QUESTIONS BASED ON HIGH ORDER THINKING SKILL

UNIT-1

SOLID STATE

1 MARK QUESTIONS

Q. 1. Name a liquefied metal which expands on solidification.

Ans. Gallium (Ga) is a silvery white metal, liquid at room temp. It expands by 3.1% on solidifica-tion.

Q. 2. How many number of molecules per unit cell which crystallizes in the form of end face centred (monoclinic) lattice with a molecule at each lattice.

Ans. 2.

Q. 3. What is the coordination number of carbon, in diamond ?

Ans. 4 and its unit cell has 8 atoms.
[The space lattice of diamond is FCC]

Q. 4. Name the solid which has weakest intermolecular force ?

Ans. Ice

Q. 5. Arrange the following types of interactions in correct order of their increasing strength :
Covalent, hydrogen bonding, Vander Waals, dipole dipole

Ans. Vander Waals < dipole dipole < hydrogen bonding < covalent.

Q. 6. Give reason for the appearance of colour in alkali metal halides.

Ans. Due to F-centres.

Q. 7. Which type of defect occur in Ag Br ?

Ans. Schottky defect and Frekel defect.

Q. 8. Give one example of doping which produces p-type of semi-conductors.

Ans. Ge doped with Al.

Q. 9. Out of (a) Graphite and (b) Carborundum which one is harder ?

Ans. Carborundum.

Q. 10. How can a material be made amorphous ?

Ans. By melting the material and by cooling it rapidly.

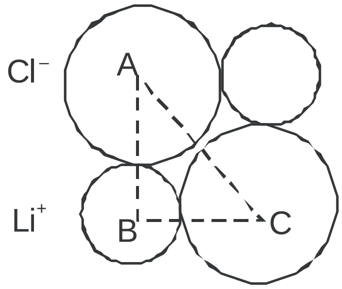
2 MARKS QUESTIONS

Q. 1. Give Reason :
The energy required to vaporize one mol of copper is smaller than that of energy required to vaporize 1 mol of diamond.

Ans. Copper is a metallic solid having metallic bonds while diamond is a covalent solid having covalent bonds. Metallic bonds are weaker than covalent bonds and thus less amount of energy is required to break metallic bonds than covalent bonds.

Q. 2. The unit cube length for LiCl (NaCl) is 5.14 °A. Assuming anion-anion contact. Calculate the ionic radius for Chloride ion.

Ans.



Interionic distance of LiCl = 5.14 / 2 = 2.57 A

AC $= \sqrt{AB^2 + BC^2}$

$= \sqrt{2.57^2 + 2.57^2}$

$= 3.63$

therefore, radius of Cl^- = ½ × 3.63 = 1.81 A

Q. 3. Give reasons :

(a) Diamond and rhombic Sulphur are covalent solids, but the latter has lower melting points.

(b) Among NaCl and CsCl, CsCl is quite stable.

Ans. (a) Due to weak Vander Waal's Force in Sulphur molecule.

(b) CsCl coordination number is 8. It is surrounded by 8 anion tightly.

Q. 4. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1 gm ?

Ans. Mass of 1 unit cell = volume × density

$= a^3 \times d$

$= \frac{a^3 \times M \times Z}{N^0 a^3}$

$= \frac{58.5 \times 4}{6.023 \times 10^{23}}$

No. of unit cells in 1 gm = 1/M

$= 6.023 \times 10^{23} / 58.5 \times 4$

$= 2.57 \times 10^{21}$

Q. 5. In the mineral spinal; having the formula $MgAl_2O_4$. The oxide ions are arranged in CCP, Mg^{2+} ions occupy the tetrahedral voids. While Al^{3+} ions occupy the octahedral voids.

(i) What percentage of tetrahedral voids is occupied by Mg^{2+} ions ?

(ii) What percentage of octahedral voids is occupied by Al^{3+} ions ?

Ans. According to the formula, $MgAl_2O_4$. If there are 4 oxide ions, there will be 1 Mg^{2+} ions and 2 Al^{3+}. But if the 4 O^{2-} ions are ccp in arrangement, there will be 4 octahedral and 8 tetrahedral voids.

(i) Percentage of tetrahedral voids occupied by Mg^{2+} = (1 / 8) × 100

= 12.5%

(ii) Percentage of octahedral voids occupied by Al^{3+} = (2 / 4) × 100

= 50%

Q. 6. Give reasons :

(a) Window glass of old building look milky.

b) Window glass of old building is thick at bottom.

(c) $CaCl_2$ will introduce Schottky defect if added to AgCl crystal.

Ans. (a) Due to annealing over a number of years glass acquires some crystalline character.

(b) Glass is not a true solid. But a super-cooled liquid of high viscosity. It has the property to flow.

(c) 2 Ag^+ will be replaced by 1 Ca^{2+} ions to maintain electrical neutrality. Thus a hole is created and lattice site for every Ca^{2+} ion introduced.

Q. 7. Analysis shows that nickel oxide has the formula $NiO_{.98}O_{1.00}$. What fractions of nickel exist as Ni^{2+} and Ni^{3+} ions ?

Ans. $NiO_{.98}O_{1.00}$

Let Ni^{2+} be x and Ni^{3+} be 0.98 – x

Total charge on compd. is equal to zero.

$[2 (Ni^{2+}) + 3 (Ni^{3+}) - 2 (O^{2-})] = 0$

$2x + 3(0.98 - x) - 2 = 0$

$x = 0.94$

Therefore $Ni^{2+}\ \% = \frac{0.94}{0.98} \times 100 = 96\%$

$Ni^{3+} = 4\%$

Q. 8. What type of defect can arise when a solid is heated ? Which physical property is affected by this and in what way ?

Ans. When a solid is heated vacancy defect arises. This is because on heating some atoms or ions leacve the lattice site completely some lattice sites are vacant. As a result of this defect the density of the substance decreases, because some atoms leave the structure completely.

Q. 9. (a) What happens when a Ferromagnetic or Ferrimagnetic solid is heated ?

(b) The ions of MgO and NaF all have the same number of electrons and intermolecular distance are about the same (235 & 215 pm). Why are the melting points are so different (2642 °C & 992 °C ?

Ans. (a) It changes into paramagnetic at hight temperature due to randomization of spins.

(b) The ions in MgO carry two unit charges. In NaCl only one unit charge. Hence electrostatic forces of attraction in MgO are stronger.

Q. 10. (a) If the radius of the Br ion is 0.182 nm, how large a cation can fit in each of the tetrahedral hole.

(b) AgI crystallizes in a cubic closed packed ZnS structure. What fraction of tetrahedral site is occupied by Ag ion ?

(c) At what temp. range, most of the metals becomes super conductors ?

Ans. (a) For a tetrahedron the limiting ratio is 0.225 – 0.414

For largest cation highest value 0.414 would be considered.

$r^+ / r^- = 0.414$

$r^+ = 0.414 \times 0.182 = 0.075$ nm.

(b) In FCC there are 8 tetrahedral voids. Out of this ½ is occupied by Ag cation.

(c) 2 k – 5 k.

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UNIT—2

SOLUTION

1 MARK QUESTIONS

Q. 1. The vapour pressure of deliquescent substance is less or more than that of water vapours in air ?

Ans. Less than that of water vapours in air.

Q. 2. If α is the degree of dissociation of Na_2SO_4 then write the Vant Hoff factor used for calculating the molecular mass.

Ans. $\alpha = i - 1 / m - 1$

$\alpha (m - 1) = i - 1$

$1 + \alpha (m - 1) = i$

$i = 1 + \alpha (3 - 1)$

$= 1 + 2 \alpha$.

Q. 3. If 6.023×10^{20} molecules of urea are present in 100 ml of its soln. then what is the conc. of urea soln. ?

Ans. $N_0 = 6.023 \times 10^{23}$ = 1 mol

6.023×10^{20} molecules = 0.001 mol in 10 ml

$$M = \frac{N \times 1000}{v} = \frac{.001 \times 1000}{10 \times 1000}$$

= 0.01 M.

Q. 4. Why camphor is used in molecular mass determination ?

Ans. Because it has very high cryoscopic constant.

It has large depression in m. p. when an organic solute is dissolved in it.

Q. 5. 0.004 M soln of Na_2SO_4 is isotonic with 0.01 M soln of glucose at the temp. What is the apparent degree of dissociation of Na_2SO_4 ?

Ans. 75%

Q. 6. What happen when mango is placed in dilute aqueous soln of HCl ?

Ans. When mango is placed in dilute aqueous soln. of HCl it swells.

Q. 7. Out of (a) 200 ml of 2 M NaCl Soln and (b) 200 ml of 1 M glucose Soln. which one has higher osmotic pressure ?

Ans. (a) 200 ml of 2 M NaCl Soln.

NaCl is an electrolyte which dissolve to give ions. Glucose and urea are non electrolytes. Thus glucose has minimum conc. and hence minimum osmotic pressure.

Q. 8. Out of (a) 0.01 M KNO_3 (b) 0.01 M Na_2SO_4 which aqueous soln. will exhibit high B. P. ?

Ans. (a) 0.01 M Na_2SO_4

Q. 9. Out of (a) 1 M $CaCl_2$ (b) 1 M $AlCl_3$ which aqueous soln. will show max. vapour pressure at 300 K ?

Ans. (a) 1 M $CaCl_3$, if we assume 100% dissociation, i for $CaCl_2$ = 3 and $AlCl_3$ = 4 and relative lowering of V. P. is directly proportional to i.

Q. 10. Out of (a) $HNO_3 + H_2O$ and (b) $C_6H_6 + C_6H_5CH_3$ which will form max. boiling azeotrope ?

Ans. (a) $HNO_3 + H_2O$.

2 MARKS QUESTIONS

Q. 1. Two solns of a substance (non-electrolyte) are mixed in the following manner – 480 ml of 1.5 M (First Soln) + 520 ml of 1.2 M (Second Soln). What is the molarity of the final mixture ?

Ans. Total molarity $= \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

$$= \frac{1.5 \times 480 + 1.2 \times 520}{480 + 520} = 1.344 \text{ M}$$

Q. 2. To get the hard boiled eggs, why common salt is added to water before boiling the eggs ?

Ans. Due to addition of common salt the B. P. of the salt containing water elevated, hence the egg at high temp. becomes hard.

Q. 3. Equimolal Soln of NaCl and $BaCl_2$ are prepared in H_2O. B. F. pt. of NaCl is found to be – 2 °C. What freezing point do you expect from $BaCl_2$ soln ?

Ans. i for NaCl = 2 i for $BaCl_2$ = 3

$$\frac{\Delta T_F(\text{NaCl})}{\Delta T_F(\text{BaCl}_2)} = \frac{2}{3}$$

Therefore ΔT_F ($BaCl_2$) = $\frac{3 \times 2}{2} = 3$

ΔT_F for $BaCl_2$ = 3 °C

T_F = – 3 °C.

Q. 4. Why water cannot be separated completely from ethyl alcohol by fractional distillation ?

Ans. Ethyl alcohol and water (95.4% ethyl alcohol and 4.6% water) form constant boiling mixture (azeotrope) boiling at 351.1 °K. Hence, further water cannot be separated completely from ethyl alcohol by fractional distillation.

Q. 5. Why a person suffering from high blood pressure is advised to take minimum quantity of common salt ?

Ans. Osmotic pressure is directly proportional to the conc. of solutes. Our body fluid contain a number of solutes. On taking large amount of salts, ions enter the body fluid there by raising the conc. of the solutes. As a result osmotic pressure increases which may rapture the blood cells.

Q. 6. Chloro acetic acid is a monoprotic acid and has $K_a = 1.36 \times 10^{-3}$. Calculate b. p. of 0.01 M aqueous soln ? (K_b = 0.51 k kg/mol)

Ans. K_b = 0.51 k kg/mol

$\alpha = K_a / C$

$= 1.36 \times 10^{-3} / 0.01$

$= 0.3687$

$i = 1 + \alpha$

$= 1 + 0.3687 = 1.3687$

$\Delta T_b = i \times K_b\, m$

$= 1.36 \times 10^{-2} \times .51$

$= 0.0069$ °C

Q. 7. Which colligative property is preferred for the molar mass determination of macro molecules ? Why ?

Ans. Osmotic pressure is preferred over all other colligative properties because :

(a) even in dil. soln the o. p.values are appreciably high and can be measured accurately.

(b) o. p.can be measured at room temp. on the other hand elevation in B. P. is measured at high temp. where the solute may decompose. The depression in freezing point is measured at low temp.

Q. 8. How much ethyl alcohol must be added to 1 litre of water so that the solution will freeze at 14 °F ? (K_f for water = 1.86 °C/mol)

Ans. $(14 - 32) / 9 = C / 5$

$C = 5 \times (-18) / 9$

$= -10\ °C$

$$\Delta T_F = \frac{K_F \times 1000 \times W_b}{W_a \times M_b}$$

W_b = mass of solute

M_b = molar mass of solute

W_a = mass of solvent

$$10 = \frac{1.86 \times 1000 \times W_b}{1000 \times 46}$$

$W_b = 247.31$ g

Q. 9. 75.2 g of phenol is dissolved in solvent of K_F = 14, if the depression in freezing point is 7 k. What is the % of phenol ?

Ans. $K_F = 14$

$$M_b = \frac{1000 \times K_F \times W_2}{W_1 \times \Delta T_F}$$

Taking the solvent as 1 kg

$$M_b = \frac{1000 \times 14 \times 75.2}{1000 \times 7k}$$

= 150.4 g per mol

phenol (molar mass) — 94 g/mol

$$i = \frac{\text{Calculated molar mass}}{\text{Observed molar mass}}$$

$= 94 / 150.4 = 0.625$

$$2\,C_6H_5OH \longleftrightarrow (C_6H_5OH)_2$$

$$\begin{array}{cc} 1 & 0 \\ 1-\alpha & \alpha / 2 \end{array}$$

Total $= 1 - \alpha + \alpha / 2$

$= 1 - \alpha / 2$

$i = 1 - \alpha + \alpha / 2$

$= 1 - \alpha / 2 = 0.625$

$\alpha / 2 = 0.375$

$\alpha = 0.75$

% of association = 75%

Q. 10. How many ml of 0.1 M HCl are required to react completely with 1 gm mixture of Na_2CO_3 & $NaHCO_3$ containing equimolar amounts of both ?

Ans. Let the amount of Na_2CO_3 be x

Let the amount of $NaHCO_3$ be 1 – x

Since no. of moles of both are equal

$$\frac{x}{N(Na_2CO_3)} = \frac{1-x}{M(NaHCO_3)}$$

$$\frac{x}{106} = \frac{1-x}{84}$$

84 x = 106 – 106 x

x = 0.5578

XNa_2CO_3 = 0.5578 / 106

= 0.00526

$XNaHCO_3$ = 0.00526

$Na_2CO_3 + 2\ HCl \longrightarrow 2\ NaCl + CO_2 + H_2$

$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

$M_1V_1 = 2\ M_2V_2 + M_3V_3$

$0.1 \times V_1 = 2 \times 0.00526 + 0.00526$

$$V_1 = \frac{0.01578}{0.1}$$

= 0.1578 L

V = 157.8 ml.

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UNIT—3

ELECTROCHEMISTRY

1 MARK QUESTIONS

Q. 1. Which solution will allow greater conductance of electricity, 1 M NaCl at 293 K or 1 M NaCl at 323 K and why ?

Ans. 1 M NaCl at 323 K as the ionic mobilities increase with increase in temperature.

Q. 2. What does the negative value of E°_{cell} indicate ?

Ans. ΔG will be positive, the cell will not work.

Q. 3. Why is the equilibrium constant K, related to only E°_{cell} and not E_{cell} ?

Ans. This is because E_{cell} is zero at equilibrium.

Q. 4. What is the sign of ΔG for an electrolytic cell ?

Ans. Positive.

Q. 5. Rusting of iron is quicker in saline water than in ordinary water. Why is it so ?

Ans. In saline water, NaCl helps water to dissociate into H^+ and OH^-. Greater the number of H^+, quicker will be rusting of Iron.

Q. 6. What would happen if the protective tin coating over an iron bucket is broken in some places ?

Ans. Iron will corrode faster as the oxidation potential of Fe is higher than that of tin.

Q. 7. Can a nickel spatula be used to stir a solution of Copper Sulphate ? Justify your answer.

($E^\circ_{Ni^{2+}/Ni} = -0.25$ V $E^\circ_{Cu^{2+}/Cu} = 0.34$ V)

Ans. Reduction potential of Ni is less than Cu. Ni will replace the Cu from $CuSO_4$. Thus Ni spatula cannot be used to stir a solution of $CuSO_4$.

Q. 8. Which out of 0.1 M HCl and 0.1 M NaCl, do you expect have greater Λ^∞_m and why ?

Ans. 0.1 M HCl will have greater Λ^∞_m because H^+ (aq) being smaller in size than Na^+ (aq) and have greater mobility.

Q. 9. Three iron sheets have been coated separately with three metals A, B, C whose standard electrode potentials are given below :

	A	**B**	**C**	**Iron**
E°_{value}	**– 0.46 V**	**– 0.66 V**	**– 0.20 V**	**– 0.44 V**

Identify in which rusting will take place faster when coating is damaged.

Ans. Rusting of iron will take place when coated with metal C as it is placed above iron more than other metal.

Q. 10. Which will have greater molar conductivity ? Solution containing 1 mol KCl in 200 cc or 1 mol of KCl in 500 cc.

Ans. 1 mol of KCl in 500 cc.

2 MARKS QUESTIONS

Q. 1. (a) How will the value of E_{cell} change in an electrochemical cell involving the following reaction of the concentration of Ag^+ (aq) is increased ?

(b) What will be e. m. f. when the cell reaches equilibrium :

$Mg (s) + 2 Ag^+ (aq) \longrightarrow Mg^{2+} (aq) + Ag (s)$

Ans. (a)

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{2} \log \frac{\left[Mg^{2+}\right]}{\left[Ag^+\right]^2}$$

As the concentration of $[Ag^+]$ ion increases, E_{cell} increases.

(b) e.m.f. = 0

Q. 2. (a) In a cell reaction, the equilibrium constant K is less than one. Is E° for the cell positive or negative ?

(b) What will be the value of K of $E^\circ_{cell} = 0$?

Ans. For a cell $E^\circ = \frac{0.0591}{n} \log K$

$K < 0 \Rightarrow \log K < 0$

i.e. log K is – ve.

Then E°_{cell} will be negative.

(b) If $E^\circ_{cell} = 9$ then $0 = \frac{0.0591}{n} \log K$

$\log K = 0 \Rightarrow K = 1$

Q. 3. Knowing that :

Cu^{2+} (aq) + 2 e^- $\longrightarrow$ Cu (s) E° = + 0.34 V

2 Ag^+ (aq) + 2 e^- $\longrightarrow$ 2 Ag (s) E° = + 0.80 V

Reason out whether, 1 M $AgNO_3$ solution can be stored in Copper Vessel or 1 M $CuSO_4$ solution in Silver Vessel.

Ans. A solution of an electrolyte can be stored in a particular vessel only in case there is no chemical reaction taking place with the material of the vessel.

Cu is a strong reducing agent and can lose electrons to Ag^+ as E° of Cu is less than that of Cu. So $AgNO_3$ cannot be kept in Copper Vessel.

$CuSO_4$ solution can be stored in Ag Vessel as no chemical reaction will take place as Ag is placed above Cu in the activity series and Ag is less reactive than Copper.

Q. 4. What is the number of electrons in one Coloumb of electricity ?

Ans. Charge on one mole of electrons = 1 F = 96500 C

96500 C of Charge is present on electrons = 6.022×10^{23}

$\therefore$ 1 C of Charge is present on electrons = $\frac{6.022 \times 10^{23}}{96500 \text{ C}} \times 1 \text{ C}$

$= 6.24 \times 10^{18}$

Q. 5. Which of the following pairs will have greater conduction and why ?

(a) Copper wire at 25 °C and Copper wire at 50 °C.

(b) 0.1 M acetic acid solution or 1 M acetic acid solution ?

Ans. (a) Copper wire at 25 °C because with increase in temperature metallic conduction decreases due to vibration of kernels.

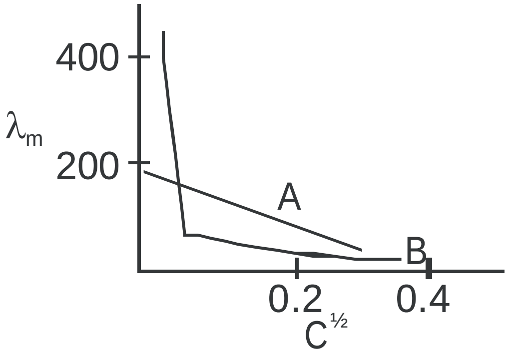
(b) 0.1 M acetic acid solution because with dilution degree of dissosciation increases and hence no. of ions.

3 MARKS QUESTIONS

Q. 1. The following curve is obtained when molar conductivity (λ_m) is plotted against the square root of concentration for 2 electrolytes A and B.

(a) What can you say about the nature of the two electroyltes A and B ?

(b) How do you account for the increase in molar conductivity λ_m for the electrolytes A and B on dilution ?



Ans. (a) A is a strong electrolyte and B is a weak electrolyte.

(b) Molar conductivity of a strong electrolyte (A) increases with dilution as ionic mobility increases.

In a weak electrolyte molar conductivity increases steeply with dilution as degree of dissociation increases and hence no. of ions increases.

Q. 2. Iron and nickel are used to make electrochemical cell by using a salt bridge to join a half cell containing 1 M Fe^{2+} (aq) in which a strip of iron has been immersed to a second half cell which contains 1 M Ni^{2+} (aq) in which a strip of Ni has been immersed ? A voltmeter is connected between the two metal strips :

$E°_{Fe^{2+}/Fe} = – 0.44$ V $E°_{Ni^{2+}/Ni} = – 0.25$ V

(a) Write the name of the cathode and anode.

(b) Write the half reactions involved ?

(c) What would be the effect on the Voltmeter reading if Fe^{2+} concentration were increased ?

Ans. (a) Anode : Fe

Cathode : Ni

(b) Reaction at anode : $Fe \longrightarrow Fe^{2+} + 2e^-$

Reaction at cathode : $Ni^{2+} + 2e^- \longrightarrow Ni$

(c) Voltmeter reading decreases.

Q. 3. Consider the electrochemical cell :

Zn (s) / Zn^{2+} (aq) // Cu^{2+} (aq) / Cu. It has an electrical potential of 1.1 V when concentration of Zn^{2+} and Cu^{2+} ions is unity.

State the direction of flow of electrones and also specify if Zinc and Copper are deposited or dissolved at their respective electrodes. When :

(a) an external opposite potential of 0.8 V is applied.

(b) an external opposite potential of 1.1 V is applied.

(c) an external opposite potential of 1.4 V is applied.

Ans. (a) Electrons flow from Zn rod to Cu rod.

Zinc dissolved and Copper gets deposited.

(b) No flow of electrons and current.

No change observed at Zinc and Copper electrodes (system is at equilibrium).

(c) Electrons flow from Cu rod to Zn rod.

Zinc is deposited and Copper gets dissolved.

Q. 4. Given that :

$CO^{3+} + e^- \longrightarrow CO^{2+}$ E° = 1.82 V

$2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$ E° = – 1.23 V

Explain why CO^{3+} is not stable in aqueous solution ?

Ans. The $E°_{cell}$ can be calculated as :

$4[CO^{3+} + e^- \longrightarrow CO^{2+}]$ E° = 1.82 V

$2\ H_2O \longrightarrow O_2 + 4\ H^+ + 4\ e^-$ E° = – 1.23 V

Cell reaction : $4\ CO^{3+} + 2\ H_2O \longrightarrow CO^{2+}\ O_2 + 4\ H^+$

$E°_{cell} = 1.82\ V - (-1.23\ V) = 3.05\ V$

Since $E°_{cell}$ is positive, the cell reaction is spontaneous. CO^{3+} iron will take part in the reaction and hence unstable in aqueous solution.

Q. 5. For the reaction :

$Ag^+ + Hg \longrightarrow Ag + Hg_2^{2+}$

E° = 0.80 V E° = 0.79 V

Predict the direction in which the reaction will proceed if :

$[Ag^+] = 10^{-1}$ mol/h $[Hg^{2+}] = 10^{-3}$ mol/h

Ans. Cell reaction is :

$2\ Ag^+ + 2\ Hg \longrightarrow 2\ Hg + Hg_2^{2+}$

$$E_{cell} = E°_{cell} - \frac{0.0591}{2} \log \frac{\left[Hg_2^{2+}\right]}{\left[Ag^+\right]^2}$$

$$= (0.80\ V - 0.79\ V) - \frac{0.0591}{2} \log \frac{10^{-3}}{\left(10^{-1}\right)^2}$$

$$= 0.01\ V - \frac{0.0591}{2} (-1) = 0.01 + 0.0295$$

$$= 0.0395\ V$$

Since E_{cell} is positive, the reaction will be spontaneous in the forward direction.

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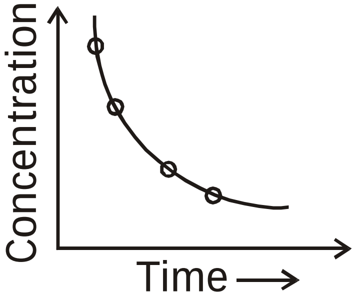
UNIT—4

CHEMICAL KINETICS

1 MARK QUESTIONS

Q. 1. In the reaction A $\longrightarrow$ B, if the concentration of A is plotted against time, the nature of the curve obtained will be as shown. What is the order of the reaction ?



Ans. First Order

Q. 2. What is the effect of temperature on activation energy ?

Ans. There is no effect of temperature on activation energy.

Q. 3. Which will dissolve in water faster, powdered sugar or crystalline sugar and why ?

Ans. Powdered sugar will dissolve in water faster as it has more surface area.

Q. 4. Which reaction will take place faster and why ?

$$C(s) + \tfrac{1}{2} O_2(g) \xrightarrow{500\,°C} CO(g)$$

$$C(s) + \tfrac{1}{2} O_2(g) \xrightarrow{1000\,°C} CO(g)$$

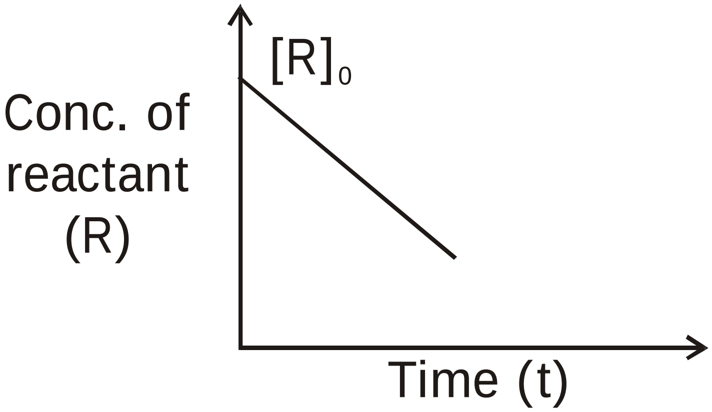
Ans. The second reaction is faster because increase in temperature increases the number of effective collisions and hence increase in rate.

Q. 5. For a reaction $A + H_2O \longrightarrow B$; $r = k[A]$. What is its (i) Molecularity (ii) Order ?

Ans. Pseudo unimolecular rection order = 1

2 MARKS QUESTIONS

Q. 1. A reaction : Reactant $\longrightarrow$ Product is represented by :



(i) Predict the order of the reaction.

(ii) What does the slope of the graph represent ?

Ans. (i) Zero order

(ii) Slope $= -k = \frac{d[R]}{dt}$

Q. 2. For a reaction, the activation energy is zero. What is the value of rate constant at 300 K if $K = 1.6 \times 10^6\ s^{-1}$ at 280 K.

Ans. $\log \frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right] = \frac{0}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right] = 0$

$\frac{K_2}{K_1}$ = antilog (0) = 1 or $K_2 = K_1 = 1.6 \times 10^6\ s^{-1}$

Q. 3. The slope of the line in the graph of log K is $\frac{1}{T}$ for a reaction is – 5841 K. Calculate E_a for the reaction.

Ans. Slope $= -\frac{E_a}{2.303R}$

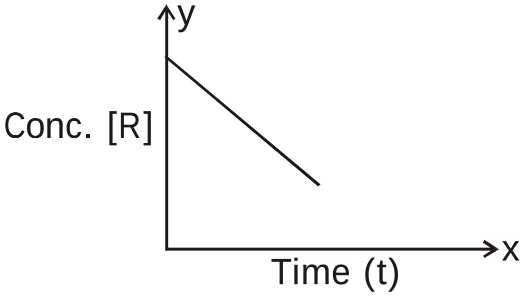
$E_a = -2.303\ R \times \text{Slope}$

$= -2.303 \times 8.314 \times -5841$

$= 1.118 \times 10^5$ g/mol

3 MARKS QUESTIONS

Q. 1. Consider the reaction $R \xrightarrow{K} P$. The change in concentration of A with time is shown in the given plot :



(i) Predict the order of the reaction.

(ii) Derive the expression for the time required for the completion of the reaction.

Ans. (i) Zero order

(ii) For the reaction $R \longrightarrow P$

$r = -\frac{d[R]}{dt} = K[R]^\circ$

$-d[R] = K\,dt$

On integration

$-[R] = Kt + C$

When $t = 0$ $[R] = [R]_0$

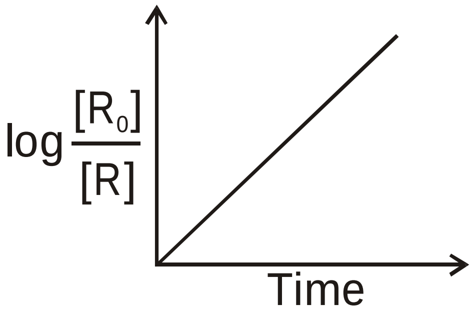
On substitution

$-[R] = Kt - [R]_0 \Rightarrow [R] = -Kt + [R]_0$

$Kt = [R]_0 - [R] \Rightarrow t = \frac{1}{K}\{[R]_0 - [R]\}$

Q. 2. Answer the following questions on the basis of the given curve for a first order reaction :

$A \longrightarrow P$



(i) What is the relation between slope of this line and rate constant ?

(ii) Calculate the rate constant of the above reaction if the slope is 2×10^{-4} s^{-1}.

Ans. (i) Slope = $\frac{K}{2.303}$

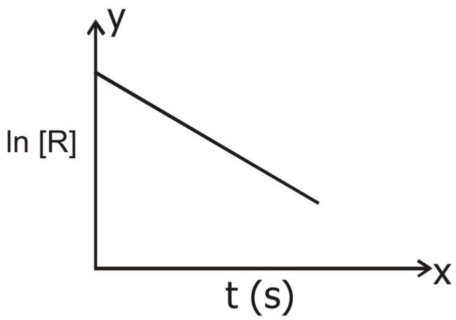
(ii) Slope = 2×10^{-4} s^{-1}

$\therefore$ K = 2.303 × Slope

= $2.303 \times 2 \times 10^{-4}$ s^{-1}

= 4.606×10^{-4} s^{-1}

Q. 3. For a certain chemical reaction variation in concentration in [R] VS time plot is given below. For this reaction write :



(i) What are the un

(ii) Give the relatio

(iii) What does the s

Ans. (i) $time^{-1}$ (s^{-1})

(ii) $K = \frac{0.693}{t_{1/2}}$

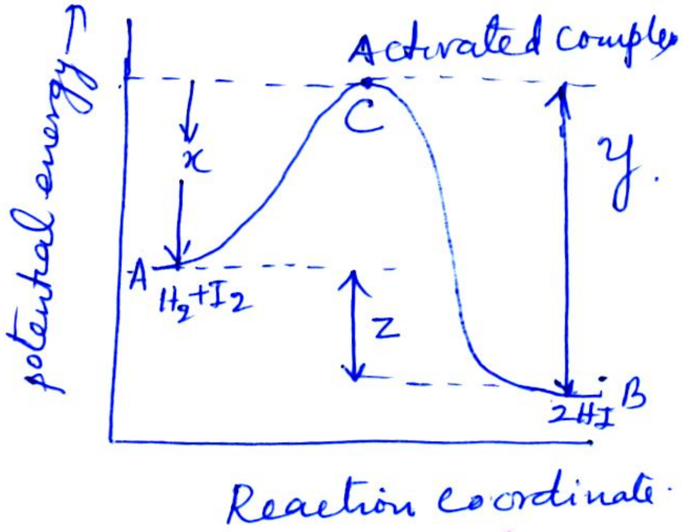
(iii) rate constant K of the reaction.

Q. 4. Consider the following diagram representing potential energy plot and answer the following questions :

(i) What do 'x' and 'y' represent ?

(ii) What does 'z' represent in this diagram ?

(iii) Is the reaction endothermic or exothermic ?

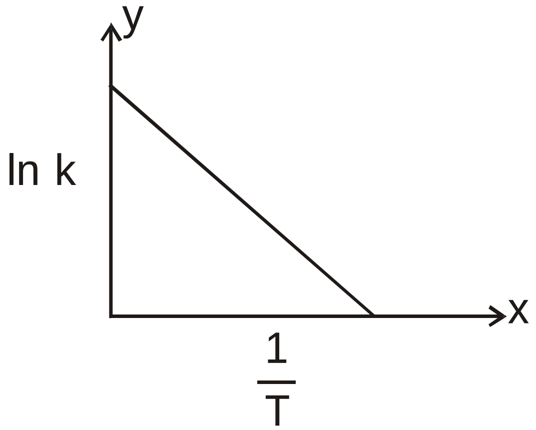


Ans. (i) 'x' represents E_a for forward reaction. 'y' represents E_a for backward reaction.

(ii) 'z' represents ΔH, the enthalpy change for the reaction.

(iii) Exothermic reaction.

Q. 5. Consider a plot between k vs $\frac{1}{T}$ where T is the temperature. On the basis of this plot, answer the following questions :



(i) What is the slope in this line ?

(ii) What is the intercept of this line on the y-axis ?

(iii) What is the relation between K and T ?

Ans. (i) Slope = $-\frac{E_a}{R}$

(ii) Intercept = ln A

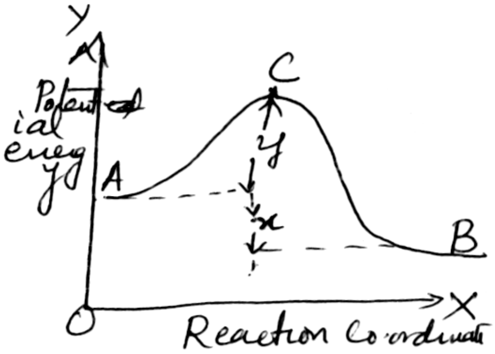
(iii) $\ln k \propto \frac{1}{T}$ or $K = A\, e^{-Ea/RT}$

Q. 6. Diagram given below shows a plot of potential energy Vs reaction co-ordination for a hypothetical reaction. Write answers to the following from the plot given :

(a) Represent reactant, product and activated complex in terms of A, B and C ?

(b) Is this reaction exothermic or endothermic ?

(c) What will be the effect of a catalyst on E_a of the reaction ?



Ans. (a) A ⟶ Reactant

B ⟶ Product

C ⟶ Activated Complex

(b) Exothermic

(c) Catalyst will lower the activation energy for the reaction.

Q. 7. The rate of a first order reaction is 0.04 mol/h/s at 10 minutes and 0.03 mol/h/s at 20 minutes. Find the half life period of the reaction.

Ans. Rate $= K\,C$

$r_1 = K\,C_1$

$r_2 = KC_2$

$$\frac{r_1(10\text{ min})}{r_2(20\text{ min})} = \frac{C_1}{C_2} = \frac{0.04}{0.03}$$

$$K = \frac{2.303}{t}\log\frac{C_1}{C_2}$$

When t = 10 min

$$K = \frac{2.303}{t}\log\frac{0.04}{0.03} = \frac{2.303}{10}\log\frac{4}{3}$$

$$= 0.0287\text{ min}^{-1}$$

$$t_{1/2} = \frac{0.693}{K} = \frac{0.693}{0.0287}$$

$$= 24.14\text{ min.}$$

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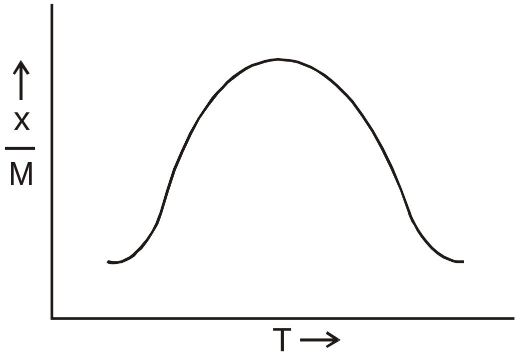
UNIT—5

SURFACE CHEMISTRY AND CATALYSIS

1 MARK QUESTIONS

Q. 1. What kind of adsorption is represented by the following graph :



Ans. Chemisorption.

Q. 2. In the titration of oxalic acid by acidified $KMnO_4$, the oxidation of oxalic acid is slow in the beginning but becomes fast as the reaction progresses. Why ?

Ans. Autocatalysis by Mn^{+2}.

Q. 3. Out of PO_4^{3-}, SO_4^{2-}, Cl^-, which wil act as the best coagulating agent for for Fe $(OH)_3$?

Ans. PO_4^{3-}.

Q. 4. Arrange the following in correct order of their coagulating power :
Na^+, Al^{3+}, Ba^{2+}

Ans. $Na^+ < Ba^{2+} < Al^{3+}$

Q. 5. Which type of charged particles are adsorbed on the surface of As_2S_3 during its preparation ?
$As_2O_3 + 3\ H_2S \longrightarrow As_2S_3 + 3\ HOH$

Ans. S^{2-}.

Q. 6. Which type of metals act as effective catalysts ?

Ans. Transition metals.

Q. 7. The colloidal solution of gold prepared by different methods have different colours. Why ?

Ans. Due to difference in the size of colloidal particles.

Q. 8. At high pressure, the entire metal surface gets covered by a mono molecular layer of the gas. What is the order of the process ?

Ans. Zero order.

Q. 9. What is the term used for minimum concentration of an electrolyte which is able to cause coagulation of a sol ?

Ans. Flocculation value.

Q. 10. A liquid is found to scatter a beam of light but leaves no residue when passed through the filter paper. What can the liquid be described as ?

Ans. Colloid.

Q. 11. If an electric field is applied to a colloidal sol, the dispersed phase particles are found to move towards the electrode of opposite charge. If however, the dispersed phase is made stationary, the dispersion medium is found to move in the opposite direction. What is the term used for such movement of dispersion medium ?

Ans. Electro osmosis.

Q. 12. Out of glucose, urea and dodecyl trimethyl ammonium chloride, which one forms micelles in aqueous solution above certain concentration ?

Ans. Dodecyl trimethyl ammonium chloride.

Q. 13. A plot of log versus log p for the adsorption of a gas on a solid gives a straight line. What is the slope equal to ?

Ans. $\frac{1}{n}$

Q. 14. The formation of micelles occurs only beyond a certain temperature. What is the temperature called ?

Ans. Kraft temperature

Q. 15. What are the signs of ΔH, ΔS and ΔG for the process of adsorption ?

Ans. $\Delta H = -ve$

$\Delta S = -ve$

$\Delta G = -ve$

Q. 16. Out of CO and NH_3 which is adsorbed on activated charcoal to a large extent and why ?

Ans. Ammonia; because more easily liquefiable gas undergoes adsorption to a greater extent.

Q. 17. On passing H_2S through dilute HNO_3 the colourless solution becomes turbid. Why ?

Ans. Due to formation of colloidal sol of Sulphur.

Q. 18. A sol is prepared by addition to excess $AgNO_3$ solution in KI solution. What charge is likely to develop on the colloidal particles ?

Ans. Positive.

Q. 19. If we add equimolar amounts of ferric hydroxide sol and arsenic sulphide sol, what will happen ?

Ans. Both the sols will get coagulated.

Q. 20. What happens when freshly precipitated $Fe(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$?

Ans. It causes peptization leading to the formation of a positively charged sol of $Fe(OH)_3$.

Q. 21. What happens to a gold sol if gelatin is added to it ?

Ans. It causes stabilisation of gold sol.

Q. 22. Out of NaCl, $MgSO_4$, $Al_2(SO_4)_3$, $K_4[Fe(CN)_6]$, which one will bring about the coagulation of a gold sol quickest and in the least of concentration ?

Ans. $Al_2(SO_4)_3$.

Q. 23. What is the unit for expressing flocculation value ?

Ans. millimole per litre.

Q. 24. Out of PO_4^{3-}, SO_4^{2-}, Al^{3+} and Na^{+}, which will have the highest coagulating power for As_2S_3 colloid ?

Ans. Al^{3+}.

2 MARKS QUESTIONS

Q. 1. Bleeding is stopped by the application of alum to a wound. Why ?

Ans. Blood is a colloid alum being an electrolyte, makes the blood to coagulate and form clot.

Q. 2. What is the purpose of adding gelatin to ice cream ?

Ans. Ice cream is a colloid. Gelatin imparts stability to it because gelatin is a protective colloid.

Q. 3. Dialysis is a method of purification of sols. But prolonged dialysis of the sol makes it unstable. Why ?

Ans. Traces of electrolytes in the sol, impart charge to dispersed phase particles making it stable. Prolonged dialysis removes all electrolytes thus making the sol unstable.

Q. 4. What is the function of gum arabic in the preparation of Indian ink ?

Ans. Gum arabic is a protective colloid and thus provides stability to Indian ink.

Q. 5. What is collodion ? What is its use ?

Ans. Cellulose dispersed in ethanol, is called collodion. It is used for making membranes for ultrafiltration.

Q. 6. Why the sun looks red at the time of setting ? Explain on the basis of colloidal properties.

Ans. At the time of setting, the sun is at the horizon. The light emitted by the sun has to travel a longer distance through the atmosphere. As a result, blue part of the light is scattered away by the dust particles in the atmosphere. Hence the red part is visible.

Q. 7. Addition of H_2 to acetylene gives ethane in presence of palladium but if $BaSO_4$ and quinoline or sulphur are also added, the product is ethane. Why ?

Ans. $BaSO_4$ + quinoline / s poison the catalyst. Hence, the efficiency of the catalyst decreases and the reaction stops at the first stage of reduction.

Q. 8. SnO_2 forms a positively charged colloidal sol in acidic medium and a negatively charged sol in the basic medium. Why ?

Ans. SnO_2 is amphoteric in nature. It reacts with acid eg. HCl to form $SnCl_4$ in the solution. The common Sn^{4+} ions are adsorbed on the surface of SnO_2 particles giving them a positive charge.

SnO_2 reacts with a base eg. NaOH to form Sodium Stannate in the solution. The stannate ions are adsorbed on the surface of SnO_2 particles giving them a negative charge.

Q. 9. Why physical adsorption is multimolecular whereas chemisorption is unimolecular ?

Ans. Chemisorption takes place as a result of reaction between adsorbent and adsorbate. When the surface of the adsorbent is covered with one layer, no further reaction can take place.

Physical adsorption is simply by Vander Waal's forces. So any number of layers may be formed one over the other on the surface of the adsorbent.

Q. 10. What is meant by induced catalysis ? Give an example.

Ans. It is a phenomenon in which a chemical reaction increases the rate of another reaction which otherwise may not occur in similar conditions.

Eg. Sodium arsenite (Na_3AsO_3) is not oxidised in air but if air is blown into a solution containing Na_3AsO_3 and Na_2SO_3, then both AsO_3^{3-} and SO_3^{2-} ions are oxidised.

Q. 11. What type of colloidal sols are formed in the following ?

- **(i) Sulphur vapours are passed through cold water.**
- **(ii) White of an egg is mixed with water.**
- **(iii) Concentration of soap solution is increased.**

Ans. (i) Multimolecular colloid

(ii) Macromolecular colloid
(iii) Associated colloid.

Q. 12. What is common to aquasol and aerosol ? In what respect do they differ ?

Ans. Both are colloids.

In aquasol, water acts as dispersion medium.

In aerosol, air acts as dispersion medium.

Q. 13. Explain as to why SnO_2 forms a positively charged sol in solutions with pH < 7 and negatively charged sol in solutions with pH > 7.

Ans. Refer Ans. 8.

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UNIT—6

GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

1 MARK QUESTIONS

Q. 1. Why carbon reduction process is not applied for reducing aluminium oxide to aluminium ?

Ans. Because aluminium metal itself a very powerful agent and can easily reduce CO formed during the reaction back to carbon.

Q. 2. Explain why thermit process is quite useful for repairing the broken parts of a machine ?

Ans. In thermit process, oxides of metals are reduced by aluminium in which large amount of beat is evolved, ∴ metal is in the motten state & is allowed to fall between the broken parts of a machine.

$$Fe_2O_3\,(s) + 2\,Al\,(s) \xrightarrow{\text{heat}} Al_2O_3 + \underset{\text{molen}}{2\,Fe\,(l)} + \text{heat}$$

Q. 3. Free energies of formation (Δ_fG) of MgO (s) and CO (g) at 1273 K and 2273 K are given below :

Δ_fG MgO (s) = – 941 KJ/mol at 1273 K

= – 344 KJ/mol at 2273 K

Δ_fG CO (g) = – 439 KJ/mol at 1273 K

= – 628 KJ/mol at 2273 K

On the basis of the above data, predict the temperature at which carbon can be used as reducing agent for MgO (s).

Ans. The redox reaction is :

$MgO\,(s) + C\,(s) \longrightarrow Mg\,(s) + CO\,(g)$

$\Delta G° = \Delta_fG°_{(Products)} - \Delta_fG°_{reactant}$

At 1273 K $\Delta G° = -439 - (-941) = 502$ KJ mol^{-1}

At 2273 K $\Delta G° = -628 - (-314) = -314$ KJ mol^{-1}

The reaction is feasible at 2273 K.

Q. 4. Why is Zinc and not Copper used for the recovery of Silver from the complex $[Ag\,(CN)_2]$?

Ans. Zinc is stronger reducing agent and more electropositive than Copper. (E° = + 0.34V)

Q. 5. Graphite is used as anode and not diamond. Assign reason.

Ans. In graphite there are free electrons which helps in electrical conductivity.

Q. 6. How is granular zinc & zinc dust obtained ?

Ans. Granular zinc is obtained by pouring molten zinc in cold water & zinc dust by melting zinc & then atomising it with blast of air.

Q. 7. How does NaCN act as a depressant in preventing ZnS from forming the froth ?

Ans. NaCN forms a layer of zinc complex, $Na_2\,[Zn\,(CN)_4]$ on the surface of ZnS and thereby prevents it from the formation of froth.

Q. 8. In the process of extraction of gold, Roasted gold ore :

$$\textbf{Roasted gold ore} + CN^- + H_2O \xrightarrow{O_2} [X] + OH^-$$

$$[X] + Zn \longrightarrow [Y] + Au$$

Identify the complexes [X] & [Y].

Ans. [X] = $[Au(CN)_2]^-$, [Y] = $[Zn(CN)_4]^{2-}$

Q. 9. Why is the reduction of a metal oxide easier if the metal formed is in liquid state at the temp. of reduction ?

Ans. The reduction of metal oxide is as :

$$M_2O\ (s) + xM^1\ (s\ or\ l) \longrightarrow x\ M\ (s\ or\ l) + M^1_xO\ (s)$$

The entropy of liquid metal is more than entropy of the metal in solid state. $\therefore$ ΔG for the reduction become more on negative side.

$$\Delta G = \Delta H - T\Delta S$$

Q. 10. What is the role of collector in froth floatation process ?

Ans. Collector enhances non-wettability of the mineral particles.

Q. 11. At which temperature direct reduction of Fe_2O_3 by carbon is possible ?

Ans. Above 1123 K, carbon can reduce Fe_2O_3.

Q. 12. Why a very high cosmic abundance of iron is there ?

Ans. A very high cosmic abundance of iron is due to its high nuclear binding energy.

Q. 13. Why refractory metals are used in construction of furnaces ?

Ans. Refractory metals are used in construction of furnaces because they can withstand high temperature.

Q. 14. What is pyrometallurgy ?

Ans. Extraction of metals using heat is called pyrometallurgy. It involves concentration of ores, roasting calcination, smelting, reduction and refining of metals. Sulphide, carbonate, oxide ores etc. are subjected to pyrometallurgy.

Q. 15. How the most electropositive metals are isolated from their ores ?

Ans. The most electropositive metals are isolated from their ores by electrolysis of fused ionic salts.

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UNIT—7 p-BLOCK ELEMENTS

1 MARK QUESTIONS

Q. 1. Arrange the following in Acidic strength :
HNO_3, H_3PO_4, H_3AsO_4

Ans. The order of acidity will be :
$HNO_3 > H_3PO_4 > H_3AsO_4$
N > P > As
$\because \longleftarrow$
Electronegativity of elements

Q. 2. Iodine is more soluble in KI, than H_2O.

Ans. Formation of soluble complex KI_3 :
$I_2 + I^- \longrightarrow KI_3$

Q. 3. $R_3P = 0$ exist but $R_3N = 0$ can not exist.

Ans. $\because$ Phosphorus can form $d\pi$-$d\pi$ bond while Nitrogen can not.

Q. 4. N-N, bond is weaker than P-P, on the contrary N_2 is very inert.

Ans. $N \equiv N$ has 941.4 KJ mol^{-1} as it is triply bonded. of small size it can form $p\pi$-$p\pi$ bonding. Single N-N bond is weaker of high interelectronic repulsion :

$$\overset{\sigma}{N \equiv N}$$

Q. 5. Why the stability order is :
$ClF_3 > BrF_3 > IF_3$ (Stable)

Ans. $\because$ Cl – F > Br – F > I – F (Bond enthalpy)

Q. 6. Both Cl and O have the same electronegativity but only O forms H-bonding ?

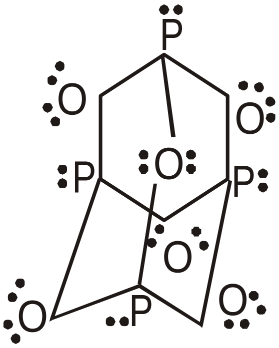
Ans. $\because$ Their sizes are different so the electron density on oxygen atom is much more than on Cl. $\therefore$ Cl is unable to form H-bonding.
Note : Sizes : O = 66 pm, Cl = 99 pm.

Q. 7. NO is paramagnetic in the gaseous state but dimagnetic in liquid and solid state ?

Ans. NO = 5 + 6 = 11 e^-, it has odd pair of e^- and hence paramagnetic in gaseous state, but in liquid and solid state, it exists as dimer.

Q. 8. Give the No. of P – O and lone pair in P_4O_6.

Ans.



Just count P – O bonds and lone pair of e^- carefully :
P – O bonds are = 12
Lone pair of e^- are = 16

Q. 9. Why the bond angle is in the following order ?

NH_3	**PH_3**	**AsH_3**	**SbH_3**
106.5°	**93.5°**	**91.5°**	**91.3°**

Ans. The bond angle in NH_3 is less than 109°.28' due to repulsion between lone pair on Nitrogen atom and bonded pairs of electron. As we move down the group the bond angles gradually decreases due to decrease in bond pair.

Q. 10. Why ICl bonds are weaker than Cl_2 ?

Ans. In Cl_2, overlapping has to be taken place between Cl – Cl atom, their sizes are equal, overlapping is effective, but in I – Cl sizes are different ∴ "<u>ineffective overlapping</u>" leads to weaker bond.

Q. 11. Among Halogens F_2 is the strongest oxidising agent ?

Ans. Bond dissociation enthalpy of F – F is lower, Hydration enthalpy of F^- is higher i. e. more negative.

OR

(i) $\frac{1}{2} F_2 \xrightarrow{\Delta \text{ B. EH}} F(g)$ is less in F of Interelectronic repulsion.

(ii) $F(g) \xrightarrow{-\Delta \text{ eg H}} F^-(g)$

(iii) $F^-(g) + aq \xrightarrow{\Delta \text{ Hydration H}} F^-(aq)$ is most negative of small size.

2 MARKS QUESTIONS

Q. 1. Apply VSEPR throry to derive the structure of XeO_3.

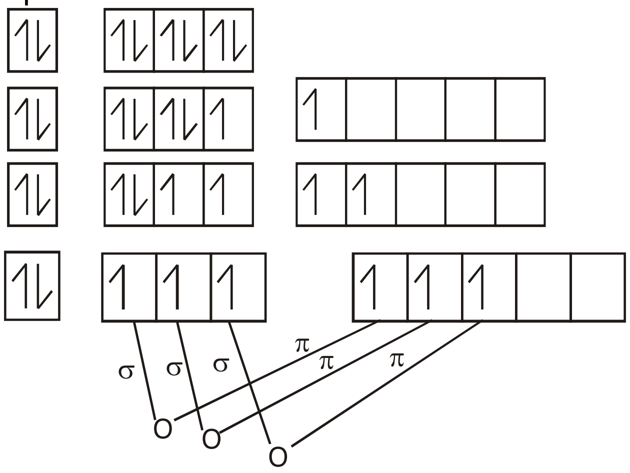
Ans. Xe = 6 s^2 p^6

G. S 6 s 6p

I-Excited State

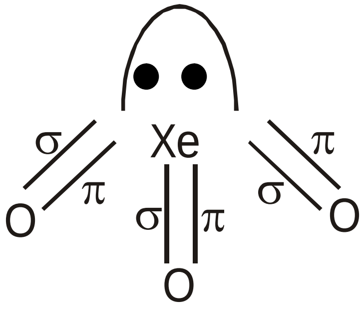
II-Excited State

III-Excited State



as π bonds are not included in hybridisation

∴ sp^3, hybridisation, Tetradedral :



Q. 2. (a) XeF_6 is reactive and F^- ion acceptor ?

OR

XeF_6 is F^- ion acceptor.

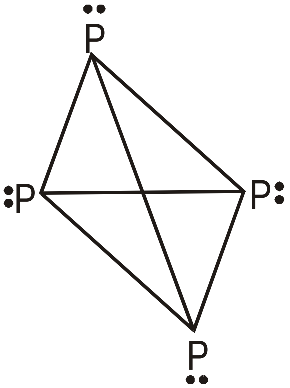
Ans. $MF + XeF_6 \longrightarrow M^+ [XeF_7^-]$ M = Na, K, Rb and Cs.

Octahedral Pentagonal bipyramidal

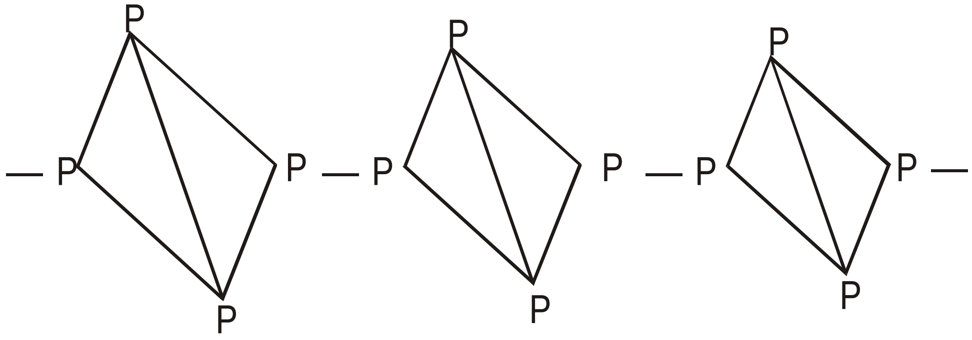
XeF_6 has unsymmetrical, distorted octahedral structure but on the acceptance of F^- it attains Pentagonal bipyramidal structure, which is symmetrical and stable.

(b) White Phosphorus is toxic, while Red Phosphorus is not.

Ans. It consists of discrete P_4 molecule, ∴ more reactive :



Red Phosphorus is polymeric, chain of P_4 linked together :



Q. 3. Cl^- does not give layer test, while Br^- and I^- gives layer test ?

Ans. Cl
Br
I ↓ oxidising behaviour decreases from top to bottom.

$\longrightarrow 2\,Cl^- + X_2$ $X^- = Br^-, I^-$

$\longrightarrow 2\,Br^- + I_2$

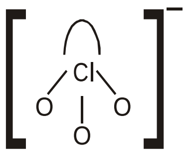
∴ Cl_2 water oxidises Br^- into Br_2 and I^- into I_2 which form layer with CCl_4. CCl_4 can dissolve Br_2 to form Brown layer, dissolves I_2 to form Violet layer.

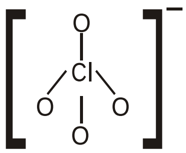
Q. 4. (a) $HClO_4$ is more acidic than $HClO_3$.

OR

pK_a of $HClO_3$ is more than $HClO_4$.

Ans.





Conjugate anion of $HClO_3$ Conjugate anion of $HClO_4$

Greater number of oxygen atom, greater is the dispersal of (–) charge, greater is stability of anion.

$HClO_4 > HClO_3$

$\therefore \xleftarrow[\text{Acidity}]{\hspace{3cm}}$

(b) Interhalogen compounds of F are good flourinating agent ?

Ans. Bonding between XX’ is weaker and are used for flourinating agent.

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UNIT—8 THE d- AND f-BLOCK ELEMENTS

Some Important Terms :

Compounds / Minerals / Reagents or mixtures etc of d- and f- block elements.

1. Argentite — Ag_2S
2. Argenti ferrous galena — $PbS + Ag_2S$
3. Azurite — $Cu(OH)_2 . 2 CuCO_3$
4. Benedict Solution — Alkaline Solution cupric ions complexed with citrate ions.
5. Blue Vitriol — $CuSO_4 . 5 H_2O$
   (Blue Stone)
6. Bayer's Reagent — Cold alkaline $KMnO_4$ Solution
7. Blister Copper — 99% Pure Copper
8. Corrosive Sublimate — $HgCl_2$
9. Calomel — Hg_2Cl_2
10. Calamine — $ZnCO_3$
11. Coinage metal — Cu, Ag and Au
12. Copper Pyrite — $CuFeS_2$ or $Cu_2S . Fe_2S_3$
13. Copper glance — Cu_2S
14. Cinnabar — HgS
15. Chromyl Chloride — CrO_2Cl_2
16. Chrome Yellow — $PbCrO_4$
   (Lemon Chrome)
17. Calaverite — $AuTe_2$
18. Chromic acid mixture — K_2CrO_7 + Con. H_2SO_4
19. Delomite — $CaCO_3 . MgCO_3$
20. Delta Metal — Cu (55%), Zn (41%), Fe (4%)
21. Fischer's Salt — $K_3 [CO (NO_2)_4]$
22. Fehling Solution — $CuSO_4$ + Sod. Pot. Tartarate + NaOH
23. Green Vitriol — $FeSO_4 . 7 H_2O$
   (Hara Kasis)
24. Ferro Chrome — Fe + 2 Cr + 4 CO
25. Guigret's green — $Cr_2O_3 . 2 H_2O$
26. Haematite — Fe_2O_3
   (Red Haematite)
27. Horn Silver — AgCl
   (Chloragynite)
28. Lucas reagent — Conc. HCl + anhydrous $ZnCl_2$
29. Lunar Caustic — $AgNO_3$
30. Lithopone — $ZnS + BaSO_4$
31. Lindar Catalyst — Palladised Charcoal deactivated with Sulphur compounds.
32. Malachite — $Cu(OH)_2 . 2 CuCO_3$
33. Monel Metal — Cu, Ni and Mn
34. Nesseler's reagent — K_2HgI_4
35. Prussian blue — $Fe_4 [Fe (CN)_6]_3$
36. Pyrites (Fool's Gold) — FeS_2
37. Quick Silver — Hg
38. Schweitzer reagent — Tetramine Copper (II) Sulphate
39. Sterling Silver — Solution of Cu in Hg
40. Scheelite — $CaWO_4$ (Calcium tungstate)
41. Tollen's reagent — $AgNO_3$ + NaOH
42. Tailing of mercury — Hg_2O
43. Vermilion — HgS
44. Willemite — Zn_2SiO_4
45. Zincite — ZnO
46. Zinc butter — $ZnCl_2 . 3 H_2O$

1 MARK QUESTIONS

Q. 1. What is the equivalent wt. of $KMnO_4$ in :

(a) Acidic Medium (b) Neutral Medium (c) In alkaline Medium

Ans. (a) In Acidic Medium the reaction is :

$$5\,e^- + 8\,H^+ + MnO_4^- \longrightarrow 4\,H_2O + Mn^{2+}$$

$$\therefore \frac{M}{5} = \frac{158}{5} = 31.6 \text{ g}$$

(b) In Neutral Medium the reaction is :

$$MnO_4^- + 2\,H_2O + 3\,e^- \longrightarrow MnO_2 + 4\,OH^-$$

$$\therefore \text{eq. wt.} = \frac{M}{3} = \frac{158}{3} = 52.67$$

(c) In Alkaline Medium the reaction is :

(i) Strongly Alkaline Medium

$$MnO_4^- + e^- \longrightarrow \underset{\text{magnate ion}}{MnO_4^{2-}}$$

$$\therefore \frac{M}{1} = \frac{158}{1} = 158$$

(ii) In Weakly Alkaline Medium the reaction is :

$$MnO_4^- + 2\,H_2O + 3\,e^- \longrightarrow MnO_2 + 4\,OH^-$$

Same as in neutral medium

$$\therefore \frac{M}{3} = \frac{158}{3} = 52.67$$

Q. 2. $K_2Pt^{+4}Cl_6$ is well known compound and corresponding Ni^{4+} Salt it unknown ? Whereas Ni^{+2} is more stable than Pt^{+2}.

Ans. The stability of the compounds depend upon sum of ionization enthalpies :

$$\underset{\text{in Ni}}{IE_1 + IE_2} < \underset{\text{in Pt}}{IE_1 + IE_2}$$

$\therefore$ Ni^{2+} is stable than Pt^{+2}.

$$\underset{\text{in } Pt^{4+}}{IE_1 + IE_2 + IE_3 + IE_4} < \underset{\text{in } Ni^{4+}}{IE_1 + IE_2 + IE_3 + IE_4}$$

$\therefore$ Pt^{4+} is stable, $\therefore$ K_2PtCl_6 is well known compound.

Q. 3. Sc^{3+} is more stable than Sc^{2+}.

Ans. $Sc = 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^1\,4s^2$

$\boxed{Sc^{3+} = 1s^2\,2s^2\,2p^6\,3s^2\,3p^6}$

Inert gas configuration $\therefore$ more stable.

Q. 4. Why $KMnO_4$ is bright in colour ?

Ans. It is due to charge transfer. In MnO_4^- an electron is momentarily transferred from O to the metal, thus momentarily O^{2-} is changed to O^- and reducing the oxidation state of the metal from Mn (VII) to Mn (VI).

Q. 5. Why gold, Pt are dissolved in aqua Ragia ?

Ans.

$$Au + 4\,Cl^- \longrightarrow AuCl_4^- + 3\,e^- \text{ (oxidation)}$$

$$3\,e^- + 4\,H^+ + NO_3^- \longrightarrow NO + 2\,H_2O \text{ (reduction)}$$

$$Au + 4\,H^+ + 4\,Cl^- + NO_3^- \longrightarrow AuCl_4^- + NO + 2\,H_2O$$

$Pt + 6\,Cl^- \longrightarrow PtCl_6^{2-} + 4\,e^- \times 3$ (oxidation)

$4\,e^- + 4\,H^+ + NO_3^- \longrightarrow NO + 2\,H_2O \times 4$ (reduction)

$18\,Cl^- + 3\,Pt + 16\,H^+ + 4\,NO_3^- \longrightarrow 3\,PtCl_6^{2-} + 4\,NO + 8\,H_2O$

Q. 6. (a) CrO is basic but Cr_2O_3 is amphoteric ?

	CrO	**Cr_2O_3**
O. N.	**+ 2**	**+ 3**

Ans. (a) Higher the oxidation state higher the acidity. In lower oxidation state some of valence e^- of the metal atom are not involved in bonding, $\therefore$ can donate e^- and behave as base. In higher oxidation state e^- are involved in bonding and are not available, rather it can accept e^- and behave as an acid.

(b) Why the following is the order :

	V_2O_3	**V_2O_4**	**V_2O_5**
O. N.	**+ 3**	**+ 4**	**+ 5**

$\longleftarrow$

Basicity.

Ans. $\therefore$ Basicity $\alpha \dfrac{1}{\text{Oxidation No.}}$ refer (a) for reason.

Q. 7. (a) How is Lanthanoids magnetic moment is calculated ?

Ans. $b = \sqrt{4\,S\,(S+1) + L\,(L+1)}$ B. M. Where S = Spin quantum no. L = Orbital quantum no.

(b) In the titration of Fe^{2+} ions with $KMnO_4$ in acidic medium, why dil. H_2SO_4 is used and not dil. HCl.

Ans. $KMnO_4$ produce Cl_2 $KMnO_4$ in presence of dil. HCl acts as oxidising agent, Oxygen produced is used up partly for oxidation of HCl :

$2\,KMnO_4 + 3\,H_2SO_4 \longrightarrow K_2SO_4 + 2\,MnSO_4 + 3\,H_2O + 5\,(O)$

$2\,KMnO_4 + 4\,HCl \longrightarrow 2\,KCl + 2\,MnCl_2 + 2\,H_2O + 6\,(O)$

$2\,HCl + (O) \longrightarrow H_2O + Cl_2$

Q. 8. (a) The E° value for Ce^{4+}/Ce^{3+} is 1.74 Volt.

(b) $K_2Cr_2O_7$ is used as Primary Standard in volumetric analysis.

Ans. (a) Ce^{4+} is strong oxidant, being Lanthanoid it reverts to Ce^{3+} as + 3 is most stable.

(b) $K_2Cr_2O_7$ is not much soluble in cold water. However, it is obtained in pure state and is not Hygroscopic in nature.

Q. 9. (a) Although Cu^+ has configuration $3\,d^{10}\,4\,s^0$ (stable) and Cu^{2+} has configuration $3\,d^9$ (unstable configuration) still Cu^{2+} compounds are more stable than Cu^+.

(b) Titanium (IV) is more stable than Ti (III) or Ti (II).

Ans. (a) It is due to much more (–) Δ Hydration H^- of Cu^{2+} (aq) than Cu^+, which is more than compensates for the II ionization enthalpy of Cu.

(b) ${}_{22}Ti = 3\,d^2\,4\,s^2$

$Ti^{III} = 3\,d^1$

$Ti^{II} = 3\,d^2$

$\boxed{Ti^{IV} = 3\,d^0}$

most stable configuration. $\therefore$ Ti^{IV} is more stable than Ti^{III} and Ti^{II}.

Q. 10. The actinoids exhibit more number of oxidation states and give their common oxidation states.

Ans. As the distance between the nucleus and 5 f orbitals (actinoides) is more than the distance between the nucleus and 4 f (lanthanoids) hence the hold of the nucleus on valence electrons decrease in actinoids. For this reason the actinoids exhibit more number of oxidation states in general.

Common O. N. exhibited are + 3 (similar to Canthanoids) besides + 3 state, also show + 4, maximum oxidation state in middle of series i. e. Pu and Np. have anoidation state upto + 7.

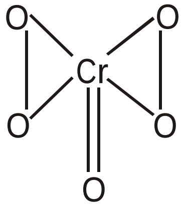
Q. 11. (a) Give reason CrO_3 is an acid anhydride.

(b) Give the structure of CrO_5.

Ans. (a) $CrO_3 + H_2O \longrightarrow H_2CrO_4$ i. e. CrO_3 is formed by less of one H_2O molecule from chromic acid :

$$H_2CrO_4 \xrightarrow{-H_2O} CrO_3$$

(b)



Q. 12. A well known orange crystalline compound (A) when burnt impart violet colour to flame. (A) on treating (B) and conc. H_2SO_4 gives red gas (C) which gives red yellow solution (D) with alkaline water. (D) on treating with acetic acid and lead acetate gives yellow p. pt. (E). (B) sublimes on heating. Also on heating (B) with NaOH gas (F) is formed which gives white fumes with HCl. What are (A) to (F) ?

Ans. (i) $\underset{(A)}{K_2Cr_2O_7} + 4\,\underset{(B)\text{ Sublime}}{NH_4Cl} + 3\,H_2SO_4 \longrightarrow K_2SO_4 + 2\,\underset{\text{Chromyl Chloride red gas (C)}}{Cr_2O_2Cl_2} + 2\,(NH_4)_2SO_4 + 3\,H_2O$

(ii) $CrO_2Cl_2 + 4\,NaOH \longrightarrow \underset{\text{(D) Yellow Soln.}}{Na_2CrO_4} + 2\,NaCl + 2\,H_2O$

(iii) $Na_2CrO_4 + (CH_3COO)_2\,Pb \longrightarrow \underset{\text{Yellow p. pt. (E)}}{PbCrO_4} + 2\,CH_3COONa$

Q. 13. Why is Cr^{2+} reducing and Mn^{3+} oxidising when both have d^4 configuration ?

Ans. Cr^{2+} is reducing as its configuration changes from d^4 to d^3, the d^3 has half-filled t_{2g} level. n the other hand, the change from Mn^{2+} to Mn^{3+} results in the half filled (dS) configuration which has extra stability.

$Cr^{2+} = 3\,d^4\,4\,s^0$ $Mn^{3+} = 3\,d^4\,4\,s^0$

$\Big\downarrow$ oxidation $\Big\downarrow$ reduction

Cr^{3+} =
Cr^{3+} =
have
t_{2g} level.

Mn^{2+} =
stable.

Q. 14. (a) In MnO_4^- ion all the bonds formed between Mn and Oxygen are covalent. Give reason.

(b) Beside + 3 oxidation state Terbium Tb also shows + 4 oxidation state. (Atomic no. = 65)

Ans. (a) In MnO_4^-, O. N. is + 7, but it is not possible to lose 7 electrons because very high energy is required to remove 7 electrons. Therefore it forms covalent bonds.

(b) Tb = 65 E. C. is $4 f^9 6 s^2$

$Tb^{4+} = 4 f^7 6 s^0$

half-filled f-orbital $\therefore$ stable.

after losing 4 e^- it attains half-filled orbital.

Q. 15. (a) Highest manganese flouride is MnF_4 whereas the highest oxide is Mn_2O_7.

(b) Copper can not librate H_2 from dil acids :

Note : Although only oxidising acids (HNO_3 and hot conc. H_2SO_4) react with Cu light.

Ans. (a) The ability of oxygen to form multiple bonds to metals, explain its superiority to show higher oxidation state with metal.

(b) Positive E° value (+ O – 34 Volt) accounts for its inability to liberate H_2 from acids. The high energy to transform Cu (s) to Cu^{2+} (aq) is not balanced by its Hydration enthalpy.

Note : For (b) Consult Fig. 8.4 in NCERT

Q. 16. A metal which is strongly attracted by a magnet is attacked slowly by the HCl liberating a gas and producing a blue solution. The addition of water to this solution causes it to turn pink, the metal is

Ans. The metal is CO

$CO + 2\ HCl \longrightarrow COCl_2 + H_2$

blue solution

$COCl_2$ in solution is $[CO\ (H_2O)_6]^{2+}$

blue pink

❑❑❑

UNIT—9 CO-ORDINATION COMPOUNDS

1 MARK & 2 MARKS QUESTIONS

Q. 1. A cationic complex has two isomers A & B. Each has one Co^{3+}, five NH_3, one Br and one SO_4^{2}. A gives a white precipitate with $BaCl_2$ solution while B gives a yellow precipitate with $AgNO_3$ solution.

(a) What are the possible structures of the complexes A and B ?

(a) Will the two complexes have same colour ?

Ans. (a) $[CO (NH_3)_5 Br] SO_4$ and $[CO (NH_3)_5 SO_4] Br$

(b) NO

Q. 2. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1 : 1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1 : 4 molar ratio does not give the test of Cu^{2+} ion. Explain why ?

Ans. When $FeSO_4$ and $(NH_4)_2SO_4$ solution are mixed in 1 : 1 molar ratio, a double salt is formed. It has the formula $FeSO_4\ (NH_4)_2SO_4 . 6\ H_2O$. In aqueous solution, the salt dissociates.

When $CuSO_4$ and NH_3 are mixed in the molar ratio of 1 : 4 in solution, a complex $[Cu (NH_3)_4] SO_4$ is formed.

Q. 3. If to an aqueous solution of $CuSO_4$ in two tubes, we add ammonia solution in one tube and HCl (aq) to the other tube, how the colour of the solutions will change ? Explain with the help of reaction.

Ans. In first case, colour will change from blue to deep blue.

$$[Cu (H_2O)_4]^{2+} + 4\ NH_3 \longrightarrow \underset{\text{deep blue}}{[Cu (NH_3)_4]^{2+}} + 4\ H_2O$$

While in second case, its colour will change to yellow.

$$[Cu (H_2O)_4]^{2+} + 4\ Cl^- \longrightarrow \underset{\text{yellow}}{[CuCl_4]^{2+}} + 4\ H_2O$$

Q. 4. A, B and C are three complexes of Chromioum with the empirical formula $H_{12}O_6Cl_3Cr$. All the three complexes have Cl and H_2O molecules as the ligands. Complex A does not react with conc. H_2SO_4. Complexes B and C lose 6.75% and 13.5% of their original weight respectively on heating with conc. H_2SO_4. Identify A, B and C.

Ans. Data suggests that the complexes are hydrate isomers.

As comples A does not lose any molecule of H_2O on heating which shows that no water molecule of H_2O is outside the co-ordination sphere.

$\therefore$ A = $[Cr (H_2O]_0] Cl_3$

As B loses 6.75% $\therefore$ actual loss in wt.

= × 266.5 = 18 au

B = $[Cr (H_2O)_5 Cl] Cl_2 . H_2O$

As C loses 13.5% of wt. on heating which is twice the loss in the first case, $\therefore$ C isomer exists as a dihydrate :

$$[Cr (H_2O)_4 Cl_2] Cl . 2\ H_2O$$

Q. 5. $$Fe^{3+} \xrightarrow[\text{excess}]{SCN^-} (A) \xrightarrow[\text{excess}]{F^-} (B)$$

What are (A) and (B) ? Give IUPAC name of (A). Find the spin only magnetic moment of (B).

Ans. A = Fe $(SCN)_3$, B = $[FeF_6]^{3-}$

IUPAC name of A = trithiocyanato iron (III)

E. C. of Fe (III) = d^5, unpaired e^-s = 5

Spin only magnetic moment = $\sqrt{5(5+2)}$ B. M.

= 5.916 B. M.

Q. 6. A complex is prepared by mixing $COCl_3$ and NH_3 in the molar ratio of 1 : 4, 0.1 M solution of this complex was found to freeze at – 0.372 °C. What is the formula of the complex ? Given that molal depression constant of water K_f = 1.86 °C/m.

Ans. The oretical $\Delta T_f = K_f \cdot m$

$= 1.86 \times 0.1$

$= 0.186°$

observed ΔT_f $= 0.372°$

As observed ΔT_f is double of the theoretical value this shows that each molecule of the complex dissociates to form two ions. $\therefore$ formula is :

$[CO(NH_3)_4Cl_2]Cl$

Q. 7. How t_{2g} and eg orbitals are formed in an octahedral complex ?

Ans. In an octahedral complex, positive metal ion is considered to be present at the centre and negative ligands at the corners. As lobes of $dx^2 - y^2$ and dz^2 lie along the axes, i. e. along the ligands repulsions are more and so is the energy. The lobes of the remaining three d-orbitals lie between the axes i. e. between the ligands, the repulsions between them are less and so is the energy.

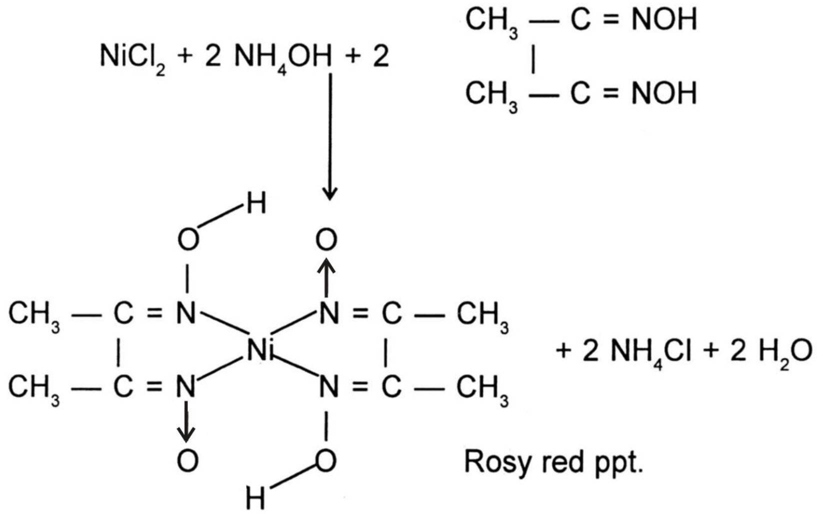
Q. 8. Dimethyl glyoxime is added to alcoholic solution of $NiCl_2$. When ammonium hydroxide is slowly added to it, a rosy red precipitate of a complex appears.

(a) Give the str. of the complex showing hydrogen bond.

(b) Give oxidation state and hybridisation of central metal ion.

(c) Identify whether it is paramagnetic or diamagnetic.

Ans. (a)



(b) O. S. = + 2

bybridisation = dsp^2

(c) diamagnetic as no unpaired electron.

Q. 9. Explain the reason behind a colour of some gem stone with the help of example.

Ans. The colours of many gem stones are due to the presence of transition metal ions & colour are produced due to d-d transition. For example the mineral corundum Al_2O_3 is colourless when pure but when various M^{3+} transition metal ions are present in trace amounts various gem stones are formed. Ruby is Al_2O_3 containing about 0.5 – 1% Cr^{3+}.

Q. 10. How many EDTA (lethylendiamine tetra acetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion.

Ans. EDTA is a hexadentate ligand therefore only one EDTA molecule is required to form octahedral complex.

Q. 11. What is the hybridisation of central metal ion and shape of Wilkinson's catalyst ?

Ans. Wilkinson's catalyst is $(PH_3P)_3$ RhCl. In this Rh has dsp^2 hybridisation and square planar shape.

Q. 12. Which vitamin is a complex compound of cobalt ?

Ans. Vitamin B_{12} is a complex compound in which central metal atom is cobalt.

Q. 13. Write the IUPAC name of $[CO\ (NH_3)_4\ B_{12}]_2\ [ZnCl_4]$.

Ans. Tetraamminedibromocobalt (III) tetrachlorozincate (II)

Q. 14. What is the value of x in the complex HxCO $(CO)_4$ on the basis of EAN rule. (At. No. Co` = 27)

Ans. x = 36 – (27 + 4 × 2)
= 36 – 35
= 1

Q. 15. Why is the silver plating of copper, K $[Ag\ (CN)_2]$ is used instead of $AgNO_3$?

Ans. This is because if $AgNO_3$ is used Cu will displace Ag^+ from $AgNO_3$. The deposit so obtained is black, soft, non-adhering. To get a good shining deposit, $[Ag\ (CN)_2]^-$ are used as it is a stable complex, the conc. of Ag^+ is very small in the solution. As such no displacement of Ag^+ ions with Cu is possible.

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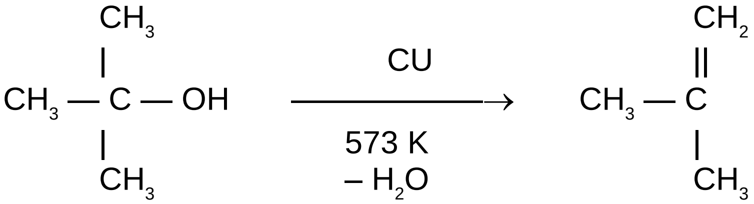
UNIT—10 HALOALKANES AND HALOARENES

1 MARK QUESTIONS

Q. 1. What happens when tert-butyl alcohol is treated with Cu / at 573 K.

Ans. Dehydration reaction will take place. Isobutene will be formed.



$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-OH \xrightarrow[573\ K\ -\ H_2O]{CU} CH_3-\underset{CH_3}{\overset{CH_2}{\underset{|}{\overset{||}{C}}}}$$

Q. 2. Arrange the following halides in order of increasing SN^2 reactivity :
CH_3 — Cl, CH_3 — Br, CH_3CH_2Cl, $(CH_3)_2$ CHCl

Ans. $(CH_3)_2$ CHCl < CH_3CH_2Cl < CH_3Cl < CH_3Br.

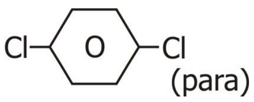
(**Hint :** As the size of the alkyl group increases SN^2 reactivity decreases.)

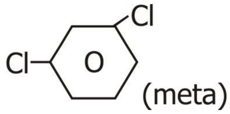
Q. 3. Alkyl halides, though polar, are immiscible with water. Why ?

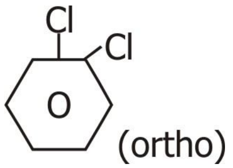
Ans. Alkyl halides cannot form H-bonds with water molecules and hence are insoluble in water.

Q. 4. p-Dichlorbenzene has higher melting point and lower solubility than those of o- and m- isomers. Discuss.

Ans.







Tl mor los lattice and thus has st ar f tha m- isomers. Since during melting or dissolu lattice a larger amount of energy is needed to melt or dissolve the p- isomer than the corresponding o- and meta isomers.

Q. 5. The treatment of alkyl chlorides with aq KOH leads to the formation of alcohols but in presence of alcoholic KOH, alkenes are the major products. Explain.

Ans. In aq. solution, KOH is almost completely ionised to give OH^- ions which being a strong nucleophile brings about a substitution reaction to form alcohols. Further in aq. solution, OH^- ions are highly solvated (hydrated).

This solution reduces the basic character of OH^- ions which fail to abstract a hydrogen from the β-carbon of the alkyl halide to form an alkene.

However an alcoholic solution of KOH contains alkoxide (RO^-) ions which being a much stronger base than OH^- ions preferentially abstracts a hydrogen from the β-carbon of the alkyl halide to form alkene.

Q. 6. Grignard reagents should be prepared under anhydrous conditions. Why ?

Ans. Because Grignard reagents have a very strong affinity for H^+ ions. In presence of water, they abstract H^+ ions from water and form alkanes. To prevent this, they should be prepared under anhydrous conditions.

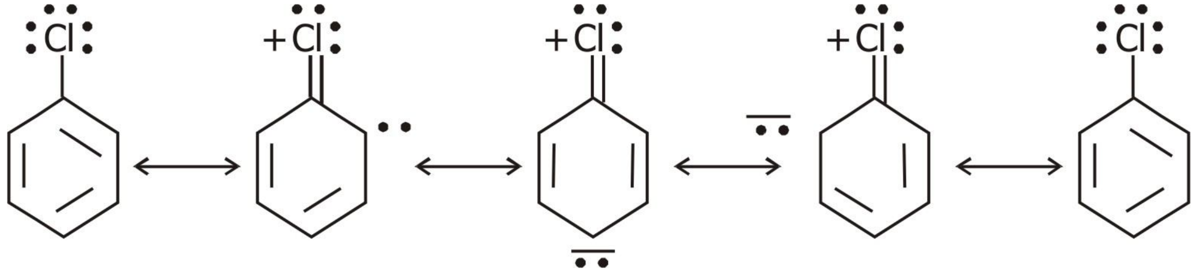
Q. 7. Haloalkanes react with KCN to form alkyl cyanides as major product while AgCN form isocyanide as the chief product. Explain.

Ans. KCN is a ionic compound and provides cyanide ions in solution. Although both carbon and nitrogen atoms are in a position to donate electron pairs, the attack takes place mainly through Carbon atom and not through nitrogen atom since C — C bond is more stable than C — N bond. However AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the main product.

Q. 8. Explain why is Chlorobenzene difficult to hydrolyse than ethyl chloride ?

Ans. The lone pair of electrons of Chlorine is Chlorbenzene participates into resonance with the benzene ring.

As a result C — Cl bond acquires a partial double bond character. Therefore, this C — Cl bond is stronger than C — Cl bond in ethyl chloride which is a pure single bond. As such the Chlorobenzene is difficult to hydrolyse than ethyl chloride.



Q. 9. Tert-butyl chloride reacts with aq. NaOH by SN¹ mechanism while n-butyl chloride reacts by SN² mechanism. Why ?

Ans. Tert-butyl chloride reacts via SN¹ mechanism because the heterolytic cleavage of C — Cl bond in tert-butyl chloride gives 3 carbocation which is highly stable and favourable for SN¹ mechanism. Moreover, tert-butyl chloride (3°) bring a bulky molecule has steric hindrance which will not allow SN² mechanism to take place. Hence only SN¹ mechanism can occur in tert-butyl chloride. However n-butyl chloride (1°) reacts via SN² because 'C' of C — Cl bond is less crowded and favourable for nucleophile to attack from back side results in the formation of transition state. It has less steric hindrance which is a favourable factor for SN² mechanism.

Q. 10. (a) Which of the following two compounds would react faster by SN² pathway : 1-bromobutane (OR) 2-bromobutane.

(b) Allyl Chloride is more reactive than n-propyl Chloride towards nucleophilic substitution reactions. Explain.

Ans. (a) The reactivity in SN² reaction depends upon the extent of steric hindrance. i-bromobutane is a 1° alkyl halide and 2-bromobutane is a 2° alkyl halide. Since there will be some steric hindrance in 2° alkyl halide than in 1° alkylhalide, therefore 1°-bromobutane will react faster than 2-bromobutane in SN² reaction.

(b) Allyl Chloride readily undergoes ionization to produce resonance stabilized allyl carbocation. Since carbocations are reactive species they readily combine with OH^- ions to form allyl alcohol.

$$CH_2 = CH — CH_2 — Cl \xrightarrow[\text{Slow}]{\text{Ionization}} CH_2 = CH — \overset{+}{C}H_2$$

$$\updownarrow$$

$$CH_2 = CH — CH_2OH \xleftarrow[\text{Fast}]{OH^-} {}^{+}CH_2 — CH = CH_2$$

In contrast, n-propyl chloride does not undergo ionization to produce n-propyl carbocation and hence allyl chloride is hydrolysed more readily than n-propyl chloride.

Q. 11. R—Cl is hydrolysed to R—OH slowly but the reaction is rapid if a catalytic amount of KI is added to the reaction mixture.

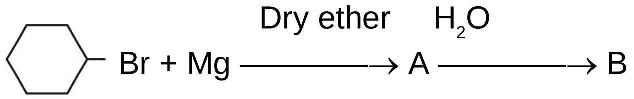
Ans. Iodide ion is a powerful nucleophile and hence reacts rapidly with RCl to form RI.

$KI \longrightarrow K^+ + I^-$; $R - Cl + I^- \longrightarrow R - I + Cl^-$

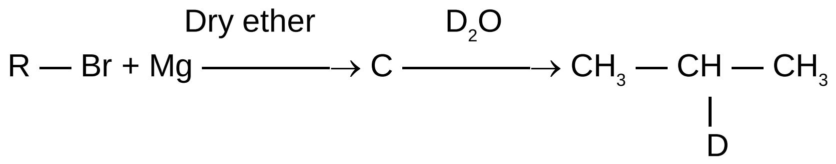
Further I^- is a better leaving group than Cl^- ion, therefore, RI is more rapidly hydrolysed than RCl to form ROH.

$HO^- + R - I \longrightarrow R - OH + I^-$

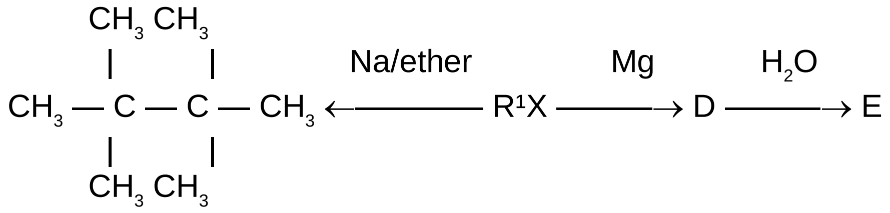
Q. 12. Identify A, B, C, D, E, R, R^1 in the following :

(i) 

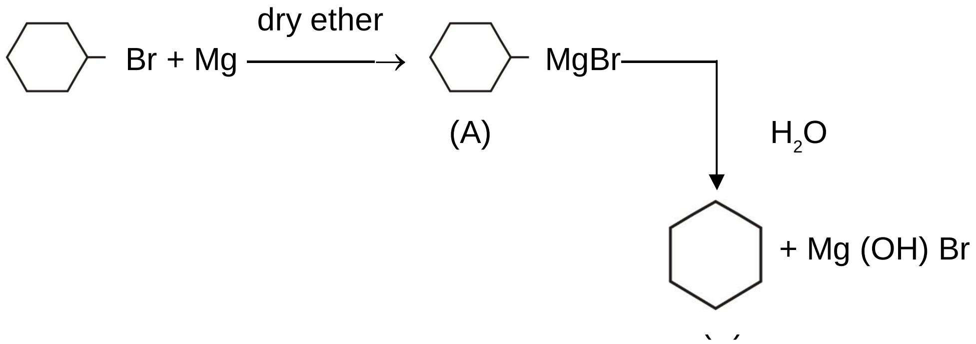
$$C_6H_{11}-Br + Mg \xrightarrow{\text{Dry ether}} A \xrightarrow{H_2O} B$$

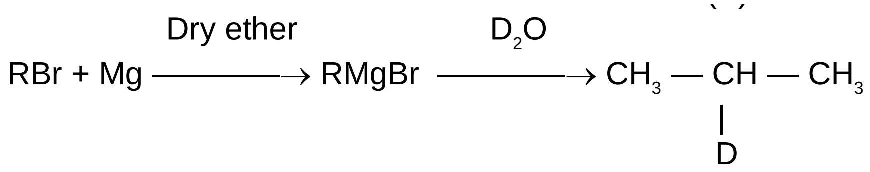
(ii) 

$$R - Br + Mg \xrightarrow{\text{Dry ether}} C \xrightarrow{D_2O} CH_3 - \underset{\underset{D}{|}}{CH} - CH_3$$

(iii) 

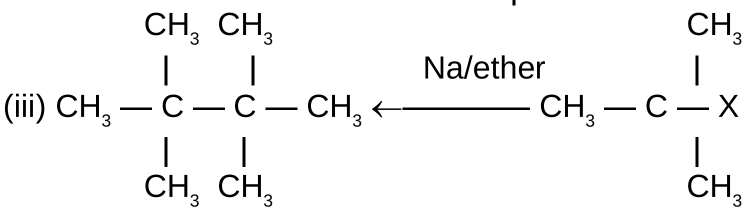
$$CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - CH_3 \xleftarrow{\text{Na/ether}} R^1X \xrightarrow{Mg} D \xrightarrow{H_2O} E$$

Ans. (i) 

(ii) 

$$RBr + Mg \xrightarrow{\text{Dry ether}} RMgBr \xrightarrow{D_2O} CH_3 - \underset{\underset{D}{|}}{CH} - CH_3$$

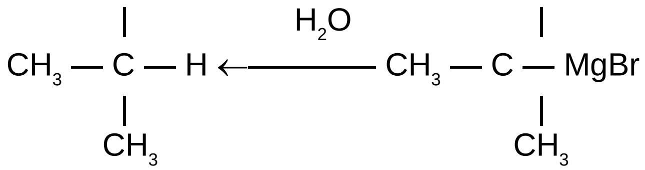
Here $R = CH_3\underset{|}{C}HCH_3$

(iii) 

$$CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - CH_3 \xleftarrow{\text{Na/ether}} CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - X$$

$$\Big\downarrow \text{Mg}$$

CH_3 CH_3


$$CH_3-\overset{|}{\underset{\underset{CH_3}{|}}{C}}-H \xleftarrow{H_2O} CH_3-\overset{|}{\underset{\underset{CH_3}{|}}{C}}-MgBr$$

1 MARK QUESTIONS

Q. 1. Explain why :
Haloalkanes undego nucleophilic substitutions whereas Haloarenes undegoes electrophilic substitutions.

Ans. Haloalkanes are more polar than haloarenes.

∴ C-atom carrying the halogen in haloalkanes is mroe e^- deficient than that in haloarenes.

∴ Haloalkanes undergo nucleophilic substitution readily

In haloarenes, the love pair of electrons present on the halogen atom goes into resonance with the aryl ring. The aryl ring being rich in electron density, undergoes electrophilic substitutions.

Q. 2. Why alkyl halides are generally not prepared in laboratory by free radical halogenation of alkanes ?

Ans. It is because :

(i) It gives a mixture of isomeric monohalogenated products whose boiling points are so close that they cannot be separated easily.

(ii) Polyhalogenation may also take place, thereby making the mixture more complex and hence difficult to separate.

Q. 3. Why preparation of aryl iodide by electrophilic substitution requires presence of an oxidising agent ? Why can aryl flouride not be prepared by this method ?

Ans. Reactions with I_2 are reversible in nature and require presence of oxidising agent (HNO_3, etc.) to <u>oxidise HI formed during iodination</u> and promote forward reaction.

Fluoro compounds cannot be prepared due to high reactivity of flourine.

Q. 4. Why is Sulphuric acid not used during reaction of alcohol with KI ?

Ans. H_2SO_4 cannot be used along with KI in conversion of an alcohol to alkyl iodide as it converts KI to corresponding HI and then oxidises it to I_2.

Q. 5. Why aryl halides are extremely less reactive towards nucleophilic substitution ?

Ans. (i) Resonance effect :

Due to resonance C — Cl bond acquires partial double bond character.

(ii) Difference in hybridisation of Carbon in C —X bond :

in haloarene C-atom attached to halogen in sp^2 hybrid while sp^3 in haloalkane.

C — X bond length in sp^2 hybrid is shorter and hence stronger and difficult to break.

(iii) <u>Instability of phenyl cation</u>

(iv) Possible repulsion of nucleophile to approach e^- rich arenes.

Q. 6. Why thionyl chloride method is preferred for the preparing alkyl chloride from alcohols ?

Ans. Because by products of the reaction, i. e., SO_2 and HCl being gases escape into atmosphere leaving behind pure alkyl chloride.

Q. 7. (i) Arrange in order of property indicated :
$CH_3CH_2CH_2CH_2Br$, $(CH_3)_3\,Br$, $(CH_3)_3\,CHCH_2\,Br$
(Increasing boiling point)

(ii) CH_3F, CH_3I, CH_3Cl, CH_3Br (nucleophilic substitution)

Ans. (i) B. P. decreases with increase in branching due to decrease in Van der Waals forces of attraction.

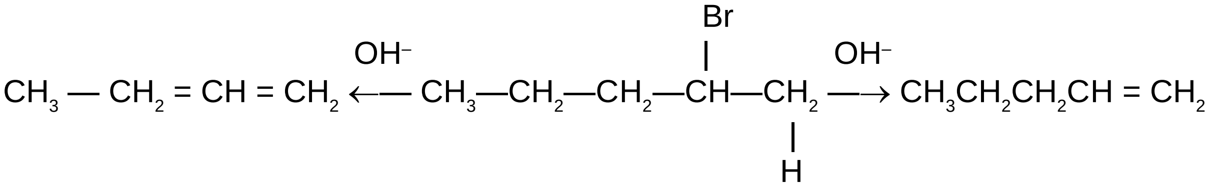
$(CH_3)_3 CBr < (CH_3)_2 CHCH_2 Br < CH_3CH_2CH_2CH_2Br$

(ii) Reactivity increases as C — X bond dissociation energy decreases.

$CH_3F < CH_3Cl < CH_3Br < CH_3I$

Q. 8. Why does 2 bromopentane gives pent-2-ene as major product in elimination reaction ?

Ans.



$$CH_3 — CH_2 = CH = CH_2 \xleftarrow{OH^-} CH_3—CH_2—CH_2—\overset{Br}{CH}—\underset{H}{CH_2} \xrightarrow{OH^-} CH_3CH_2CH_2CH = CH_2$$

(81%)
(Pent-2-ene)

(19%)
(Pent-1-ene)

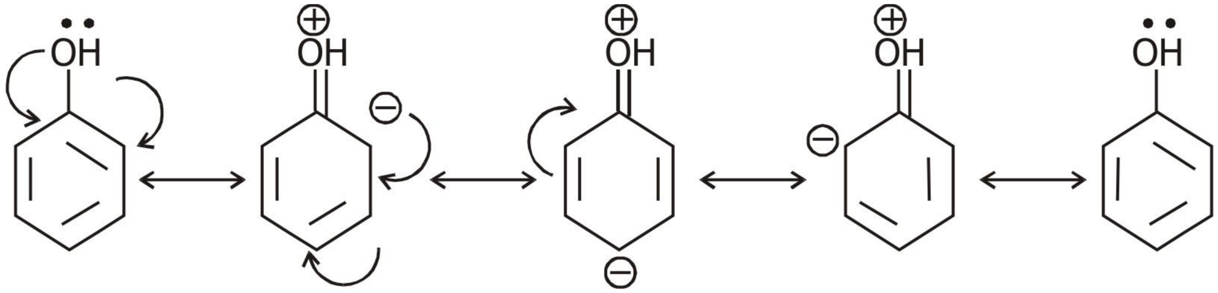
This is because of Saytzeff's rule — In dehydrohalogen reactions, the preferred product is that alkene which has the greater number of alkyl groups attached to the doubly bonded carbon atoms.

Q. 9. Why is bond angle in ethers slightly greater than tetrahedral angle ?

Ans. Because, the interaction beetween the two bulky groups is quiet repulsive. Hence angle is slightly larger.

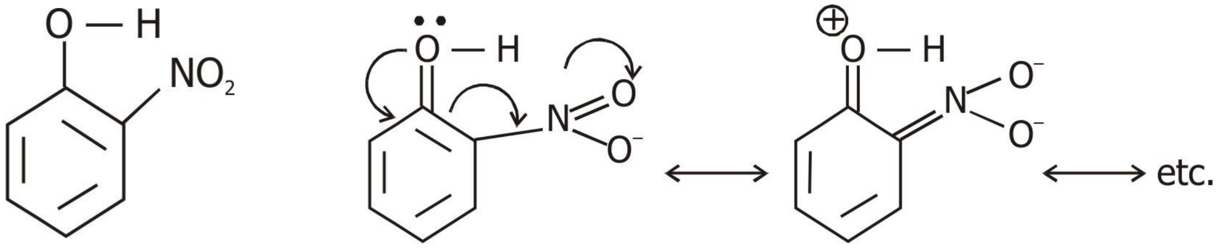
Q. 10. Alcohols reacts with halogen acids to form haloalkenes but phenol does not form halobenzene. Explain.

Ans. The C—O bond in phenol acquires partial double bond character due to resonance and hence be cleared by X^- ions to form halobenzenes.



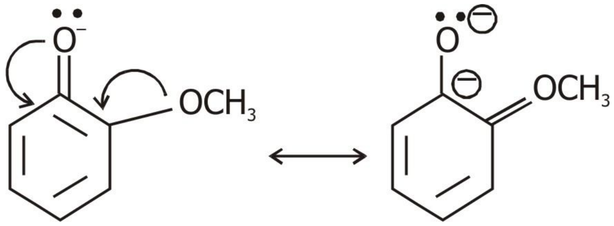
Q. 11.

Ans. Due to — R and — I effect of — NO_2 group, e^- density on 'O' if O — H bond decreases and loss of H^+ is easy.



——→ release of H^+ easier.

In contrast in o-methoxy phenol due to + R effect, – OCH_3 increases. e^- density on 'O' of O — H group, and hence less of H^+ is difficult.


OCH3
OCH3

(both –ve charge repel each other)

Q. 12. Why is preparation of ethers by acid catalysed dehydration of 2° and 3° alcohols not a suitable method ?

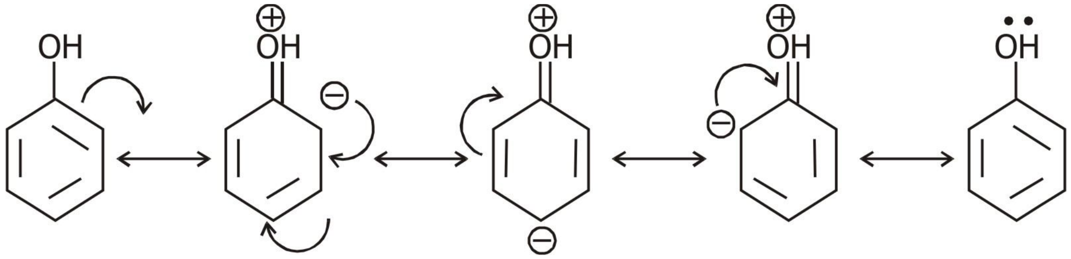
Ans. Acid catalysed dehydration of 1° alcohols to ethers occurs by SN² reaction involving attack of nucleophile by alcohol on protonated alcohol molecule.

Under these conditions, 2° and 3° alcohols give alkenes rather than others. Due to steric hindrance nucleophilic attack on protonated alcohol does not occur instead they lose one H_2O and produce alkenes.

Q. 13. Of benzene and phenol, which is more easily nitrated and why ?

Ans. Nitration is an electrophilic substitution reaction.

The — OH group in phenol increases the e^- density at o- and p- position as follows :

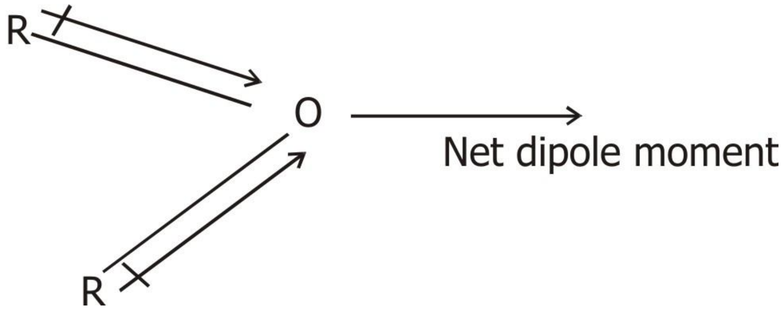


ure of OH group, compared to benzene, therefore nitration is easy in phenol than benzene.

Q. 14. How will you account for the following :

Ethers possess a net dipole moment even if they are symmetrical in structure ?

Ans.



on C – O bonds are polar.

C – O bond are inclined to each other at an angle of 110° (or more), two dipoles do not cancel out each other.

Q. 15. How do 1°, 2° and 3° alcohols differ in terms of their oxidation reaction and dehydrogenation ?

Ans. (I) Oxidation reaction :

$$\text{1° alcohol} \xrightarrow{(O)} \text{aldehyde} \xrightarrow{(O)} \text{carboxylic acid}$$

$$\text{2° alcohol} \xrightarrow{(O)} \text{ketone} \xrightarrow{(O)} \text{carboxylic acid}$$

(acid with loss of 1 carbon atom)

$$\text{3° alcohol} \xrightarrow{(O)} \text{resistant to oxidation}$$

(II) Hydrogenation reaction :

1° alcohol $\xrightarrow{\text{give}}$ aldehyde
2° alcohol $\longrightarrow$ ketone
3° alcohol $\longrightarrow$ alkene
3° alcohols prefer to undergo dehydration and form alkene.

Q. 16. (I) How is diethyl ether prepared from ethyl alcohol ?

Ans. Ethyl alcohol is first treated with sodium to form sodium ethoxide.

$C_2H_5OH + Na \longrightarrow C_2H_5O^- Na^+ + H_2$

Sodium ethoxide is then treated with ethyl halide to form di ethyl ether.

$C_2H_5O\,Na + X — C_2H_5 \xrightarrow{SN^2} C_2H_5O\,C_2H_5 + NaX$

(Williamson synthesis)

(II) Complete the rxn :

(a) $\mathbf{CH_3OCH_3 + PCl_5 \longrightarrow}$

(b) $\mathbf{C_2H_5OCH_3 + HCl \longrightarrow}$

(c) $\mathbf{(C_2H_5)_2\,O + HCl \longrightarrow}$

Ans. (a) $2\ CH_3Cl$

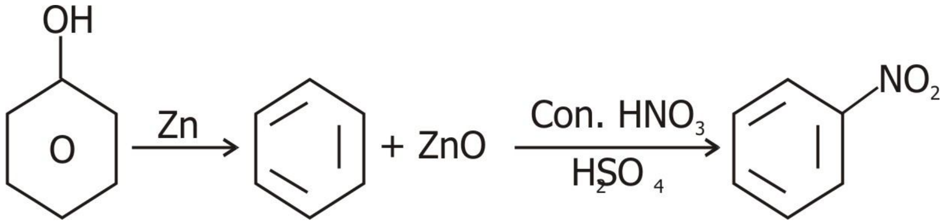
(b) $CH_3Cl + C_2H_5OH$

(c) $C_2H_5Cl + C_2H_5OH$

Q. 17. Why is reactions of alcohol/phenol and with acid chloride in the presence of pyridine ?

Ans. Because esterification rxn is reversible and presence of base (pyridine) neutralises HCl produced during reaction thus promoting forward reaction.

Q. 18. How can we produce nitro benzene from phenol ?



Ans. (

(II) Nitration of benzene with conc. nitric acid in presence of conc. sulphuric acid.

* * *

ALCOHOLS, PHENOLS AND ETHERS UNIT—11

1 MARK QUESTIONS

Q. 1. What is the main product obtained when vapours of t-butyl alcohol are passed over copper at 300° ?

Ans. Isobutylene (2-Methyl propene)

Q. 2. What is usually added to ethyl alcohol to make it unfit for drinking purposes ?

Ans. Methanol and Pyridine.

Q. 3. Phenol has smaller dipole moment than methanol.

(OR)

Why are dipole moments of phenols smaller than dipole moments of alcohols ?

Ans. Due to electron-withdrawing effect of the benzene ring, the C — O bond in phenol is less polar but in case of methanol due to electron-donating effect of — CH_3 group, C — O bond is more polar.

Q. 4. Name the products obtained when anisole is treated with HI.

Ans. Phenol and methyl iodide.

Q. 5. Why are Grignard reagents soluble in ether but not in benzene ?

Ans. Grignard reagents from co-ordination complexes with ether but not benzene since the former has lone pair of electrons but the later does not.

Q. 6. Alcohols are easily protonated than phenols. Justify.

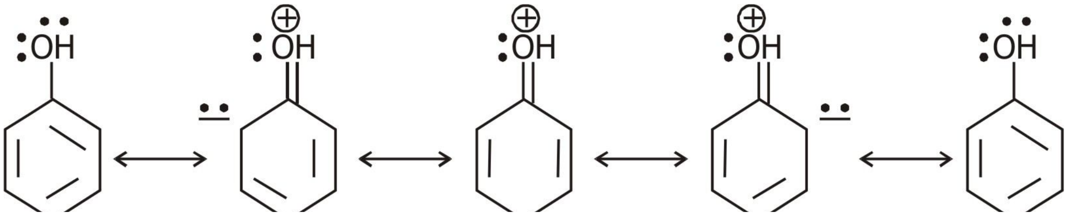
Ans. In phenols lone pair of electrons on the oxygen atom are delocalised over the benzene ring due to resonance and hence are not easily available for protonation. In contrast in alcohols, the lone pairs of electrons on the oxygen atom are localized due to absence of resonance and hence are easily available for protonation.

Q. 7. Di-tert butyl ether cannot be made by Williamson's synthesis. Explain why ?

Ans. To prepare di tert-butyl ether by Williamson's synthesis, we need tert-butyl bromide and Sodium tertiary butoxide. Since tert-butyl bromide being 3°-alkyl halide prefers to undergo elimination rather than substitution, therefore the product obtained is isobutylene rather than ditertiary butyl ether.

Q. 8. How an — OH group attached to carbon in the benzene ring activates benzene towards electrophilic substitution ?

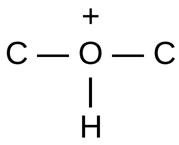
Ans.



e with the
p- position
lectrophilic

Q. 9 Ethers are cleaved by acids not by based. Why ?

Ans. The C — O — C bond in ethers like the C — OH bond in alcohols is quite strong. In order to weaken it, the oxygen atom must be protonated. A subsequent nucleophile attack by a strong nucleophile such as Br^- as I^- ion on the less hindered carbon atom of the protonated :



$$C - \overset{+}{\underset{H}{\underset{|}{O}}} - C$$

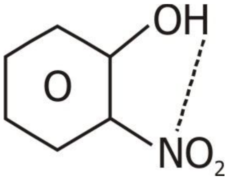
bond brings about the cleavage of ethers to form an alcohol and an alkyl halide. The acids only can provide the H^+ ion required for protonation of O atom of ether and therefore only acids can bring about the cleavage of ethers and not bases.

Q. 10. Phenols do not undergo substitution of the — OH group like alcohols. Explain.

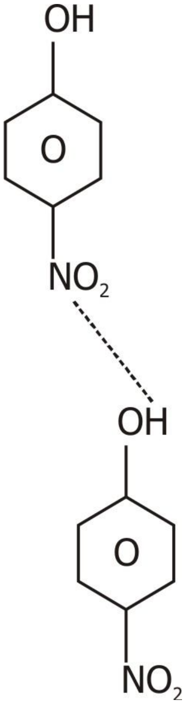
Ans. The C — O bond in phenols has some double bond character due to resonance and hence cannot be easily cleaved by a nucleophile. In contrast, the C — O bond in alcohols is a pure single bond and hence can be easily cleaved by a nucleo phile.

Q. 11 While separating a mixture of ortho and para-nitro phenols by steam distillation, name the isomer which will be steam volatile. Give reasons.

Ans. In o-nitrophenol, there is intramolecular hydrogen bonding as follows :



In p-nitrophenol, there is intramolecular hydrogen bonding as follows :



Due to intermolecular H bonding in p-nitrophenol, its b. p. is much higher than that of o-nitrophenol. Hence o-nitraphenol due to its lower b. p. is steam volatile while p-nitrophenol is not.

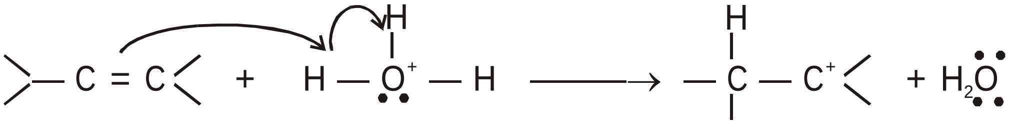
Q. 12. Alcohols acts as weak bases. Explain.

Ans. The oxygen atom of the hydroxyl group has two lone pairs of electrons. Therefore alcohols accept a proton from strong mineral acid to form oxonium ions. Hence act as weak bases.

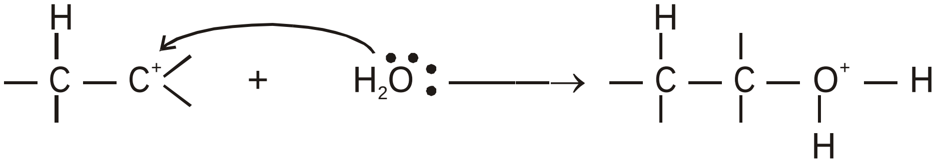
Q. 13. Write the mechanism of hydration of ethene to yield ethanol.

Ans. $H_2O + H^+ \longrightarrow H_3O^+$

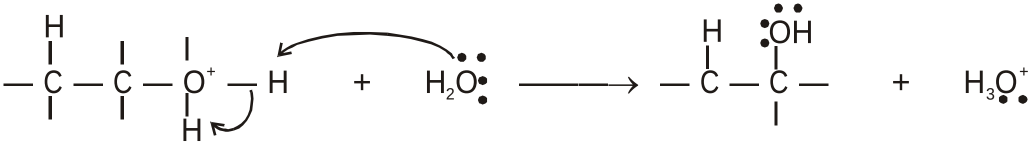
Step (i) : — Protonation of alkene to form carbocation by electrophilic attack :



Step (ii) : — Nucleophilic attack of water on carbocation :



Step (iii) : — Deprotonation to form an alcohol :



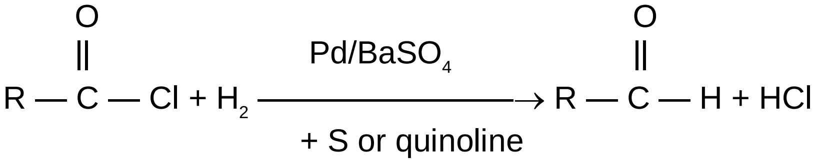
UNIT—12 ALDEHYDES, KETONES AND CARBXYLIC ACID

1 MARK QUESTIONS

Q. 1. Name the reaction and the reagent used for the conversion of acid chlorides to the corresponding aldehydes.

Ans. Name : Rosenmund's reaction

Reagent : H_2 in the presence of Pd (supported over $BaSO_4$) and partially poisoned by addition of Sulphur or quinoline.



$$R-\overset{\overset{O}{\|}}{C}-Cl + H_2 \xrightarrow[+\text{ S or quinoline}]{Pd/BaSO_4} R-\overset{\overset{O}{\|}}{C}-H + HCl$$

Q. 2. Suggest a reason for the large difference in the boiling points of butanol and butanal, although they have same solubility in water.

Ans. The b. pt. of butanol is higher than that of butanal because butanol has strong intermolecular H-bonding while butanal has weak dipole-dipole interaction. However both of them form H-bonds with water and hence are soluble.

Q. 3. What type of aldehydes undergo Cannizaro reaction ?

Ans. Aromatic and aliphatic aldehydes which do not contain α hydrogens.

Q. 4. Out of acetophenone and benzophenone, which gives iodoform test ? Write the reaction involved.

(The compound should have CH_3CO-group to show the iodoform test.)

Ans. Acetophenone ($C_6H_5COCH_3$) contains the grouping (CH_3CO attached to carbon) and hence given iodoform test while benzophenone does not contain this group and hence does not give iodoform test.

$$\underset{\text{Acetophenane}}{C_6H_5COCH_3} + 3\,I_2 + 4\,NaOH \longrightarrow \underset{\text{Iodoform}}{CHI_3} + C_6H_5COONa + 3\,NaI + 3\,H_2O$$

$$C_6H_5COC_6H_5 \xrightarrow{I_2/NaOH} \text{No reaction}$$

Q. 5. Give Fehling solution test for identification of aldehyde gp (only equations). Name the aldehyde which does not give Fehling's soln. test.

Ans. $R-CHO-2\,Cu^{2+} + 50\,H^- \longrightarrow RCOO^- + Cu_2O \downarrow 3\,H_2O$

Benzaldehyde does not give Fehling soln. test.

(Aromatic aldehydes do not give this test.)

Q. 6. What makes acetic acid a stronger acid than phenol ?

Ans. Greater resonance stabilization of acetate ion over phenoxide ion.

Q. 7. Why HCOOH does not give HVZ (Hell Volhand Zelinsky) reaction but CH_3COOH does ?

Ans. CH_3COOH contains α hydrogens and hence give HVZ reaction but HCOOH does not contain α-hydrogen and hence does not give HVZ reaction.

Q. 8. During preparation of esters from a carboxylic acid and an alcohol in the presence of an acid catalyst, water or the ester formed should be removed as soon as it is formed.

Ans. The formation of esters from a carboxylic acid and an alcohol in the presence of acid catalyst in a reversible reaction.

$$RCOOH + R'OH \xrightleftharpoons{H_2SO_4} RCOOR' + H_2O$$

Carboxylic acid alcohol Ester

To shift the equilibrium in the forward direction, the water or ester formed should be removed as fast as it is formed.

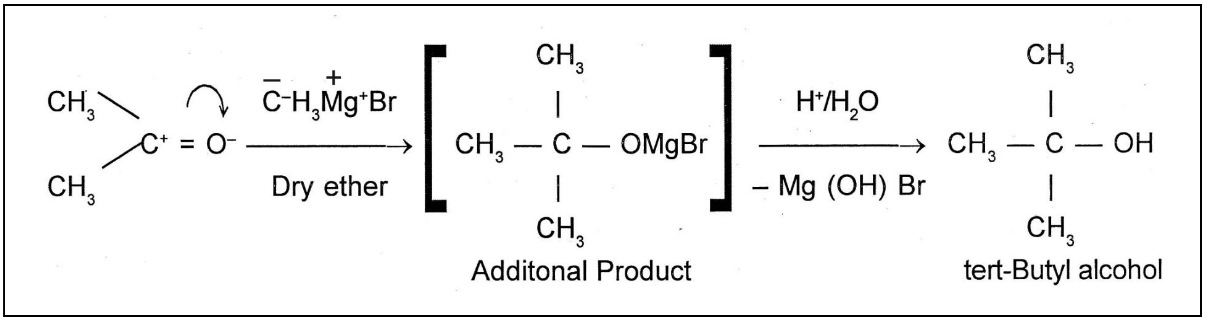
Q. 9. Arrange the following compounds in increasing order of their acid strength. Benzoic acid, 4-Nitrobenzoic acid, 3, 4-dinitrobenzoic acid, 4-methoxy benzoic acid.

Ans. Since electron donating gps. decrease the acid strength therefore 4-methoxybenzoic acid is a weaker acid because methoxy sp. is E. D. G. than benzoic acid. Further since electron withdrawing gps. increase the acid strength, therefore both 4 nitrobenzoic acid and 3, 4-dinitrobenzoic acids are stronger acid than benzoic acid. Further due to the presence of additional NO_2 gp at m-position wrt COOH gt, 3, 4-dinitrobenzoic acid is a lattice stronger acid than 4-nitrobenzoic acid. Thus the increasing order of acid strength will be :

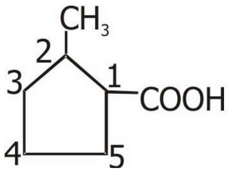
4-methoxybenzoic acid < benzoic acid < 4-nitrobenzoic acid < 3, 4, dinitrobenzoic acid.

Q. 10. How is tert-butyl alcohol obtained from acetone ?

Ans.



Q. 11. Give IUPAC name of the following compound :



Ans. -3-ene-1-oic acid

Q. 12. How will you distinguish between methanol and ethanol ?

Ans. By Iodoform test :

Ethanol having α-methyl gp will give yellow ppt. of iodoform whereas methanol does not have α-methyl gp will not give ppt. of iodoform.

Q. 13. Distinguish between :

(i) Acetaldehyde and acetone

(ii) Methanoic acid and Ethanoic acid.

Ans. (i) Acetaldehyde will give positive tests with Tollen's reagent and Fehling Solns. whereas acetone will not give these test.

(ii) Methanoic acid gives Tollen's reagent test whereas ethanoic acid does not due to difference in their boiling points.

Q. 14. Why are aldehydes more reactive than ketones ?

Ans. It is because of 2 reasons :

The carboxyl compounds (both aldehydes & ketones) undergo nucleophilic addition reaction.

(i) + I effect : The alkyl group in ketones due to their e^- releasing character decrease the electrophilicity / + ve charge on c-atom and thus reduce its reactivity.

(ii) Steric hindrance : Due to steric hindrance in ketones, they are less reactive.

Q. 15. Give the composition of Fehling A and Fehling B ?

Ans. Fehling A = aq. $CuSO_4$

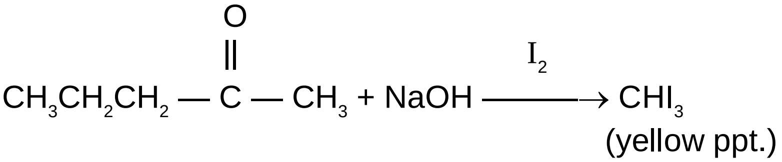
Fehling B = alkaline sodium potassium tartarate
(Rochelle Salt)

Q. 16. Name one reagent which can distiguish between 2-pentanone and 3-pentanone ?

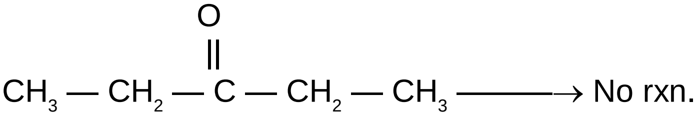
Ans. 2-pentanone has a CH_3CO-group, hence gives positive iodoform test.

3-pentanone does not have a CH_3CO-group, hence does not give positive iodoform test.

Iodoform test $\longrightarrow$ I_2/NaOH



$$CH_3CH_2CH_2-\overset{\overset{\displaystyle O}{||}}{C}-CH_3 + NaOH \xrightarrow{I_2} \underset{\text{(yellow ppt.)}}{CHI_3}$$



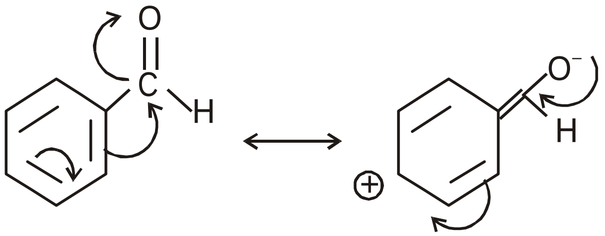
$$CH_3-CH_2-\overset{\overset{\displaystyle O}{||}}{C}-CH_2-CH_3 \longrightarrow \text{No rxn.}$$

Q. 17. Why pcc cannot oxidise methanol to methane and while $KMnO_4$ can ?

Ans. This is because pcc is a mild oxidising agent and can oxide methanol to methanal only. While $KMnO_4$ being strong oxidising agent oxidises it to methanoic acid.

Q. 18. Would you expect benzaldehyde to be more reactive or less reactive in nucleophlic addition reaction than propanal ? Explain.

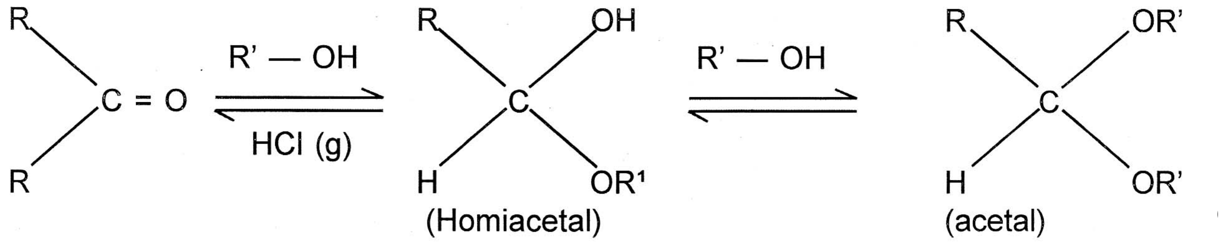
Ans. C-atom of carbonyl group of benzaldehyde is less electrophilic than C-atom of carbonyl group in propanal. Polarity of carbonyl group is in benzaldehyde reduced due to resonance making it less reactive in nucleophilic addition reactions.



There is no such resonance effect in propanal and so the polarity of carboxyl group in it is more than in benzaldehyde. This makes propanal more reactive than benzaldehyde.

Q. 19. What are Hemiacetal and acetal ?

Ans. Hemiacetal and acetals are formed by addition of alcohols on carboxyl compounds.



Q. 20.

Ans. [illegible]

Methanal has no α hydrogen atoms, hence does not undergo aldol condensation.

Q. 21. Why does methanal undergoes Cannizaro's rxn ?

Ans. Because it does not possesses α hydrogen atom. Only those aldehydes can undergo Cannizaro reaction which do not possess α hydrogen atoms.

Q. 22. Arrange the following in order of increasing boiling points :

$CH_3CH_2CH_2OH$, $CH_3CH_2CH_2CH_3$, $CH_3CH_2 — OCH_2CH_3$, $CH_3CH_2CH_2CHO$

Ans. $CH_3CH_2CH_2CH_3 < C_2H_5OC_2H_5 < CH_3CH_2CH_2CHO < CH_3\,(CH_2)_2\,OH$

(hydrogen) (ether) (aldehyde) (alcohol)

$\xrightarrow{\hspace{12em}}$

increase in bond polarity.

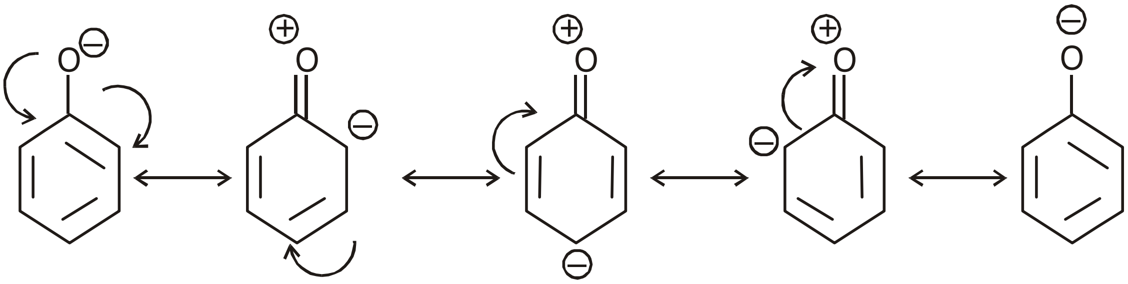
Q. 23. Why does solubility decreases with increasing molecular mass in carboxylic acid ?

Ans. Because of increase in alkyl chain length which is hydrophobic in nature.

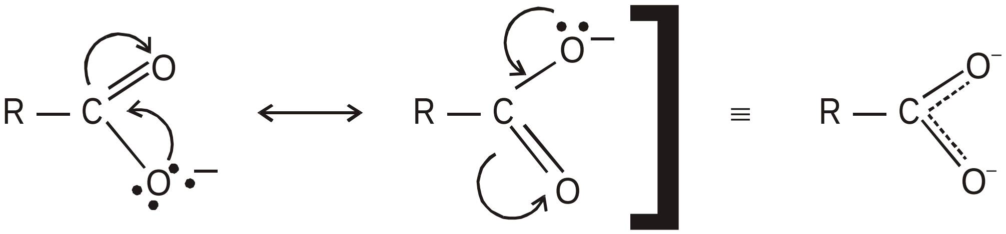
Q. 24. Although phenoxide ion has more no. of resonating structures than carboxylate ion, carboxylic acid is a stronger acid. Why ?

Ans. Conjugate base of phenol —→ phenoxide ion has non equivalent resonance structures in which –ve charge is at less electronegative C-atom and +ve charge is at more electronegative O-atom.

∴ Resonance is not so effective.

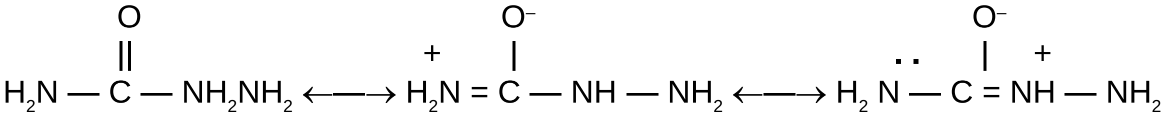


In carboxylate ion, – ve charge is delocalised on two electronegative O-atoms hence resonance is more effective.



Q. 25. There are two — NH_2 group in semicarbazide. However, only one is involved in formation of semicarbazones. Why ?

Ans. Although semicarbazide has two — NH_2 groups but one of them is involved in resonance.



$$H_2N — \overset{\overset{\displaystyle O}{\|}}{C} — NH_2NH_2 \longleftrightarrow \overset{+}{H_2N} = \overset{\overset{\displaystyle O^-}{|}}{C} — NH — NH_2 \longleftrightarrow H_2\,N — \overset{\overset{\displaystyle O^-}{|}}{C} = \overset{+}{\ddot{N}H} — NH_2$$

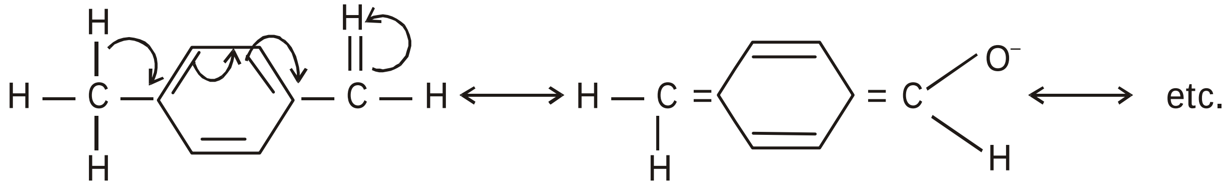
As a result, e^- density on one of the — NH_2 group is reduced and hence it does not act as nucleophile.

∴ Lone pair of other — NH_2 group is not involved in resonance and is available for nucleophilic attack.

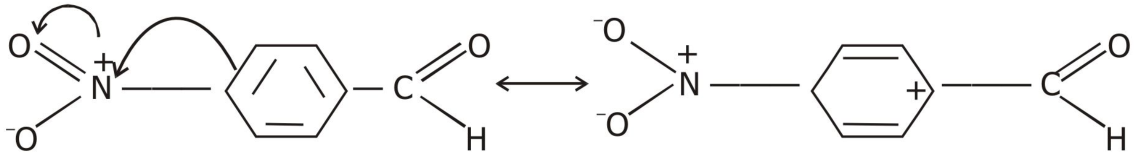
2 MARKS QUESTIONS

Q. 1. Arrange the following carboxyl compounds in increasing order of their reactivity in nucleophilic addition reactions. Explain with proper reasoning :
Benzaldehyde. p-tolualdeyde, p-nitrobenzaldehyde, Acetophenone.

Ans. Acetophenone is a ketone while all others are aldehydes, therefore it is least reactive. In p-tolualdehyde, there is methyl group (CH_3) at para position w.r.t. to the carboxyl gp, which increases electron density on the carbon of the carboxyl gp by hyperconjugation effect thereby making it less reactive than benzaldehyde.



On the other hand, in p-nitrobenzaldehyde, the NO_2 gp is a powerfuil electron-withdrawing gp. It withdraws electrons both by inductive and resonance effect thereby decreasing the electron density on the carbon atom of carboxyl gp. This facilitates the attack of the nucleophile and hence makes it more reactive than benzaldehyde.



acetophenone < p-tolualdehyde < benzaldehyde < p-nitrobenzaldehyde.

Q. 2. Arrange the following compounds in increasing order of their boiling points. Explain by giving reasons.
CH_3CHO, CH_3CH_2OH, CH_3OCH_3, $CH_3CH_2CH_3$.

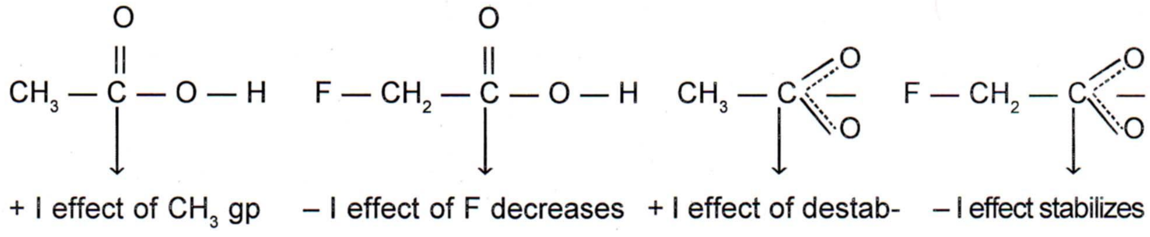
Ans. The molecular masses of all these compounds are comparable :
CH_3CHO (44), CH_3CH_2OH (46), CH_3COCH_3 (46), $CH_3CH_2CH_3$ (44).

CH_3CH_2OH exists as associated molecule due to extensive intermolecular hydrogen bonding and hence its boiling point is the highest (351 K). Since dipole-dipole interaction are stronger in CH_3CHO than in CH_3OCH_3, hence boiling point of CH_3CHO (293 K) is much higher than that of CH_3OCH_3 (249 K). Further, molecules of $CH_3CH_2CH_3$ have only weak Vander Waals forces while the molecules of CH_3OCH_3 have little stronger dipole-dipole interactions and hence the boiling point of CH_3OCH_3 is higher (249 K) than that of $CH_3CH_2CH_3$ (231 K). Thus the over all increasing order of boiling points is :

$$CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CHO < CH_3CH_2OH$$

Q. 3. Which acid of each pair shown here would you expect to be stronger ?
CH_3CO_2H or FCH_2CO_2H

Ans.

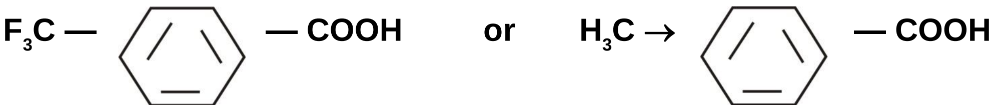


increases the electron	the electron density in the	lizes the carboxylate	the carboxyate
density in the O — H	O — H bond thereby	ion by intensifying	ion by
dispersing			
bond thereby making	making the release of a	the – ve charge.	the – ve charge.
the relase of a proton	proton easier.		

difficult.

Thus due to lesser electron density in the O — H bond and greater stability of FCH_2COO^- ion over CH_3COO^- ion FCH_2COOH is a stronger acid than CH_3COOH.

Q. 4. Which acid is stronger and why ?



Ans.

CF_3 has a strong – I effect.	CH_3 has a weak + I effect.
It stabilises the carboxylate ion by dispersing the – ve charge.	It stabilises the carboxylate ion by intensifying the – ve charge.

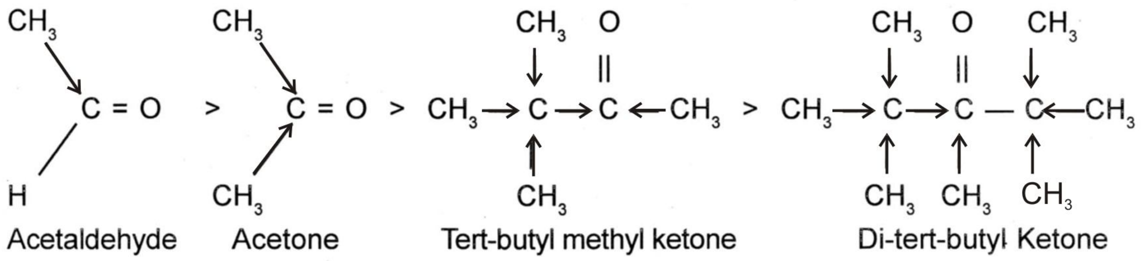
Therefore due to greater stability of $F_3C — C_6H_4 — COO^-$ (p) ion over $CH_3 — C_6H_4COO^-$ (p) ion, $F_3C — C_6H_4 — COOH$ is a much stronger acid than $CH_3 — C_6H_4 — COOH$.

Q. 5. Arrange the following compounds in increasing order of their reactivity towards HCN. Explain it with proper reasoning.

Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone.

Ans. Addition of HCN to the carboxyl compounds is a nucleophilic addition reaction.

The reactivity towards HCN addition decreases as the + I effect of the alkyl gp/s increases and/or the steric hindrance to the nucleophilic attack by CN^- at the carboxyl carbon increases. Thus the reactivity decreases in the order.



——————— Steric hindrance increases———————→

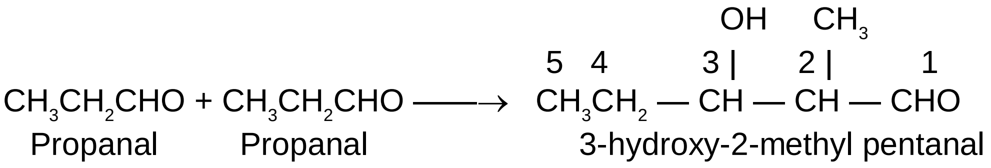
——————— Reactivity towards HCN addition decreases ———————→

In other words, reactivity increases in the reverse order, i. e.,

Ditert-butyl Ketone < tert-Butyl methyl Ketone < Acetone < Acetaldehyde

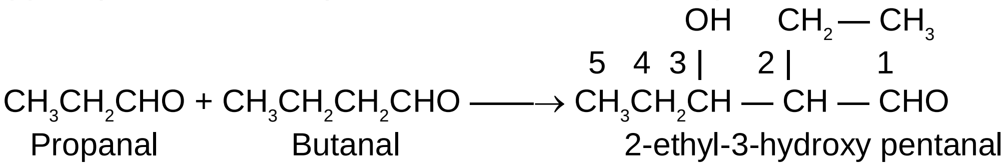
Q. 6. Write structural formulae and names of four possible aldol condensation products from propanal and butanal. In each case, indicate which aldehyde acts as nucleophile and which as electrophile.

Ans. (i) Propanal as nucleophile as well as elecrophile.



$$\underset{\text{Propanal}}{CH_3CH_2CHO} + \underset{\text{Propanal}}{CH_3CH_2CHO} \longrightarrow \underset{\text{3-hydroxy-2-methyl pentanal}}{\overset{5}{C}H_3\overset{4}{C}H_2 — \overset{3}{\underset{|}{C}}H(OH) — \overset{2}{\underset{|}{C}}H(CH_3) — \overset{1}{C}HO}$$

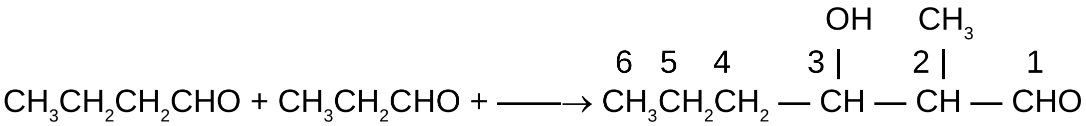
(ii) Propanal as electrophile and butanal as nucleophile.



$$\underset{\text{Propanal}}{CH_3CH_2CHO} + \underset{\text{Butanal}}{CH_3CH_2CH_2CHO} \longrightarrow \underset{\text{2-ethyl-3-hydroxy pentanal}}{\overset{5}{C}H_3\overset{4}{C}H_2\overset{3}{C}H(OH) — \overset{2}{C}H(CH_2 — CH_3) — \overset{1}{C}HO}$$

(Electrophile) (Nucleophile)

(iii) Butanal as electrophile and propanal as nucleophile.

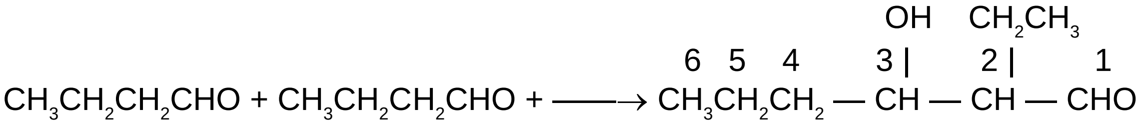


$$\mathrm{CH_3CH_2CH_2CHO + CH_3CH_2CHO} + \longrightarrow \mathrm{\overset{6}{C}H_3\overset{5}{C}H_2\overset{4}{C}H_2 - \overset{\overset{OH}{3\,|}}{CH} - \overset{\overset{CH_3}{2\,|}}{CH} - \overset{1}{C}HO}$$

Butanal Propanal 3-hydroxy-2-methyl pentanal

(Electrophile) (Nucleophile)

(iv) Butanal both as nucleophile as well as an elecrophile.



$$\mathrm{CH_3CH_2CH_2CHO + CH_3CH_2CH_2CHO} + \longrightarrow \mathrm{\overset{6}{C}H_3\overset{5}{C}H_2\overset{4}{C}H_2 - \overset{\overset{OH}{3\,|}}{CH} - \overset{\overset{CH_2CH_3}{2\,|}}{CH} - \overset{1}{C}HO}$$

Butanal Butanal 2-ethyl-3-hydroxy hexanal

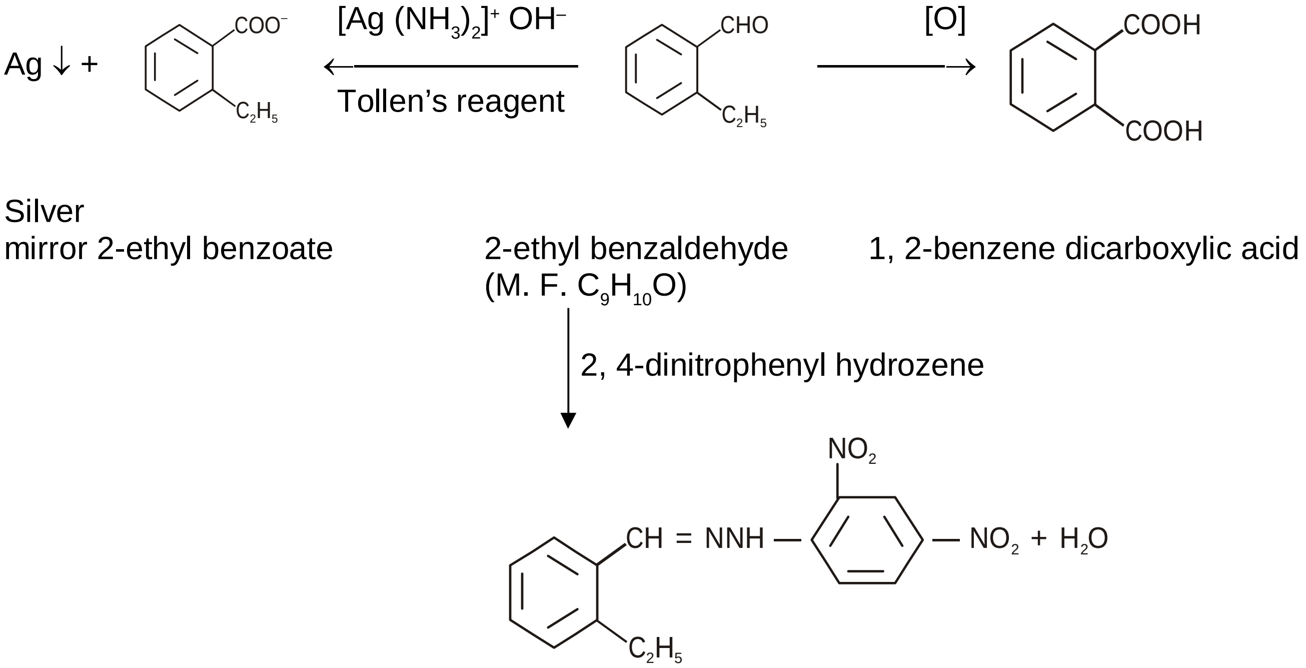
(Electrophile) (Nucleophile)

Q. 7. An organic compound with the molecular formula $C_9H_{10}O$ forms 2, 4-DNP derivative, reduces Tollen's reagent and undergoes Cannizaro reaction. On vigorous oxidation, it gives 1, 2-benzenedicarboxylic acid. Identify the compound.

Ans. (i) Since the given compound with M. F. $C_9H_{10}O$ forms a 2, 4-DNP derivative and reduces Tollen's reagent, it must be an aldehyde.

(ii) Since it undergoes Cannizaro reaction, therefore CHO gp. is directly attached to the benzene ring.

(iii) Since on vigorous oxidation, it gives 1, 2-benzene dicarboxylic acid, therefore it must be an ortho substituted benzaldehyde. The only o-substituted aromatic aldehyde having M. F. $C_9H_{10}O$ is 2-ethyl benzaldehyde. All the reactions can now be explained on the basis of this structure.

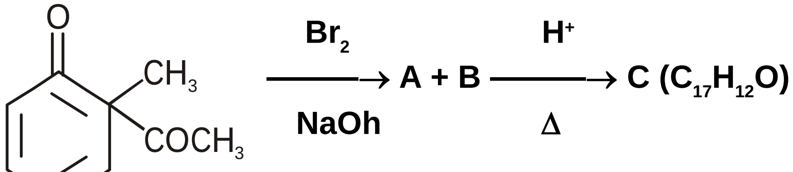


2, 4-DNP derivative

Q. 8. Explain why o-hydroxybenzaldehyde is a liquid at room temperature while p-hydroxybenzaldehyde is a high melting solid.

Ans. Due to interamolecular H-bonding ortho-hydroxy benzaldehyde exists as discrete molecule whereas due to intermolecular H-bonding, p-hydroxybenzaldehyde exists as associated molecules. To break these intermolecular H-bonds, a large amount of energy is needed. Consequently, p-hydroxybenzaldehyde has a much higher m. pt. and b. pt. than that of o-hydroxy benzaldehyde. As a result, o-hydroxy benzaldehyde is a liquid at room temperature while p-hydroxy benzaldehyde is a high melting solid.

Q. 9. Identify A, B and C and give their structures :



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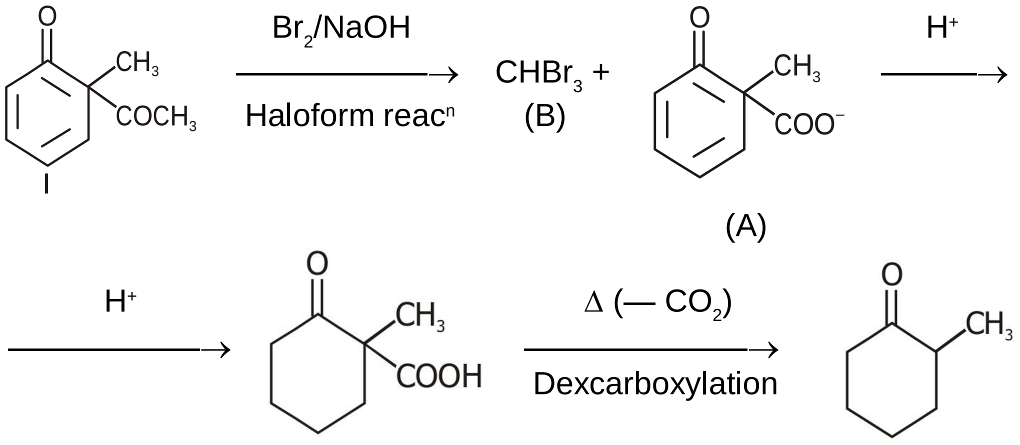
Ans. und (I) contains CH_3CO gp and hence in the presence of Br_2/NaOH undergoes haloform reaction to give sodium salt of carboxylic acid (A) and bromoform $CHBR_3$ (B). (A) on protonation gives the corresponding acid (II). (II) being a β-ketoacid readily undergoes decarboxylation to give 2-methylcylohexanane (C).



(A)

(A β-keto acid)

2-methyl cyclo hexanone
(C) M. F. = $C_7H_{12}O$

❑❑❑

UNIT—13

ORGANIC COMPOUNDS CONTAINING NITROGEN

1 MARK QUESTIONS

Q. 1. Why the presence of a base is essential in the ammonolysis of alkyl halides ?

Ans. During ammonolysis of alkyl halides, the acid liberated during the reaction combines with the amine formed to form amine salt. To liberate free amine from the amine salt, a base is needed.

Q. 2. Although — NH_2 gp is an ortho and para directing gp, nitration of aniline gives along with ortho and para, meta derivatives also.

Ans. Nitration is carried out with a mixture of Conc. NO_3 + Conc. H_2SO_4 (nitrating mix). In the presence of these acids, most of aniline gets protonated to form anilinium ion. Therefore, in the presence of acids, the reaction mixture consists of aniline and anilinium ion. Now – NH_2 gp in aniline is O, p-directing and activating while $-N^+H_3$ gp in anilinium ion is m-directing and deactivating hence a mixture of all three–ortho, para and meta derivatives is formed.

Q. 3. Pk_b of aniline is more than that of methyl amine.

Ans. In aniline, the lone pair of electrons on the N-atom are delocalized over the benzene ring. As a result electron density on the nitrogen decreases. In contrast in CH_2NH_2, + I effect of CH_3 increase the electron density on the N-atom. Therefore, aniline is a weaker base than methylamine and hence its Pk_b value is higher than that of methylamine.

Q. 4. Aniline gets coloured on standing in air for a long time. Why ?

Ans. Due to strong electron-donating effect (+ R effect) of NH_2 gp, the electron density on the benzene ring increases. As a result, aniline is easily oxidised on standing in air for a long time to form coloured products.

Q. 5. CH_3CONH_2 is a weaker base than $CH_3CH_2NH_2$.

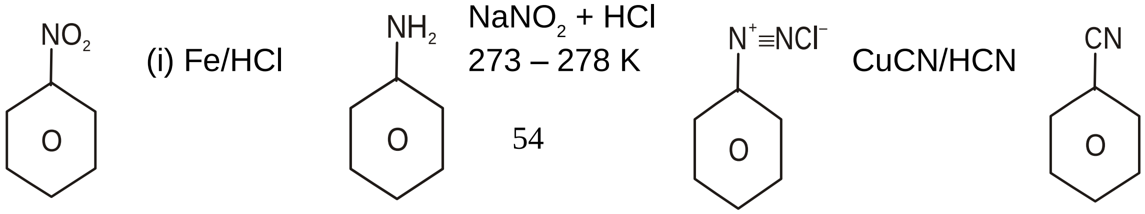
Ans. Due to resonance, the lone pair of electrons on the nitrogen atom in CH_3CONH_2 is delocalised over the keto gp. There is no such effect in $CH_3CH_2NH_2$. Due to reduction in electron density on N of CH_3CONH_2, it is a weaker base than $CH_3CH_2NH_2$.

Q. 6. Aromatic primary aminies can't be prepared by Gabriel phthalimide synthesis.

Ans. The preparation of aromatic primary amines (Aniline) by Gabriel phthalimide reaction requires the treatment of pot. phthalimide with C_6H_5Cl or C_6H_5Br, which is a nucleophilic substitution Rx^n. Since aryl halides do not undergo nucleophilic substitution under ordinary laboratory conditions, therefore C_6H_5Cl or C_6H_5Br does not react with pot. phthalimide to give N-phenyl. Phthalimide and hence aromatic primary amines can't be prepared by this method.

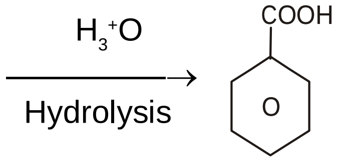
Q. 7. Accomplish the following conversions :
(i) Nitrobenzene to benzoic acid
(ii) Benzyl Chloride to 2-phenylethanamine

Ans. (i)



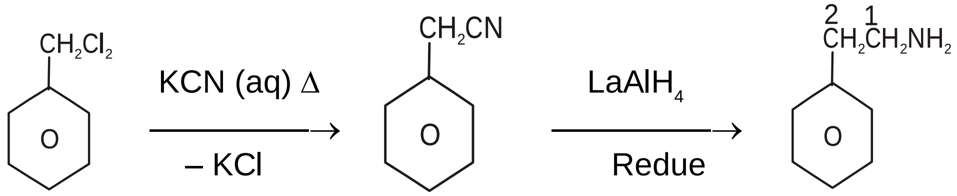
$\xrightarrow[\text{(ii) NaOH}]{}$ $\xrightarrow[\text{Diazotization}]{}$ $\xrightarrow[\text{Benzene Diazanium Chloride}]{}$

Aniline Benzene Diazanium Chloride Benzonitrile



Benzoic acid

(ii)



Benzyl Chloride Phenyl ethanenitrite 2-phenylethanamine

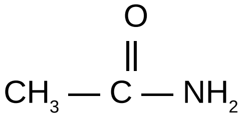
Q. 8. Give the structures of A, B and C in the following compounds :

(i) $CH_3CH_2I \xrightarrow{NaCN} A \xrightarrow[\text{Partial Hydrolysis}]{OH^-} B \xrightarrow{NaOH + Br_2} C$

(ii) $CH_3COOH \xrightarrow[D]{NH_3} A \xrightarrow{NaOBr} B \xrightarrow{NaNO_2/HCl} C$

Ans.

(i) $CH_3CH_2I \xrightarrow{NaCN} CH_3CH_2CN \xrightarrow[\text{(Partial Hydrolysis)}]{OH^-}$



$CH_3 - \overset{\overset{O}{\|}}{C} - NH_2$

Propanenitrile (A) Ethanamide (B)

$\xrightarrow[\text{Hofmann bromamide reac}^n]{NaOH + Br_2} CH_3 - NH_2$

Methanamine (C)

(ii) $CH_3COOH \xrightarrow[D]{NH_3} CH_3CONH_2 \xrightarrow[\text{(Hofmann bromamide reac.)}]{NaOBr} CH_3NH_2 \xrightarrow{NaNO_2/HCl} CH_3OH$ ↓

Ethanoic acid Ethanoimide (A) Methanamine (B) Methanol (C)

Q. 9. Why is it difficult to prepare pure amines by ammonolysis of alkyl halides ?

Ans. By ammonolysis of alkyl halides, a mixture of primary, secondary and tertiary amines is formed. So it is difficult to separate it.

$NH_3 \xrightarrow{Rx} R - NH_2 \xrightarrow{Rx} R_2 - NH \xrightarrow{Rx} R_3 - N \xrightarrow{Rx} R_4\,N^+\,X^-$

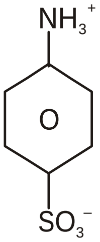
1° amine 2° amine 3° amine Quaternary Salt

Q. 10. Can tertiary amines undergo acetylation reactions ? Explain.

Ans. For an amine to undergo acetylation, it should have a replaceable hydrogen atom**.** Tertiary amines cannot undergo acetylation reactions because these do not have replaceable hydrogen atom.

Q. 11. Sulphanilic acid has acidic as well as basic group; but it is soluble in alkali but insoluble in mineral acids. Explain.

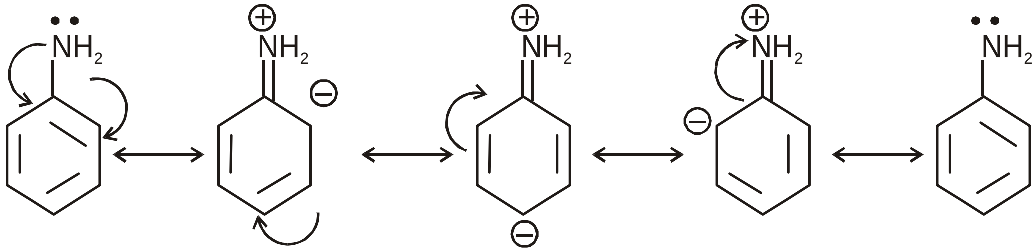
Ans. Sulphanilic acid exists as Zwitter ion as :



In the presence of dil. NaOH the weakly acidic — NH_3^+ group transfers its H^+ to OH^- to form soluble salt P — $NH_2C_6H_4SO_3^-Na^+$. On the other hand, — SO_3^+ group is a very weak base and does not accept H^+ from dil HCl to form $NH_3C_6H_4SO_3H$ and therefore, it does not dissolve in dil HCl.

Q. 12. Why are aliphatic amines more basic than aromatic amines ?

Ans. In Aromatic amines, due to resonance, N-atom acquries +ve charge and ∴ lone pair of N-atom is less available.



In aliphatic amines, due to e^- releasing nature of alkyl groups lone pair of e^- on N-atom is more available.

∴ More basic.

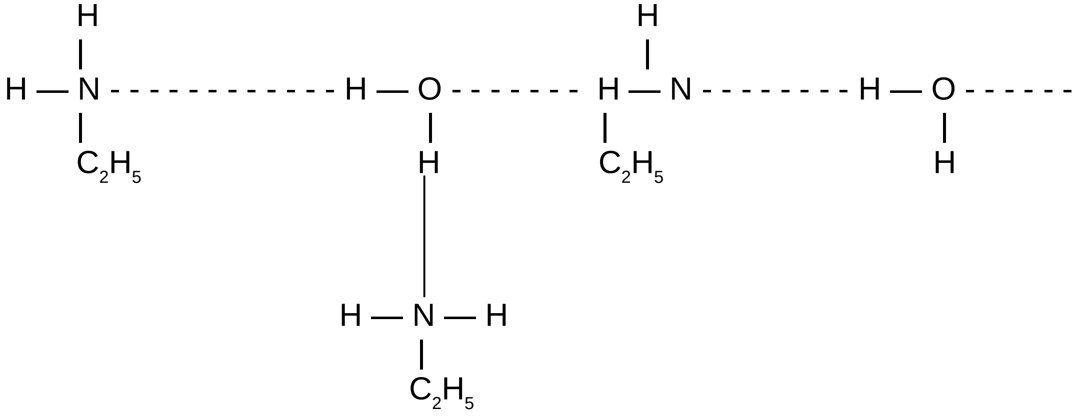
Q. 13. Explain why :

(i) Ethylamine is soluble in water but aniline is not.

(ii) Aniline does not undergo Friedel Crafts reaction.

(iii) Diazonium salts of aromatic amines are more stable than that of aliphatic amines.

Ans. (i) Ethyl amine dissolves in water due to formation of H-bonding with water molecules.



However in Aniline, due to larger hydrophobic alkyl part extent of H-bonding decreases considerably

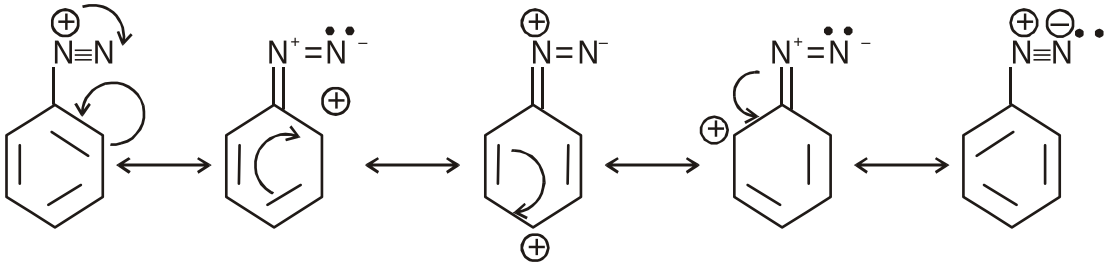
∴ insoluble in water.

(ii) Aniline being a Lewis base reacts with Lewis acid $AlCl_3$ or $FeCl_3$ to form a salt.

$$\underset{\text{Lewis base}}{C_6H_5NH_2} + \underset{\text{Lewis acid}}{AlCl_3} \longrightarrow C_6H_5NH_2^+AlCl_3^-$$

As a result, N-atom acquires + ve charge and hence acts as a strong deactivating group for electrophilic reaction.

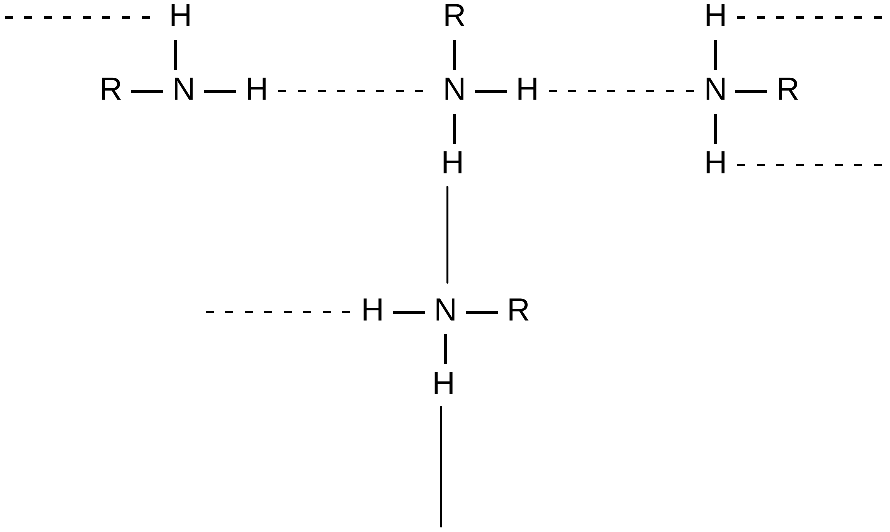
(iii) Diazonium salts of aromatic amines are more stable due to dispersal of +ve charge on benzene ring due to resonance.



In aliphatic amines, there is no such dispersal of + ve charge due to absence of resonance.

Q. 14. Why 1° amines have got higher boiling point than 3° amines ?

Ans. Due to presence of two H-atoms, in 1° amines they undergo extensive hydrogen bonding while due to absence of H-atom in 3° amines do not undergo H-bonding.



Due to extensive hydrogen bonding in 1° amines, they have higher boiling point – 7 than 3° amines.

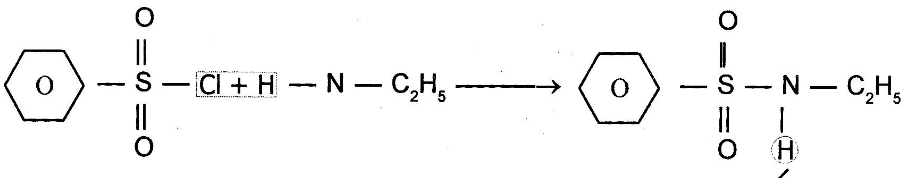
Q. 15. How can you distinguish between 1° and 2° amine ?

Ans. (i) Carbylamine test :

$$R — NH_2 + CHCl_3 + 3\,KOH \longrightarrow \underset{\text{(pungent smelling)}}{R — NC} + 3\,KCl + H_2O$$

2° amines do not give this test.

(ii) Aryl sulphonyl chloride test :



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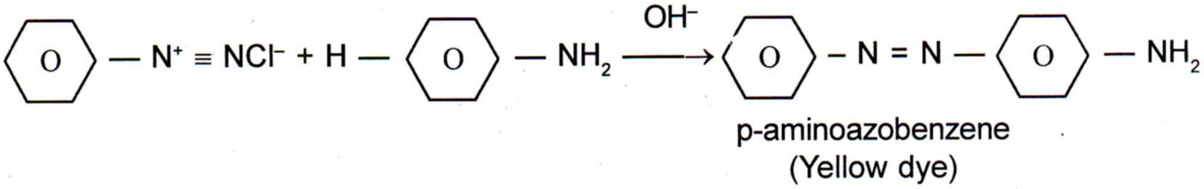
Q. 16. How can you distinguish between aromatic and aliphatic amines ?

Ans. The diaronium salts of Aromatic amines undergo coupling reactions with phneol or andine to form coloured compounds used as dyes.



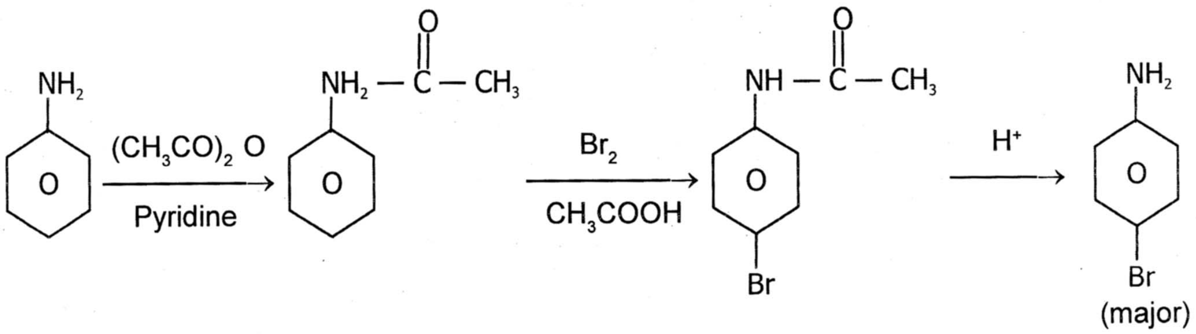
No such reactions are given by aliphatic amines.

Q. 17. How can tri substitution of Bromine be prevented in aniline ?

OR

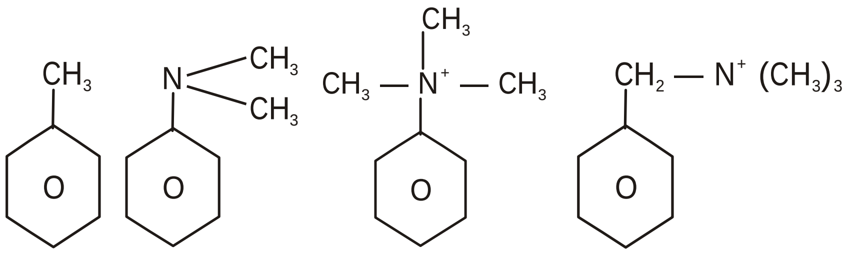
How can we prepare mono bromo aniline ?

Ans. Because of high reactivity of aromatic amines substitution tends to occur at o- and p-positions. Monosubstituted aniline can be prepared by protecting — NH_2 group by acetylation with acetic anhydride, then carrying out substitution followed by hydrolysis of substituted amide.

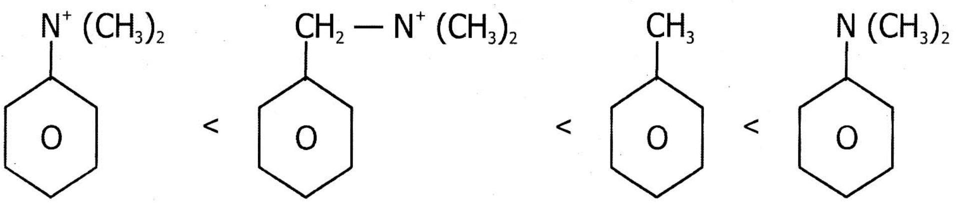


2 MARKS QUESTIONS

Q. 1. Give increasing order of reactivity towarads electrophilic substitution reaction of the following compounds :



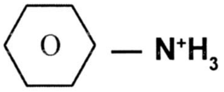
Ans. Higher the electron density in the benzene ring, more reactive is the aromatic compound towards electrophilic substitution reaction. Now due to the presence of a lone pair of electrons on the N-atom which it can directly donate to the benzene ring. N $(CH_3)_2$ (due to two alkyl groups on N) is a much stronger electron donating gp than CH_3 gp. (only one alkyl group on N). The remaining two gps contain a positive charge on the N-atom and hence act as electron withdrawing gps. But in $(CH_3)_3$ N^+ — gp, the +vely charged N is directly attached to the benzene ring, therefore, its electron withdrawing ability is much stronger than — CH_2N^+ $(CH_3)_2$. From the above, it follows that the electron density in the benzene ring increases in the order :

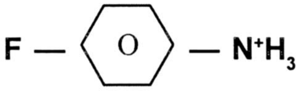


Therefore, their reactivity towards electrophilic substitution reactions also increases in the same order.

Q. 2. Which one is more acidic ? Explain :

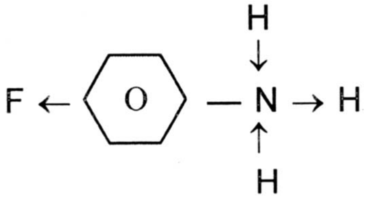
Ans.





withdraws electrons from N^+H_2 gp. As a result, electron density in the N — H bond of p-fluoroanilinium ion decreases and hence release of a proton from p-fluoroanilinium ion is much more easier than from anilinium ion. Therefore, p-fluoroanilinium ion is more acidic than anilinium ion.

Q. 3.



ity of the following compounds in (i) Gaseous phase

NH_3

Ans. Due to + I effect of alkyl gps, the electron density on the N-atom of 1°, 2° and 3° amines is higher than that on the N-atom in NH_3. Therefore, all amines are more basic than NH_3.

(i) In gaseous phase, solvation effects are absent and hence the relative basicity of amines depends only on + I effect of the alkyl gps. Now since + I effect increases in going from 1° to 2° to 3° amine, so the basicity of amines decreases in the order :

3° amine > 2° amine > 1° amine

$(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$

(ii) In aq. soln, the basicity depends upon two factors :

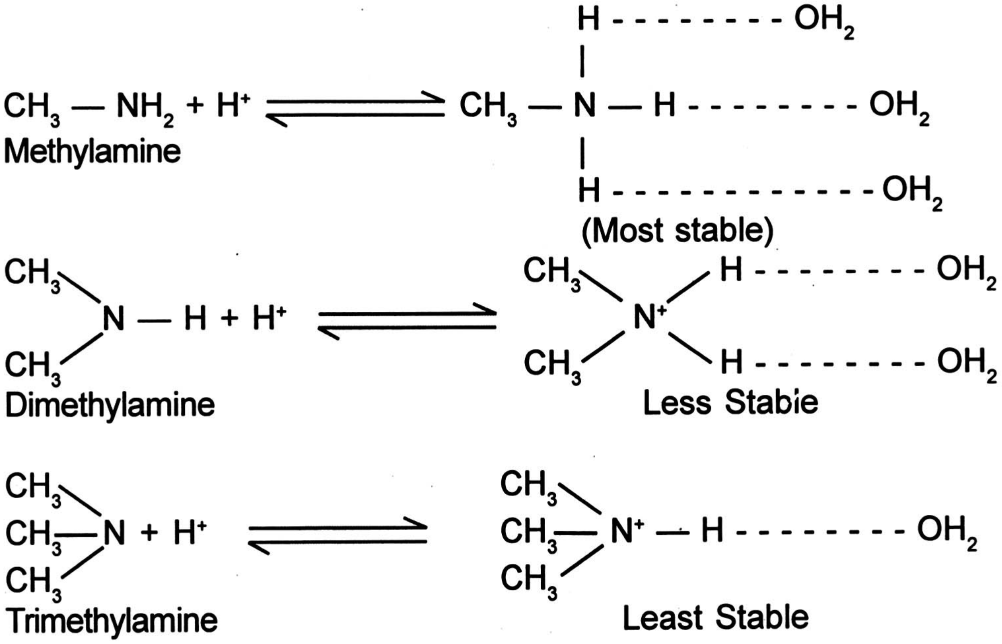
(a) + I effect of CH_3 gp and

(b) Solvation effect.

Stabilization of the conjugate acid (formed addition of a proton to amine) by H-bonding explained above on the basis of + I effect, the order will be :

$(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

On the basis of Stabilisation of conjugate acids by H-bonding alone as explained below :



the strongest

predeminates

er than $(CH_3)_3$

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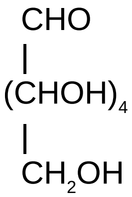
UNIT—14

BIOMOLECULES

1 MARK QUESTIONS

Q. 1. Which carbohydrate is called grape-sugar ? Give its condensed structural formula.

Ans. Glucose is called grape-sugar ? Its condensed structural formula is :



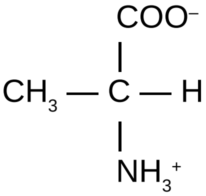
$$\begin{array}{l} \;CHO \\ \;| \\ (CHOH)_4 \\ \;| \\ \;CH_2OH \end{array}$$

Q. 2. Which of the following is not an α-amino acid ?
Histidine, trypsin, cysteine, proline

Ans. Trypsin, it is a protein made from amino acids.

Q. 3. Write the structure of Zwitter ion formed from Alanine.

Ans.

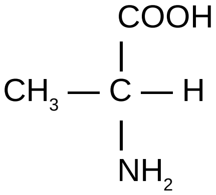


$$CH_3 - \overset{\overset{\displaystyle COO^-}{|}}{\underset{\underset{\displaystyle NH_3^+}{|}}{C}} - H$$

Q. 4. Wreite the name and structure of the simplest amino acid which can show optical activity.

Ans. Alanine,

Structure :



$$CH_3 - \overset{\overset{\displaystyle COOH}{|}}{\underset{\underset{\displaystyle NH_2}{|}}{C}} - H$$

Q. 5. How many hydrogen bonds are present between (i) A and T (ii) C and G in a double helix structure ?

Ans. (i) between A and T there exist two hydrogen bonds :

A - - - - - - - - - - T
 - - - - - - - - - -

(ii) between C and G there exist three hydrogen bonds :

 - - - - - - - - - -
C - - - - - - - - - - G
 - - - - - - - - - -

Q. 6. When RNA in hydrolysed there is no relationship among the quantities of four bases obtained like DNA. What does this fact indicate about structure of RNA ?

Ans. This indicate that RNA has a single strand structure.

Q. 7. Where does the water present in the egg go after boiling the egg ?

Ans. After boiling, the water soluble globular protein of egg while get denatured and it cogulates into hard and rubbery insoluble mass.

Q. 8. Which vitamin is helpful in healing wound and cuts ? What is the chemical name of this vitamin ?

Ans. Vitamin-C is helpful in healing wounds and cuts, its chemical name is Ascorbic acid.

2 MARKS QUESTIONS

Q. 1. What type of bonding helps in stabilising the α-helix structure of proteins ?

Ans. In a α-helix structure, polypeptide chain of amino acids coils as a right handed screw because of the formation of all possible Hydrogen bonds between — NH group at each amino residue and > C = 0 group of adjacent turn of helix.

Q. 2. Name the water insoluble fraction of Starch. Name the monomer of this.

Ans. Amylopectin is water insoluble fraction of starch. It is a polymer of α-glucose.

Q. 3. What are the products of hydrolysis of (i) lactose (ii) sucrose. Also name the enzyme used for reaction.

Ans. (i) $$\underset{\text{Lactose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Lactase}} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{glactose}}{C_6H_{12}O_6}$$

(ii) $$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$$

Q. 4. How will you prove that all the carbon atoms of glucose are in straight chain ?

Ans. The reaction of glucose with HI gives n-hexane and it proves that all sin-carbon-atom are in straight chain.

$$\text{Ho } CH_2 - (CHOH)_4 - CHO \xrightarrow[\text{Heat}]{\text{HI}} \underset{\text{n-hexane}}{CH_3 - (CH_2)_4 - CH_3}$$

Q. 5. Enumerate two reactions of glucose which cannot be explained by its open chain structure.

Ans. (i) Glucose does not give Schiff's Test although it contains aldehyde group.

(ii) Glucose does not form crystaline product with $NaHSO_3$.

Q. 6. B-complex is an often prescribed Vitamin. What is complex about it ? What is its usefulness ?

Ans. It is a type of Vitamin which contains B_1, B_2, B_6 and B_{12}. It required to release energy from food and to promote healthy skin and muscles. Its deficiency causes beri-beri (Vitamin B_1) and Anaemia (Vitamin B_{12}).

Q. 7. What are anomers ? Give two points of difference between two anomer of glucose.

Ans. The pair of optical Isomers which differ in the orientation of H and OH gp only at C_1 Carbon atom are called anomers.

Difference between two anomers of glucose :

α-D (+) glucose	β-D (+) glucose
(1) The specific rotation is + 111°.	(1) The specific rotation is + 19.2°.
(2) The – OH gp at C_1 is below the plane.	(2) The – OH gp at C_{-1} is above the plane.

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UNIT—15

POLYMERS

1 MARK QUESTIONS

Q. 1. Write an equation for the Chemistry involved when a drop of hydrochloric acid make a hole in nylon stockings.

Ans. The (— CO — NH —) amide bond in nylon gets hydrolysed.

Q. 2. Fibres are of crystalline structure. Why ?

Ans. Fibres have strong intermolecular forces of attraction which leads to close packing of their chains and impart crystalline structure.

Q. 3. Which artificial polymer is present in bubble gum or chewing gum ?

Ans. Bubble gum or chewing gum contains synthetic Styrene-butadiene rubber.

Q. 4. Name the polymer used for making medicinal Capsule.

Ans. PHBVUC Polyhydroxy butyrate-CO-β-hydroxy valerated.

Q. 5. Which polymer is used in making electrical goods and why ?

Ans. Bakelite because of its electrical insulator property.

Q. 6. Is $(CH_2 — CH — C_6H_5)_n$ a homo polymer or a copolymer.

Ans. It is a homo polymer and the monomer from which it is obtained in styrene C_6H_5 CH = CH_2.

Q. 7. Which colligative property is used to determine the molecular masses of the polymers ?

Ans. Osmotic pressure is the colligative property used to determine the molecular masses of polymer.

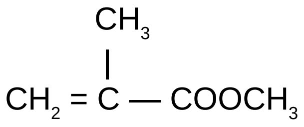
2 MARKS QUESTIONS

Q. 8. Write the names of monomers and structure used for getting the following polymers ?
PmmA, PVC, Teflon

Ans. (i) PVC — monomer — Vinylchloride, $CH_2 = CH — Cl$

(ii) Teflen — monomer — Tetrafluoro ethylene, $F_2C = CF_2$

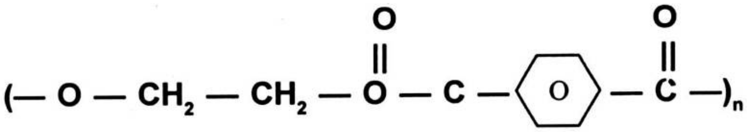
(iii) PMMA — monomer — Methyl methacrylate,



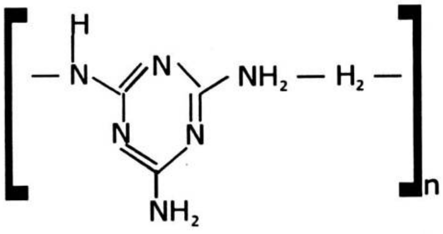
$$CH_2 = \overset{\overset{\displaystyle CH_3}{|}}{C} — COOCH_3$$

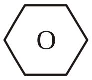
Q. 9. Identify the monomer in the following polymer structures :

(i)



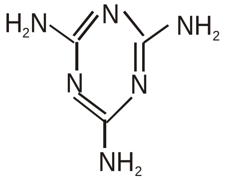
(ii)



Ans. (i) $HOCH_2 — CH_2OH$ and HOOC —  — COOH

ethane-1, 2-dial — Benzene-1, 4-dicarboxylic acid

(ii) Melamine — Formaldehyde



and HCHO

Q. 10. How dc in the rubber molecule influence their structure and reactivity ?

Ans. Due to presence of double bond the rubber molecule show cis-configuration because which the polymer chains can not come close to each other and get boiled but as they have their hindrance problem. This causes them to have weak Vander Waals intraction between the molecules consequently they get elastic property, solubility in organic solvents etc.

Q. 11. Why are the No. of 6, 6 and 6 put in the names of nylon-6, 6 and nylon-6 ?

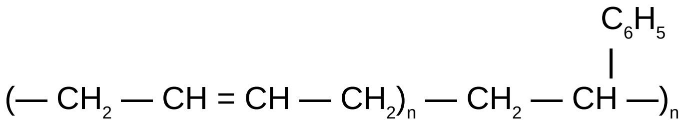
Ans. The no. of 6, 6 in nylon-6, 6 implies that both the monomers of nylon-6, 6 namely hexamethylene diamine and adipic acid contain six carbon atom each. The no. of 6 in nylon-6 contains six carbon atom each. The no. of 6 in nylon-6 indicates that its monomer Caprolectum has six carbon atom in its molecule.

Q. 12. Could a copolymer be formed in both addition and condensation polymerisation or not ? Explain.

Ans. Yes, though copolymers are mostly addition polymers like styrcue butadiene rubber and butyl rubber, the term can be used for condensation polymers also eg. for example.

(i) Addition polymerisation of styrene and butadiene form copolymer styrene butadiene rubber.

$$n\ CH_2 = CH — CH = CH_2 + n\ C_6H_5CH = CH_2 \longrightarrow$$



$$(— CH_2 — CH = CH — CH_2)_n — CH_2 — \underset{}{\overset{C_6H_5}{\overset{|}{CH}}} —)_n$$

(ii) Condensation polymer became thylene diamine and adipic acid form nylon-6, 6.

$$n\ HOOC — (CH_2)_4 — COOH + n\ H_2N — (CH_6) — NH_2 \longrightarrow$$

adipic acid — hexamethylene diamien — $n\ H_2O$

$$(— NH\ (CH_2)_6 — NH — CO — (CH_2)_4 — CO —)_n$$

Q. 13. Arrange the following polymer in increasing order of their molecular forces :

(a) nylon-6, 6, Buna-S, polythene.

(b) nylon-6, Neoprene, polyvinyl chloride.

Ans. (a) Buna S < Polythene < Nylon-6, 6.

(b) Neoprene < Polyvinyl Chloride < Nylon-6.

Q. 14. Explain the difference between Buna— S and Buna — N.

Ans. Buna — N is a copolymer of 1, 3-butadiene and acrylo nitrile, Buna — S is a copolymer of 1, 3-butadiene and styrene.

Q. 15. Why should we always use purest monomer in free radical mechanism ?

Ans. Monomer has to be as pure as possible because the presence of any other molecule during free radical polymerisation can act chain initiator or inhibitor which will interfere with the normal polymerisation reaction.

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UNIT—16

CHEMISTRY IN EVERYDAY LIFE

1 MARK QUESTIONS

Q. 1. Give an example of a chemical substance which can act both as an antiseptic and disinfectant.

Ans. Phenol.

Q. 2. What is the chemical name of antiseptic chloroxylenol ?

Ans. 4-Chloro-3, 5-dimethyl phenol.

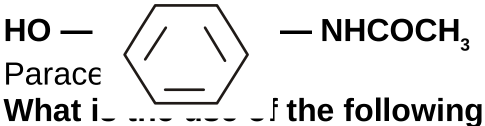
Q. 3. Which alkaloid is used to control hypertension ?

Ans. Reserpine.

Q. 4. Which alkaloid is used to treat malaria ?

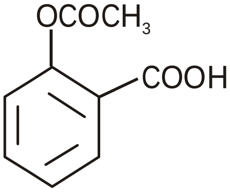
Ans. Quinine.

Q. 5. Identify the following :



Ans. Parace

Q. 6. What is the use of the following compound :



Ans. Analgesic.

Q. 7. Which artificial sweetner has the lowest sweetness value ?

Ans. Aspartame.

Q. 8. Which artificial sweetner has the highest sweetness value ?

Ans. Alitame.

Q. 9. What kind of a drug is Chlorpheniramine maleate ?

Ans. Anti histamine drug.

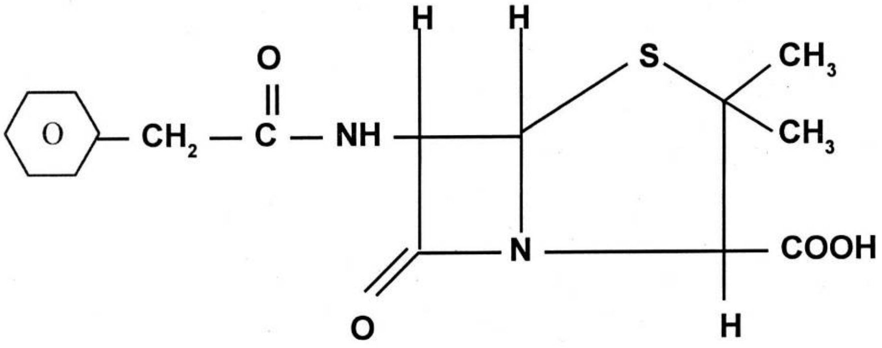
Q. 10. What is the chemical name of aspirin ?

Ans. 2-Acetoxy benzoic acid.

Q. 11. Name the antibacterial present in toothpaste.

Ans. Triclosan.

Q. 12. Identify the drug :



Ans. Penicillin G.

Q. 13. Which antibiotic contains NO_2 group attached to aromatic nucleus in its structure ?

Ans. Chloramphenicol.

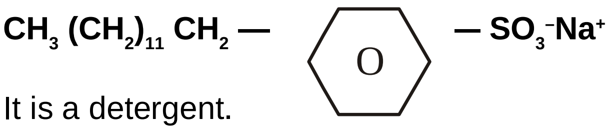
Q. 14. What is the use of barbituric acid ?

Ans. Tranquilizer.

Q. 15. Name one analgesic drug which is also used to prevent heart attacks.

Ans. Aspirin.

Q. 16. What is the application of the following molecule in everyday life ?



Ans. It is a detergent.

Q. 17. Give an example of a drug that is antipyretic as well as analgesic.

Ans. Paracetamol.

Q. 18. Out of morphine, N-Acetyl-para-aminophenol, Diazepam and tetrahydrocatenol, which can be used as analgesic without causing addiction ?

Ans. N-Acetyl-para-aminophenol.

Q. 19. Name a sugar substitute which is 160 times as sweet as surcrose.

Ans. Aspartame.

2 MARKS QUESTIONS

Q. 1. When a mixture of salicylic acid, acetic anhydride and acetic acid is refluxed, what is the product obtained and what is its use in everyday life ?

Ans. Aspirin used as analgesic.

Q. 2. Distinguish between a narrow spectrum and broad spectrum antibiotic.

Ans. A narrow spectrum antibiotic works against a limited range of microbes whereas a broad spectrum antibiotic works against a large variety of microbes.

Q. 3. What is Salvarson ? To which class of drugs does it belong ? For what distance is it used ?

Ans. Antimicrobial agent.
Used for the treatment of STD called Syphilis.

Q. 4. How does apirin act as an analgesic ?

Ans. It inhibits the synthesis of prostaglandins which stimulates inflammation of the tissue and cause pain.

Q. 5. What are barbiturates ? To which class of drugs do they belong ?

Ans. 5, 5-derivatives of barbituric acid are called barbiturates. They belong to the class of tranquilizers. They also act as sleep producing agents.

Eg. Luminal, Veronal.

Q. 6. What is tincture iodine ? What is its use ?

Ans. Alcoholic Solution of I_2.

Used as an antiseptic.

Q. 7. To what class of medicines does chloramphericol belong ? For what disease can it be used ?

Ans. Broad spectrum antibiotic

Used to cure typhoid, dysentry, acute fever.

Q. 8. Pick the odd one amongst the following on the basis of their medicinal properties mentioning the reason.

(i) Luminal, seconal, phenacetin, equanil

(ii) Chloroxylenol, phenol, chloramphERICAL, bithional

Ans. (i) Phenacetin is an antipyretic while all the rest are tranquilisers.

(ii) Chlorampherical is an antibiotic while all the remaining are antiseptics.

Q. 9. Why is bithional added to soap ?

Ans. Acts as an antiseptic and reduces the odours produced by bacterial decomposition of organic matter on the skin.

Q. 10. Why are cimetidine or ranitidine better antacids than sodium bicarbonate or magnesium or aluminium hydroxide ?

Ans. If excess of $NaHCO_3$ or Mg $(OH)_2$ or Al $(OH)_3$ is used, it makes the stomach alkaline and thus triggers the release of even more HCl. In contrast, cimetidine or ranitidine prevent the interaction of histamine with the receptor cells in the stomach wall and thus release lesser amount of HCl.

Q. 11. Why is the use of aspartame limited to cold foods and drinks ?

Ans. It decomposes at baking or cooking temperatures and hence can be used only in cold foods and drinks.

Q. 12. What problem arises in using alitane as artificial sweetener ?

Ans. It is a high potency artificial sweetener. Therefore it is difficult to control the sweetness of the food to which it is added.

Q. 13. What is the purpose of adding antioxidants to food ? Give two examples of antioxidants.

Ans. They are added to prevent oxidation of fats and oils present in food thus preventing food from becoming rancid.

Eg. BHA (Butylated hydroxy anisole)

BHT (Butylated hydroxy toluene)

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PAPER-1

MODEL QUESTION PAPER

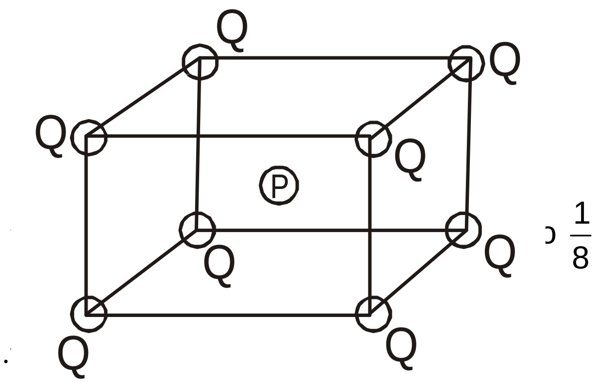
Duration : 3 Hrs **Max. Marks : 70**

General Instructions :

- *(1) All questions are compulsory.*
- *(2) Marks against each question are indicated.*
- *(3) Questions from one to eight are very short answer type questions carrying one mark each.*
- *(4) Questions from nine to eighteen are short answer type questions carrying two marks each.*
- *(5) Questions from nineteen to twenty seven are short answer type questions carrying three marks each.*
- *(6) Questions from twenty eight to thirty are long answer type questions carrying five marks each.*
- *(7) Use log tables, if necessary. Calculators are not permitted.*

Q. 1. A cubic solid is made of 2 elements P & Q are at the corners of the cube & P at the body centre. What is the formulae of the compound ? What are the coordination no. of P & Q ?

Ans.



$\therefore$ formula is PQ

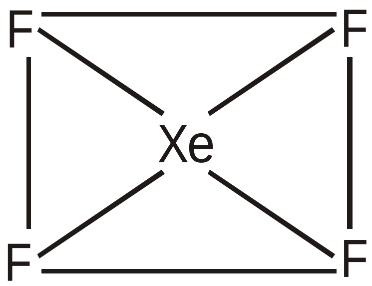
Cordination No. is 8 : 8.

Q. 2. Name one important catalyst used in petroleum industry. For what purpose it is used for ?

Ans. It is ZSM–5. It converts alcohol directly into gasoline.

Q. 3. Give the hybridisation and shape of XeF_4.

Ans.



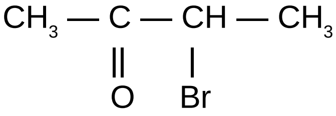
"Square planar shape".

Q. 4. Zn, Cd, Hg are not regarded as transition elements. Why ?

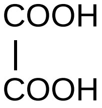
Ans. Zn, Cd, Hg have completely filled d-orbitals in them. Hence, they are not regarded as transition elements.

Zn (30) = 3 d^{10} 4 s^2
Cd (40) = 4 d^{10} 5 s^2
Hg (80) = 5 d^{10} 6 s^2

Q. 5. Write IUPAC name of the following compounds :

(i) 

$$CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{Br}{|}}{CH} - CH_3$$

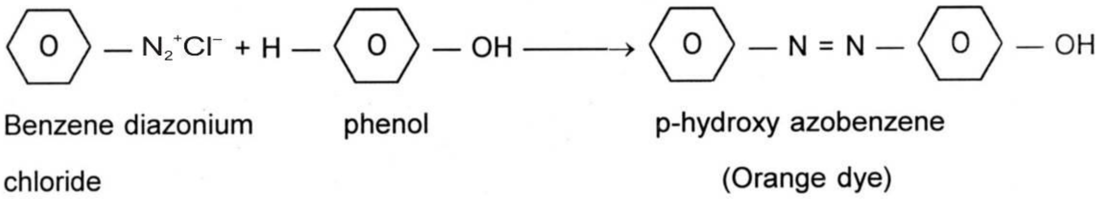
(ii) 

$$\begin{array}{c} COOH \\ | \\ COOH \end{array}$$

Ans. (i) 3-Bromo-2-butanone
(ii) Ethane-1, 2-dioic acid

Q. 6. What do you understand by the term coupling reaction ?

Ans.



Q. 7.

Ans. s.

Q. 8. What is a broad spectrum antibiotic ? Give examples.

Ans. An antibiotic which can be used for curing from several types of microorganisms i. e. several diseases is called as a broad spectrum antibiotic.

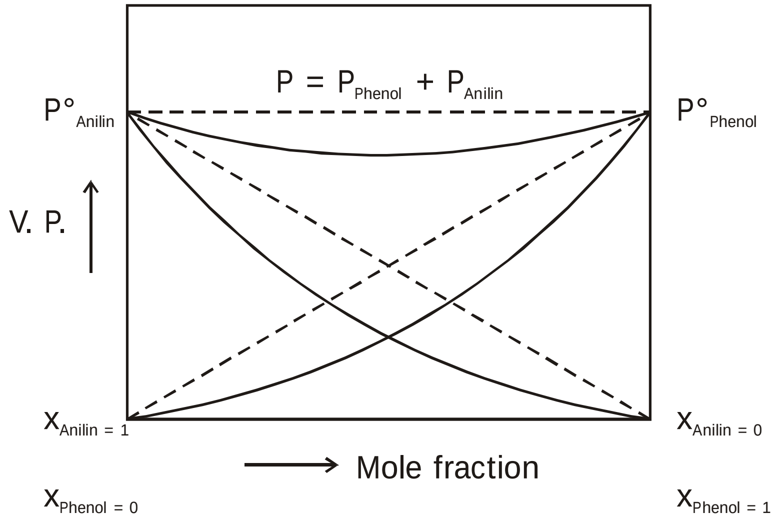
eg. Chloramphenicol.

Q. 9. Show the graph of the deviation shown by anilin and phenol, give reason.

Ans. Negative deviation, ∴ A — B interactions are stronger than A — A and B — B interactions.

OR

H-Bonding between phenolic H^+ and lone pair on nitrogen atom of anilin is stronger than individual molecules.



Q. 10. (a) Write the unit of molar conductivity.
(b) Why does the conductivity of a solution decrease with dilution ?

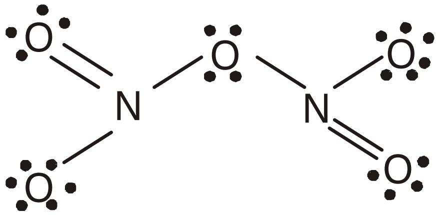
Ans. (a) $Ohm^{-1}\ cm^2\ mol^{-1}$

(b) Conductivity of a solution depends upon number of ions present in per unit volume. On dilution, the number of ions per unit volume decreases, ∴ conductivity also decreases.

Q. 11. (i) What is the covalence of Nitrogen in N_2O_5 ?

(ii) Cl_2 is a bleaching reagent. Justify.

Ans. (i)



It is evident tha

(ii) It is due

$Cl_2 + H_2$(

Due to the presence of the nescent oxygen in HOCl it possess bleaching property.

$$\text{Coloured Substance} + O \longrightarrow \text{Colourless Substance}$$

Q. 12. Give reason for the following :

(i) Zr & Hf exhibit similar properties.

(ii) Transition elements forms alloys.

Ans. (i) Due to lanthanoid contraction, Hf & Zr have almost similar size & therefore, their properties are similar.

(ii) Transition elements have nearly the same atomic size. Hence, they can substitute one another in crystal lattice to form substitutional alloys.

Q. 13. Describe the steps involved in the preparation of potassium permanganate from manganese dioxide.

Ans. Step 1 : $2\,MnO_2 + 4\,KOH + O_2 \longrightarrow 2\,K_2MnO_4 + 2\,H_2O$

Step 2 : $\underset{\text{green}}{MnO_4^{2-}} \longrightarrow \underset{\text{purple}}{MnO_4^{-}} + e^{-}$ (Anode)

$2\,H^+ + 2\,e^- \longrightarrow H_2$ (Cathode)

OH^- ions remain in the soluⁿ.

Electrolytic Oxidation

OR

Write the steps involved in the preparation of $K_2Cr_2O_7$ from Chromite ore.

Ans. (i) $4\,FeCrO_4 + 16\,NaOH + 7\,O_2 \longrightarrow 8\,Na_2CrO_4 + 2\,Fe_2O_3 + 8\,H_2O$

(ii) $2\,Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(iii) $Na_2Cr_2O_7 + 2\,KCl \longrightarrow K_2Cr_2O_7 + 2\,NaCl$

Q. 14. Write a brief notes on :

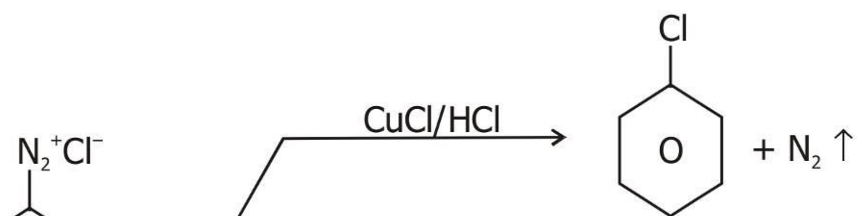
(a) Williamson's ether synthesis

(b) Sandmeyer's reaction.

Ans. (a) Alkylhalides react with sodium alkoxides to give symmetrical/unsymmetrical ethers :

$$R - \boxed{X + Na} - O - R' \longrightarrow R - O - R' + NaX$$

(b) The conversion of benzene diazonium chloride into chlorobenzene/bromobenzene using CuCl — HCl/CuBr — HBr is known as Sandmeyer's reaction.



Q. 15. Explain why :

(a) Alkylhalides, though polar, are immiscible with water.

(b) Grignard reagents should be prepared under anhydrous conditions.

Ans. (a) Alkylhalides can not form H-Bonds with water and hence Alkylhalides are insoluble in water.

(b) Grignard reagent react with water and get decomposed :

$R\,Mg\,X + H_2O \longrightarrow R - H + Mg\,(OH)\,X$

Hence they have to be prepared under anhydous conditions.

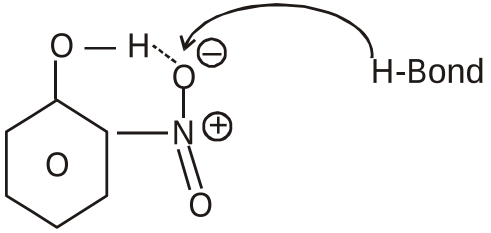
Q. 16. Give reasons :

O-nitrophenol has lower boiling point than p-nitrophenol.

Ans. O-nitrophenol shows intra molecular hydrogen bonding and exists as discrete molecules.

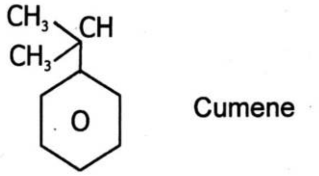
Low intermolecular forces, low boiling point.

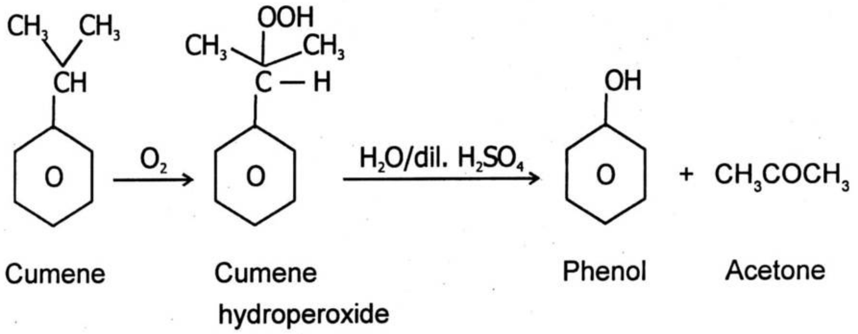
Intermolecular H-bonding takes place in p and m nitro phenol, form associated molecule, high intermolecular forces, high boiling point.



Q. 17. What is cumene ? How is phenol prepared from cumene ? Isopropyl or 2 phenyl propane is cumene.

Ans.





Q. 18. E

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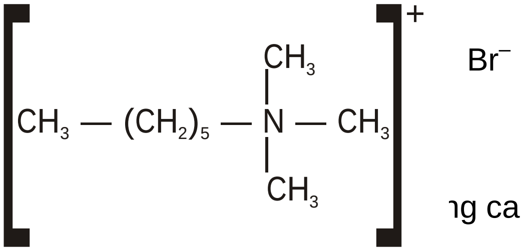
Ans. (Cationic Detergent :

Acetates, chlorides or bromides of quarternary ammonium salts with long hydrocarbon chain forming cationic part.



$$\left[CH_3-(CH_2)_5-\overset{\overset{\Large CH_3}{|}}{\underset{\underset{\Large CH_3}{|}}{N}}-CH_3\right]^+ Br^-$$

(b) A

A ng carbon chain forming Alkyl part.

C

Sodium louryl sulphonate

Q. 19. (a) Gold (atomic radius = 0.144 nm) crystallises in a face centered unit cell. What is the length of a side of the cell ?

(b) If NaCl is doped with 20% $CdCl_2$. What is the concentration of cation vacancies.

Ans. (a) For fcc $a = 2 \times r$

$= 2 \times 1.414 \times 0.144$

$= 0.407$

(b) 20% vacancies

Na^+ Cl^- Na^+ Cl^-

Cl^- Cl^- Na^+

Na^+ $\boxed{Cd^{2+}}$ $\boxed{\phantom{Cd^{2+}}}$ Cl^-

Q. 20. 45 g of eth $_2H_6O_2$) is mixed with 600 g water. Calculate :

(a) freezing point depression

(b) freezing point of solution

Given that K_f for water = 1.86 K kg mol^{-1}

Ans. $\Delta T_f = \dfrac{K_1 \times W_b \times 1000}{M_B \times W_A}$

$\Delta T_f = \dfrac{1.86 \times 45 \times 1000}{62 \times 600} = 2.25\text{ K} = 2.25\text{ K}$

then $\Delta T_f = T_0 - T_1 = 273 - T_1$

$T_1 = 273 - 2.25 = 270.75$ K

Q. 21. Following data were obtained during the first order thermal decomposition of N_2O_5 (g) at constant volume :

$$2\,N_2O_5\,(g) \longrightarrow 2\,N_2O_4\,(g) + O_2\,(g)$$

Calculate the rate constant if :

S. No.	Time/s	Total pressure/atm
1	0	0.5
2	100	0.512

Ans.

	$2\,N_2O_5$ (g) $\longrightarrow$	$2\,M_2O_4$ (g) +	O_2 (g)
Initially	0.5 atm	0 atm	0 atm
At tiem (t)	(0.5 –2 x) atm	2 x atm	2 x atm

Pt = (0.5 – 2 x) + 2 x + x = 0.5 + x

x = Pt – 0.5

= 0.5 – 2 (pt – 0.5) = 1.5 – 2 Pt

At t = 100 sec.

Pt = 0.512 atm

PN_2O_5 = 1.5 – 2 × 0.512 = 0.476 atm

Using Ist order reaction

$$K = \frac{2.303}{t} \log \frac{Pinitial}{P_A}$$

$$= \frac{2.303}{100\ sec} \log \frac{0.5\ atm}{0.476\ atm}$$

$$= \frac{2.303}{100\ sec} \times 0.0216 = 4.98 \times 10^{-4}\ sec^{-1}$$

Q. 22. Explain the following observations :

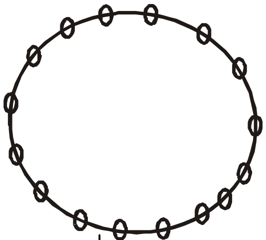
(a) Physical adsorption in multilayered, while chemisorption is unilayer.

(b) Adsorption is always exothermic process.

(c) Ferric hydroxide sol^n coagulates on addition of potassium sulphate.

Ans. (a) Physical adsorption is non-specific i. e. adsorbade can be held on adsorbadely weak Vander-waal forces. Therefore no bonds have to be set up, therefore it continues while chemisorption is highly specific, chemical bonds have to be set up.

(b)



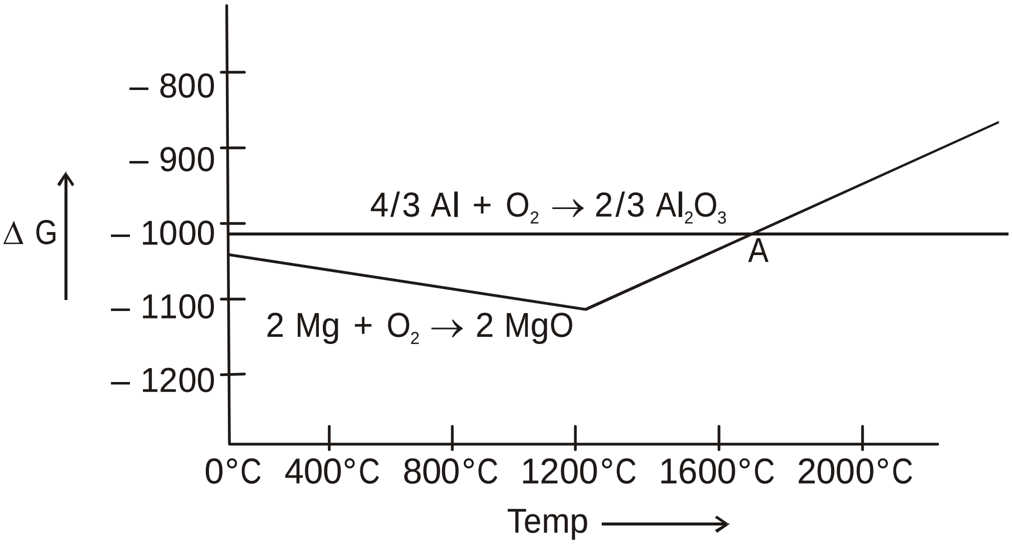
In Adsorption order increas ... :omes (–) ve for a reaction to be spontaneous i. e. ΔG shoul ... hat is possible only :

ΔH | Δ | – TΔS

– ve | – + | – ΔH > TΔS

(c) Coagulation takes place, since adsorption of SO_4 ions on $Fe(OH)_3$ which is positively charged colloid.

Q. 23.



(a)

(b)

(c)

Ans. (a)

(b) um can

(c)

$$Ni + CO \xrightarrow{330\ to\ 350\ K} Ni\ (CO)_4$$

Tetracarboxyl nickel
(volatile)

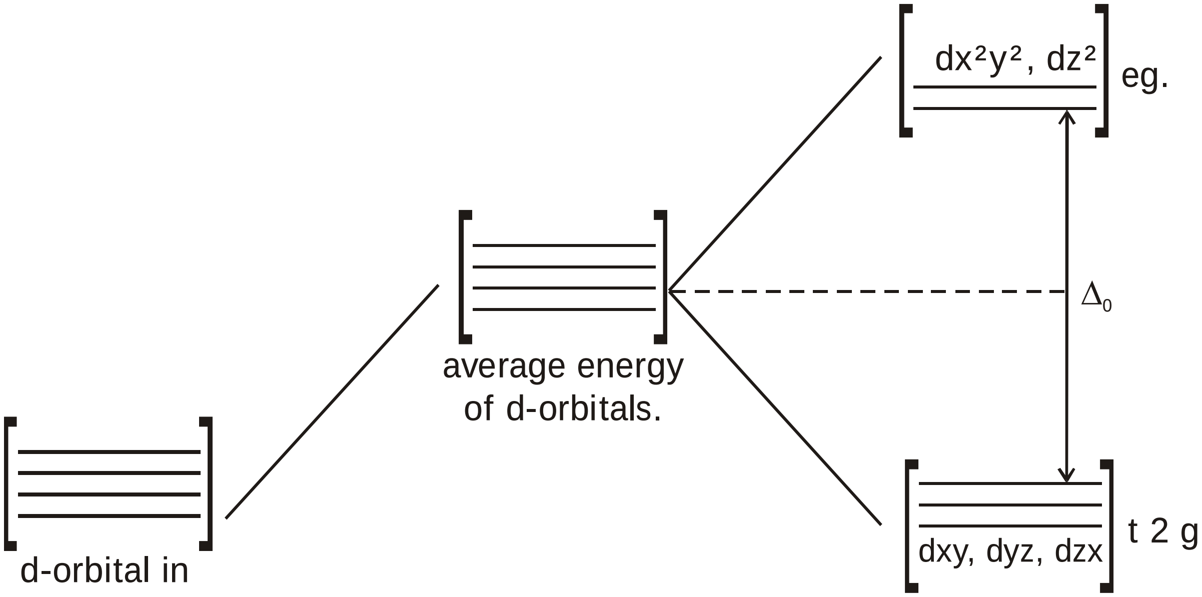
450-470 K ↓ High temperature
Decomposed

Ni + 4 CO
(Pure metal)

Q. 24. Draw a figure to show splitting of degenerate d-orbitals in an octahedral. How is the magnitude of Δ_0 affected by :

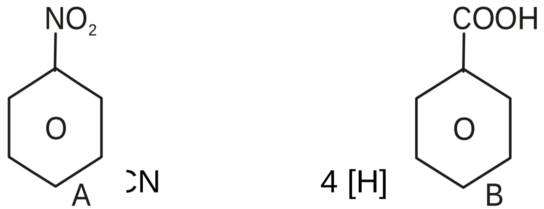
(i) Nature of ligand.
(ii) Oxidation State of metal ion.

Ans.



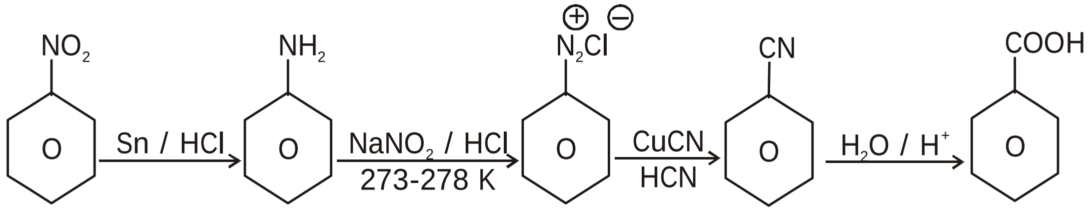
Splitting of d-orbitals in an octahedral crystal field.

Q. 25.



Ans. (1) $RCl \xrightarrow{CN} RCN \xrightarrow{4\,[H]} RCH_2NH_2$

(2)



Q. 26. (1)
(2)
(3) Give an example of each thermoplastic & thermosetting plastic.

Ans. (1) BUNA-S — 1-3 butadiene $CH_2 = CH — CH = CH_2$
styrene

Teflon — $(CF_2 = CF_2)$

(2) Nylon-6 — Condensation polymer of caproductum.
Nylon-66 — Condensation polymer of Adipic acid :
$(HOOC — CH_2 — CH_2 — CH_2 — CH_2 — COOH)$
& hexamethylene diamine :
$H_2N — (CH_2)_6 — NH_2$

(3) Thermoplatic — Polythene

Thermosetting plastic — Bakelite

Q. 27. Answer the following questions briefly :

(a) What are reducing sugars ?

(b) What are nucleotides ?

(c) Define enzymes.

Ans. (a) The sugar which contain free aldehydic group and reduce Tollen's reagent or Fehling's reagent.

(b) Nucleotide is a phosphate ester of nucleoside.

(c) Enzymes are the biological catalyst which increases the rate of metabolism and they are highly specific in nature.

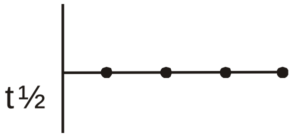
Q. 28. (a) Write the Nearnst equation and the emf of the following cells at 298 K :

Sn / Sn^{2+} (0.050 M) // H^+ (0.020 M) / H_2 (g) / Pt (s)

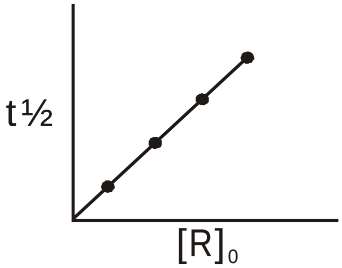
1 bar

(b) (i) Give the order of the reaction :

(a)



(b)



(ii) Write Arrh t of temperature on rate of reaction.

Ans. (a) Reaction :

At Anode

At Cathode $H^+ + e^- \longrightarrow H_2 \times 2$

$Sn + 2H^+ \longrightarrow H_2 + Sn^{2+}$

$\therefore$ n = 2

Neutral Equation

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{2} \log \frac{[Sn^{2+}]}{[H^+]^2}$$

$$= \{0 - (-0.14)\} - \frac{0.059}{2} \log \frac{0.05}{(0.02)^2}$$

$$= 0.14 - \frac{0.059}{2} \log 125$$

$$= 0.14 - \frac{0.059}{2} \times 2.0969$$

= 0.078 Volt.

(b) (i) (a) Order as $t\frac{1}{2}$ is independent of $[R]_0$.

(b) Zero Order $\because$ $t\frac{1}{2} \alpha [R]_0$

(ii) $K = A e^{-Ea/Rt}$

$$\log K = \log A - \frac{Ea}{2.303\,RT}$$

OR

Q. 28. (a) Predict the products of electrolysis of dilute aqueous solution of H_2SO_4 with platinum electrodes.

(b) How will you calculate λ_0 of $Ba(OH)_2$ with the help of Kohlrausch's law.

Ans. (a) $H_2SO_4\,(aq) \longrightarrow 2\,H^+\,(aq) + SO_4^{2-}\,(aq)$

H_2O $\quad H^+ + OH^-$

At Cat $\rightleftharpoons$ $\longrightarrow H$

. . . . . $\longrightarrow H_2\,(g)$

At Anode $\quad OH^- \longrightarrow OH + e^-$

$4\,OH \longrightarrow 2\,H_2O + O_2 \uparrow$

Thus H_2 is liberated at cathode, and O_2 is liberated at anode.

(b) $\Lambda^\circ_m\, Ba(OH)_2 \longrightarrow \lambda^\circ\, Ba^{2+} + 2 \times \lambda^\circ\, OH^-$

Q. 29. Complete the following reactions :

(a) (i) $PCl_5 + H_2O \longrightarrow$

(ii) $XeF_2 + PF_5 \longrightarrow$

(iii) $NaCl + MnO_2 + H_2SO_4 \longrightarrow$

(b) H_3PO_4 is tribasic whereas H_3PO_3 is dibasic.

(c) PCl_5 is solid in ionic state.

Ans. (a) (i) $PCl_5 + H_2O \longrightarrow POCl_3 + 2\,HCl$

$POCl_3 + 3\,H_2O \longrightarrow H_3PO_4 + 3\,HCl$

(ii) $XeF_2 + PF_5 \longrightarrow [XeF]^+\,[PF_6]^-$

(iii) $4\,NaCl + MnO_2 + 4\,H_2SO_4 \longrightarrow MnCl_2 + 4\,NaHSO_4 + 2\,H_2O + Cl_2$

(b) $H_3PO_4 + H_2O \longrightarrow H_3O^+ + H_2PO_4^-$

$H_2PO_4^- + H_2O \longrightarrow H_3O^+ + HPO_4^{2-}$

$HPO_4^{2-} + H_2O \longrightarrow H_3O^+ + PO_4^{3-}$

(c) $[PCl_4]^+\,[PCl_6]^-$ because of formation of this ionic compound.

OR

(a) Give the hybridisation of ClF_5.

(b) Complete the following reactions :

(i) $F_2 + 2\,X^- \longrightarrow$

X = ?

(ii) $MnO_2 + 4\,HCl \longrightarrow$

(iii) $XeF_2 + 2\,H_2O \longrightarrow$

$PbS + O_3 \longrightarrow$

(c) Give reasons :

(i) NH_3 is more basic than PH_3.

(ii) ICl is more reactive than I_2.

Ans. (a) Structure + hybridisation of ClF_5

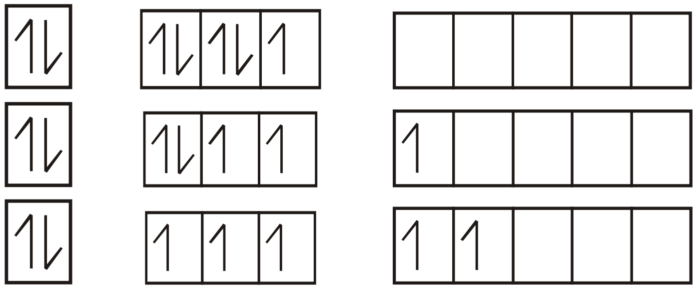
$Cl = 3\,s^2\,3\,p^5$

3 p $\qquad$ 3 d

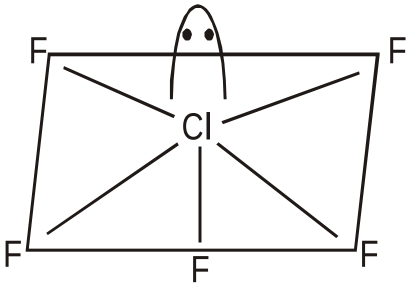
G. S.

I Excited State

II Excited State



$\therefore sp^3d^2$



Square Pyramidal

(b) (i)

(ii) $l_2 + Cl_2 + 2 H_2O$

(iii) $O_3 \longrightarrow O_2 + O \times 4$

$PbS + 4 [O] \longrightarrow PbSO_4$

$4 O_3 + PbS \longrightarrow 4 O_2 + PbSO_4$

(c) (i) Because of high electronegativity & small size of nitrogen electron density is high because lone pair are diffused over a smaller area.

(ii) I — Cl bonds are weaker than I — I because of ineffective overlapping.

Q. 30. (a) By which test the following pairs of organic compounds can be distinguished :

(i) CH_3CHO and C_6H_5CHO

(ii) H — COOH and CH_3COOH

(b) Complete the following :

(i) $CH_3COCl \xrightarrow{Pd — BaSO_4 / S}$

(ii) $C_6H_5CHO \xrightarrow{\text{Conc. NaOH}}$

(iii) $CH_3CH_2COOH \xrightarrow{Cl_2 / \text{Red } P_4}$

Ans. (a) (i) Iodoform test :

CH_3CHO give + ve test for Iodoform :

$$CH_3CHO \xrightarrow{NaOH + I_2} CI_3CHO \xrightarrow{NaOH} \underset{\text{Iodoform}}{CHI_3} + HCOONa$$

$$C_6H_5CHO \xrightarrow{NaOH + I_2} \underset{\text{Iodoform}}{NO}$$

(ii) Tollens reagent test :

$$HCOOH + 2 [Ag (NH_3)_2] + OH^- \xrightarrow{heat} 2 Ag + 4 NH_3 + CO_2 + 2 H_2O$$

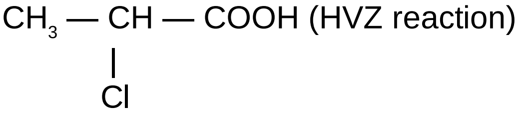
mirror

$CH_3COOH \xrightarrow{\text{Tollen reagent}} Na$

mirror

(b) (i) $CH_3 — CHO$ (Rosenmund reduction)

(ii) $C_6H_5CH_2OH$ and C_6H_5COONa (Cannizaro's reaction)

(iii) 

$CH_3 — \underset{\underset{Cl}{|}}{CH} — COOH$ (HVZ reaction)

OR

(a) How will you distinguish between aniline and N-Methylaniline (write the chemical reaction.) ?

(b) What happens when :

(i) Acetamide is treated with Br_2 / NaOH.

(ii) Acetaldehyde is treated with aq. NaOH.

(iii) Ethylamine is treated with HNO_2.

Ans. (a) By carbylamine test we can distinguish aniline and N-methylaniline.

$C_6H_5NH_2 + CHCl_3 + 3\ KOH \longrightarrow C_6H_5NC + 3\ KCl + 3\ H_2O$

$C_6H_5 — NH — CH_3 + CHCl_3 + 3\ KOH \longrightarrow$ No reaction

(b) (i) CH_3NH_2 will be formed. (Hoffmann's reagent)

(ii) Hydroxybutanol will be formed. (Aldol Condensation reaction)

(iii) $C_2H_5 — OH$ will be formed.

❑❑❑

PAPER—2

MODEL QUESTION PAPER

Duration : 3 Hours **Max. Marks : 70**

General Instructions :

(1) All questions are compulsory.

(2) Marks against each question are indicated.

(3) Questions from one to eight are very short answer type questions carrying one mark each.

(4) Questions from nine to eighteen are short answer type questions carrying two marks each.

(5) Questions from nineteen to twenty seven are short answer type questions carrying three marks each.

(6) Questions from twenty eight to thirty are long answer type questions carrying five marks each.

(7) Use log tables, if necessary. Calculators are not permitted.

Q. 1. Name a salt that can be added in AgCl so as to produce cation vacancies. 1

Q. 2. What type of deviation from ideal behaviour will be shown by the solution of chloroform and acetone ? 1

Q. 3. What happens when a colloidal sol of Fe $[OH]_3$ is mixed with that of AS_2S_3 ? 1

Q. 4. Why NCl_3 gets hydrolysed and NF_3 does not ? 1

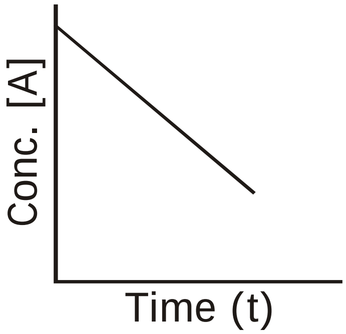
Q. 5. What is the order of reaction whose rate constant has same unit as the rate of reaction ? 1

Q. 6. Why aldehydes are more reactive than ketones towards nucleophilic substitution reaction ? 1

Q. 7. Write difference between multimolecular and macromolecular colloid ? 1

Q. 8. Why phenol is more acidic than ethanol ? 1

Q. 9. Consider the reaction $A \xrightarrow{k} P$. The change in concentration of A with time is shown in the following plot :



(i) Predict the order of the reaction.

(ii) Derive the expression for the time required for the completion of the reaction. 2

Q. 10. How do you account for the increase in the molar conductivity in care of KCl and CH_3COOH on dilution ? 2

Q. 11. How can the constant k and n of the Freundlich adsorption equation be calculated using graph ? Explain. 2

Q. 12. For the cell reaction :

Ni (s) / Ni^{2-} (aq) // (aq) Ag^{+} (aq) / Ag

Calculate the equilibrium constant at 25 °C. How much maximum work would be obtained by operation of this cell ?

E° Ni^{2+}/Ni = – 0.25 V and E° Ag^{+}/Ag = 0.80 V

Q. 13. The rate constant of a reaction is 1.5×10^{7} s^{-1} at 50 °C and 4.5×10^{7} s^{-1} at 100 °C. Calculate activation energy. 2

Q. 14. (i) Write the value of Van't Hoff factor for H_2SO_4.

(ii) Why rusting of iron is quicker in saline water ? 2

Q. 15. (i) Why H_3PO_4 is tripotic whereas H_3PO_3 is diprotic ?

(ii) Give reason why NO_2 dimenises to form N_2O_4 ? 2

Q. 16. Difference between :

(i) Starch and Cellulose

(ii) Reducing and Non-Reducing sugar 2

Q. 17. (i) What do you understand by denaturation of proteins ?

(ii) Write the two important functions of nucleic acid. 2

Q. 18. (i) Explain ethylamine is souble in H_2O whereas aniline is not.

(ii) What are ambident nucleophiles ? Explain with example. 2

Q. 19. (i) Zinc Oxide is white but it turns yellow on heating, explain why ?

(ii) Aluminium crystallises in a cubic close packed structure. Its metallic radius is 125 pm.

(A) What is the length of the side of the unit cell ?

(B) How many unit cells are there in 1.00 cm^3 of aluminium ? 2+1=3

Q. 20. (i) State Henry's law.

(ii) Arrange the following solution in the increasing order of their osmotic pressure :

(a) 34.2 g / lit sucrose ($C_{12}H_{22}O_{11}$)

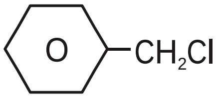
(b) 60 g / lit urea [NH_2CONH_2] 2+1=3

Q. 21. (i) What is the role of graphite rod in the electrometallurgy of aluminium ?

(ii) Write the principle of zone refining method.

(iii) Out of C and CO, which is a better reducing agent for ZnO. 3

Q. 22. (i) Which alkyl halide from the following pair would you expect to react more rapidly by an SN^2 mechanism and why ?



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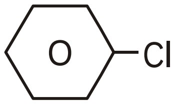
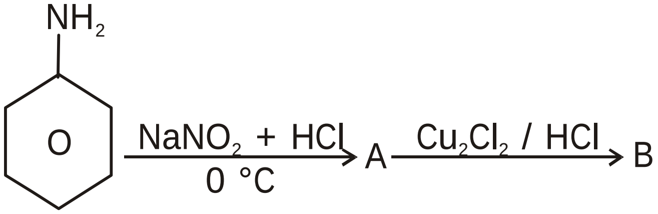


(ii) Write the chemical equation for the following conversion :

2-chloro propane to 1-bromo propane

(iii) Complete the following equation :



3

Q. 23. Write short notes on :

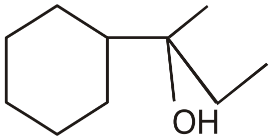
(i) Reimer Tiemann reaction

(ii) Friedel Craft reaction

(iii) Aldol Condensation. 3

OR

(i) Write IUPAC name of the following compound :

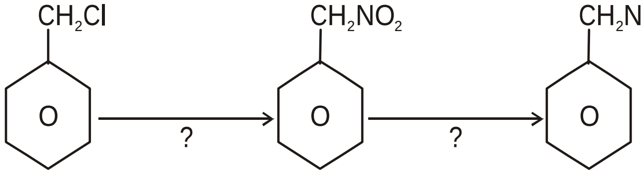


(ii) Explain why is ortho-nitrophenol more acidic than orthomethoxyphenol ?

(iii) Distinguish between propanone and propanol. 3

Q. 24. (i) Arrange the following in increasing order of basic strength :
$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

(ii) Complete the following giving appropriate represent :



Benzyl chloride Benzyl nitromethane Benyzlamine

(iii) Write Hofmann's Bromamide reaction. 3

Q. 25. (i) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)]_4$ is diamagnetic though both are tetrahedral. Why ?

(ii) Write IUPAC name of $[CO(en)_3]^{3+}$

(iii) Explain why $K_3[Fe(CN)_6]$ is more stable than $K_4[Fe(CN)_6]$. 3

Q. 26. (i) Write the name of monomers of the following polymers :

(A) Nylon-6

(B) Terylene.

(ii) Write free radical mechanism for the polymerisation of ethene.

(iii) What is the full form of PHBV ? 3

Q. 27. (i) Explain the following terms with suitable examples :

(A) Narrow spectrum antibiotic

(B) Non ionic detergents.

(ii) Label the hydrophilic and hydrophobic part in the given compound :
$CH_3(CH_2)_{10}CH_2SO_3^- Na^+$

(iii) Write the constituents of dettol. 3

Q. 28. (i) Arrange $HClO_4$, $HClO_3$, $HClO_2$, $HClO$ in order of increasing acidic strength. Give reason.

(ii) Why inter halogen are more reactive than halogens ?

(iii) OF_2 should be called oxygen difluoride and not fluorine oxide. Why ?

(iv) Why HF acid is stored in wax coated glass bottles ?

(v) SF_6 is known but SH_6 is not known. Explain. 5

OR

(i) Deduce the molecular shape of BrF_3 or the basis of VSEPR theory.

(ii) Arrange NH_3, PH_3, AsH_3, SbH_3, BIH_3 in order of increasing acidic strength.

(iii) Why do noble gases form compound with oxygen and fluorine only ?

(iv) Write balanced equation for the following :

  (a) NaCl is heated with sulphuric acid in presence of MnO_2.

  (b) Cl_2 gas is passed into a solution of NaI in water. 5

Q. 29. (i) What is the effect of pH on the $K_2Cr_2O_7$ solution ?

(ii) Transition metal exhibit higher enthalpies of atonisation, explain why ?

(iii) Why the transition metal generally form coloured compounds ?

(iv) Which out of the following are transition element and why ?
Zn, Ag, Cd, Au

(v) Why is the separation of lanthanide elements difficult ? 5

OR

(i) Transition metal and their many compounds act as good catalyst.

(ii) Actinoid contraction is greater from element to element than lanthanoid contraction. Why ?

(iii) K_2PtCl_6 is a well known compound whereas corresponding Ni compound is not known. State a reason for it.

(iv) A mixed oxide of Iron and Chronium FeO . Cr_2O_3 is fused with Na_2CO_3 in presence of air to form a yellow coloured compoud A. On acidification the compound (A) form an orange coloured compound (B) which is a strong oxidizing agent.

  (a) Identify A and B.

  (b) Write balanced chemical equation for each step. 5

Q. 30. An organic compound contain 69.77% carbon, 11.63% hydrogen and rest oxygen. The molecular mass of compound is 86. It does not reduce Tollen's reagent but form an addition compound with sodium hydrogen sulphide and give positive iodoform test. On vigorous oxidation it gives ethanoic and propanoic acid. Write the possible structure of the compound. 5

OR

An organic compound (A) having molecular formula $C_9H_{10}O$ form an orange red precipitate (B) with 2, 4 — DNP reagent. Compound (A) gives a yellow precipitate (C) when heated in the presence of iodine and NaOH along with a colourless compound (D). (A) does not reduce Tollen's reagent or Fehling's solution nor does it decolourise Bromine water. On drastic oxidation of (A) with chromic acid, a carboxylic acid (E) of molecular formula $C_7H_6O_2$ is formed. Deduce the structure of organic compounds A to E. 5

SOLUTION TO THE MODEL QUESTION PAPER

Ans. 1. $CdCl_2$ or $SrCl_2$ 1

Ans. 2. Chloroform and acetone shows –ve (negative deviation) from ideality. 1

Ans. 3 Fe $(OH)_3$ sol being positively changed whereas AS_2S_3 being negatively changed, their charges are neutralised on mixing. Hence, there mutual precipitation (cogulation) occur. 1

Ans. 4. In NCl_3, has vacant d-orbitals to accept the lone pair of electrons donated by O-atom of H_2O molecule but NF_3 . F does not have d-orbitals. 1

Ans. 5. Zero order reaction 1

Ans. 6. Aldehydes are more reactive than ketones due to following reasons :

(i) Inductive effect and

(ii) Steric effect.

(i) Inductive effect — Two alkyl gp attached to carbonyl carbon in ketone, alkyl gp is electron donating therefore greater is the electron density on carbonyl carbon in ketones.

(ii) Steric effect — In ketones there are two alkyl gp attached to the carbonyl carbon. As crowding increases, the reactivity increases accordingly. ½+½=1

Ans. 7.

Multi molecular	Macro molecular
They are formed by aggregation of large number of atoms or molecules. eg. gold, S etc.	They are molecules of large size. eg. proteins, starch, nylon etc.

1

Ans. 8. Since the phenolic ion left after the removal of a proton is stabilized by reronance whereas alkoxide ion (left after the removal of a proton from alcohol) is not. 1

Ans. 9. (i) Order of reaction = zero

(ii) Consider

$$R \longrightarrow P$$

$$\text{Rate} = -\frac{d[R]}{dt} = k\,[R]^{\circ} \qquad (\because\ R]^{\circ} = 1)$$

$$\text{Rate} = -\frac{d[R]}{dt} = k \times 1$$

$$d\,[R] = -k\,dt$$

Integrated both sides

$$[R] = -kt + I \qquad \text{— (i)}$$

where I is the constant of integration.

At t = 0 the conc. of the reactant R = $[R]_0$

where $[R]_0$ is the initial conc. of reactant.

Substituting in equatiuon (i)

$$[R]_0 = -k \times 0 + I$$

$$[R]_0 = I$$

Substituting the value of I in the equ. (i)

$$[R] = -kt + [R]_0 \qquad \text{— (ii)}$$

$$k = \frac{[R]_0 - [R]}{t}$$

$$\boxed{t = \frac{[R]_0 - [R]}{k}}$$

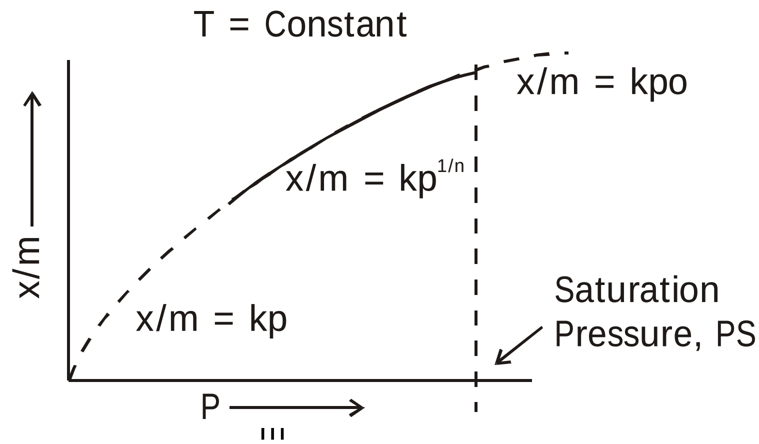
1+1=2

Ans. 10. CH_3COOH is a weak electrolyte, the molar conductivity increases with dilution. KCl is a strong electrolyte also molar conductivity increases with dilution. This increase in molar conductivity in strong electrolyte is very less.

Reason — In weak electrolyte, the increase on dilution is due to increase in degree of dissociation, which increases the number of ions.

In strong electrolyte, the increase is because of decrease in interionic hindrance towards mobility ions. 1+1=2

Ans. 11.



— (i)

lues of P. In this range of pressure

$$\frac{x}{m} \propto P^{\circ} \quad \text{or} \quad \frac{x}{m} = \text{constant} \times P^{\circ} \qquad \text{— (ii)}$$

In the intermediate range of pressure, $\frac{x}{m}$ will depend on P raised to power between 1 and 0 i. e. fractions. For a small range of pressure values, we can write :

$$\frac{x}{m} \propto P^{\frac{1}{n}} \quad \text{or} \quad \frac{x}{m} = k\ P^{\frac{1}{n}} \qquad \text{— (iii)}$$

Taking logarithms of both sides, we get :

$$\log \frac{x}{m} = \log k + \frac{1}{n} \log P$$

2

Ans. 12. $Ni + 2\,Ag^{+} \longrightarrow Ni^{2+} + 2\,Ag$

$E^{\circ}_{cell} = E_{cathode} - E_{anode}$

$= 0.80 - (-0.25) = 1.05$ U

T =273 + 25 = 298 k

$$E_{cell} = E^{\circ}_{cell} - \frac{2.303}{nF} \log k_C$$

at equ^n :

$$0 = 1.05\text{ V} - \frac{2.303 \times 8.314 \times 298}{2 \times 96500} \log k_c$$

$$0 = 1.05\text{ V} - \frac{0.0591}{2} \log k_c \text{ at 298 k}$$

$\log k_c$ = Antilog 35.6 = 3.981×10^{35}

$$\log k_c = \frac{2 \times 1.05}{0.0591} = 35.6$$

$$\boxed{k_c = 3.981 \times 10^{35}}$$

$$W_{max} = -\Delta G° = n\,F\,E°_{cell}$$
$$= 2 \times 96500 \times 1.05$$
$$= 202650 \text{ Joules}$$
$$\boxed{W_{max} = 202.65 \text{ k Joules}}$$ 2

Ans. 13. $$\log\frac{k_2}{k_1} = \frac{Ea}{2.303\,R}\left(\frac{T_2 - T_1}{T_1 \times T_2}\right)$$

T_1 =273 + 50 = 323 k

T_2 =273 + 100 = 373 k

$$\log \frac{4.5 \times 10^7 \text{ sec}^{-1}}{1.5 \times 10^7 \text{ sec}^{-1}} = \frac{Ea}{2.303 \times 8.314}\left(\frac{373 - 323}{323 \times 373}\right)$$

$$\log 3 = \frac{Ea}{2.303 \times 8.314}\left(\frac{50}{323 \times 373}\right)$$

$$0.4771 = \frac{Ea}{2.303 \times 8.314}\left(\frac{50}{323 \times 373}\right)$$

$$Ea = \frac{0.4771 \times 2.303 \times 8.314 \times 323 \times 373}{50}$$

Ea = 22011.75 Joules/mole 2

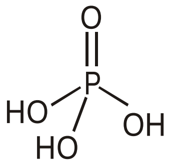
Ans. 14. (i) $K_2SO_4\text{ (aq)} \longrightarrow 2\,K^+ + SO_4^-$

i (Vant's Hoff factor) = 2 + 1 = 3

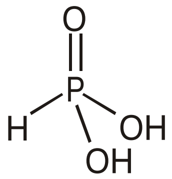
(ii) H^+ ions are involved in the reduction of O_2. As the H^+ ion conc. is lowered i. e. pH is increased, the reduction of O_2 become less favourable. If water is saline, it helps in the flow of current in the miniature cell and hence enhances the process of Rusting of Iron. 1+1=2

Ans. 15. (i) Structure :

H_3PO_4



H_3PO_3



1. H_3PO_4 contains 3 (three) ionizable H-atoms which are present as — OH gp, It behave as a tribasic acid.
2. H_3PO_3 contains 2 (two) ionizable H-atoms which are present as — OH gp, It behave as a dibasic acid.

(ii) NO_2 is an odd electron (7 + 2 × 8 = 23) molecule. In the valence shell, N has seven electrons and hence is less stable. To become more stable by having even (8) number of electrons in the valence shell it undergoes dimerization to form N_2O_4. 2

Ans. 16. Difference between Starch and Cellulose :

(i)	Starch	Cellulose
	Starch consist of amylose and amylopectin. Amylose is linear polymer of α-D glucose.	Cellulose is linear polymer of β-D glucose and highly branched structure.
(ii)	Reducing Sugar	Non-Reducing Sugar
	All those carbohydrates in which	All those carbohydrates in which

aldehyde or ketonic gp is free and reduce Fehling's solution and Tollen's reagent are known as reducing sugar.	aldehyde or ketonic gp is not free and cannot reduce Fehling's solution and Tollen's reagent is known as non-reducing sugar.
eg. — glucose, fructose etc.	eg. — starch, cellulose. 1+1=2

Ans. 17. (i) When a protein is in its native form, is subjected to a physical change, like change in temperature or a chemical change like change in pH, the native conformation of the molecule is distrupted. As a result, glubules unfold and helices get uncoiled and biological activity is lost is known as denaturation of protein.

(ii) Two functions of Nucleic acid :

(a) Replication

(b) Synthesis of protein

Explain

1+1=2

Ans. 18. (i) Ethylamine is dissolves in wa [illegible] nolecular H-bonding. However aniline, due to large hydroph[illegible]ydrocarbon part, the extent of hydrogen bonding decreases considerably and hence aniline is insoluble in water.

(ii) When a nucleophile contain two sites but only one of them form bond with carbon is called Ambident nucleophile. eg. – CN^- or NC^-, NO_2^- or ONO_2^-.1+1=2

Ans. 19. (i) When Zinc oxide heated, it loses oxygen according to the following Rxn. :

$$ZnO \longrightarrow Zn^{2+} + \frac{1}{2} O_2 + 2e^-$$

Zn^{2+} ions are entrapped in the interstial voids and electrons in the neighbouring interstial voids to maintain electrical neutrality. This give rise to access metal defect. Due to pressure of electrons in the interstial voids the colour is yellow as the remaining colour of white light are absorbed by these electrons.

(ii) (a) ccp = fcc for fcc a = 2 r

$a = 2\sqrt{2}\ r$

$= 2 \times 4.414 \times 125$ om

$a = 354$ pm <u>Ans.</u>

(b) Volume of one unit cell = $(3.54 \times 10^{-10}\ cm)^3$

$= 4.44 \times 10^{-23}\ cm^3$

Unit cells 1 cm^3 = $\frac{1}{4.44 \times 10^{-23}}$

Unit cells = 2.25×10^{22} Ans. 1+2=3

Ans. 20. (i) Henry's law : The mass of a gas dissolved in a given volume of the liquid at constant temperature is directly proportional to the presence of the gas present in equilibrium with the liquid.

Mathematically, $m \propto p$

$m = k_H p$

where m = mass of gas

p = pressure of gas in equ^n with the solvent.

k_H = Constant called Henry's law constant

(ii) No. of moles of Sucrose = $\frac{34.2}{342}$ = 0.1 moles

No. of moles of Urea = $\frac{60}{60}$ = 1 moles

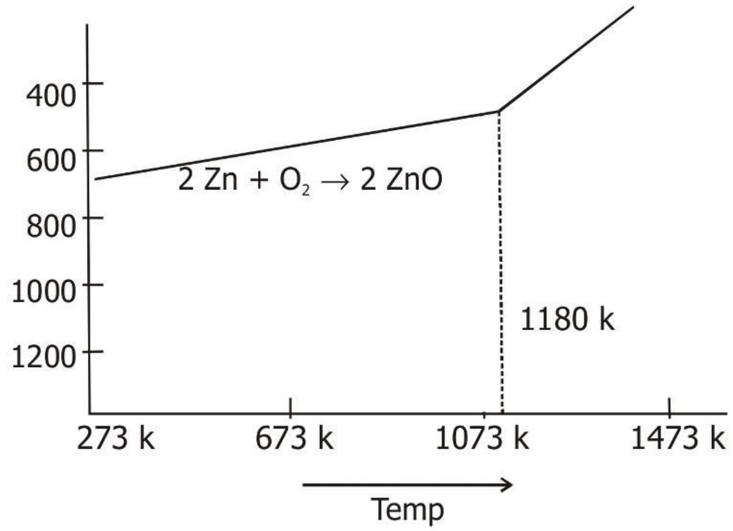
As the osmotic pressure is directly proportion of the number of particles in the solution hence increasing order of osmotic pressure will be Sucrose < Urea.

Ans. 21. (i) Since graphite is much cheaper than other metal is used as anode, thus the role of graphite in electrometallurgy of Al is to prevent the liberation of O_2 at the anode which may otherwise oxidise same of the liberated Al back to Al_2O_3.

(ii) Zone Refining method is based upon the principle that the impurities are more soluble in the molten State (melt) than in the solid state of the metal.

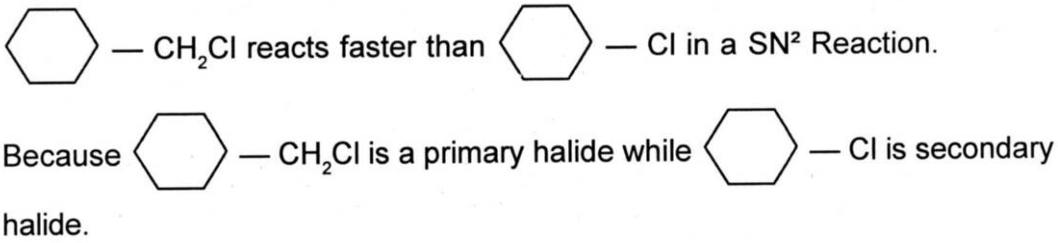
(iii) The standard force energy of formation $\Delta G°_f$ of CO from C becomes lower above 1223 k and that of CO_2 from C becomes lower above 1323 k than $\Delta G°_f$ of ZnO. Therefore, above this temp. C can reduce ZnO to Zn. In actual practice reduction in usually carried at around 1673 k. However, $\Delta G°_f$ at CO_2 from CO is always higher than that of ZnO. Therefore, CO cannot reduce ZnO to Zn even around 1673 k. Thus out of C and CO, C is better reducing agent than CO for ZnO. 1+1+1=3

Ans. 22. (i)



(ii)

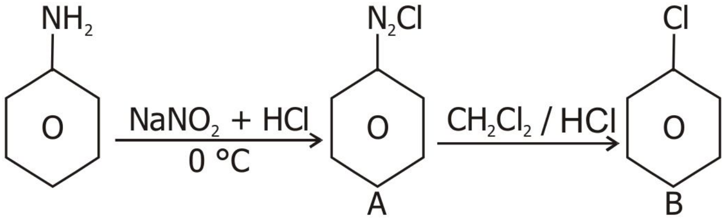
alc. KOH HBr


— CH_2Cl reacts faster than — Cl in a SN² Reaction.

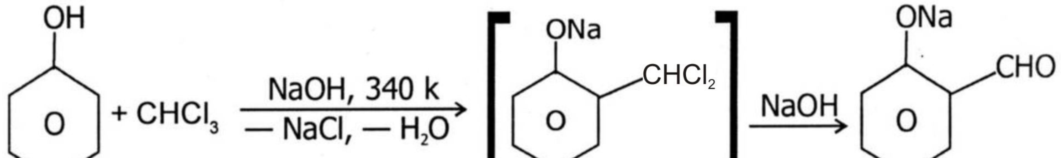
Because — CH_2Cl is a primary halide while — Cl is secondary halide.

(iii) =3

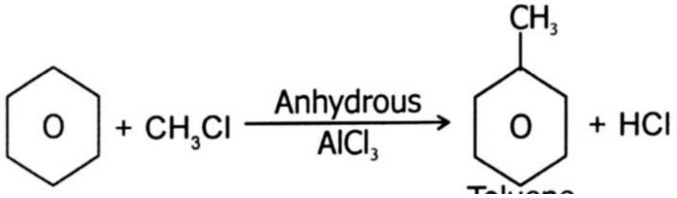
Ans. 23. (i)



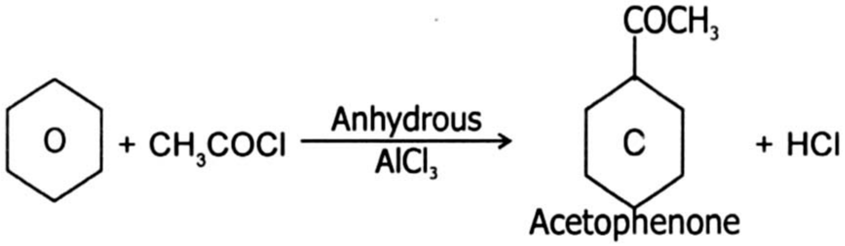
ɔform in the presence of resulting product gives 2 hydroxybenzaldehyde. This Rxⁿ is called Reimer Tiemann Rxⁿ.



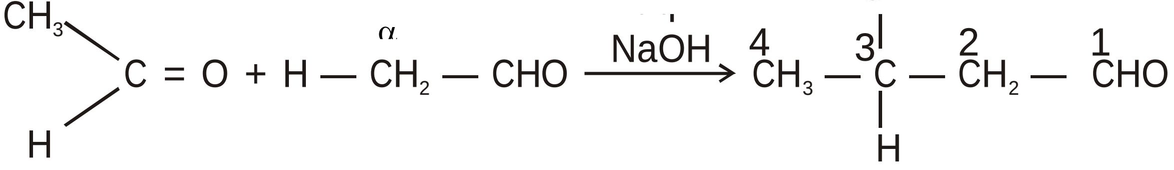
(ii) Benzene and other organic compounds react with alkyl halides or acid chlorides/acid an



(iii)



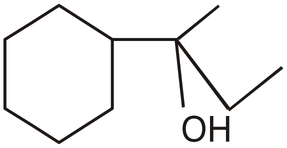
ogen atoms on
rm β-hydrogen
. 1+1+1=3



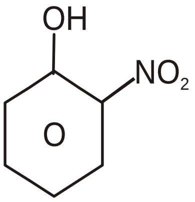
3 Hydroxy butanal

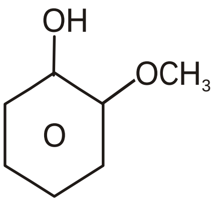
OR

(i) IUPAC name :

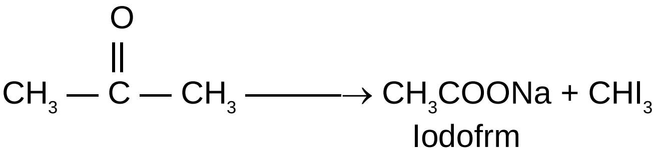


(ii) The — NO_2 (nitro gp) is an electro with drawing gp. So nitrophenol is more acidic than phenol. — OCH_3 (methoxy gp) is an electron releasing gp. So methoxy phenol is less acidic than phenol. So orthonitro phenol is more acidic than orthomethoxy phenol.





(iii) Distinguish between propanone and propanol :
Propanone gives Iodoform Test :



$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3 \longrightarrow CH_3COONa + CHI_3$$

Iodofrm

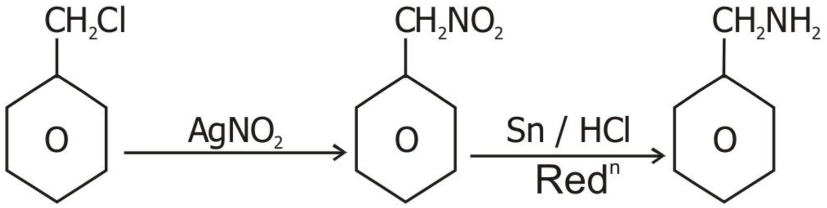
propanol gives Iodoform Test :

$$\begin{tikzcd}
CH_3 - CH_2 - CH_2OH \arrow[r, "NaOH + I_2"] & CH_3CH_2 - CHO \arrow[d, "NaOH + I_2"] \\
 & \text{No Rx}^n
\end{tikzcd}$$

1+1+1=3

Ans. 24. (i) $C_6H_5N(CH_3)_2 < C_6H_5NH_2 < CH_3NH_2 < (C_2H_5)_2NH$

(ii)



(iii) mide to a primary amine containing one carbon atom less than the original amide on heating with a mixture of Br_2 in presence of NaOH is called Hofmann bromoamide Rx^n.

eg.

$$\underset{\text{Acetamide}}{CH_3CONH_2} + Br_2 + NaOH \xrightarrow{\Delta} \underset{\text{Methyl amine}}{CH_3NH_2} + 2\,NaBr + Na_2CO_3 + 2\,H_2O$$

1+1+1=3

Ans. 25. (i) In $[NiCl_4]^{2-}$, Cl^- is a weak field ligand and therefore no pairing of 3d electrons in Ni^{2+} :

$[NiCl_4]^{2-}$

& then it h xid. state & it involve sp³ hybridisation.

$[Ni(CO)_4]$

As no un

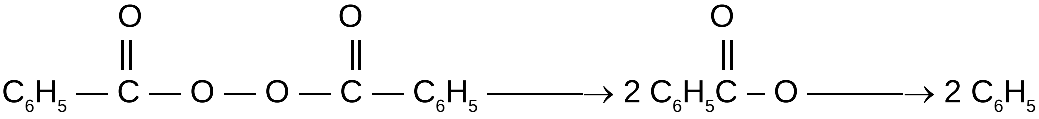
(ii) Tris (1, 2-ethane diamine) cobalt (III) ion

(iii) It is because the stability of complex depends upon the charge density (i. e. charge/radius ratio) on central ion. More is the charge density greater is the stability. 1+1+1=3

Ans. 26. (i) (a) Caprolactum

(b) Ethylene glycol and terephthalic acid

(ii) Chain Initiation Step :



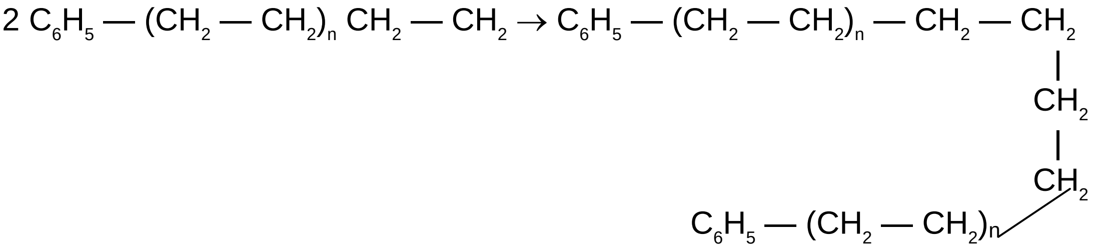
$$C_6H_5 - \overset{\overset{\displaystyle O}{\|}}{C} - O - O - \overset{\overset{\displaystyle O}{\|}}{C} - C_6H_5 \longrightarrow 2\,C_6H_5\overset{\overset{\displaystyle O}{\|}}{C} - O \longrightarrow 2\,C_6H_5$$

$$C_6H_5 + CH_2 = CH_2 \longrightarrow C_6H_5 - CH_2 - CH_2$$

Chain propagating Step :

$$C_6H_5CH_2CH_2 + CH_2 - CH_2 \longrightarrow C_6H_5 - (CH_2 - CH_2)_n - CH_2 - C^{-}H_2$$

Chain terminating Step :



$$2\,C_6H_5-(CH_2-CH_2)_n\,CH_2-CH_2 \rightarrow C_6H_5-(CH_2-CH_2)_n-CH_2-CH_2-CH_2-CH_2-(CH_2-CH_2)_n-C_6H_5$$

(iii) Poly-Hydroxybutyrate-co-β-Hydroxyvalerate 1+1+1=3

Ans. 27. (i) (a) Def. eg. Penicilin

(b) Def. eg. Pentaerythritol monostearate

(ii) hydrophobic — $CH_3\,(CH_2)_{10}\,CH_2O$

hydrophilic — $SO_3^-\,Na^+$

(iii) Chloroxylenol and terpineol 1+1+1=3

Ans. 28. (i) $HClO < HClO_2 < HClO_3 < HClO_4$

Conjugate base of weak acid is strong and conjugate base of strong acid is weak.

ClO_4^- is stable than ClO^-.

$ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

(ii) X — Y bond is weaker than X — X & Y — Y bonds.

(iii) Because fluorine is more electronegative than oxygen.

(iv) Because in glass SiO_2 is present which dissolve in HF to give soluble $H_2[SiF_6]$.

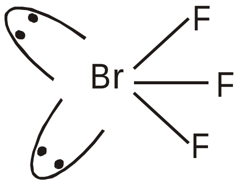
$SiO_2 + 4\,HF \longrightarrow SiF_4 + 2\,H_2O$

$SiF_4 + 2\,HF \longrightarrow H_2SiF_6$

(v) In the highest oxidation state, sulphur can combine only with highly electro negative element like fluorine. 1×5=5

OR

(i) Bent T-shaped with sp^3d hybridisation :



(ii) $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$

(iii) Both oxygen and fluorine being highly electronegative atom can easily cause promotion of electrons from filled p-orbital to vacant d-orbital.

(iv) (a) $2\,NaCl + MnO_2 + 2\,H_2SO_4 \longrightarrow NaSO_4 + MnSO_4 + 2\,H_2O + Cl_2\uparrow$

(b) $2\,NaI + Cl_2 \longrightarrow 2\,NaCl + I_2$ 5

Ans. 29. (i) $Cr_2O_7^{2-} + H_2O \rightleftharpoons 2\,Cr_2O_4^{2-} + 2\,H^+$

In acidic medium, it exists as $Cr_2O_7^{2-}$ & hence has orange colour. In basic medium, it exists mainly as $Cr_2O_4^{2-}$ & hence has yellow colour.

(ii) Transition elements have strong interatomic bonds due to their small size and large no. of unpaired electrons in their atom.

(iii) Due to the presence of unpaired electrons and d-d transition.

(iv) Zn & Cd are not transition elements, since their d-orbitals are completely filled in their ground state as well as in their common oxidation states.

(v) Due to lanthanoid contraction, there is very small difference in the size and as a result similar chemical properties.

OR

(i) (a) They show variable Oxidation State & then also form unstable intermediate compounds & provide a new path with lower activation energy.

(b) Transition metals provide a suitable surface for the reaction to take place.

(ii) Due to poor screening by 5 f electrons.

(iii) The sum of first two ionization energies is less for Ni than Pt whereas sum of first four ionisation energies is less for Pt than Ni.

(iv) $$4\,FeCr_2O_4 + 8\,Na_2CO_3 + 7\,O_2 \longrightarrow \underset{(A)}{8\,Na_2CrO_4} + 2\,Fe_2O_3 + 8\,CO_2$$

$$Na_2CrO_4 + H_2SO_4 \longrightarrow \underset{(B)}{Na_2Cr_2O_7} + Na_2SO_4 + H_2O$$ 5

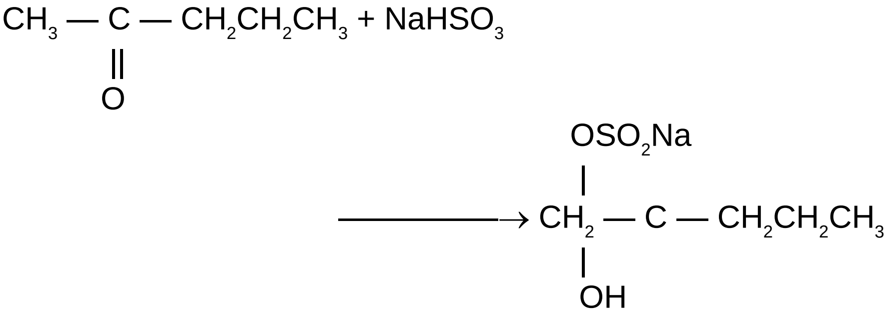
Ans. 30.

S. No.	Element	%	Mole Ratio	Relative Ratio
1	C	69.77	$\frac{69.77}{12} = 5.84$	$\frac{5.814}{1.16} = 5$
2	H	11.63	$\frac{11.63}{1} = 11.63$	$\frac{11.63}{11.63} = 10$
3	O	18.60	$\frac{18.6}{16} = 1.16$	$\frac{1.16}{1.16} = 1$

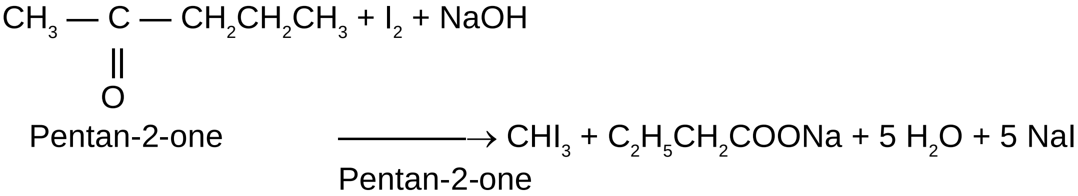
E. F. Mass = 86

E. F. = $C_5H_{10}O$ M. M. = 86

$\boxed{M.\ F. = C_5H_{10}O}$ $n = \frac{M.\,Mass}{E.\,F.\,Mass}$ $n = \frac{86}{86} = 1$



$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2CH_2CH_3 + NaHSO_3 \longrightarrow CH_2-\overset{\overset{OSO_2Na}{|}}{\underset{\underset{OH}{|}}{C}}-CH_2CH_2CH_3$$



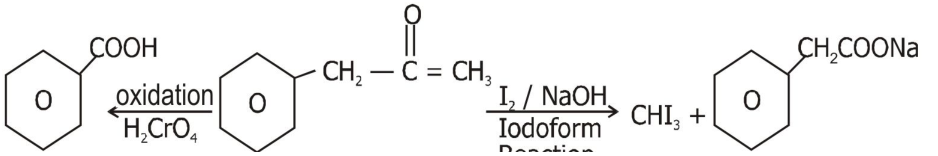
$$CH_3-\underset{\underset{O}{\|}}{C}-CH_2CH_2CH_3 + I_2 + NaOH$$

Pentan-2-one

$$\longrightarrow CHI_3 + C_2H_5CH_2COONa + 5\,H_2O + 5\,NaI$$

Pentan-2-one

OR



mF — $C_7H_6O_2$ **1-phenyl propanone** **1-phenylethanote**

5

* * *

PAPER—3

MODEL QUESTION PAPER

Duration : 3 Hours **Max. Marks : 70**

General Instructions :

1. *All questions are compulsory.*
2. *Questions No. 1 to 8 are very short answer questions and carry 1 mark each.*
3. *Questions No. 9 to 18 are short answer questions and carry 2 marks each.*
4. *Questions No. 19 to 27 are also short answer questions and carry 3 marks each.*
5. *Questions No. 28 to 30 are long answer questions and carry 5 marks each.*
6. *Use Log tables, if necessary, use of calculators is not allowed.*

Q. 1. What happens when freshly precipitated Fe $(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$?

Q. 2. Give the IUPAC name of $K_3\,[Co(NO_2)_6]$.

Q. 3. Ortho-Nitro phenol is more acidic than ortho-methoxy phenol. Why ?

Q. 4. Name the reaction and the reagent used for the conversion of acid chlorides to the corresponding aldehydes ?

Q. 5. Identify A and B in the following :

$$C_6H_5NH_2 \xrightarrow[\text{HCl } (0-5\ ^\circ\text{C})]{NaNO_3} A \xrightarrow{CuBr} B$$

Q. 6. What type of linkage holds together the monomers of DNA ?

Q. 7. Give the name of the polymer which is used for making non stick utensils ?

Q. 8. Name the chemicals responsible for the antiseptic properties of Dettol ?

Q. 9. State the difference between Schottky and Frenkel defects ? Which of these two changes the density of the solids ? (Any 2 differences)

Q. 10. Caesium Chloride crystallizes as a body centered cubic lattice and has a density of 4 g/cm^3. Calculate the length of the edge of the unit cell of Caesium Chloride Crystal ? (Molar Mass of CsCl = 168.5 g/mol)

Q. 11. State Henry's law and write one important application of the law ?

Q. 12. What is a fuel cell ? Write the electrode reactions in a fuel cell ?

Q. 13. Which of the d-block elements are not regarded as transition metals and why ?

Q. 14. $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[Co(F_6)]^{3-}$ is paramagnetic. Give reasons.

Q. 15. Explain why :

(i) Haloalkanes are more reactive towards nucleophilic substitution reaction than haloarenes.

(ii) Thionyl Chloride method is preferred for preparing alkyl chlorides from alcohols.

Q. 16. Write the structure of the major product in each of the following reactions :

(i) $(CH_3)_3\,CBr + KOH \xrightarrow[\text{heat}]{\text{ethanol}}$

(ii) $CH_3CH_2CH = CH_2 + HBr \xrightarrow{\text{Peroxide}}$

Q. 17. What is a biodegradable polymer ? Give an example.

Q. 18. Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem ? Name any two drugs.

OR

Differentiate between bactericidal antibiotics and bacteriostatic antibiotics with one example each.

Q. 19. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non volatile non-electrolyte solid weighing 0.5 g is added to 39 g of benzene. The vapour pressure of the solution is 0.845 bar. What is the molar mass of the solid substance ?

Q. 20. Represent the cell and calculate the emf of the cell in which the following reactions takes place :

$Mg\,(s) + 2\,Ag^+\,(0.0001\,M) \longrightarrow Mg^{2+}\,(0.130\,M) + 2\,Ag\,(s)$

$E^\circ_{cell} = 3.17\,V$

OR

The conductivity of 0.001028 mol/L acetic acid is $4.95 \times 10^{-5}\,S\,cm^{-1}$.

Calculate its dissociation constant if Λ°_m is $390.5\,S\,cm^2\,mol^{-1}$.

Q. 21. Explain what is observed :

(a) (i) When a beam of light is passed through a colloidal solution.

(ii) Electric current is passed through a colloidal solution.

(b) What do you mean by activity and selectivity of a catalyst ?

Q. 22. Name the chief ore of aluminium and describe the steps involved in the extractions of aluminium metal from its ore.

Q. 23. Give reasons for the following :

(i) Noble Gases have very low boiling points.

(ii) Halogens have maximum negative electron gain enthalpy in the respective period of the periodic table.

(iii) Ozone acts as a powerful oxidising agent.

Q. 24. Indicate the steps in the preparation of $K_2Cr_2O_7$ from Chromite ore.

Q. 25. You are given benzene, concentrated Sulphuric Acid and Sodium Hydroxide. Write the equations for the preparation of phenol using these reagents ?

Q. 26. Arrange the following :

(i) Increasing order of basic strength : Aniline, p-nitroaniline and p-toluidine

(ii) Increasing order of boiling points : C_2H_5OH, $(CH_3)_2\,NH$, $C_2H_5NH_2$

(iii) Increasing order of solubility in water : $C_6H_5NH_2$, $(C_2H_5)_2\,NH$, $C_2H_5NH_2$

Q. 27. What happens when D-Glucose is treated with the following reagents :
- (i) HI
- (ii) Bromine Water
- (iii) HNO_3

Q. 28. For a certain chemical reaction, variation in the concentration in [R] vs time (s) plot is given. For this reaction :
- (i) What is the order of the reaction ?
- (ii) What are the units of rate constant k ?
- (iii) Give the relationship between k and $t_{½}$?
- (iv) What does the slope of the plot line indicate ?
- (v) Draw the plot log $\frac{[R_0]}{[R]}$ vs time t (s).

OR

For a certain chemical reaction :

$A + 2B \longrightarrow 2C + D$

The experimentally obtained information is tabulated before :

Experiment	$[A]_0$	$[B]_0$	Initial rate of reaction
1.	0.30	0.30	0.096
2.	0.60	0.30	0.384
3.	0.30	0.60	0.192
4.	0.60	0.60	0.768

For this reaction :
- (i) Derive the order of the reaction with respect to both reactants A and B.
- (ii) Write the rate law.
- (iii) Calculate the value of rate constant.
- (iv) Write the expressions for the rate of the reaction in terms of A and C.

Q. 29. Arrange the following in the order of property indicated for each set :
- (a) F_2, Cl_2, Br_2, I_2 ; Increasing Bond Energy
- (b) HF, HCl, HBr, HI ; Increasing acid strength
- (c) NH_3, PH_3, AsH_3, BiH_3 ; Increasing base strength
- (d) H_2O, H_2S, H_2Se, H_2Te ; Increasing acid strength
- (e) NaF, NaCl, NaBr, NaI ; decreasing ionic character

OR

- (a) How are XeO_3 and XeF_4 prepared ? Draw their molecular shape.
- (b) Write the formulae of the noble gas compound that is isostructural with
  - (i) IBr_2^-
  - (ii) BrO_3^-

Q. 30. An organic compound (A) having molecular formula C_8H_8O forms an orange red precipitate (B) with 2, 4 — DNP reagent. Compound (A) gives a yellow precipitate (C) when heated in the presence of iodine and Sodium Hydroxide along with a colourless compound (D). (A) does not reduce Tollen's reagent or Fehling's solution nor does it decolourise bromine water. On drastic oxidation of (A) with chromic acid, a carboxylic acid (E) of molecular formula $C_7H_6O_2$ is formed. Deduce the structure of organic compounds A to E.

OR

Write Chemical equations for the following reactions :
- (i) Aldol Condensation

(ii) Canizzaro Reaction
(iii) Clemmenson Reduction Reaction
(iv) Gattermann Koch Reaction
(v) Esterification Reaction

SOLUTION TO THE MODEL QUESTION PAPER

Ans. 1. Peptization (The precipitate changes into a colloidal sol) 1

Ans. 2. Potassium hexanitrito-N-cobaltate (III) 1

Ans. 3 — NO_2 group is electron withdrawing, decreases electron density on benzene ring, facilitating the release of H^+. 1

— OCH_3 group is electron releasing, it increases electron density on benzene ring thereby making the release of H^+ comparatively difficult. 1

Ans. 4. Rosenmund Reduction :

H_2 / Pd / $BaSO_4$ 1

Ans. 5. A— $C_6H_5N_2Cl$

B— C_6H_5Br 1

Ans. 6. Phosphodiester linkage 1

Ans. 7. Polytetra fluoro ethylene (Teflon) 1

Ans. 8. Chloroxylenol and turpeniol 1

Ans. 9.

Schottky defect	Frenkel defect
Equal number of cations and atoms are completely missing from their lattice sites.	The smaller ion usually the cation is dislocated from its normal site to an interstitial. site.
Density of substance reduced.	No effect on density of the substance.
Shown by substance in which cation and anion are almost of same size.	Shown by substances in which there is a large difference in the size of ions.

Schottky defect changes the density of the solid. 2

Ans. 10. $d = \dfrac{z \, . \, M}{a^3 \, . \, N_A}$

$a^3 = \dfrac{z \, . \, M}{d \, . \, N_A}$

$= \dfrac{2 \times 168.5 \text{ g/mol}}{4 \text{ g / cm}^3 \times 6.023 \times 10^{23} \text{ /mol}}$

$a^3 = \dfrac{2 \times 168.5}{4 \times 6.023 \times 10^{23}}$

$a^3 = 1.39 \times 10^{-22}$; $a = 2.404 \times 10^{-7}$ cm 2

Ans. 11. The solubility of a gas in a liquid is directly proportional to the pressure of the gas.

Applications :

To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure. 2

Ans. 12. Fuel cell is a device that can convert the energy of combustion of fuels like hydrogen, methane, methanol etc. directly into electrical energy. 2

At cathode : $O_2 (g) + 2 H_2O (l) + 4 e^- \longrightarrow 4 OH^- (aq)$

At anode : $2 H_2 (g) + 4 OH^- (aq) \longrightarrow 4 H_2O (l) + 4 e^-$

Ans. 13. Zinc, cadmium and mercury are not regarded as transition metals because they have completely filled d orbitals in their ground state as well as in their oxidised state. 2

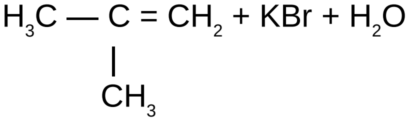
Ans. 14. In $[Co(NH_3)_6]^{3+}$, cobalt ion is in + 3 oxidation state and has the electronic configuration 3 d^6. It undergoes d^2 sp^3 hybridisation. Each hybrid orbital receives 1 pair of electrons from ammonia. Since all electrons are paired it is diamagnetic.

In $[CoF_6]^{3+}$, cobalt ion is in + 3 oxidation state and has the electronic configuration $3d^6$. It undergoes sp^3 d^2 hybridisation. Each hybrid orbital receives a pair of electrons from F^-. THe 3 d electrons of Co remain unpaired making it paramagnetic. 2

Ans. 15. (i) In haloarenes, there is resonance. Due to resonance, the C — X bond aquires a double bond character making its cleavage difficult whereas there is no such resonance in haloalkanes.

(ii) Because the side products are gaseous so the main product is easily obtained in a pure form. 2

Ans. 16. (a)



$$H_3C - \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2 + KBr + H_2O$$

(b) $CH_3CH_2CH_2CH_2Br$ 2

Ans. 17. Those polymers which can be easily degraded by microorganisms in the environment.

Eg. PHBV 2

Ans. 18. Antidepressants.

Eg. Iproniazid and phenelzine. 2

OR

Bactericidal antibiotics kill the bacteria.

Eg. Penicillin.

Whereas bacteriostatic antibiotics only inhibit the growth of bacteria.

Eg. Tetracycline.

Ans. 19. Given p° = 0.850 bar, p = 0.845 bar

Molar Mass of solvent (M_1) = 78 g/mol,

Mass of Solvent w_1 = 39 g

Mass of Solute w_2 = 0.5 g

$$\frac{P^0 - P}{P^0} = \frac{W_2 M_1}{M_2 W_1}$$

$$\frac{(0.850 - 0.845)}{0.850} = \frac{0.5 \times 78 \text{ g/mol}}{M_2 \times 39}$$

M_2 = 170 g/mol 3

Ans. 20. Mg / Mg^{2+} (0.130 M) || Ag^+ (0.0001 M) / Ag

$$E_{cell} = E°_{cell} - \frac{RT}{2F} \ln \frac{[Mg^{2+}]}{[Ag^+]^2}$$

$$= 3.17 \text{ V} - \frac{0.059 \text{ V}}{2} \log \frac{0.130}{(0.001)^2}$$

$$= 3.17 \text{ V} - 0.21 \text{ V}$$

$$= 2.96 \text{ V}$$ 3

OR

$$\Lambda_m = \frac{K}{C} = \frac{4.95 \times 10^{-5} \text{ S cm}^{-1}}{0.001028 \text{ mol L}^{-1}} \times \frac{1000 \text{ cm}^3}{\text{L}} = 48.15 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\alpha = \frac{\Delta_m}{\Delta_m^0} = \frac{48.15\ \text{S cm}^2\text{mol}^{-1}}{390.5\ \text{S cm}^2\text{mol}^{-1}} = 0.1233$$

$$K = \frac{C\alpha^2}{(1-\alpha)} = \frac{0.001028\ \text{mol L}^{-1} \times (0.1233)^2}{1-0.1233} = 1.78 \times 10^{-5}\ \text{mol L}^{-1}$$

Ans. 21. (a) (i) The path of beam in the colloidal dispersion is illuminated. Light is scattered by the sol particles.

(ii) The dispersed phase particles start moving towards the electrode of opposite charge. The process is called as electrophoresis.

(b) The activity of a catalyst is its ability to catelyse a reaction or its ability to accelerate the reaction.

While selectivity of a catalyst is its ability to direct a reaction to yield a particular product. 3

Ans. 22. Chief ore of aluminium — Bauxite

Extraction of Aluminium :

(a) Concentration of ore :

(i) The powdered ore is treated with Conc. NaOH.

$Al_2O_3\ (s) + 2\ NaOH\ (aq) + 3\ H_2O\ (l) \longrightarrow 2\ Na\ [Al\ (OH)_4]\ aq$

(ii) The aluminate in solution is neutralised by passing CO_2 gas and hydrated Al_2O_3 is precipitated.

$2\ Na\ [Al\ (OH)_4]\ (aq) + CO_2\ (g) \longrightarrow Al_2O_3\ .\ x\ H_2O\ (s) + 2\ NaHCO_3\ (aq)$

(iii) The hydrated alumina is filtered, dried and heated to give back pure Al_2O_3.

$$Al_2O_3\ .\ x\ H_2O\ (s) \xrightarrow{1470\ K} Al_2O_3\ (s) + x\ H_2O\ (g)$$

(b) Reduction of Al_2O_3 to Al :

Electrolyte — molten Al_2O_3 and cryolite

Anode — Carbon rods

Cathode — Carbon lining inside the electrolytic tank

At cathode — $Al^{3+} + 3\ e^- \longrightarrow Al\ (l)$

At anode — $C\ (s) + O^{2-} \longrightarrow CO\ (g) + 2\ e^-$

$C\ (s) + 2\ O^{2-} \longrightarrow CO_2\ (g) + 4\ e^-$ 3

Ans. 23. (i) Being monoatomic, they have no interatomic forces except weak dispersion forces, hence they have low boiling point.

(ii) Smallest size in the respective period, therefore high effective nuclear charge, facilitating electron gain.

(iii) Thermodynamically unstable with respect to oxygen and hence easily liberates nascent oxygen :

$O_3 \longrightarrow O_2 + O$ 3

Ans. 24. (1) Fusion of chromite ore ($FeCr_2O_4$) with sodium on potassium carbonate in free access of air.

$4\ FeCr_2O_4 + 8\ Na_2CO_3 + 7\ O_2 \longrightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$

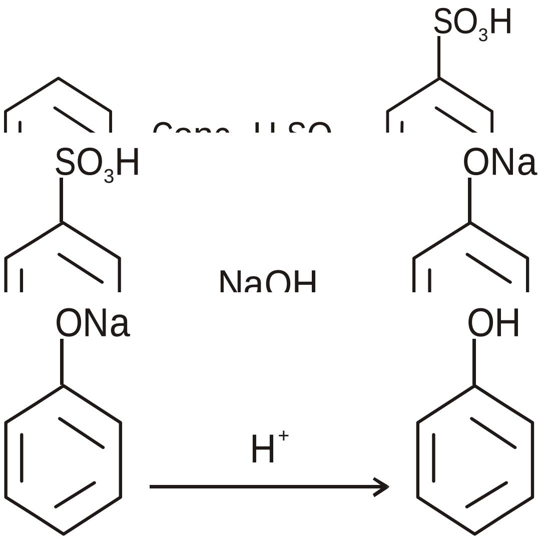
(2) Sodium chromate is filtered and acidified with sulphuric acid to give a solution from which sodium dichromate can be crystallised.

$2\ Na_2CrO_4 + 2\ H^+ \longrightarrow Na_2Cr_2O_7 + 2\ Na^+ + H_2O$

(3) Sodium dichromate on treating with potassium chloride, gives potassium dichromate.

$Na_2Cr_2O_7 + 2\,KCl \longrightarrow K_2Cr_2O_7 + 2\,NaCl$ 3

Ans. 25. 3



Ans. 26. (i)

(ii)

(iii) $C_6H_5NH_2 < (C_2H_5)_2\,NH < C_2H_5NH_2$ 3

Ans. 27. (i) n-hexane is formed.

$$\begin{array}{l} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow[\Delta]{HI} CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$$

(ii) Gets oxidised to six carbon carboxylic acid. (Gluconic acid)

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

(iii) A dicarboxylic acid, saccharic acid is formed.

$$\begin{array}{l} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \xrightarrow[HNO_3]{Oxidation} \begin{array}{l} COOH \\ | \\ (CHOH)_4 \\ | \\ COOH \end{array}$$ 3

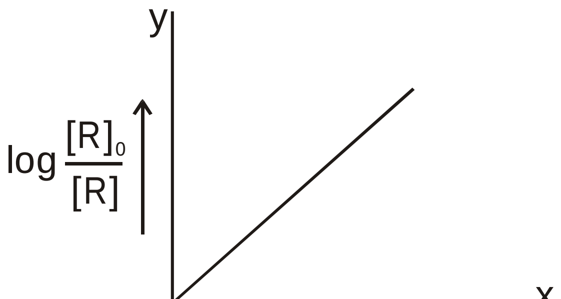
Ans. 28. (i) First order

(ii) s^{-1}

(iii) $t_{1/2} = \dfrac{0.693}{K}$

(iv) – K

(v) 5



OR

(i) Rate = K

$0.096 = K\,[0.30]^x\,[0.30]^y$ .... (1)

$0.384 = K\,[0.60]^x\,[0.30]^y$ .... (2)

$0.192 = K\,[0.30]^x\,[0.60]^y$ .... (3)

Dividing (1) by (2)

$$\frac{0.096}{0.384} = \frac{[0.30]^x}{[0.60]^x}$$

$$\frac{0.096}{0.384} = \left[\frac{0.30}{0.60}\right]^x$$

$$\frac{1}{4} = \left[\frac{1}{2}\right]^x$$

$x = 2$

Dividing (1) by (3)

$$\frac{0.096}{0.192} = \frac{[0.30]^y}{[0.30]^y}$$

$$\frac{1}{2} = \left[\frac{1}{2}\right]^y$$

$y = 1$

Order wrt A = 2

wrt B = 1

(ii) Rate = $K \,.\, [A]^2\,[B]^1$

(iii) $0.096 = K\,(0.30)^2\,0.30$

$$K = \frac{0.096}{0.30 \times 0.30 \times 0.30}$$

(iv) Rate = $\dfrac{-d[A]}{dt}$

Rate = $\dfrac{1}{2}\dfrac{d[C]}{dt}$

Ans. 29. (a) $I_2 < F_2 < Br_2 < Cl_2$

(b) $HF < HCl < HBr < HI$

(c) $BiH_3 < AsH_3 < PH_3 < NH_3$

(d) $H_2O < H_2S < H_2Se < H_2Te$

(e) $NaF > NaCl > NaBr > NaI$ 5

OR

(a) XeO_3 is prepared by hydrolysis of XeF_4 and XeF_6 with water.

$$6\,XeF_4 + 12\,H_2O \longrightarrow 4\,Xe + 2\,XeO_3 + 24\,HF + 3\,O_2$$

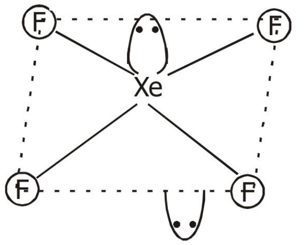
$$XeF_6 + 3\,H_2O \longrightarrow XeO_3 + 6\,HF$$

XeF_4 is prepared by direct combination of Xe and F_2 in (1 : 5) ratio, at 873 K, 7 bar.

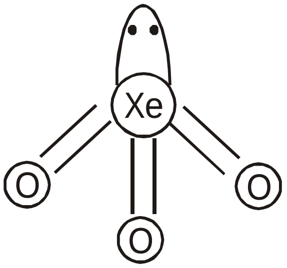
873 K, 7 bar

$Xe\,(g) + 2\,F_2\,(g) \longrightarrow XeF_4\,(s)$

1 : 5 Ratio



XeF_4

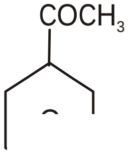


XeO_4

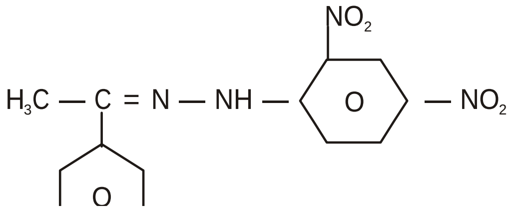
(b) (i) XeF_2

(ii) XeO_3

Ans. 30. (a)

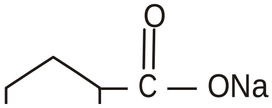


(b)

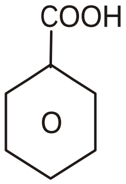


(c)

(d) ppt

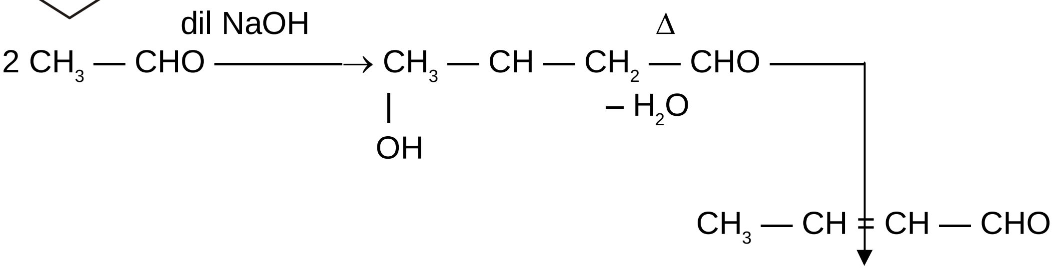


(e) 5



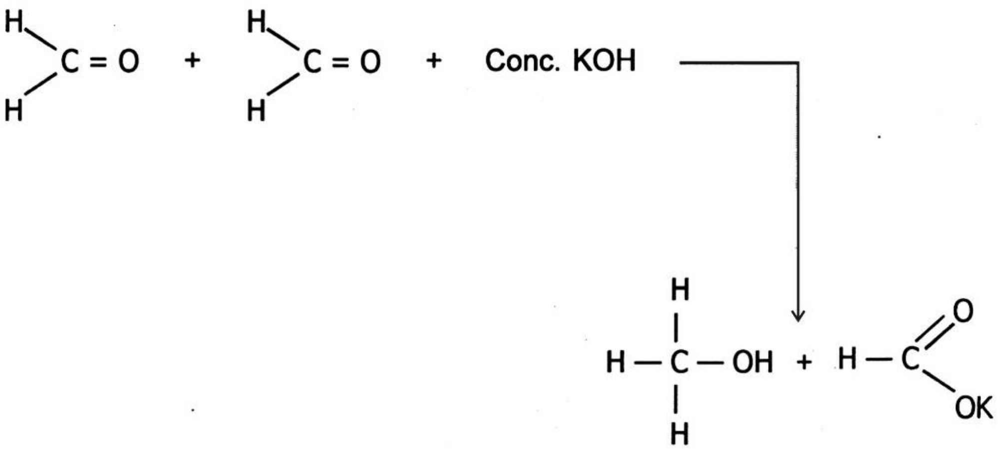
OR

(i) ensation :



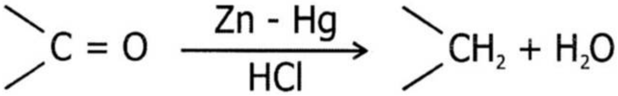
$$2\,CH_3-CHO \xrightarrow{\text{dil NaOH}} \underset{\displaystyle OH}{\underset{|}{CH_3-CH}}-CH_2-CHO \xrightarrow[-H_2O]{\Delta} CH_3-CH=CH-CHO$$

(ii) Cannizaro Reaction :

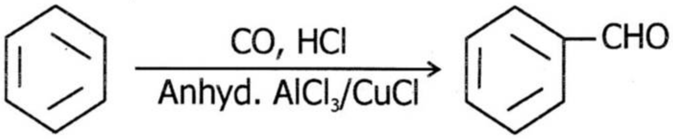


(iii)

(iv)



(v)



$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

❑❑❑