PRACTICE PAPER – 6

ANSWERS

SECTION – A

1. Define mole fraction.

Ans. Mole fraction : The ratio of number of moles of the one component of the solution to the total number of moles of all the components of the solution is called mole fraction.

$$\text{Mole fraction of solute } X_s = \frac{n_s}{n_0 + n_s}$$

$$\text{Mole fraction of solvent } X_0 = \frac{n_s}{n_0 + n_s}$$

$$\left[\begin{array}{l} n_s = \text{number of moles of solute} \\ n_0 = \text{number of moles of solvent} \end{array}\right]$$

$\rightarrow$ It has no units.

2. By how many times the rate constant increases for a rise of reaction temperature by 10°C ?

Ans. For every 10°C rise of temperature rate constant of chemical reactions may be doubled (some times tripled).

3. Explain "poling".

Ans. When the metals are having the metal oxides as impurities this method is employed. The impure metal is melted and is then covered by carbon powder. Then it is stirred with green wood poles. The reducing gases formed from the green wood and the carbon, reduce the oxides to the metal.

Eg : Cu & Sn metals are refined by this method.

4. What is an alloy ? Give example.

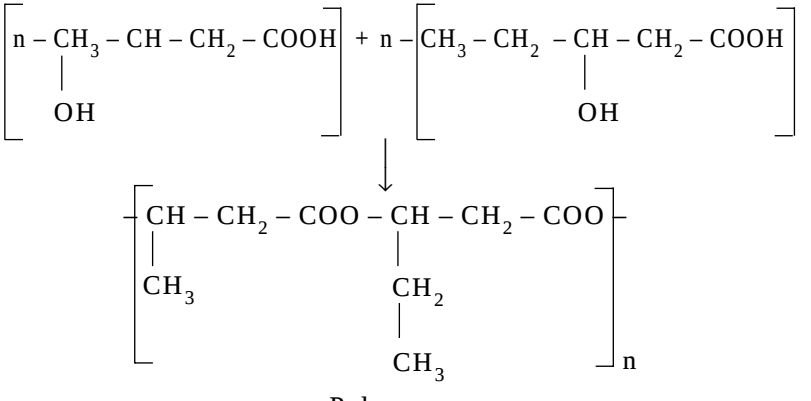
Ans. Alloy : An intimate mixture having physical properties similar to that of the metal formed by a metal with other metals or metalloids or sometimes a non metal is called as an alloy.

Eg. : Invar – 64% Fe, 35% Ni, Mn 8cc in traces

Nichrome – 60% Ni, 25% Fe, 15% Cr.

5. What is PHBV ? How is it useful to man ?

Ans. Poly β – hydroxy butyrate – CO – β – hydroxy Valerate (PHBV) : It is a Copolymer of 3 –hydroxy butanoic acid and 3 – hydroxy pentanoic acid.



Polymer

Properties & Uses : The properties of PHBV vary according to the ratio of both the acids, 3–hydroxy butanoic acid provides stiffness and 3–hydroxy pentanoic acid imparts flexibility to copolymer.

It is used in medicine for making capsules.

PHBV also undergoes degradation by bacteria.

6. Write the names and structures of the monomers used for getting the following polymers i) Polyvinyl chloride ii) Teflon

Ans. i) Polyvinyl chloride

Monomer : Vinyl chloride

Structure : $CH_2 = CH - Cl$

ii) Teflon

Monomer : Tetrafluoro ethylene

Structure : $CF_2 = CF_2$

7. What are the components of a nucleic acid ?

Ans. → Nucleic acids are long chain polymers of nucleotides i.e poly nucleotides.

→ Nucleic acids are constituted by pentose sugar, phosphoric acid, and nitrogenous hetero cyclic base (purine (or) pyrimidine).

8. Name the vitamin responsible for the coagulation of blood.

Ans. The vitamin responsible for the coagulation of blood is vitamin K.

9. Why is the use of aspartame limited to cold foods and drinks ?

Ans. Aspartame is unstable at cooking temperature so it's use is limited to cold foods and soft drinks.

10. What are antagonists and agonists ?

Ans. Antagonists : The drugs that bind to the receptor site and inhibit its natural function are called antagonists.

→ These are useful when blocking of message is required.

Agonists : The drugs that mimic the natural messenger by switching on receptors are called agonists.

→ These are useful when there is lack of natural chemical messenger.

SECTION – B

11. a) What are isotonic solutions ?

Ans. Isotonic solutions : Solutions having same osmotic pressure at a given temperature are called isotonic solutions.

e.g. : Blood is isotonic with 0.9% $\left(\frac{W}{V}\right)$ NaCl [Saline]

b) What is an ideal solution ?

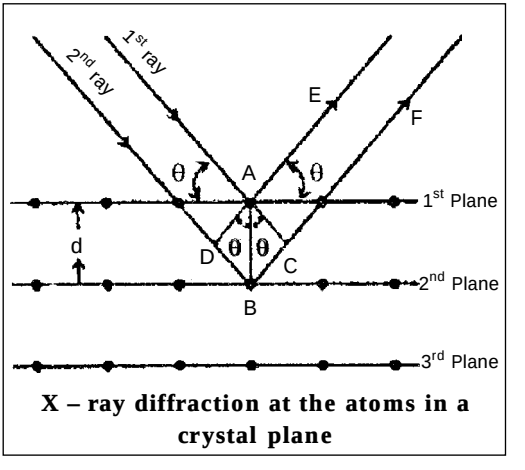
Ans. A solution of two or more components which obeys Raoult's law at all concentrations and at all temperatures is called ideal solution. In ideal solution there should not be any association between solute and solvent, (i.e.) no chemical interaction between solute and solvent of solution.

Ex : The following mixtures form ideal solutions.

- Benzene + Toluene
- n – hexane + n – heptane
- ethyl bromide + ethyl iodide

12. Derive Bragg's equation.

Ans. Derivation of Bragg's equation : When X-rays are incident on the crystal or plane, they are diffracted from the lattice points (lattice points may be atoms or ions or molecules). In the crystal the lattice points are arranged in regular pattern. When the waves are diffracted from these points, the waves may be constructive or destructive interference.



X – ray diffraction at the atoms in a crystal plane

The 1st and 2nd waves reach the crystal surface. They undergo constructive interference. Then from the figure 1st and 2nd rays are parallel waves. So, they travel the same distance till the wave form AD. The second ray travels more than the first by an extra distance (DB + BC) after crossing the grating for it to interfere with the first ray in a constructive manner. Then only they can be in the same phase with one another. If the two waves are to be in phase, the path difference between the two ways must be equal to the wavelength (λ) or integral multiple of it ($n\lambda$, where n = 1, 2, 3, ...)

(i.e.,) $n\lambda = (DB + BC)$ [where n = order of diffraction]

$DB = BC = d \sin\theta$ [θ = angle of incident beam, d = distance between the planes]

$(DB + BC) = 2d \sin\theta$

$\boxed{n\lambda = 2d \sin\theta}$ This relation is known as **Bragg's equation**.

13. Discuss the characteristics of physical adsorption.

Ans. Characteristics of physical adsorption :

→ **Lack of specificity :** Physisorption is not specific. In this adsorption the given surface of adsorbent doesnot show any preference for a particular gas as the forces present are vanderwaal's forces (Universal).

→ **Nature of adsorbate :** The amount of gas adsorbed by a solid depends on the nature of gas.

→ Easily liquefiable gases are readily adsorbed.

→ The gas with high critical temperature value is easily liquefied and gets readily adsorbed.

→ **Reversible Nature :** Physical adsorption is reversible and occurs rapidly at low temperatures.

→ **Surface area of adsorbent :** The extent of adsorption increase with increase in surface area of adsorbent.

→ Finely divided metals and porous substances having large surface area are good adsorbents.

→ **Enthalpy of adsorption :** Physisorption is an exothermic process but the enthalpy of adsorption is low (20 - 40 KJ/mole). This is due to the presence of Vander waal's forces.

14. Write down the chemical reactions taking place in different zones in the blast furnace during the extraction of iron.

Ans. The chemical reactions taking place in different zones in the blast furnace during the extraction of iron are

$$3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2$$

Iron ore

$$Fe_3O_4 + CO \longrightarrow 3FeO + CO_2$$

$$CaCO_3 \longrightarrow CaO + CO_2$$

Limestone

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

Slag

$$FeO + CO \longrightarrow Fe + CO_2$$

$$C + CO_2 \longrightarrow 2CO$$

Coke

$$C + O_2 \longrightarrow CO_2$$

$$FeO + C \longrightarrow Fe + CO$$

15. How are Xenon fluorides XeF_2, XeF_4 and XeF_6 obtained ?

Ans. Xenon forms the binary fluoridy XeF_2, XeF_4, XeF_6 as follows. These are formed by direct combination of Xe and F_2.

$$Xe + F_2 \xrightarrow[1\ bar]{673\ K} XeF_2$$

(Xenon in excess)

$$Xe + 2F_2 \xrightarrow[7\ bar]{873K} XeF_4$$

(1 : 5 ratio)

$$Xe + 3F_2 \xrightarrow[60 - 70\ bar]{573\ K} XeF_6$$

(1 : 20 ratio)

16. Predict which of the ions Cu^+, Sc^{3+}, Mn^{2+}, Fe^{2+} are coloured in aqueous solution ? Give reasons.

Ans. Only those ions will be coloured which have incomplete d-orbitals. Ions which has complete or vacant d-orbitals are colourless.

$Cu^+ = [Ar]\ 3d^{10}$	Colourless
$Sc^{3+} = [Ar]$	Colourless
$Mn^{2+} = [Ar]\ 3d^5$	Pink
$Fe^{2+} = [Ar]\ 3d^5$	Light green

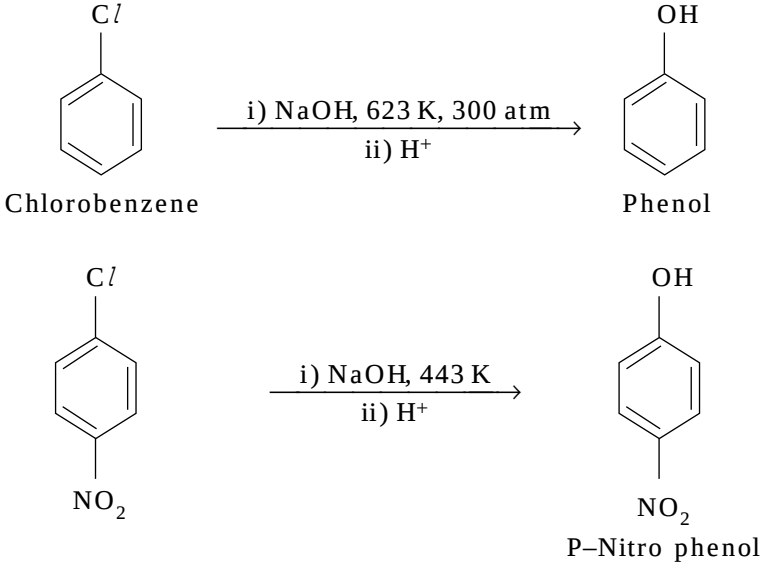
As Sc^{3+} and Cu^+ have $3d^0$ and $3d^{10}$ configuration in their valence shell so their aqueous solutions are colourless. All others, i.e., Ti^{3+}, V^{3+}, Mn^{2+} Fe^{+2} and Co^{2+} are coloured in aqueous medium.

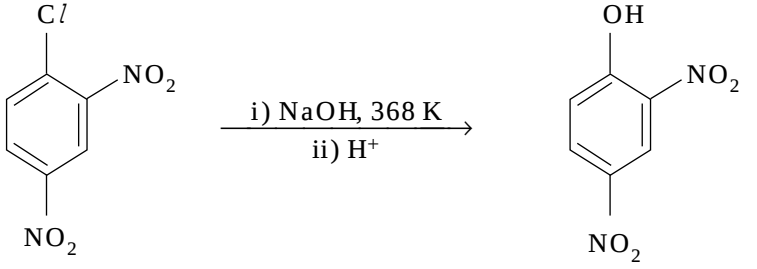
17. Account for the following statements : p-Nitrochlorobenzene and o, p-dinitrochlorobenzene undergo Nucleophilic substitution readily compared to chlorobenzene.

Ans. p – nitrochlorobenzene and o, p – dinitro chlorobenzene undergo nucleophillic substitution reachily compared to chlorobenzene due to the following reasons.

→ Due to presence of – NO_2 group which is an electron with drawing group at 'O' and 'P' – positions in the ring makes the bond breaking easy.

→ As the number of NO_2 groups increases reactivity of aryl halide also increases. This can be evidended by the following reactions.

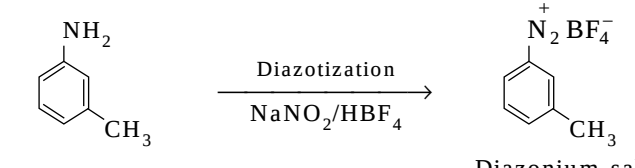




O, P – dinitrophenol

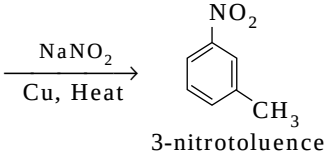
18. Convert : (i) 3-methyl aniline into 3-nitrotoluene.
(ii) anline into 1, 3, 5-tribromobenzene.

Ans. i) 3-methyl aniline into 3-nitrotoluene



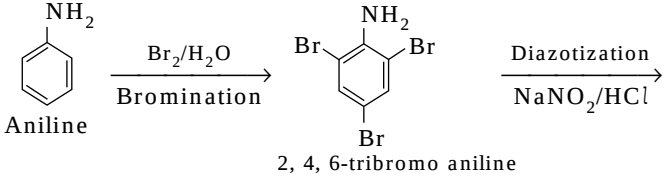
3-methyl aniline

Diazonium salt



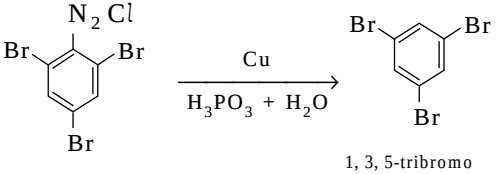
3-nitrotoluence + $NaBF_4$ + N_2

ii) Aniline into 1, 3, 5-tribromobenzene



Aniline

2, 4, 6-tribromo aniline



Diazonium salt

1, 3, 5-tribromo benzene

SECTION – C

19. a) What are the fuel cells ? How are they different from galvanic cells ? Give the construction of H_2, O_2 fuel cell ?

Ans. A fuel cell is a galvanic cell in which the chemical energy of fuel-oxidant system is converted directly into electrical energy.

→ Conventional Galvanic cell converts chemical energy into electrical energy by spontaneous redox reactions.

→ Fuel cell convert energy of combustion of fuels like hydrogen, methane etc., into electrical energy. These cause less pollution.

H_2 – O_2 fuel cell : In this cell, hydrogen and oxygen are bubbled through porous carbon electrodes into Conc. NaOH solution. Electrodes are embedded with suitable catalysts. The electrode reactions are :

$$O_{2(g)} + 2\,H_2O_{(l)} \xrightarrow{+\,4e^-} 4\,OH^-_{(aq)} \quad \text{(Cathode)}$$

$$2H_{2(g)} + 4\,OH^-_{(aq)} \longrightarrow 4\,H_2O_{(l)} + 4e^- \quad \text{(anode)}$$

Overall reaction : $2H_{2(g)} + O_{2(g)} \longrightarrow 2\,H_2O_{(l)}$

The cell functions as long as the reacting gases are in supply. The heat of combustion is directly converted into electrical energy.

b) i) What is rate law ? Illustrate with an example.

Ans. The equation that describes mathematically the dependence of the rate of a reaction on the concentration terms of the reactions is known as the rate equation (or) rate law.

Eg : $2A + 3B \longrightarrow 3C$

Rate of the given reaction $\propto [A]^2\,[B]^3$

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

Sol. $A + B \rightarrow$ product; $r = k\,[A]^{1/2}\,[B]^2$

Rate of the reaction $r = \frac{1}{2} + 2 = 2.5$

20. a) How does SO_2 react with the following ?

i) Na_2SO_3(aq) ii) Cl_2 iii) Fe^{+3}ions iv) $KMnO_4$

Ans. i) Sodium sulphite (aq) reacts with So_2 to form sodium hydrogen sulphite.

$$Na_2SO_3 + H_2O + SO_2 \longrightarrow 2NaHSO_3$$

ii) SO_2 gas reacts with chlorine gas in the presence of charcoal to form suphuryl chloride.

$$SO_{2(g)} + Cl_{2(g)} \longrightarrow SO_2Cl_{2(l)}$$

iii) Fe^{+3}ions are reduced to Fe^{+2} ions by SO_2.

$$2Fe^{+3} + SO_2 + 2H_2O \longrightarrow 2Fe^{+2} + SO_4^{-2} + 4H^+$$

iv) SO_2 gas decolourises acidified potassium permanganate (VII) solution.

$$5SO_2 + 2MnO_4^- + 2H_2O \longrightarrow 5SO_4^{-2} + 4H^+ + 2Mn^{+2}$$

b) Give the reason for bleaching action of Cl_2 ?

Sol. Bleaching action of chlorine is due to its oxidizing property. When chlorine reacts with water, it gives nascent oxygen which decoloures is the coloured substance.

$$Cl_2 + H_2O \longrightarrow 2HCl + [O]$$

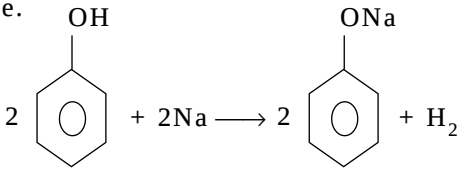
Coloured substance + [O] $\longrightarrow$ Colourless substance

Bleaching action of chlorine creates permanent effect. It bleaches the vegetable of organic matter in the presence of moisture.

21. a) Explain the acidic nature of phenols and compare with that of alcohols.

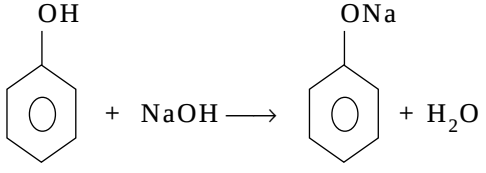
Ans. The reaction of phenol with sodium metal and with aq.NaOH indicates the acidic nature of phenol.

i) Phenol reacts with sodium metal to form sodium phenoxide.



Phenol **Sodium phenoxide**

ii) Phenol reacts with aq.NaOH and forms sodium phenoxide.



Phenol **Sodium phenoxide**

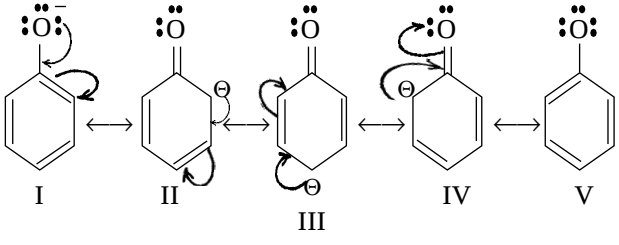
→ In phenol hydroxyl group is attached to the Sp^2 hydridised carbon of benzene ring which acts as electron with drawing group. The formed phenoxide ion from phenol is more stabilised due to delocalisation of negative charge.

Comparison of acidic character of Phenol and Ethanol :

→ The reaction of phenol with aq. NaOH indicates that phenols are stronger acids than alcohols.

→ The hydroxyl group attached to an aromatic ring is more acidic than in hydroxyl group is attached to an alkyl group.

→ Phenol forms stable phenoxide ion stabilised by resonance but ethoxide ion is not.



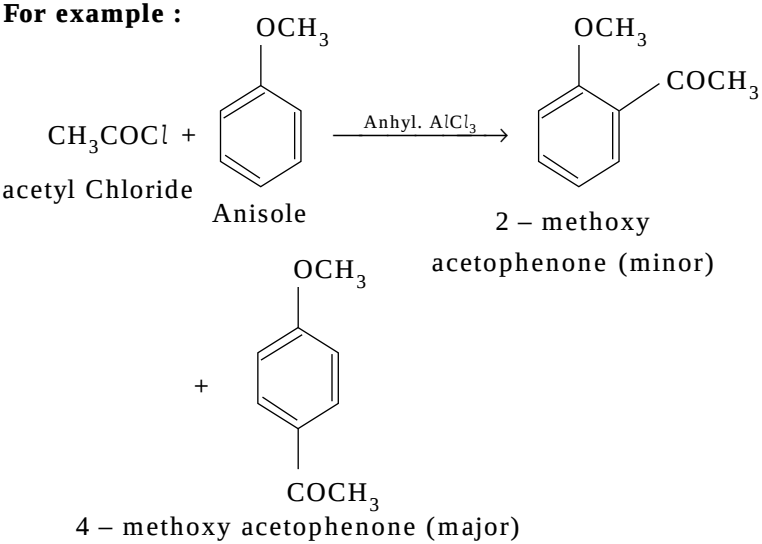
b) Describe the following.

i) Acetylation ii) Cannizaro reaction

Ans. i) Acetylation : When active hydrogen atom of alcohol, phenol (or) an amine is replaced by acetyl ($CH_3CO–$) group to form corresponding ester (or) amide, the reaction is known as acetylation.

→ Reagents used are acid chloride (or) acid anhydride in presence of a base like pyridine (or) dimethylaniline.

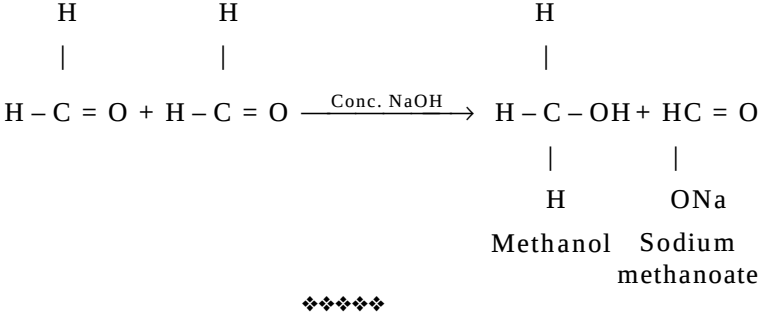
For example :



ii) Cannizaro reaction : On treating with concentrated alkali, aldehydes which do not have any α – hydrogen atom, undergo self oxidation and reduction (disproportionation) reaction. This reaction is called cannizaro reaction.

→ As a result, one molecule of aldehyde is reduced to alcohol while another is oxidised to carboxylic acid salt.

For example :



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