XII - ISC Board

Date: 05.03.2018 Chemistry - Question Paper Solutions

Question 1

(a) Fill in the blanks by choosing the appropriate word/words from those given in the brackets: [4×1]

(square pyramidal, electrical, 74; 26, sp^3d^2, sp^3d, chemical, 68, 32, tetrahedral, yellow, white, iodoform, Lucas)

(i) A Galvanic cell converts _____ energy into _____ energy.

Ans. A Galvanic cell converts **chemical** energy into **electrical** energy.

(ii) The percentage of unoccupied spaces in bcc and fcc arrangements are _____ and _____respectively.

Ans. The percentage of unoccupied spaces in bcc and fcc arrangements are **32** and **26** respectively.

(iii) Propan-2-ol on reaction with iodine and sodium hydroxide gives _____ precipitate and the reaction is called _____ test.

Ans. Propan-2-ol on reaction with iodine and sodium hydroxide gives **yellow** precipitate and the reaction is called **iodoform** test.

(iv) The geometry of $XeOF_4$ molecule is _____ and the hybridisation of Xenon atom in the molecule is _____.

Ans. The geometry of $XeOF_4$ molecule is **pyramidal** and the hybridisation of Xenon atom in the molecule is **sp^3d^2**.

(b) Complete the following statements by selecting the correct alternative from the choices given: [4×1]

(i) During the course of an S_N1 reaction, the intermediate species formed is:

(1) a carbocation (2) a free radical (3) a carbanion (4) an intermediate complex

Ans. (1) a carbocation

(ii) Purification of aluminium by electrolytic refining is called:

(1) Serpeck's process (2) Hoope's process

(3) Hall's process (4) Baeyer's process

Ans. (2) Hoope's process

(iii) An aqueous solution of urea freezes at – 0.186°C, K_f for water = 1.86 K kg $mo1^{-1}$, K_b for water = 0.512 K kg $mo1^{-1}$. The boiling point of urea solution will be:

(1) 373.065 K (2) 373.186 K (3) 373.512 K (4) 373.0512 K

Ans. (4) 373.0512 K

$$[0-(-0.186)]=1.86\times m$$

$$\therefore m=\frac{0.186}{1.86}=0.1$$

$$\Delta T_b = K_b \cdot m$$

$$\therefore \Delta T_b = 0.512\times 0.1$$

$$=0.0512$$

$$T-T^\circ=0.0512$$

$$T=0.0512+T^\circ$$

$$=0.0512+373$$

$$=373.01512\,K$$

(iv) In the dehydration of alcohols to alkenes by heating with concentrated sulphuric acid, the initiation step is:

(1) formation of carbocation (2) formation of an ester

(3) protonation of alcohol molecule (4) elimination of water

Ans. (3) protonation of alcohol molecule

(c) Match the following: **[4×1]**

(i) Rate constant	(a) Dialysis
(ii) Biodegradable polymer	(b) Glycine
(iii) Zwitter ion	(c) Arrhenius equation
(iv) Purificaiton of colloids	(d) PHBV

Ans.

(i) Rate constant	Arrhenius equation
(ii) Biodegradable polymer	PHBV
(iii) Zwitter ion	Glycine
(iv) Purificaiton of colloids	Dialysis

(d) Answer the following questions: **[4×2]**

(i) (1) Why does the density of transition elements increase from Titanium to Copper? (at. no. Ti = 22, Cu = 29)

Ans. Across the period from Ti to Cu as atomic size decreases, the density of element increases.

(2) Why is zinc not regarded as a transition element? (at. no. Zn = 30)

Ans. $Zn\,(30)-[Ar]_{18}\,4s^2 3d^{10}$

Transition metals show vacant d-orbitals but Zn metal has completely filled d-orbitals.

$\therefore$ Zn is not regarded as transition element.

(ii) Identify the compounds A, B, C and D.

$$CH_3CN \xrightarrow{H_2O/H^+} A \xrightarrow{NH_3} B \xrightarrow{heat} C \xrightarrow{Br_2/KOH} D$$

Ans.

$$CH_3CN \xrightarrow[H^+]{H_2O} \underset{(A)}{CH_3COOH} \xrightarrow{NH_3} \underset{(B)}{CH_3COONH_4}$$

$$\downarrow \text{heat}$$

$$\underset{(D)}{CH_3NH_2} \xleftarrow[KOH]{Br_2} \underset{(C)}{CH_3CONH_2}$$

(iii) Calculate the osmotic pressure of a solution prepared by dissolving 0.025 g of K_2SO_4 in 2.0 litres of water at 25°C assuming that K_2SO_4 is completely dissociated. (mol. wt. of K_2SO_4 = 174 g mol^{-1})

Ans. Mass of K_2SO_4 = 0.025 gm

Molar mass of K_2SO_4 = 174 g / mol

Volume = 2 L

Temperature = 25°C (298 K)

$$\pi V = nRT$$

$$\pi = \frac{n}{V}RT$$

$$= \frac{\text{mass}}{\text{molar mass}} \times \frac{1}{V}RT$$

$$= \frac{0.025}{174} \times \frac{1}{2} \times 8.314 \times 298$$

$$= 0.173\, atm$$

(iv) What type of isomerism is shown by the following coordination compounds:

$[PtCl_2(NH_3)_4]Br_2$ and $[Pt\,Br_2(NH_3)_4]Cl_2$

Write their IUPAC names.

Ans. These coordination compounds show ionization isomerism.

$[PtCl_2(NH_3)_4]Br_2$: Tetraammine dichloro platinum (IV) bromide

$[Pt\,Br_2(NH_3)_4]Cl_2$: Tetraammine dibromo platinum (IV) chloride

Question 2

(a)

(i) Write the rate law expression for the reaction $A + B + C \rightarrow D + E$, if the order of reaction is first, second and zero with respect to *A*, *B* and *C*, respectively.

Ans. Rate law expression

Rate = $K[A]^1.[B]^2[C]^0$

(ii) How many times the rate of reaction will increase if the concentration of *A*, *B* and *C* are doubled in the equation given in (i) above?

Ans. If concentration of *A* is doubled then rate also increases by double. If conc. of B is doubled then rate increases by four times and conc. of C is doubled then no change in rate of reaction.

OR

(b) The rate of reaction becomes four times when the temperature changes from 293 K to 313 K. Calculate the energy of activation (E_a) of the reaction assuming that it does not change with temperature. ($R = 8.314\ J\ K^{-1}\ mol^{-1}$)

Ans. $T_1 = 293\ K \quad T_2 = 313\ K \quad R = 8.314$

$K_1 = K \quad K_2 = 4K$

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{T_2 - T_1}{T_1T_2}\right)$$

$$\log\frac{4K}{K} = \frac{E_a}{2.303\times 8.314}\left(\frac{313-293}{293\times 313}\right)$$

$$0.6020 = \frac{E_a}{2.303\times 8.314}\left(\frac{20}{293\times 313}\right)$$

$$E_a = \frac{0.6020\times 2.303\times 8.14\times 293\times 313}{20}$$

$$= 52854\ J$$

$$= 52.854\ KJ$$

Question 3

(a) How do antiseritics differ from disinfectants?

Ans. Antiseptic is used to clean wounds and kill the microorganisms of living tissues.

Disinfections are not safe to be applied on living tissues. They are used to clean drains, toilets and public sanitation.

(b) State the role of the following chemicals in the food industry:

(i) Sodium benzoate

(ii) Aspartame

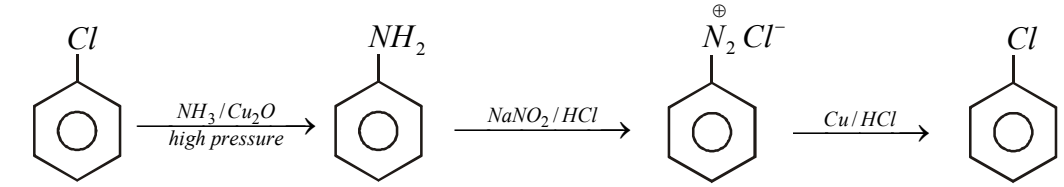
Ans. (i) Sodium benzoate : Chemical preservative

(ii) Aspartame : Artificial sweetener

Question 4

An aromatic organic compound [A] on heating with NH_3 and Cu_2O at high pressure gives [B]. The compound [B] on treatment with ice cold solution of $NaNO_2$ and HCI gives [C], which on heating with Cu/HCl gives compound [A] again. Identify the compounds [A], [B] and [C]. Write the name of the reaction for the conversion of [B] to [C].

Ans.



chlorobenzene (A) | aniline (B) | Benzene diazonium chloride (C) | (D)

Conversion of B to C is called Sand-Meyer reaction.

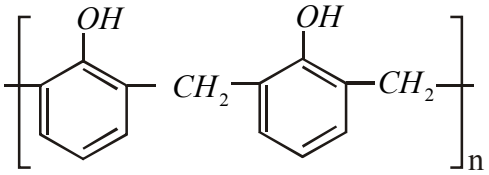
Question 5

Write the names of the monomers for each of the following polymers:

(a) Bakelite

(b) Nylon–2–nylon–6

Ans. (a) Monomer of Bakelite



Novolac

Its, a phenol formaldehyde resin

(b) Monomer of Nylon–2–nylon–6 is glycine and amino caproic acid.

Question 6

Name the purine bases and pyrimidine bases present in RNA and DNA.

Ans. In DNA : Adenine, Guanine, Cytosine, Thymine

RNA : Adenine, Guanine, Cytosine, Uracil.

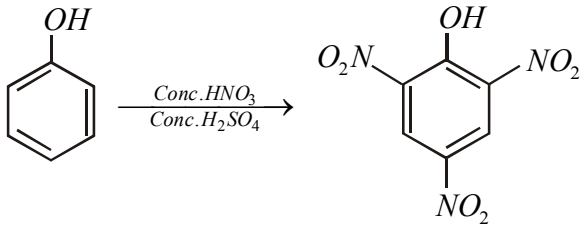
Question 7

(a) How will you obtain the following? (Give balanced equation.)

(i) Picric acid from phenol

(ii) Ethyl chloride from diethyl ether.

Ans. (i)

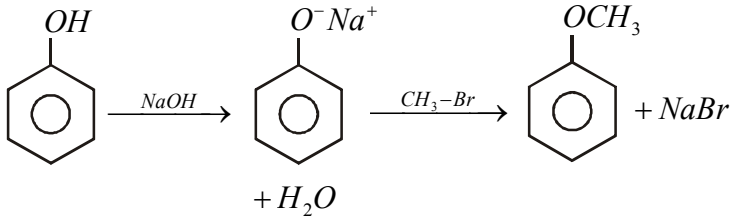


(ii) $CH_3CH_2 - O - CH_2 - CH_3 + PCl_5 \xrightarrow{\Delta} 2CH_3CH_2 - Cl + POCl_3$

OR

(b) How will you obtain the following? (Give balanced equation.)
(i) Anisole from phenol
(ii) Ethyl acetate from ethanol.

Ans. (i)



(ii) $CH_3-CH_2-OH + CH_3-\overset{\overset{O}{\|}}{C}-OH \xrightleftharpoons{conc.H_2SO_4} CH_3-CH_2-\overset{\overset{O}{\|}}{C}-OCH_3 + H_2O$

Question 8

40% of a first order reaction is completed in 50 minutes. How much time will it take for the completion of 80% of this reaction?

Ans. The integrated rate Equation for i[st] order reaction, is

$$K = \frac{2.303}{t}\log\frac{[A]_o}{[A]_t}$$

According to question.

$$K = \frac{2.303}{50\,\text{min}}\log\frac{[100]}{[60]}$$

$\Rightarrow$ K= 0.0102 min^{-1}

$$K = \frac{2.303}{t}\log\frac{100}{20}$$

$$\Rightarrow t = \frac{2.303}{0.0102}\log 5\,\text{min}$$

$$\Rightarrow t = 157.81\,\text{min}$$

Question 9

(a) The freezing point of a solution containing 5.85 g of NaCl in 100 g of water is –3.348°C. Calculate van't Hoff factor for this solution. What will be the experimental molecular weight of NaCI? (K_f for water = 1.86 K kg mol^{-1}, at wt, Na = 23, Cl = 35.5)

Ans.

$$\text{Molality}\,(m) = \frac{\text{no. of mole of solute}}{\text{mass of solvent in kg}}$$

$$\text{no. of mole of } NaCl = \frac{5.85}{58.5} = 0.1$$

$$m = \frac{0.1\,mole}{0.1\,kg}$$

$$= 1 \text{ mole/kg}$$

$$\Delta T_f = i \times k_f \times m$$

$$\Rightarrow 3.348 = i \times 1.86 \times 1$$

$$\Rightarrow i = 1.8$$

$$i = \frac{\text{Theoretical molar mass}}{\text{Experimental molar mass}}$$

$$\Rightarrow 1.8 = \frac{58.5}{\text{Experimental molar mass}}$$

$$\Rightarrow \text{Experimental molar mass} = \frac{58.5}{1.8} = 32.5\,gm/mol$$

OR

(b) An aqueous solution containing 12.48 g of barium chloride ($BaCl_2$) in 1000g of water, boils at 100.0832°C. Calculate the degree of dissociation of barium chloride.
(K_b for water = 0.52 K kg mol–1, at. wt. Ba = 137, Cl = 35.5)

Ans. $\Delta T_b = i \times k_b \times m$

Molar Mass of $Bacl_2$ = 137 + 35.5 × 2
= 137 + 70
= 207

$$m_2 = \frac{12.48}{207}$$

$$= 0.06$$

$$m = \frac{0.06\,\text{mole}}{1\,\text{kg}}$$

$$= 0.06 \text{ moles/kg}$$

$$\Delta T_b = i \times k_b \times m$$

$$\Rightarrow 0.0832 = i \times 0.52 \times 0.06$$

$$\Rightarrow i = 2.66$$

$$\alpha = \frac{i-1}{n-1} \quad \text{for } BaCl_2 \quad m = 1 + 2 = 3$$

$$\Rightarrow \alpha = \frac{2.66-1}{3-1}$$

$$\Rightarrow \alpha = \frac{1.66}{2} = 0.83$$

Question 10

Examine the defective crystal given below and answer the question that follows :

A^+	B^-	A^+	B^-	A^+
B^-		B^-	A^+	B^-
A^+	B^-	A^+		A^+
B^-	A^+	B^-	A^+	B^-

State if the above defect is stoichiometric or non-stoichiometric. How does this defect affect the density of the crystal ? Also, write the term used for this type of defect.

Ans. The above defect is stoichiometric.
As the number of ions are missing from the crystal, density decreases.
This defect is known as schotky defect.

Question 11

Give reason for each of the following :

(a) For ferric hydroxide sol the coagulating power of phosphate ion is more than chloride ion.

(b) Medicines are more effective in their colloidal form.

(c) Gelatin is added to ice creams.

Ans. (a) According to Schulze-Hardy rule, to coagulate a positively charged colloid system, higher the negative charge higher will be its effectiveness.

$PO_4^{3-} > Cl^-$

(b) Medicines are more effective in their colloidal form as absorption will be better.

(c) (i) It act as a stabilizer in ice-cream are to produce smooth and creamy texture.
(ii) It also helps to reduce ice and lactose crystal growth during storage.

Question 12

(a) For the complex ion $\left[Fe(CN)_6\right]^{3-}$, state :

(i) the type of hybridisation

(ii) the magnetic behaviour

(iii) the oxidation number of the central metal atom

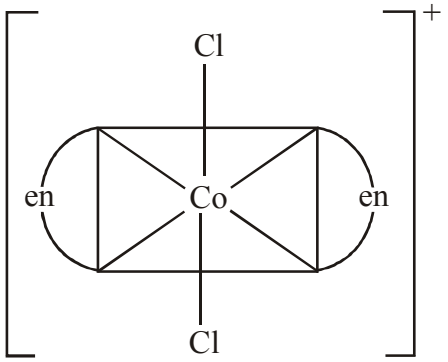
Ans. (i) The type of hybridisation is d^2sp^3.

(ii) As $CN^{\ominus}$ is a strong field ligand there will be only 1 unpaired electron in t_2g orbital so magnetic behaviour is paramagnetic.

(iii) The oxidation number of Fe is (+3) in this complex.

(b) Write the IUPAC name of $\left[Co(en)_2 Cl_2\right]^+$ ion and draw the structures of its geometrical isomers.

Ans. IUPAC name - Dichlorobis (ethyldiammine) cobalt (iii) ion.



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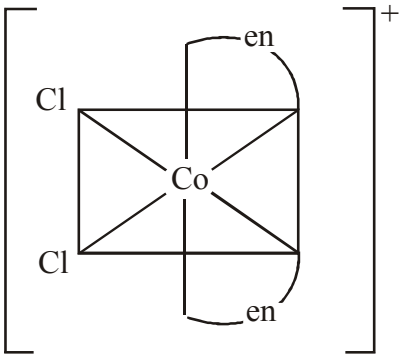


cis

Question 13

(a) Explain why :

(i) Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.
(At. no. of $Mn = 25$, $Fe = 26$)

(ii) Transition elements usually form coloured ions

(iii) Zr and Hf exhibit similar properties
(At. no. of $Zr = 40$, $Hf = 72$)

Ans. (i) $Mn : [Ar] 4s^2 3d^5$ $\qquad$ $Fe : [Ar] 4s^2 3d^6$

$Mn^{2+} : [Ar] 4s^0 3d^5$ $\qquad$ $Fe^{+2} : [Ar] 4s^0 3d^6$

Mn^{2+} has a stable half filled d – subshell. Whereas Fe^{2+} has a partially filled d–subshell hence as Fe^{2+} loses an electron and gets converted to Fe^{3+} it achieves stable half filled d–subshell. Therefore Mn^{2+} is more stable than Fe^{2+} towards oxidation to +3 state.

(ii) In case of the transition metal ions the electrons can be easily promoted from one energy level to another in the same d–subshell. These are called d-d- transitions. This transition is responsible for corresponding colours.

(iii) (1) Zr and Hf have same number of electrons in the outermost shell.

(2) They have the comparable atomic size due to lanthanoid contraction. they are called chemical twins.

Hence they exhibit same chemical properties.

OR

Complete and balance the following chemical equations :

(i) $KMnO_4 + KI + H_2SO_4 \rightarrow \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_$

(ii) $K_2Cr_2O_7 + H_2SO_4 + H_2S \rightarrow \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_$

(iii) $KMnO_4 + H_2SO_4 + FeSO_4 \rightarrow \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_$

Ans. (i) $2KMnO_4 + 10KI + 8H_2SO_4 \rightarrow 6K_2SO_4 + 2MnSO_4 + 5I_2 + 8H_2O$ ***3M***

(ii) $K_2Cr_2O_7 + 4H_2SO_4 + 3H_2S \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 3S + 7H_2O$

(iii) $2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \rightarrow 5Fe_2(SO_4)_3 + K_2SO_4 + 2MnSO_4 + 8H_2O$

Question 14

(a) Arrange the following in the increasing order of their basic strength :

$C_2H_5NH_2,\ C_6H_5NH_2,\ (C_2H_5)_2NH$

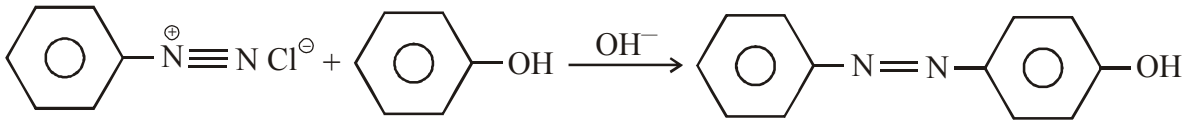
Ans. $(C_2H_5)_2NH > C_2H_5NH_2 > C_6H_5NH_2$

(b) Give a balanced chemical equation of convert methyl cyanide to ethyl alcohol.

Ans. $CH_3 - C \equiv N + 4[H] \xrightarrow{Na/C_2H_5OH} CH_3 - CH_2 - NH_2 \xrightarrow{NaNO_2/HCl} \left[CH_3{-}CH_2{-}N_2^{\oplus}Cl^{\ominus}\right] \xrightarrow{H_2O} CH_3{-}CH_2{-}OH$

Ethanol

(c) What happens when benzene diazonium chloride reacts with phenol in weak alkaline medium ? (Give balanced equation).

Ans. 

p-Hydroxyazobenzene

Orange dye

It gives a orange coloured dye

Question 15

Name the sulphide ore of Copper. Describe how pure copper is extracted from this ore.

Ans.
* Concentration : Copper is extracted mainly from copper pyrites. The powdered ore is concentrated by froth floatation process.
* Roasting : The concentrated ore is roasted in a limited supply of air in reverberatory furnace when a mixture of FeS and Cu_2S is formed while As and Sb present in impurities are removed as volatile oxides.
  $2CuFeS_2 + O_2 \rightarrow Cu_2S + 2FeS + SO_2$
* Smelting : The roasted ore is mixed with sand and coke and heated strongly in a blast furnace when most of the iron is converted into iron oxide. It then combines with silica and is removed as slag.

$$2FeS + 3O_2 \rightarrow 2FeO + 2SO_2$$

$$FeO + SiO_2 \rightarrow FeSiO_3\,(\text{slag})$$

The molten material thus obtained from the blast furnace consists of sulphides of Cu^+, Fe^{2+} coke and sand. It is called matter.

* Bessemerization : The molten mate is then transferred to a Bassemer converter and blast of air is blown. During this process, some Cu_2S is oxidized to Cu_2O which then reacts with more Cu_2S to give copper metal (auto reduction).

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2 \qquad 2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$$

After the reductoin is complete, the molten copper is poured into sand moulds. As the metal solidifies, SO_2 escapes and leaves blisters on the surface. The solid metal thus obtained is called the blister copper and is about 99% pure.

* Refining : Blister copper impurities of Ag and Au mainly. Impure copper is further refined electrolytically to obtain 99.95 to 99.99% pure copper by using impure copper as a anode, a rod of pure copper as cathode and acidified solutoin acid present in the electrolyte and thus settle down as anode mud while impurities of Fe, Ni, Zn ets. pass into electrolytic solution. Copper thus obtained is 99.99% pure and gets deposited at the cathode.

Question 16

(a) (i) Calculate the emf and $\Delta G°$ for the cell reaction at 25°C :

$$Zn(s)\,|\,Zn^{2+}_{(aq)}\,||\,Cd^{2+}_{(aq)}\,|\,Cd_{(s)}$$
$$(0.1M)\quad(0.01M)$$

Given $E°Zn^{2+}/Zn = -0.763$ and $E°Cd^{2+}/Cd = -0.403V$

(ii) Define the following terms :

(1) Equivalent conductivity

(2) Corrosion of metals

Ans. (i) $E^0_{cell} = E^0_{Cd^{2+}/Cd} - E^0_{Zn^{2+}/Zn}$

$= -0.403 - (-0.763)$

$= 0.360$

$Zn + Cd^{2+} \rightarrow Cd + Zn^{2+}$

$E^0_{cell} = 0.36V$

$$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{\left[Zn^{2+}\right]}{\left[Cd^{2+}\right]}$$

$$= 0.36 - \frac{0.0591}{2}\log\frac{0.1}{0.01}$$

$$= 0.36 - \frac{0.591}{2}\log 10$$

$$= 0.36 - \frac{0.0591}{2}$$

$$= 0.36 - 0.0295$$

$$E_{cell} = 0.331V$$

$$\Delta G^0 = -nFE^0$$

$$= -2 \times 96500 \times 0.36$$

$$= -69,480J$$

$$= -69.48kJ$$

(ii) (a) It is defined as conductivity power of all ions produced by dissolving one gram equivalent of an electrolyte in solution. $\wedge_e = \frac{k \times 1000}{C}$

(b) When metals are exposed to atmospheric conditions, they react with air or water in the environment to form undesirable oxides. This process is called corrosion.

(b) (i) The specific conductivity of a solution containing 5 g of anhydrous $BaCl_2$ (mol. wt = 208) in 1000 cm^3 of a solution is found to be 0.0058 $ohm^{-1}cm^{-1}$. Calculate the molar and equivalent conductivity of the solution.

(ii) What is an electrochemical series ? How is it useful in predicting whether a metal can liberate hydrogen from acid or not ?

Ans. (i)

$$M = \frac{5}{208} \times \frac{1}{1000} \times 1000 = 0.024M$$

$$K = 0.0058$$

$$\wedge_M = \frac{1000K}{C} = \frac{1000 \times 0.0058}{0.024} = 241.66 Scm^2 mol^{-1}$$

$$N = \frac{5}{104} \times \frac{1}{1000} \times 1000 = 0.048N$$

$$\wedge_{eq} = \frac{1000K}{C} = \frac{1000 \times 0.0058}{0.048} = \frac{5.8}{0.048} = 120.83\, Scm^2 g.eq^{-1}$$

(ii) 2 M

The arrangement of elements in order of increasing reduction potential values is called electrochemical series.

Only the metals can liberate hydrogen from the acid which have negative values of reduction potential i.e. $-E^0$ values.

Question 17

(a) (i) Explain why :

(1) Nitrogen does not form pentahalides

(2) Helium is used for filling weather balloons

(3) ICl is more reactive than I_2

(ii) Draw the structures of the following :

(1) $HClO_4$

(2) H_3PO_3

Ans. (i) (1) (a) Nitrogen has maximum covalency of four.

(b) Nitrogen does have d-orbitals.

(c) Hence it cannot expand its octate and form hypervalent compounds.

(2) (a) Helium is non-combustable gas.

(b) Its lighter than air.

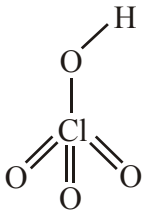
(c) Hence it is used in weather balloon.

(3) (a) The bond enthalpy of I_2 is higher than ICl.

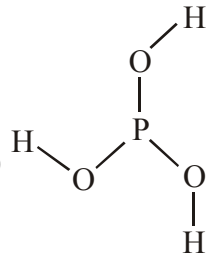
(b) Hence it is easier to break ICl bond as compare to I_2.

(c) Therefore reactive of ICl is more than I_2.

(ii) (1)



(2)



OR

(b) (i) Explain why :

(1) Mercury loses its meniscus in contact with ozone.

(2) Halogens are coloured and the colour deepens on moving down in the group from fluorine to iodine.

(3) Hydride of sulphur is a gas while hydride of oxygen is a liquid.

(ii) Complete and balance the following reactions :

(1) $NaCl + MnO_2 + H_2SO_4 \rightarrow$ _____ + _____ + _____ + _____

(2) $KMnO_4 + SO_2 + H_2O \rightarrow$ _____ + _____ + _____

Ans. (i) (1) When ozone is passed through mercury, it loses its meniscus and sticks to the glass due to formation mercurous orxide.

$$2Hg + O_3 \longrightarrow O_2 + Hg_2O$$

Mercurous oxide

(2) (a) This is due to absorption of energy from visible light which results in excitation of outer electron.

(b) As the atomic size increases from F and I, the electrons are relatively loosely bound and hence less energy is required for excitation.

(3) (a) H_2O form hydrogen bonds, hence its a liquid.
(b) In H_2S hydrogen bonding is not possible.

(ii) (1) $2NaCl + MnO_2 + 3H_2SO_4 \rightarrow 2NaHSO_4 + MnSO_4 + Cl_2 + 2H_2O$

(2) $2KMnO_4 + 5SO_2 + 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 2H_2SO_4$

Question 18

(a) (i) Give balanced equations for the following reactions:

(1) Benzaldehyde reacts with hydrazine.

(2) Acetic acid reacts with phosphorous pentachloride.

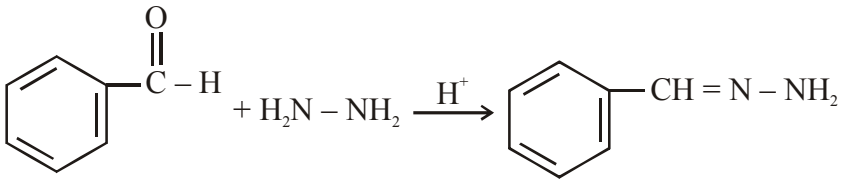
(3) Acetone reacts with sodium bisnlphite.

(ii) Give one chemical test each to distinguish between the following pairs of compounds:

(1) Ethanol and acetic acid

(2) Acetaldehyde and benzaldehyde

Ans. (i) (1)



(2) $CH_3 - \overset{\overset{O}{\|}}{C} - OH + PCl_5 \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} - Cl + POCl_3 + HCl$

(3) $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3 + NaHSO_3 \longrightarrow CH_3 - \underset{\underset{O-SO_2H}{|}}{\overset{\overset{O^{\ominus}Na^{\oplus}}{|}}{C}} - CH_3 \longrightarrow CH_3 - \underset{\underset{OSO_2Na}{|}}{\overset{\overset{OH}{|}}{C}} - CH_3$

(ii) (1) $CH_3 - CH_2 - OH$

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

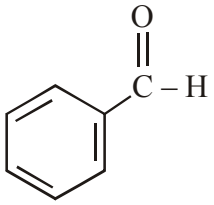
Distinguishing test between ethanol and acetic acid

Acetic acid on action of sodium bicarbonate gives CO_2 gas.

Ethanol does not react with sodium bicarbonate.

(2) $CH_3 - \overset{\overset{O}{\|}}{C} - H + I_2 + NaOH \longrightarrow H - \overset{\overset{O}{\|}}{C} - O^{\ominus}Na^{\oplus} + CHI_3 + NaI + H_2O$

Yellow ppt



$$+ I_2 + NaOH \longrightarrow \text{No reaction}$$

OR

(b) (i) Write chemical equations to illustrate the following name reactions:

(1) Clemmensen's reduction

(2) Rosenmund's reduction

(3) HVZ reaction

(ii) Explain why:

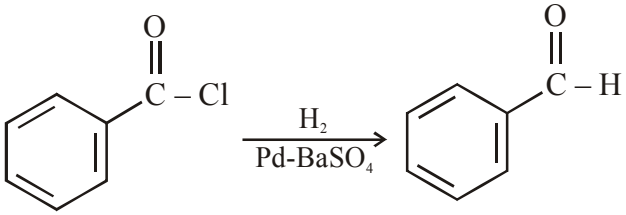
(1) Acetaldehyde undergoes aldol condensation, but formaldehyde does not.

(2) Acetic acid is weaker acid as compared to formic acid.

Ans. (i) (1) **Clemmensen's reduction**

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3 \xrightarrow{Zn\text{–}Hg/HCl} CH_3 - CH_2 - CH_3$$

(2) **Rosenmund's reduction**



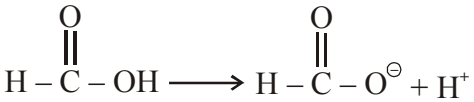
(3) **HVZ reaction**

$$CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - OH \xrightarrow[P_4]{Br_2} CH_3 - \underset{\underset{Br}{|}}{CH} - \overset{\overset{O}{\|}}{C} - OH$$

(ii) (1) Aldol condensation is possible for aldehyde and ketone with α -hydrogen.

Acetaldehyde $\left(CH_3 - \overset{\overset{O}{\|}}{C} - H \right)$ has a α -hydrogen whereas formaldehyde $\left(H - \overset{\overset{O}{\|}}{C} - H \right)$ does not have α -hydrogen.

(2) $$CH_3 - \overset{\overset{O}{\|}}{C} - OH \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} - O^{\ominus} + H^+$$



Conjugate base of acetic acid, acetate ion is less stable than the conjugate base of formic acid, formate ion. This is due to the +I effect of alkyl group.