ISC Solved Paper 2019

Chemistry

Class-XII

(Maximum Marks : 80)

(Time allowed : Three hours)

*Candidates are allowed an additional **15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time.*

All questions are compulsory
Question 1 is of 20 marks having four sub parts, all of which are compulsory. Question numbers 2 to 8 carry 2 marks each, with any two questions having internal choice.
Question numbers 9 to 15 carry 3 marks each, with any two questions having an internal choice.
Question numbers 16 to 18 carry 5 marks each, with an internal choice.
All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.
The intended marks for questions or parts of questions are given in brackets [J.
Balanced equations must be given wherever possible and diagrams where they are helpful.
When solving numerical problems, all essential working must be shown.
In working out problems, use the following data:.
Gas constant R = 1.987 cal deg^{-1} mol^{-1} = 8.314 JK^{-1} mol^{-1} = 0.0821 dm^3 atm. 11 atm = / dm^3 atm = 101.3 J.
1 Faraday = 96500 coulombs. Avogadro's number = 6.023×10^{23}

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

(more than, primary, cathode, Lucas reagent, two, four, less than, Grignard's reagent, tertiary, anode, zero, equal to, three)

(i) The elevation of boiling point of 0.5 M K_2SO_4 solution is __________ that of 0.5 M urea solution. The elevation of boiling point of 0.5 M KCl solution is __________ that of 0.5 M K_2SO_4 solution.

(ii) A mixture of conc. HCl and anhydrous $ZnCl_2$ is called __________ which shows maximum reactivity with ________ alcohol.

(iii) In electrolytic refining the impure metal is made __________ while a thin sheet of pure metal is used as __________.

(iv) When the concentration of a reactant of first order reaction is doubled, the rate of reaction becomes __________ times, but for a __________ order reaction, the rate of reaction remains the same.

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

(i) The cell reaction is spontaneous or feasible when emf of the cell is :

(1) negative
(2) positive
(3) zero
(4) either positive or negative

(ii) Which among the following polymers is a polyester ?

(1) melamine **(2)** bakelite
(3) terylene **(4)** polythene

(iii) The correct order of increasing acidic strength of the oxoacids of chlorine is :

(1) $HClO_3 < HClO_4 < HClO_2 < HClO$
(2) $HClO < HClO_2 < HClO_3 < HClO_4$
(3) $HClO_2 < HClO < HClO_4 < HClO_3$
(4) $HClO_3 < HClO_4 < HClO < HClO_2$

(iv) A catalyst is a substance which :

(1) changes the equilibrium constant of the reaction.
(2) increases the equilibrium constant of the reaction.
(3) supplies energy to the reaction.
(4) shortens the time to reach equilibrium.

***(c) Match the following :** **[4 × 1]**

(i)	Diazotization	**(1)**	Anisotropic
(ii)	Crystalline solid	**(2)**	Reimer-Tiemann reaction
(iii)	Phenol	**(3)**	Diphenyl
(iv)	Fittig reaction	**(4)**	Aniline

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

(i) **(1)** Which trivalent ion has maximum size in the Lanthanoid series *i.e.*, Lanthanum ion (La^{3+}) to Lutetium ion (Lu^{3+}) ? (at. no. of Lanthanum = 57 and Lutetium = 71)

(2) Explain why Cu^{2+} is paramagnetic but Cu^{+} is diamagnetic.
(at. no. of Cu = 29)

(ii) When a coordination compound $CoCl_3.6NH_3$ is mixed with $AgNO_3$, three moles of AgCl are precipitated per mole of the compound. Write the structural formula and IUPAC name of the coordination compound.

(iii) Calculate the boiling point of urea solution when 6 g of urea is dissolved in 200 g of water. (K_b for water = 0.52 K kg mol^{-1}, boiling point of pure water = 373 K, mol. wt. of urea = 60)

(iv) Identify the compounds A, B, C and D in the given reaction :

$$HC \equiv CH \xrightarrow[Hg^{2+}/H_2SO_4]{H_2O} A \xrightarrow[K_2Cr_2O_7+H_2SO_4]{[O]} B \xrightarrow{Ca(OH)_2} C \xrightarrow[\text{dry distillation}]{\text{heat}} D$$

Ans.

(a) **(i)** more than, less than
(ii) Lucas reagent, tertiary
(iii) anode, cathode
(iv) two, zero

(b) **(i)** (2) positive
(ii) (3) terylene
(iii) (2) $HClO < HClO_2 < HClO_3 < HClO_4$
(iv) (4) shortens the time to reach equilibrium.

(d) **(i)** **(1)** La^{3+}, as size decreases with increase in atomic number (lanthanoid contraction).

(2) Electronic configuration of Cu^{+}: $3\underline{d}^{10}$

$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}$

Electronic configuration of Cu^{2+}: $3\underline{d}^{9}$

$\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow}$

As, Cu^{+} contains no unpaired electron therefore, it is diamagnetic whereas Cu^{2+} contains one unpaired electron therefore, it is paramagnetic in nature.

(ii) Structural formula : $[Co(NH_3)_6]\,Cl_3$
IUPAC name : Hexa amine cobalt (III) chloride

(iii) Given : K_b = 0.52 K kg mol^{-1}, W_2=6g, W_1=200g,

$$T_b° = 373\text{ K}, M_2 = 60$$

$$\Delta T_b = K_b \times \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$T - T_b° = K_b \times \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$T_b - 373 = \frac{0.52 \times 6 \times 1000}{60 \times 200}$$

$$T_b - 373 = 0.26$$

$$T_b = 0.26 + 373$$

$$= 373.26\text{ K}$$

(iv)

$$HC \equiv CH \xrightarrow[Hg^{2+}/H_2SO_4]{H_2O} \underset{\text{A}}{\underset{\text{Acetaldehyde}}{CH_3CHO}} \xrightarrow[K_2Cr_2O_7+H_2SO_4]{[O]} \underset{\text{B}}{\underset{\text{Acetic acid}}{CH_3COOH}} \xrightarrow{Ca(OH)_2} \underset{\text{C}}{\underset{\text{Calcium acetate}}{(CH_3COO)_2Ca}} \xrightarrow[\text{dry distillation}]{\text{heat}} \underset{\text{D}}{\underset{\text{Acetone}}{CH_3COCH_3}}$$

2. (a) For the reaction A + B → C + D, the initial rate for different reactions and initial concentration of reactants are given below: **[2]**

S.No.	Initial Conc.		Initial rate
	[A] mole L^{-1}	[B] mole L^{-1}	(mole L^{-1} sec^{-1})
1	1.0	1.0	2×10^{-3}
2	2.0	1.0	4×10^{-3}
3	4.0	1.0	8×10^{-3}
4	1.0	2.0	2×10^{-3}
5	1.0	4.0	2×10^{-3}

(i) What is the overall order of reaction ?
(ii) Write the rate law equation.

OR

(b) 25% of a first order reaction is completed in 30 minutes. Calculate the time taken in minutes for the reaction to go to 90% completion.

Ans. (a) Rate = $\underline{k}\,[A]^x\,[B]^y$

$2 \times 10^{-3} = \underline{k}\,(1)^x\,(1)^y$ .... (1)
$4 \times 10^{-3} = \underline{k}\,(2)^x\,(1)^y$ .... (2)
$8 \times 10^{-3} = \underline{k}\,(4)^x\,(1)^y$ .... (3)
$2 \times 10^{-3} = \underline{k}\,(1)^x\,(2)^y$ .... (4)
$2 \times 10^{-3} = \underline{k}\,(1)^x\,(4)^y$ .... (5)

From equation (1) and (2)

$$\frac{2 \times 10^{-3}}{4 \times 10^{-3}} = \frac{k\,(1)^x\,(1)^y}{k\,(2)^x\,(1)^y}$$

*Out of Syllabus

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x$$

$\therefore \quad x = 1$

From equation (1) and (4)

$$\frac{2\times10^{-3}}{2\times10^{-3}} = \frac{k\,(1)^x\,(1)^y}{k\,(1)^x\,(2)^y}$$

$$\frac{1}{1} = \left(\frac{1}{2}\right)^y$$

$\therefore \quad y = 0$

(i) Order of reaction $= x + y$

$= 1 + 0$

$= 1$

(ii) Rate law equation $= \underline{k}\,[A]^1\ [B]^0$

OR

(b) For the first order reaction :

For 25% completion of reaction.

$$k = \frac{2.303}{t}\,log\frac{a}{a-x}$$

$$k = \frac{2.303}{30}\,log\frac{100}{100-25}$$

$$k = \frac{2.303}{30}\,log\frac{100}{75}$$

$$k = \frac{2.303}{30}\,log\,1.333$$

$$= \frac{2.303}{30}\times 0.1248$$

$= 0.00958$

$= 9.58\times10^{-3}$ minutes

For 90% completion of reaction

$$k = \frac{2.303}{t}\,log\frac{a}{a-x}$$

$$9.58\times10^{-3} = \frac{2.303}{t}\,log\frac{100}{100-90}$$

$$9.58\times10^{-3} = \frac{2.303}{t}\,log\frac{100}{10}$$

$$9.58\times10^{-3} = \frac{2.303}{t}\,log\,10$$

$$t = \frac{2.303}{9.58\times10^{-3}}\times1$$

$t = 0.240396\times10^3$

$= 240.396$ minutes

***3. (a) Name the type of drug which lowers the body temperature in high fever condition.**

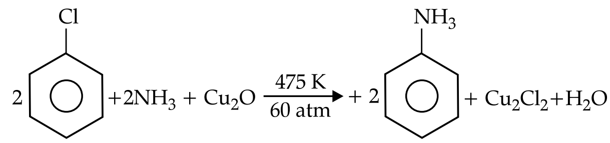
(b) What are tranquilizers ? Given one example of a tranquilizer. [2]

4. Write the balanced chemical equation for each of the following :

(a) Chlorobenzene treated with ammonia in the presence of Cu_2O at 475 K and 60 atm.

(b) Ethyl chloride treated with alcoholic potassium hydroxide.

Ans. (a)



Chlorobenzene Aniline

(b) $C_2H_5Cl + KOH(alc) \rightarrow CH_2{=}CH_2 + KCl + H_2O$

Ethyl chloride Ethene

5. (a) Name the monomer and the type of polymerisation that takes place when PTFE is formed.

(b) Name the monomers of nylon 6, 6. [2]

Ans. (a) Monomer : $CF_2 = CF_2$

Tetrafluoroethene

Type of polymerisation : Addition

(b) Monomer : $NH_2{-}(CH_2)_6{-}NH_2$;

Hexamethylenediamine

and $COOH{-}(CH_2)_4{-}COOH$;

Adipic acid

6. Name two water soluble vitamins and the diseases caused by their deficiency in the diet of an individual.

Ans. Vitamin B and Vitamin C are two water soluble vitamins. Deficiency of Vitamin B cause Beriberi, Paralysis, Convulsions and deficiency of Vitamin C causes Scurvy.

7. (a) How will you obtain the following (give balanced chemical equations) ?

(i) Benzene from phenol.

(ii) Iodoform from ethanol.

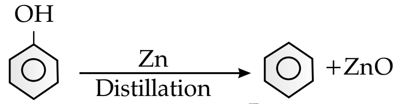
OR

(b) How will you obtain the following (give balanced chemical equations) :

(i) Salicylaldehyde from phenol.

(ii) Propan–2–ol from Grignard's reagent.

Ans. (a) (i) Benzene from phenol :



Phenol Benzene

(ii) Iodoform from ethanol :

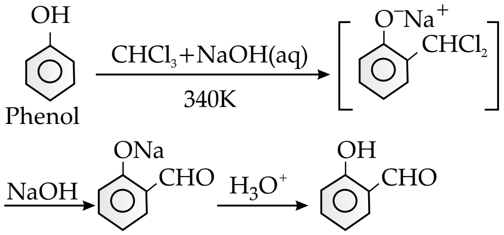
$$CH_3CH_2OH + 4I_2 + 6NaOH \xrightarrow{\Delta} CHI_3 + HCOONa + 5NaI + 5H_2O$$

Ethanol Iodoform

*Out of Syllabus

OR

(b) **(i)** Salicylaldehyde from phenol; (Reimer-Tiemann reaction)



Salicylaldehyde

(ii) Propan-2-ol from Grignard's reagent:

$$\underset{\text{Acetaldehyde}}{CH_3\text{–}CHO} + CH_3MgX \xrightarrow[\text{ether}]{\text{Dry}} \underset{\underset{\text{Propan–2–ol}}{OH}}{CH_3\text{–}\overset{}{CH}\text{–}CH_3} + Mg\langle^{X}_{OH}$$

8. Show that for a first order reaction the time required to complete 75% of reaction is about 2 times more than that required to complete 50% of the reaction. [2]

Ans. For a first order reaction,

$$t = \frac{2.303}{k} \log \frac{[R]_o}{[R]_t}$$

For 75% completion of reaction,

$$t_{75\%} = \frac{2.303}{k} \log \frac{100}{25}$$

$$t_{75\%} = \frac{2.303}{k} \log 4$$

$$t_{75\%} = \frac{2.303}{k} \log (2)^2$$

$$t_{75\%} = \frac{2.303}{k}\, 2 \log 2 = 2 \times \frac{2.303}{k} \log 2 \qquad ...(i)$$

For 50% completion of reaction,

$$t_{50\%} = \frac{2.303}{k} \log \frac{100}{50}$$

$$t_{50\%} = \frac{2.303}{k} \log 2 \qquad ...(ii)$$

From equation (i) and (ii), we get

$t_{75\%} = 2 \times t_{50\%}$

9. (a) When 0.4 g of acetic acid is dissolved in 40 g of benzene, the freezing point of the solution is lowered by 0.45 K. Calculate the degree of association of acetic acid. Acetic acid forms dimer when dissolved in benzene.

(K_f for benzene = 5.12 K kg mol^{-1}, at. wt. C = 12, H = 1, 0 = 16) [3]

OR

(b) A solution is prepared by dissolving 9.25 g of non-volatile solute in 450 ml of water. It has an osmotic pressure of 350 mm of Hg at 27°C. Assuming the solute is non-electrolyte, determine its molecular mass.

(R = 0.0821 L atm K^{-1} mol^{-1})

Ans. (a) w=0.4g, W=40g, ΔT=0.45K, k_f=5.12 K kg mol^{-1}

Given, $\Delta T = \dfrac{1000 \times k_f \times w}{m \times w}$

$$0.45 = \frac{1000 \times 5.12 \times 0.4}{m \times 40}$$

$$m = \frac{1000 \times 5.12 \times 0.4}{40 \times 0.45}$$

$m_{\text{observed}} = 113.77$

Molecular weight of acetic acid = 60 gmol-1

$$2CH_3COOH \rightleftharpoons (CH_3COOH)_2$$

Initial.	1	0
After association	1–α	α/2

Degree of association, $i = 1 - \alpha + \dfrac{\alpha}{2}$

$$i = \frac{\text{Normal molecular mass}}{\text{Observed molecular mass}} = \frac{60}{113.77}$$

$$\frac{60}{113.77} = 1 - \alpha + \frac{\alpha}{2}$$

$$0.527 = \frac{2 - 2\alpha + \alpha}{2}$$

$$1.054 = 2 - \alpha$$

$$\alpha = 2 - 1.054$$

$$\alpha = 0.946.$$

OR

(b) $W = 9.25g,\ \pi = 350 \text{ mm Hg} = \dfrac{350}{760} = 0.46 \text{ atm},$

$R = 0.0821 \text{ L atm K}^{-1} \text{mol}^{-1},\ V = 450 \text{ ml}$

$\pi = CRT$

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

$$0.46 = \frac{n}{450} \times 0.0821 \times 300 \times 1000$$

$$n = \frac{0.46 \times 450}{0.0821 \times 300 \times 1000}$$

$$= 0.0084$$

$$\text{Molar mass} = \frac{W}{n} = \frac{9.25}{0.0084} = 1101g$$

***10. An element occurs in body centered cubic structure. Its density is 8.0 g/cm^3. If the cell edge is 250 pm, calculate the atomic mass of an atom of this element.**

($N_A = 6.023 \times 10^{23}$) [3]

***11. Describe the role of the following :**

(a) Cryolite in the extraction of aluminium from pure alumina.

(b) NaCN in the extraction of silver from a silver ore.

(c) Coke in the extraction of iron from its oxides. **[3]**

12. (a) Write the IUPAC names of the following :

(i) $K_3[Fe(C_2O_4)_3]$

(ii) $[Co(NH_3)_5Cl]SO_4$

(b) $[Fe(CN)_6]^{4-}$ is a coordination complex ion.

(i) Calculate the oxidation number of iron in the complex.

(ii) Is the complex ion diamagnetic or paramagnetic ?

(iii) What is the hybridisation state of the central metal atom ?

(iv) Write the IUPAC name of the complex ion.

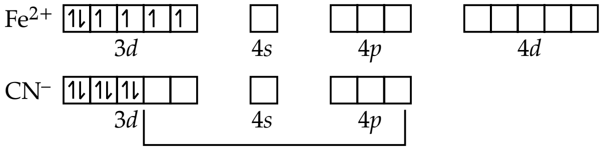
Ans. (a) (i) Potassium trioxalatoferrate (III)

(ii) Pentaaminechlorocobalt (III) sulphate

(b) (i) Oxidation number : + 2

(ii) Diamagnetic

(iii)



With strong field ligand,

$[Fe(CN)_6]^{4-}$ 

Hybridisation d^2sp^3

(iv) Hexacyanoferrate (III)

13. (a) Explain why :

(i) Transition elements form alloys.

(ii) Zn^{2+} salts are white whereas Cu^{2+} salts are coloured.

(iii) Transition metals and their compounds act as catalyst. **[3]**

OR

(b) Complete and balance the following chemical equations.

(i) $KMnO_4 + H_2SO_4 + H_2C_2O_4 \rightarrow$ ________ + ________ + ________ + ________

(ii) $K_2Cr_2O_7 + H_2SO_4 + KI \rightarrow$ ________ + ________ + ________ + ________

(iii) $K_2Cr_2O_7 + H_2SO_4 + FeSO_4 \rightarrow$ ________ + ________ + ________ + ________ **[3]**

Ans. (a) (i) Transition elements forms alloy due to almost similar size of the metal ions, their high ionic size and availability of *d*-orbitals. Therefore, they can mutually substitute their position in crystal lattice to form alloys.

(ii) Electronic Configuration :

$Zn^{2+} : 3d^{10}$

$Cu^{2+} : 3d^9$

Zn^{2+} has completely filled *d*-orbitals ($3d^{10}$) whereas Cu^{2+} has incompletely filled *d*-orbital ($3d^9$). Therefore, in Zn^{2+} *d-d* transition does not take place imparting white colour whereas in Cu^{2+} *d-d* transition takes place causing electrons to emit light in visible range which imparts blue colour.

(iii) Transition metals act as catalysts because they have variable valencies and show multiple oxidation state leading to formation of unstable intermediate compounds. This provides a new path with lower activation energy for the reaction. Transition metals and their compounds also provides suitable surface for a reaction to take place.

OR

(b) (i) $2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \longrightarrow 2MnSO_4 + 10CO_2 + K_2SO_4 + 8H_2O$

(ii) $K_2Cr_2O_7 + 7H_2SO_4 + 6KI \longrightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 3I_2 + 7H_2O$

(iii) $K_2Cr_2O_7 + 7H_2SO_4 + 6FeSO_4 \longrightarrow Cr_2(SO_4)_3 + 3Fe_2(SO_4)_3 + K_2SO_4 + 7H_2O$

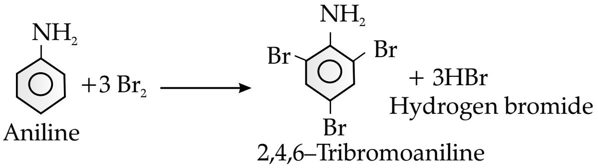
14. Give balanced equations for the following :

(i) Aniline is treated with bromine water.

(ii) Ethylamine is heated with chloroform and alcoholic solution of potassium hydroxide.

(iii) Benzene diazonium chloride is treated with ice cold solution of aniline in acidic medium.

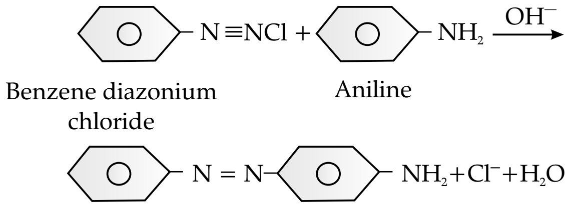
Ans. (i)



2,4,6–Tribromoaniline

(ii) $\underset{\text{Ethylamine}}{C_2H_5NH_2} + \underset{\text{Chloroform}}{CHCl_3} + 3KOH(alc.) \longrightarrow \underset{\text{Ethyl isocyanide}}{C_2H_5NC} + 3KCl + 3H_2O$

(iii)



p–Aminazobenzene
(yellow dye)

***15. Define the following terms with suitable examples:**

(i) Peptization

(ii) Electrophoresis.

(iii) Dialysis **[3]**

16. (a) (i) Calculate the mass of silver deposited at cathode when a current of 2 amperes is passed through a solution of $AgNO_3$ for 15 minutes.

(at. wt. of Ag = 108, 1 F = 96,500 C)

(ii) Calculate the emf and ΔG for the cell reaction at 298 K.

$Mg_{(s)} \mid Mg^{2+}_{(0.1M)} \parallel Cu^{2+}_{(0.01M)} \mid Cu_{(s)}$

Given, E°cell = 2.71V

1F = 96,500 C **[5]**

OR

(b) (i) Define the following terms :

(1) Specific conductance

(2) Kohlrausch's Law

(ii) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 ohm. What is the cell constant and molar conductivity of 0.001 M KCl solution, if the conductivity of this solution is 0.146×10^{-3} S cm^{-1} at 298 K ? **[5]**

Ans. (a) **(i)** Molar mass of silver = 108 g mol^{-1},

t = 15 min = 15×60 s, 1F = 96500 C, i = 2 A

$$Q = It = 2 \times 15 \times 60 = 1800 \text{ C}$$

$$w = ZQ$$

$$Z = \frac{M}{nF}$$

Here, $n = 1$

So, $Z = \frac{108}{1 \times 96500}$

$$\omega = \frac{108}{1 \times 96500} \times 1800 = 2.014\text{g}$$

Mass of silver deposited at cathode is 2.014g

(ii) $Mg_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Mg^{2+}_{(aq)} + Cu_{(s)}$

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\frac{[Mg^{2+}]}{[Cu^{2+}]}$$

$$= 2.71 - \frac{0.0591}{2}\log\frac{[0.1]}{[0.01]}$$

$$= 2.71 - \frac{0.0591}{2}\log 10$$

$$= 2.71 - \frac{0.0591}{2} \times 1$$

$$= 2.71 - 0.02955 = 2.68 \text{ V}$$

$$\Delta G = -nFE_{cell}$$

$$= -2 \times 96500 \times 2.68$$

$$= -517240 \text{ J}$$

$$= -517.240 \text{ kJ}$$

OR

(b) (i) (1) Specific conductance can be defined as the reciprocal of specific resistance or conductance of a solution of definite dilution enclosed in a cell having two electrodes of unit area separated by 1 cm.

(2) Kohlrausch's law states that the limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anions and cations of the electrolyte.

$\Lambda^\circ = v_+\lambda_+^\circ + v\_\lambda\_^\circ$

where v^+ and v^- =number of cations and anions

(ii) $k = 0.146 \times 10^{-3}$ Scm^{-1}, R = 1500 ohm, C = 0.001 M

Cell constant= $k \times R$

$= 0.146 \times 10^{-3} \times 1500$

$= 0.219\ cm^{-1}$

Molar conductivity, $\Lambda_m = \frac{k \times 1000}{C}$

$$= \frac{0.146 \times 10^{-3} \times 1000}{0.001}$$

$$= 146 \text{ S cm}^2 \text{ mol}^{-1}.$$

***17. (a) (i)** Explain why :

(1) Fluorine has lower electron affinity than chlorine.

(2) Red phosphorus is less reactive than white phosphorous.

(3) Ozone acts as a powerful oxidising agent.

(ii) Draw the structures of the following :

(1) XeF_6

(2) IF_7 **[5]**

OR

(b) (i) Explain why :

(1) Interhalogen compounds are more reactive than the related elemental halogens.

(2) Sulphur exhibits tendency for catenation but oxygen does not.

(3) On being slowly passed through water, PH_3 forms bubbles but NH_3 dissolves.

(ii) Complete and balance the following reactions :

(1) $P_4 + H_2SO_4 \rightarrow$ ______ + ______ + ______

(2) $Ag + HNO_3 \rightarrow$ _____ + ______ + ______
(dilute) **[5]**

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

(1) Acetaldehyde reacts with hydrogen cyanide.

(2) Acetone reacts with phenyl hydrazine.

(3) Acetic acid is treated with ethanol and a drop of conc. H_2SO_4.

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

(1) Acetone and benzaldehyde.

(2) Phenol and benzoic acid. **[5]**

OR

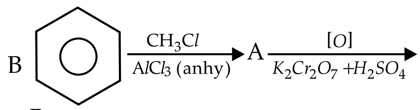
(b) (i) Write chemical equations to illustrate the following name reactions :

(1) Aldol condensation.

(2) Cannizzaro's reaction.

(3) Benzoin condensation.

(ii) Identify the compounds A and B in the given reactions :

(1) 

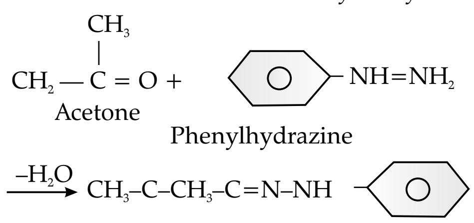
Benzene

(2) $CH_3COCH_3 \xrightarrow[HNO_3(\text{conc.})]{[O]} A \xrightarrow{PCl_5} B$ **[5]**

Ans.

(a) (i) (1) $H_3C—\underset{\underset{O}{||}}{C}—H + HCN \longrightarrow CH_3—\underset{\underset{OH}{|}}{CH}—CN$

Acetaldehyde → Acetaldehyde cyanohydrin

(2) 

(3) $CH_3—COOH + CH_3CH_2OH \xrightarrow{\text{conc.}H_2SO_4}$

Acetic acid, Ethanol

$CH_3 — \underset{}{\overset{\overset{O}{||}}{C}} — O\ CH_2CH_3 + H_2O$

Ethyl acetate

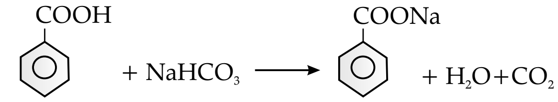
(ii) (1) Benzaldehyde being aldehyde reduces Tollen's reagent to form silver mirror but acetone being ketone does not.

$C_6H_5CHO + 2\,[Ag\,(NH_3)^2]^+ + 2OH^- \longrightarrow$

Benzaldehyde

$C_6H_5COOH + 2\,Ag + 4NH_3 + H_2O$

(2) Benzoic acid reacts with $NaHCO_3$ to give CO_2 gas with effervescence whereas phenol does not.



Benzoic acid → Sodium Benzoate

OR

(b) (i) (1) Aldol condensation :

$2CH_3-CHO \underset{}{\overset{\text{dil.NaOH}}{\rightleftharpoons}} CH_3—\underset{|}{\overset{OH}{CH}}—\overset{CHO}{CH_2}$

Ethanal → 3-Hydroxybutanal (Aldol)

$\xrightarrow[-H_2O]{\Delta} CH_3 — CH = CH — CHO$

But – 2 – enal (Aldol condensation product)

(2) Cannizzaro reaction :

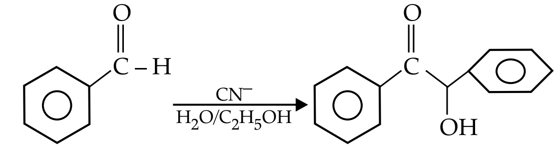
$\overset{H}{\underset{H}{>}}C = O + \overset{H}{\underset{H}{>}}C = O + \text{conc. KOH} \xrightarrow{\Delta}$

Foomaldehyde

$H—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—OH + H—C\overset{\nearrow O}{\searrow OK}$

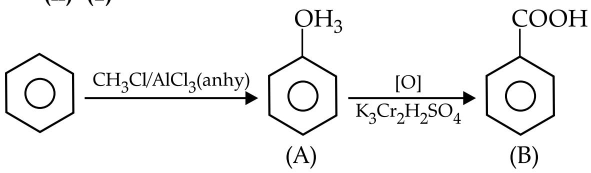
Methanol, Potassium formate

(3) Benzoin condensation :



Benzaldehyde → Benzoin

(ii) (1)



(A) Toluene (B) Benzoin

(2) $CH_3COCH_3 \xrightarrow[\text{conc.}HNO_3]{[O]} CH_3COOH$

Acetic acid (A)

$\xrightarrow{PCl_5} CH_3COCl$

Acetyl chloride (B)