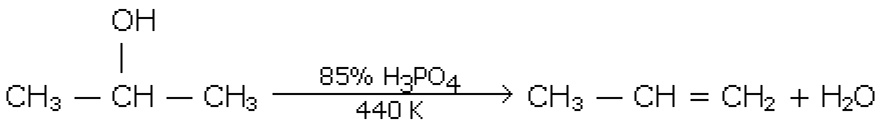
a. Nitrogen has unique ability to form $p\pi - p\pi$ multiple bond because of its small size and high electronegativity . Phosphorus do not form $p\pi - p\pi$ multiple bond as their atomic orbitals are large and diffuse that they cannot have effective overlapping. (1)

b. Noble gases have weak intermolecular van der Waals forces between them. (1)

Ans 14.

(a) $RCHO + H_2 \xrightarrow{Pd} RCH_2OH$ (1)

(b)

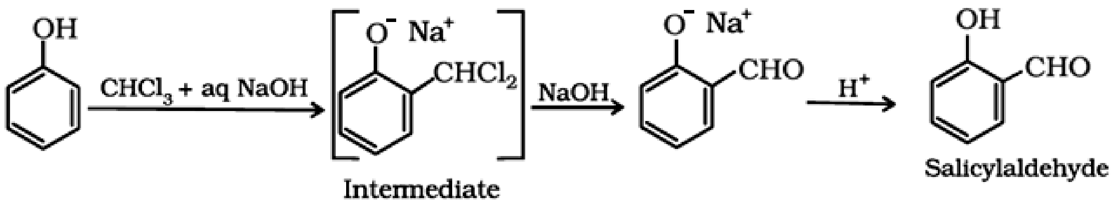


$$CH_3 - \overset{\overset{\displaystyle OH}{|}}{C}H - CH_3 \xrightarrow[440\,K]{85\%\ H_3PO_4} CH_3 - CH = CH_2 + H_2O$$

(1)

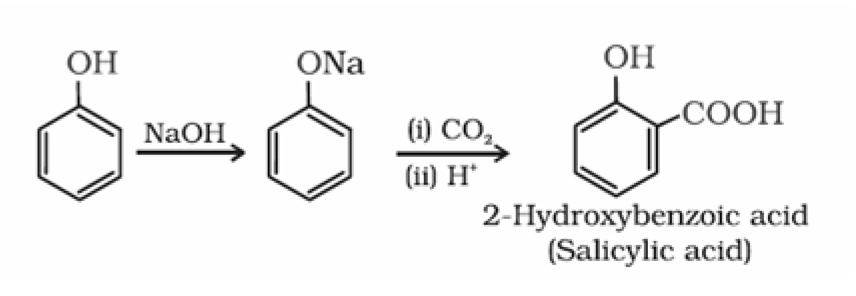
Ans 15.

a. Reimer – Tiemann reaction –



(1)

b. Kolbe's reaction-



(1)

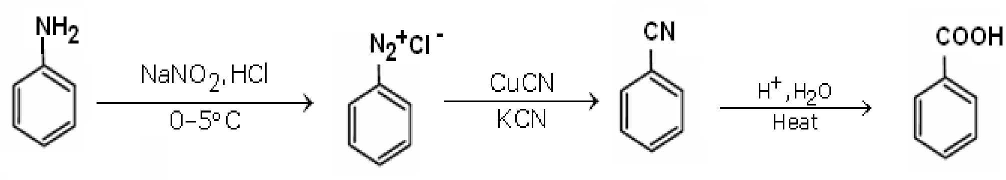
Ans 16.

(a) $CH_3CH_2COOH \xrightarrow{SOCl_2} CH_3CH_2COCl \xrightarrow{NH_3} CH_3CH_2CONH_2$

$\downarrow Br_2, NaOH$

$CH_3CH_2NH_2$ (1)

(b)



(1)

Ans 17.

$NH_3 < C_2H_5NH_2 < (C_2H_5)_2NH < (C_2H_5)_3N$ (1)

Ethyl group has electron releasing inductive effect or +I effect. As the number of ethyl group increases, the basicity increases. (1)

Ans 18.

(a) Phosphine is formed

$$P_4 + 3NaOH + 3H_2O \xrightarrow{Heat} \underset{\text{Phosphine}}{PH_3} + \underset{\text{Sodium hypophosphite}}{3NaH_2PO_2}$$ (1)

(b) On heating, PCl_5 first sublimes and then decomposes on strong heating.

$$PCl_5 \xrightarrow{Heat} PCl_3 + Cl_2$$ (1)

Ans 19.

The rate law may be written as:

Rate = k $[NO]^p [Br_2]^q$

The initial rate becomes

$(Rate)_0 = k[NO]^p[Br_2]^q$

Comparing experiment I and II, we get

$(Rate)_1 = k(0.1)^p (0.1)^q = 1.3 \times 10^{-6}$ ....(i)

$(Rate)_2 = k(0.2)^p (0.1)^q = 5.2 \times 10^{-6}$ ....(ii)

Dividing Eq. (ii) by eq. (i)

$$\frac{(Rate)_2}{(Rate)_1} = \frac{k(0.2)^p(0.1)^q}{k(0.1)^p(0.1)^q} = \frac{5.2 \times 10^{-6}}{1.3 \times 10^{-6}}$$

$(2)^p = 4$

$(2)^p = 2^2$

$\therefore$ p = 2

Thus, order with respect to NO is 2. $(\frac{1}{2})$

Comparing experiments II and III

$(\text{Rate})_2 = k(0.2)^p\,(0.1)^q = 5.2 \times 10^{-6}$ .....(iii)

$(\text{Rate})_1 = k(0.2)^p\,(0.3)^q = 1.56 \times 10^{-5}$ .....(iv)

Dividing Eq. (iv) by Eq. (iii), we get:

$$\frac{k(0.2)^p(0.3)^q}{k(0.2)^p(0.1)^q} = \frac{1.56 \times 10^{-5}}{5.2 \times 10^{-6}}$$

Or, $(3)^p = 3$

Or, $q = 1$

Thus, order with respect to Br_2 is 1. $(\frac{1}{2})$

(ii) The rate law for the reaction

Rate = $k[NO]^2\,[Br_2]$ $(\frac{1}{2})$

(iii) Rate constant can be calculated by substituting the values of rate, [NO] and $[Br_2]$ for any experiment.

From equation (i),

$$k = \frac{\text{Rate}}{[NO]^2[Br_2]} = \frac{1.3 \times 10^{-6}}{(0.1)^2 \times (0.1)}$$

$= 1.3 \times 10^{-3}\ \text{mol}^{-2}\ \text{L}^2\ \text{s}^{-1}$ $(\frac{1}{2})$

Ans 20. $\Lambda^o_{m\,(HCOOH)} = \lambda^o_{(H^+)} + \lambda^o_{(HCOO^-)}$ $(\frac{1}{2})$

$= 349.6 + 54.6$

$= 404.2\ \text{S cm}^2\ \text{mol}^{-1}$ $(\frac{1}{2})$

$\alpha = \frac{\Lambda^c_m}{\Lambda^0_m} = \frac{46.1}{404.2}$ $(\frac{1}{2})$

$= 0.114$ $(\frac{1}{2})$

$K_c = \frac{c\alpha^2}{1-\alpha}$ $(\frac{1}{2})$

$$= \frac{0.025 \times (0.114)^2}{1 - 0.114}$$

$= 3.67 \times 10^{-4}$ $(\frac{1}{2})$

Ans 21.

(a)

(i) Mond's process $(\frac{1}{2})$

(ii) Van Arkel method $(\frac{1}{2})$

(b) Gold is leached by dilute solution of NaCN in the presence of air (O_2) from which the metal is obtained later by replacement by zinc.

$$4\,Au(s) + 8\,CN^-(aq) + 2\,H_2O(l) + O_2(g) \longrightarrow 4\left[Au(CN)_2\right]^-(aq) + 4\,OH^-$$

$$2\left[Au(CN)_2\right]^-(aq) + Zn(s) \longrightarrow \left[Zn(CN)_4\right]^{2-}(aq) + 2\,Au(s)$$

(1)

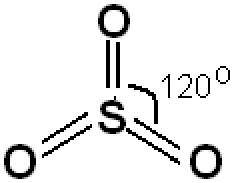
The first step involves oxidation while the second step involves reduction. (1)
Therefore, this process involves both oxidation and reduction.

Ans 22.

(a) H_2O has the largest bond angle. Oxygen has the smallest size among the group 16 elements and the highest electronegativity. Therefore, the bond pair of electrons is closest to the oxygen atom. As a result the force of repulsion between the bond pairs of electrons is the highest in H_2O. Hence, the bond angle is the largest in H_2O. (1)

(b) Sulphur dioxide (SO_2) acts as oxidising as well as reducing agent. (1)

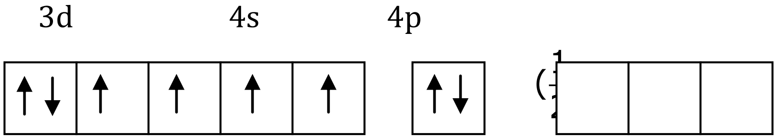
(c) In the gaseous state, SO_3 has trigonal planar structure with O=S=O bond angles of 120° each. Therefore, individual S=O dipole moment cancel each other and resultant dipole moment is zero. (1)



Ans 23.

In this case $Fe(CO)_5$, iron is in 0 oxidation state and has the electronic configuration $3d^6\,4s^2$.

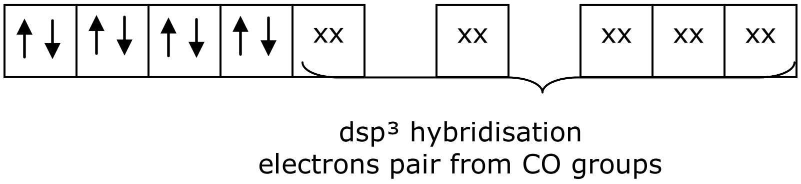
Fe (Z = 26)



In $Fe(CO)_5$ all the d– electrons get paired up leaving one empty orbital and the two electrons from 4s – orbital shift to 3d – orbitals. Thus, $Fe(CO)_5$ involves dsp^3 hybridisation resulting in trigonal bipyramidal geometry. (1)

$Fe(CO)_5$ is diamagnetic since all the electrons are paired. (1)

$Fe(CO)_5$



dsp³ hybridisation
electrons pair from CO groups

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

Ans 24.

(a) In the refinery / petrochemical industry hydrogen gas is evolved as a bi-product. Hence to recycle this hydrogen a fertilizer unit is established nearby. (2)

(b) Recycling of industrial waste keeps the environment clean. (1)

Ans 25.

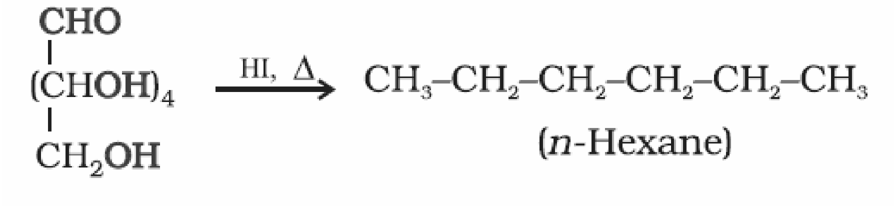
It is a homopolymer. (1)

Its monomer is styrene ($C_6H_5CH = CH_2$). (1)

Since the monomer contains a double bond, it forms an addition polymer. (1)

Ans 26.

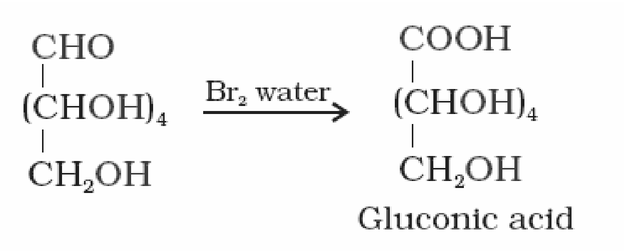
(a) When glucose is treated with HI, it forms n – hexane, suggesting that all the six carbon atoms are linked in a straight chain.



$$\begin{array}{c} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow{HI,\ \Delta} \underset{(n\text{-Hexane})}{CH_3{-}CH_2{-}CH_2{-}CH_2{-}CH_2{-}CH_3}$$

(1)

(b) On heating glucose with bromine water, it gets oxidized to six carbon carboxylic acid, gluconic acid.

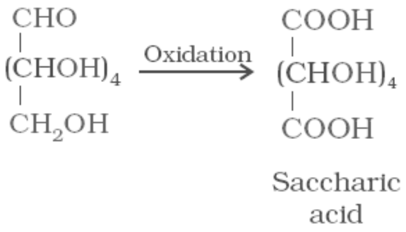


$$\begin{array}{c}\mathrm{CHO}\\ |\\ \mathrm{(CHOH)_4}\\ |\\ \mathrm{CH_2OH}\end{array} \xrightarrow{\mathrm{Br_2\ water}} \begin{array}{c}\mathrm{COOH}\\ |\\ \mathrm{(CHOH)_4}\\ |\\ \mathrm{CH_2OH}\end{array}$$

Gluconic acid

(1)

(c) Glucose on treatment with nitric acid gives a dicarboxylic acid, saccharic acid.



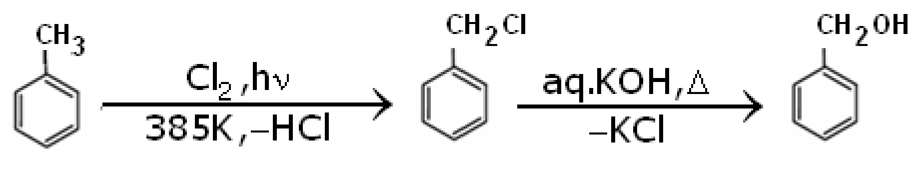
$$\begin{array}{c}\mathrm{CHO}\\ |\\ \mathrm{(CHOH)_4}\\ |\\ \mathrm{CH_2OH}\end{array} \xrightarrow{\mathrm{Oxidation}} \begin{array}{c}\mathrm{COOH}\\ |\\ \mathrm{(CHOH)_4}\\ |\\ \mathrm{COOH}\end{array}$$

Saccharic acid

(1

Ans 27.

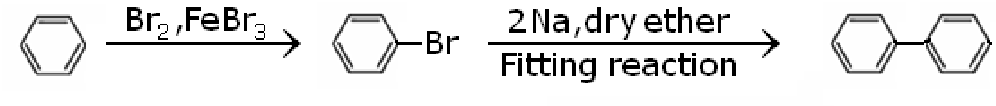
(a)



(1)

(b) $\underset{\text{Ethanol}}{\mathrm{CH_3CH_2OH}} \xrightarrow[-\mathrm{SO_2},\,-\mathrm{HCl}]{\mathrm{SOCl_2.py}} \mathrm{CH_3CH_2Cl} \xrightarrow[-\mathrm{Hg_2Cl_2}]{\mathrm{Hg_2F_2}} \underset{\text{Ethyl flouride}}{\mathrm{CH_3CH_2F}}$ (1)

(c)



(1)

OR

(a) $$\underset{\text{Sodium phenoxide}}{C_6H_5O^-Na^+} + C_2H_5Cl \xrightarrow[\text{Synthesis}]{\text{Williamson's}} C_6H_5OCH_2CH_3 + NaCl$$ (1)

(b) $$CH_3CH_2CH=CH_2 + HBr \xrightarrow{\text{Peroxide}} \underset{\text{1 – Bromobutane}}{CH_3CH_2CH_2CH_2Br}$$ (1)

$$CH_3CH=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_3 + HBr \xrightarrow{\text{Markovnikov's rule}} CH_3CH_2-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle Br}{\underset{|}{C}}}}-CH_3$$

2 – Bromo – 2 – methylbutane

(c)

(1)

Ans 28.

(a) $$\Delta T_f = \frac{K_f \times w_B \times 1000}{w_A \times M_B}$$ (1)

w_A = 600 g

w_B = 45 g

K_f = 1.86 K kg mol^{-1}

M_B = 2 x 12 + 6 x 1 + 2 x 16 = 62 mol^{-1}

$$\therefore \quad \Delta T_f = \frac{1.86 \times 45 \times 1000}{600 \times 62}$$

$$= 2.25 \text{ K}$$ (1)

(1 mark for calculations)

∴ Freezing point depression = 2.25 K

(b) Freezing point of aqueous solution = 273.15 – 2.25 (1)

= 270.90 K

(1)

OR

After mixing the volume of the solution = 200mL

(i) Osmotic pressure of urea

w_B = 3.4 g. V = 200mL = 0.2 L, T = 293 K

M_B = 60, R = 0.083 L bar mol^{-1} K^{-1}

$$\pi = \frac{w_B RT}{M_B V}$$

(1)

$$\text{Or,} \quad \pi = \frac{3.4 \times 0.083 \times 293}{60 \times 0.2} = 6.89 \text{ bar}$$

(1)

(1 mark for calculations)

(ii) Osmotic pressure of cane sugar

$w_B = 1.6$ g, $V = 200$mL $= 0.2$ L, $T = 293$ K, $M_B = 342$, $R = 0.083$ L bar mol^{-1} K^{-1}

$$\pi = \frac{w_B RT}{M_B V}$$

$$\text{Or,} \quad \pi = \frac{1.6 \times 0.083 \times 293}{342 \times 0.2} = 0.57 \text{ bar}$$

(1)

Since the dilute solutions behave like ideal gases, the total osmotic pressure will be equal to the sum of the partial osmotic pressure.

$\pi = 6.89 + 0.57 = 7.46$ bar (1)

Ans 29.

(a) Cerium (Z = 58) exhibits +4 oxidation state. (1)

(b) This is because of relatively poor shielding by 5f electrons in actinoids in comparison with shielding of 4f electrons in lanthanoids. (1)

(c) Last actinoid is lawrencium (Z= 103) $(\frac{1}{2})$

Electronic configuration: $[Rn]^{86}\, 5f^{14}\, 6d^1\, 7s^2$ (1)

Possible oxidation state: + 3 $(\frac{1}{2})$

(d) $La(OH)_3$ is more basic than $Lu(OH)_3$. $(\frac{1}{2})$

Due to lanthanoid contraction the size of lanthanoid ions decreases regularly with increase in atomic size. As a result of decrease in size, their covalent character between lanthanoid ion and OH^- ions increases from La^{3+} to Lu^{3+}. Therefore, the basic character of hydroxides decreases from $La(OH)_3$ to $Lu(OH)_3$. $(\frac{1}{2})$

Or

(a) Due to lanthanoid contraction, Hf and Zr have almost similar size and therefore, their properties are similar. (1)

(b) Transition elements have general electronic configuration: $(n-1)\ d^{1-10}ns^{1-2}$ while inner transition elements have the general electronic configuration $(n-2)\ f^{1-14}\ (n-1)\ d^{0-1}\ ns^2$. (1)

(c) Thus, in transition elements the last electron enters d orbital of penultimate (n–1) shell while in inner transition elements the last electron enters the (n–2) shell.

(d) Disproportion reactions are those reactions in which the same substance gets oxidized as well as reduced. (1)

(e) For example: $3Mn^{VI}O_4^{2-} + 4H^+ \longrightarrow 2Mn^{VII}O_4^{-} + Mn^{IV}O_2 + 2\ 2H_2O$ (1)

Ans 30.

Since the given compound on hydrolysis with dil. H_2SO_4 gives carboxylic acid (B) and an alcohol (C), it must be an ester. $(\frac{1}{2})$

Also, the oxidation of alcohol C gives carboxylic acid B, so both the carboxylic acid and alcohol contains the same number of carbon atoms. $(\frac{1}{2})$

Alcohol C on dehydration gives but-1-ene. So, the carboxylic acid B and alcohol C both contain 4 carbon atoms. $(\frac{1}{2})$

Alcohol C on dehydration gives but-1-ene and therefore, C must be a straight chain alcohol, i.e., butan-1-ol. $(\frac{1}{2})$

This also suggests that the ester A must be butyl butanoate.
The reactions are:

$$\underset{\substack{\text{A}\\ \text{Butyl butanoate}\\ (\text{M.F.}C_8H_{16}O_2)}}{CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3} \xrightarrow[\text{Hydrolysis}]{\text{dil. } H_2SO_4} \underset{\substack{\text{B}\\ \text{Butanoic acid}}}{CH_3CH_2CH_2COOH} + \underset{\substack{\text{C}\\ \text{Butan}-1-\text{ol}}}{CH_3CH_2CH_2CH_2OH} \quad (1)$$

$$\underset{\text{B}}{CH_3CH_2CH_2CH_2OH} \xrightarrow[\text{Oxidation}]{CrO_3\,/\,CH_3COOH} \underset{\text{C}}{CH_3CH_2CH_2COOH} \quad (1)$$

$$\underset{\text{B}}{CH_3CH_2CH_2CH_2OH} \xrightarrow{\text{Dehydration}} \underset{\text{But}-1-\text{ene}}{CH_3CH_2CH = CH_2} \quad (1)$$

OR

(a) Electron donating groups decrease the acid strength and therefore, 4 – methoxy benzoic acid is a weaker acid than benzoic acid. (1)
Since electron withdrawing groups increase the acid strength, therefore both 4 – nitrobenzoic acid and 3, 4 – dinitrobenzoic acid are stronger acids than benzoic acid. Further because of the presence of an additional $-NO_2$ group at meta position w.r.t –COOH group, 3, 4- dinitrobenzoic acid is a stronger acid than 4 – nitrobenzoic acid. (1)

Thus, the increasing order of acid strength is
4- methoxy benzoic acid < benzoic acid < 4 – nitrobenzoic acid
< 3, 4 – dinitrobenzoic acid

(1)

(b)

(i) Propanal is an aldehyde and therefore gives silver mirror with Tollen's reagent. $(\frac{1}{2})$

$$CH_3CHO + 2\left[Ag(NH_3)_2\right]^+ + 3OH^- \longrightarrow CH_3COO^- + 4NH_3 + \underset{\text{Silver mirror}}{2Ag} + 2H_2O \quad (\frac{1}{2})$$

Propanone is a ketone and therefore does not give silver mirror with Tollen's reagent.

(ii) Benzoic acid and ethyl benzoate

When treated with NaHCO3 solution, benzoic acid gives brisk effervescence while ethyl benzoate does not. $(\frac{1}{2})$

$$C_6H_5COOH + NaHCO_3 \longrightarrow C_6H_5COONa + CO_2\uparrow + H_2O$$

$$C_6H_5COOC_2H_5 + NaHCO_3 \longrightarrow \text{No effervescence of } CO_2 \quad (\frac{1}{2})$$