Previous Year Question Paper 2019

General Instructions:

- I. All questions are compulsory
- **II.** Section A : Question no. 1 to 5 are very short-answer questions and carry 1 mark each.
- **III.** Section B: Question no. 6 to 12 are short-answer questions and carry 2 marks each.
- **IV.** Section C: Question no. 13 to 24 are also short-answer questions and carry 3 marks each.
- V. Section 13: Question no. 25 to 27 are long-answer questions and carry 5 marks each.
- VI. There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- **VII.** Use log tables if necessary. Use of calculators is not allowed.

SECTION-A

1: Out of NaCl and AgCl, which one shows Frenkel defect and why?

Sol:-

The Frenkel defect is that in which one smaller ion (usually cations) move from its lattice position to an interstitial site i.e. a tetrahedral octahedral hole to form a vacancy in the lattice. Of course, AgCl has the defect because, the size of AgCl is intermediate and since, the size of

 Ag^+ cation is smaller than chloride ion so it can move to interstitial spaces causing Frenkel defect while in NaCl (alkali metal halide) they have larger size of cations which do not fit into voids and so the defect is not shown by the alkali metal halides.

2: Arrange the following in increasing order of boiling points:

 $(CH_3)_3$ N,C₂H₅OH,C₂H₅NH₂

Sol:-

This increasing order of boiling point can be explained by intermolecular hydrogen bonding. Tertiary amines, cannot engage in hydrogen bonding because they have no hydrogen atom bonded to the nitrogen atom, while primary amine undergoes intermolecular hydrogen bonding. But in case of alcohol, the extent of hydrogen bonding is more as compared to amines because of more electronegative oxygen atom in alcohols.

 $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$

3: Why are medicines more effective in colloidal state?

OR

What is difference between an emulsion and a gel?

Sol:-

Some medicines are more effective in colloidal form because medicine in colloidal form is easily absorbed by the body tissues. For example, Antibiotics like streptomycin in the form of the colloidal sol is injected into the body for the more effective result.

OR

Emulsion: It is a colloidal mixture in which both the dispersed phase and the dispersion medium are liquids. The two or more liquids present in the mixture are generally immiscible in nature. Example: Milk. Gel: It is a colloid in which the dispersed phase i.e. liquid has combined with the dispersion medium i.e. solid to produce a semisolid material. Example: jellies.

4: Define ambident nucleophile with an example.

Sol:-

Ambident Nucleophile- An anionic nucleophile, which has two nucleophilic centres, or two negative sites is known as ambident nucleophile. In this negative charge is delocalized due to resonance.

Example – Cyanide and Thiocyanate are examples of ambident nucleophiles.

⊝C≡≡N	-	-	C=N⊖
s=c=n⊖	-	→ ⊖s-	–c≡n

5: What is the basic structural difference between glucose and fructose?

OR

Write the products obtained after hydrolysis of lactose.

Sol:-

Both Glucose and Fructose are hexose sugars with six carbon atoms but Glucose is an aldohexose and fructose is ketohexose which means the functional group present in glucose is aldehyde and the functional group in fructose is ketone.



OR

Lactose is composed of β -D galactose and β -D glucose. Thus on hydrolysis, it gives β -D galactose and β -D glucose.

 $\begin{array}{rrrr} C_{12}H_{22}O_{11}+&H_2O \rightarrow & C_6H_{12}O_6 & + & C_6H_{12}O_6 \\ \\ Lactose & Water & D\text{-}Glucose & D\text{-}Galactose \end{array}$

SECTION B

6: Write balanced chemical equations for the following processes:

(i) XeF₂ undergoes hydrolysis.

(ii) MnO_2 is heated with conc. HCl.

OR

Arrange the following in order of property indicated for each set.

(i) H₂O,H₂S,H₂Se,H₂ Teincreasing acidic character

(ii) HF,HCI,HBr,HI-decreasing bond enthalpy

Sol:-

(i)
$$2XeF_2(s)+2H_2O(l) \rightarrow 2Xe(g)+4HF(aq)+O_2(g)$$

(ii) $4HCl+MnO_2 \rightarrow Cl_2+MnCl_2+2H_2O$

OR

(i) The increasing order of acidic character is $H_2O < H_2S < H_2Se < H_2Te$ (ii)The decreasing order of bond enthalpy is $HF > HCl > HBr > 2H_2O$

7: State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obeys Raoult's law at all concentrations.

Sol:-

Raoult's Law: According to Raoult's law, for a solution of two volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution.

 $P_1 \propto x_1$

Implies that

 $P_1 = P_1^{\circ} x_1$

 P_1 = Partial pressure of component 1.

 x_1 =mole fraction of component 1.

 P_1° =pure vapour pressure of component 1.

Ideal solution obeys Raoult's law at all concentrations. The conditions obeyed are:

(i) $\Delta_{mix}H = 0$

(ii)
$$\Delta_{mix}V = 0.$$

8:

For a reaction

 $2H_2O_2 \xrightarrow{I^-} 2H_2O + O_2$ The Proposed mechanism is given below: (1) $H_2O_2+I^- \rightarrow H_2O+IO^-$ (slow) (2) $H_2O_2+IO^- \rightarrow H_2O+I^-+O_2$ (fast) (i) Write rate law for the reaction. (ii) Write the over all order of reaction. (iii) Out of steps(1) and (2), which one is rate determining step?

Sol:-

Let us consider the problem:

 $2H_2O_2 \xrightarrow[]{I^*} alkaline medium \rightarrow 2H_2O+O_2$

In Some cases, the rate of reaction depends not only on the reactant but may also depend on the substance present as a catalyst. This is also seen in the above reaction. The rate of reaction depends on the slowest step in case of a complex reaction.

(1)
$$H_2O_2+I^- \xrightarrow{slow} H_2O+IO^-$$

(2) $H_2O_2+IO^- \xrightarrow{Fast} H_2O+I^-+O_2$
(i) Rate law:
Rate $= -\frac{1}{2} \frac{d[H_2O_2]}{dt} = k[H_2O_2][I^-]$
(ii) The overall order of reaction:
Rate $=k[H_2O_2][I^-]$
Order $= 1+1=2$

(iii) Slowest step is the rate determining step. Hence, step 1 is rate determining step.

9: When MnO_2 is fused with KOH in the presence of KNO_3 as an oxidizing agent, it

gives a dark green compound (A).

Compound (A) disproportionates in acidic solution to give purple compound (B). An alkaline solution of compound (B) oxidises KI to compound (C) whereas an acidified solution of compound (B) oxidises KI to (D). Identify (A), (B), (C), and (D).

Sol:-

Potassium permanganate is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent like KNO_3 . This produces the dark green K_2MnO_4 which disproportionates in a neutral or acidic solution to give permanganate.

 $2MnO_{2} + 4KOH + O_{2} \rightarrow 2K_{2}MnO_{4} + 2H_{2}O$ (A)Dark Green $3MnO_{4}^{2^{-}} + 4H^{+} \rightarrow 2MnO_{4}^{-} + MnO_{2} + 2H_{2}O$ (B) purple
In acid solutions:
Iodine is librated from potassium iodine: $10I^{-}+2MnO_{4}^{-}+16H^{+} \rightarrow 2Mn^{2^{+}}+8H_{2}O+5I_{2}$ (B)
(D)
In neutral or faintly alkaline solution:
A notable reaction is the oxidation of iodine to iodate: $2MnO_{4}^{-}+H_{2}O+I^{-} \rightarrow 2MnO_{2}+2OH^{+}+IO_{3}^{-}$ (B)
(C)

10: Write IUPAC name of the complex [Pt(en)2Cl2]. Draw structures of geometrical isomers for this complex. [2]

OR

Using IUPAC norms write the formulae for the following :

- (i) Hexaamminecobalt(III) sulphate
- (ii) Potassium trioxalatochromate(III)

Sol:-

 $\left\lceil Pt(en)_2 Cl_2 \right\rceil - Dichloridobis(ethane-1,2-diammine) platinum (II)$

Geometrical isomer:



(i)
$$\left[\operatorname{Co}(\operatorname{NH}_3)_6 \right]_2 (\operatorname{SO}_4)_3$$

(ii) $\operatorname{K}_3 \left[\operatorname{Cr}(\operatorname{C}_2 \operatorname{O}_4)_3 \right]$

11: Out of $[CoF_6]^{3-}$ and $[Co(en)_3]^{3+}$, which one complex is [2] (i) paramagnetic (ii) more stable (iii) inner orbital complex and (iv) high spin complex (Atomic no. of Co = 27)

Sol:-

(i) $[CoF_6]^{3+}$ is paramagnetic due to presence of four unpaired electrons (ii) $[Co(en)_3]^{3+}$ is more stable due to chelation (iii) $[Co(en)_3]^{3+}$ forms inner orbital complex (d^2sp^3) 1

- (iv) $\left[CoF_{6} \right]^{3-}$ forms high spin complex (sp3d2)
- 12: Write structures of compounds A and B in each of the following reactions :



Sol:-





Sol:-

Given that: $k=4 \times 10^{-3} \text{ Ms}^{-1}$ $[A_{\circ}]=0.1 \text{ M}$ [A]=0.064 MFor a zero-order reaction,

$$k = \frac{1}{t} \{ [A_{\circ}] - [A] \}$$

$$4 \times 10^{-3} \text{ Ms}^{-1} = \frac{1}{t} \{ [0.1] - [0.064] \}$$

$$t = \frac{0.1 - 0.064}{4 \times 10^{-3}} = 0.009 \times 10^{3} = 9 \text{ seconds}$$

14: (i) What is the role of activated charcoal in gas mask?(ii) A colloidal sol is prepared by the given method in figure. What is the charge on hydrated ferric oxide colloidal particles formed in the test tube? How is the sol ution represented?



(iii) How does chemisorption vary with temperature?

Sol:-

(i) In gas mask activated charcoal is used to adsorb poisonous gases in coal mines.

(ii) If ${\rm FeCl}_{3}$ is added to NaOH , a negatively charged sol is obtained with adsorption of ${\rm OH}^{\text{-}}$

ions. Sol is represented as $\,Fe_2O_3.xH_2O\!/OH^{-}$ (negatively charged) .

(iii) With increase in temperature chemisorption first increases as molecules get activation energy for adsorption. After certain chemisorption decreases.temperature,



15 An element crystallizes in fcc lattice with a cell edge of 300 pm. The density of the element is $10.8 \,\mathrm{gcm^{-3}}$. Calculate the number of atoms in $108 \,\mathrm{g}$ of the element.

Sol:-

Volume of unit cell
=
$$(300 \ pm)^3$$

= $(3.00 \times 10^{-8} \ cm)^3$
= $2.7 \times 10^{-23} \ cm^3$
Volume of 108 g of element= $\frac{\text{mass}}{\text{density}} = \frac{108g}{10.8 \ cm^{-3}} = 10 \ cm^3$
Number of unit cells in this volume = $\frac{10 \ cm^3}{2.7 \times 10^{-23} \ cm^3 \ / \ unit \ cell} = \frac{10^{24}}{2.7}$ Unit cells
Since each FCC unit cell contains 4 atoms, therefore the total number of atoms in 108 g
4 atoms/unit cell $\times \frac{10^{24}}{2.7}$ unit cell
= 1.48×10^{24} atoms

16 A 4% solution(w/w) of sucrose (M = 342 g mol –1) in water has a freezing point of 271.15 K. Calculate the freezing point of 5% glucose (M = 180 g mol–1) in water. (Given: Freezing point of pure water = 273.15 K)

Sol:-

Molality (m) =
$$\frac{n}{W_{\text{solvent(kg)}}}$$

For sucrose solution:
 $m = \frac{\frac{4}{342}}{\frac{96}{1000}} = \frac{4}{342} \times \frac{1000}{96} = 0.122 \text{m}$
 $(\Delta T_f)_1 = (273.15 - 271.15) K = 2K$
 $(\Delta T_f)_1 = K_f m = K_f \times 0.122$
 $2 = K_f \times 0.122$...(1)
For glucose solution :
 $\frac{5}{2}$

$$m = \frac{\frac{5}{180}}{\frac{95}{1000}} = \frac{5}{180} \times \frac{1000}{95} = 0.292m$$

$$\begin{split} \left(\Delta T_{f}\right)_{2} &= K_{f} \times 0.292 \dots (2) \\ \text{Dividing eqn. (2) by (1)} \\ &\frac{\left(\Delta T_{f}\right)_{2}}{2} = \frac{K_{f} \times 0.292}{K_{f} \times 0.122} \\ &\left(\Delta T_{f}\right)_{2} = \frac{0.292}{0.122} \times 2 = 4.79 \\ &T_{f} &= 273.15 - 4.79 = 268.36 \ K \\ \text{Freezing point of glucose solution will be 268.36 K} \end{split}$$

- **17**: (a) Name the method of refining which is
 - (i) Used to obtain semiconductor of high purity.
 - (ii) Used to obtain low boiling metal.
 - (b) Write chemical reactions taking place in the extraction of copper from Cu_2S .

Sol:-

- (a)
- (i) Zone refining
- (ii) Distillation
- (b) The sulphide ores are roasted to give oxides
- $2Cu_2S+3O_2 \rightarrow 2Cu_2O+2SO_2$

The oxide can easily be reduced to metallic copper using coke Cu $_{2}\mathrm{O+C} \rightarrow 2\mathrm{Cu+CO}$

18: Givereasons for the following:

(i) Transition elements and their compounds act as catalysts.

(ii) E° value for $(Mn^{2+}|Mn)$ is negative whereas for $(Cu^{2+}|Cu)$ is positive.

(iii) Actinoids show irregularities in their electronic configuration.

Sol:-

(i) Transition elements and their compounds act as catalysts. This is because of their ability to adopt multiple oxidation states and to form complexes.

(ii) E° value for $(Mn^{2+}|Mn)$ is negative whereas for $(Cu^{2+}|Cu)$ is positive as the hydration

enthalpy of Cu^{2+} ion is not sufficient to compensate the sum of sublimation as well as first and second ionisation enthalpy of copper.

(iii) Actinoids show irregularities in their electronic configuration are related to their stabilities f of the₀, f_7 and f_{14} occupancies of the 5f orbital.

19: Write the structures of monomers used for getting the following polymers:

- (i) Nylon-6, 6
- (ii) Glyptal
- (iii) Buna-S

(i) Is $(H_2 - CH_2 - CH_n)^{-1}$ a homopolymer or copolymer? Give reason. (ii) Write the monomers of the following polymer :



(iii) What is the role of Sulphur in vulcanization of rubber?

Sol:-

(i) Nylon-6, 6: Hexamethylenediamine \rightarrow H₂N-CH₂-



OR

(i) This is a homopolymer formed by a propene monomer because in this polymerization only one monomer is being used without losing any molecule.



(ii)

(iii) In vulcanization, sulphur forms cross links at the reactive sites of double bonds of natural rubber so the rubber gets stiffened.

20: (i) What type of drug is used in sleeping pills?
(ii) What type of detergents are used in toothpastes?
(iii) Why the use of alitame as artificial sweetener is not recommended?

OR

Define the following terms with a suitable example in each :

- (i) Broad-spectrum antibiotics
- (ii) Disinfectants
- (iii) Cationic detergents

Sol:-

(i) Tranquilizers are used in sleeping pills.

(ii) Anionic detergents are used in toothpastes.

(iii) The control of sweetness of food is difficult while using alitame, hence its use as artificial sweetener is not recommended.

OR

(i) Broad-spectrum antibiotics – Antibiotics which kill or inhibit a wide range of gram-positive and gram-negative bacteria are called broad-spectrum antibiotics.

e.g. - Chloramphenicol / Vancomycin / Ofloxacin

(ii) Disinfectants – The chemicals which either kill or prevent the growth of microorganisms are called disinfectants.

e.g. Chlorine or SO_2

(iii) Cationic detergents – They are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

e.g. Cetyltrimethylammonium bromide

21:

(i) Out of $(CH_3)_3 C-Br$ and $(CH_3)_3 C-I$, which one is more reactive towards $S_N 1$ and why? (ii) Write the product formed when p-nitrochlorobenzene is heated with aqueous **NaOH** at 443K followed by acidification?

(iii) Why dextro and laevo -rotatory isomers of Butan -2-ol are difficult to separate by fractional distillation?

Sol:-

(i) In $S_N 1$ reactions, reactivity depends on the stability of carbocation after removing the leaving group form the reactant. Since the carbocation is same here, so, we will see the tendency of leaving group. As we can see in the following reactions Br and r are the leaving groups, out of them r is a better leaving group. Hence SN1 reaction will be faster in $(CH_3)_3 C-I$

$$(CH_3)_3$$
 –Br



(iii) Dextro and laevo rotatory isomers of Butan-2-ol are enantiomers of each other and both have same boiling point and hence they cannot be separated by fractional distillation.

 $\label{eq:22: An aromatic compound 'A' on heating with Br_2 and KOH forms a compound 'B' of molecular formula C_6H_7N which on reacting with $CHCl_3$ and alcoholic KOH produces a foul smelling compound 'C'. Write the structures and IUPAC names of compounds A,B and C.}$

Sol:-

Sol:-



23: complete the following reactions:



OR

Write chemical equations for the following reactions :

(i) Propanone is treated with dilute $Ba(OH)_2$. (ii) Acetophenone is treated with $\frac{Zn(Hg)}{Conc.HCl}$. (iii) Benzoyl chloride is hydrogenated in presence of $\frac{Pd}{BaSO}$

Reaction of benzaldehyde with $\ensuremath{\operatorname{NaCN/HCL}}$ gives cyanohydrins.



(II)Treatment of acyl chlorides with dialkycadium gives a ketone.

$$(C_{6}H_{5}CH_{2})_{2}Cd+2CH_{3}COCl \rightarrow 2C_{6}H_{5}CH_{2}-C-CH+CdCl_{2}$$

(iii)Carboxylic acid having a-hydrogen are halogenated at a-position on treatment with Br_2 in presence of red phosphorous to give a -halocarboxylic acids. This is HeII-Volhard-Zelinsky reaction.



OR

This is a self-aldol condensation reaction.



(ii) The reaction of aldehydes and ketones with zinc amalgam (Zn/Hg) in concentrated HCl, reduces the aldehyde or ketone to a hydrocarbon, and is called Clemmensen reduction.



(iii) Benzoyl chloride is hydrogenated over catalyst $Pd-BaSO_4$ to give benzaldehyde. This reaction is called Rosenmund Reaction.



24: Differentiate between the following

(i) Amylose and Amylopectin

(ii) Peptide linkage and Glycosidic linkage

(iii) Fibrous proteins and Globular proteins

OR

Write chemical reactions to show that open structure of D-glucose contains the following :

(i) Straight chain

(ii) Five alcohol groups

(iii) Aldehyde as carbonyl group

Sol:-

	Amylose	Amylopectin
(a)	Only $C_1 - C_4$ glycosidic linkage	$\rm C_1-\rm C_4$ glycosidic linkage but,
		branching occurs by $\rm C_1-C_6$
		glycosidic linkage
(b)	Water soluble component of	Water insoluble component
	starch (15-20%)	of starch (80-85%)
4.13		

(ii)

(i)

(··/		
Peptide linkage	Glycosidic linkage	
It is -CONH- linkage which exists in proteins	It is –O–linkage. In disaccharide two	
formed by condensation of amino acids.	monosaccharide units are joined through	
	oxygen atom i.e. glycosidic linkage.	

(iii)

	Fibrous proteins	Globular protein
(a)	Polypeptide chains run parallel to give fibre-like structure	Polypeptide chains coil around to give spherical shape
(b)	Generally insoluble in water such as keratin, myosin	Usually soluble in water such as insulin, albumins

(i)On prolonged heating with HI, glucose forms n-hexane, suggesting that all the six carbon atoms are linked in a straight chain.

(ii)Acetylation of glucose with acetic anhydride gives glucose pentaacetate which confirms the presence of five -OH groups. Since it exists as a stable compound, five -OH groups should be attached to different carbon atoms.



(iii)Glucose gets oxidised to six carbon carboxylic acid (gluconic acid) on reaction with a mild oxidising agent like bromine water. This indicates that the carbonyl group is present as an aldehydic group

CHO
$$CHO$$
 $COOH$
 $| CHOH)_4 \xrightarrow{Br_2/H_2O} (CHOH)_4$
 $| CH_2OH CH_2OH$
Glucose Gluconic acid

25:

 $Mg_{(s)} + Cu^{2+}_{(0.01 M)} \rightarrow Mg^{2+}_{(0.001 M)} + Cu_{(s)}$

 E° cell for the given redox reaction is 2.71 V

Calculate E_{cell} for the reaction. Write the direction of flow of current when an external opposite potential applied is (i) less than 2.71 V and (ii) greater than 2.71 V

OR

(a) A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes FeSQ and $ZnSQ_4$ until 2.8g of Fe deposited at the cathode of cell X. How long did the current flow? Calculate the mass of Zn deposited at the cathode of cell Y.

(Molar mass :Fe=56g mol⁻¹,Zn=65.3g mol⁻¹,1 F=96500C mol⁻¹)

(b) In the plot of molar conductivity (Λ_m) vs square root of concentration $(c^{1/2})$ following curves are obtained for two electrolytes A and B :



Sol:-

$$Mg(s)+Cu^{2+}(aq) \to Mg^{2+}(aq)+Cu(s)$$
$$Q=\frac{[Mg^{2+}][Cu]}{[Mg][Cu^{2}]}=\frac{(0.001)(1)}{(1)(0.01)}=0.1$$

Using Nernst equation,

$$E_{cell} = E_{cell}^{o} - \frac{0.0591}{n} \log Q$$
$$E_{cell} = 2.71 - \frac{0.0591}{2} \log 0.1$$
$$E_{cell} = 2.74 V$$

(i) Since the voltage applied externally is less than $\,E_{_{cell}}\,$ then the direction of flow of current is from cathode to anode

(ii) When the external voltage applied exceeds $E_{\mbox{\tiny cell}}$, the direction of flow of current is from anode to cathode.

If voltage is applied is greater than $2.74\,\mathrm{V}$, the direction of current is from anode to cathode.

OR

)

I=2 A $W_1 = 2.8 \text{ g}$ $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ 96500×2 C of charge is required to deposit=56 g of Fe 9650 C of charge is required to deposit=2.8 g of Fe

(a)

:: Q=1t or t=
$$\frac{9650}{2}$$
=4825s

Using Faraday's second law of electrolysis,

 $\frac{W_1(\text{Weight of Fe deposited})}{W_2(\text{Weight of Zn deposited})} = \frac{E_1(\text{Equivalent weight of Fe})}{E_2(\text{Equivalent weight of Fe})}$

 $\frac{2.8}{W_2} = \frac{56/2}{65.3/2} = \frac{56}{65.3}$ Or W₂=3.265 g

(b) Electrolyte A is strong electrolyte & Electrolyte B is weak electrolyte On extrapolation of Λ_m to concentration approaching zero for strong electrolytes, we get the value of Λ_m° i.e. molar conductance at infinite dilution In the case of weak electrolytes, Λ_m increases steeply on dilution. Therefore, Λ_m° cannot be obtained by extrapolation.

26:

(a) How do you convert the following :

(i) Phenol to Anisole

(ii) Ethanol to Propan -2-ol

(b) Write mechanism of the following reaction :

 $\text{C}_{2}\text{H}_{5}\text{OH}\xrightarrow{\text{H}_{2}\text{SO}_{4}}_{443\text{K}} \rightarrow \text{CH}_{2}\text{=}\text{CH}_{2}\text{+}\text{H}_{2}\text{O}$

(c) Why phenol undergoes electrophilic substitution more easily than benzene?

OR

(a) Account for the following :

(i) o-nitrophenol is more steam volatile than p -nitrophenol.

(ii) t- butyl chloride on heating with sodium methoxide gives 2-methylpropeneinstead of tbutylmethylether.

(b) Write the reaction involved in the following :

(i) Reimer-Tiemann reaction

(ii) Friedal-Crafts Alkylation of Phenol

(c) Give simple chemical test to distinguish between Ethanol and Phenol

Sol:-

(a) (i) Phenol to anisole



(b) Mechanism : Dehydration of ethanol





Step 2: Formation of carbocation (slow step)



Step 3: Formation of ethene



(c) –OH group of phenol is activating group which increases the electron density at ortho/para position within the benzene ring so that electrophile can easily attack at ortho/para position in phenol than in benzene.

OR

(a) (i) o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding while pnitrophenol is less volatile due to intermolecular hydrogen bonding



27:

- (a) Give reasons for the following :
- (i) Sulphur in vapour state shows paramagnetic behaviour.
- ii) N-N bond is weaker than P-Pbond.
- (iii) Ozone is thermodynamically less stable than oxygen.
- (b) Write the name of gas released when Cu is added to

(i) dilute HNO_3 and (ii) conc. HNO_3

OR

(a)

(i) Write the disproportionation reaction of H_3PO_3 .

(ii) Draw the structure of XeF_4 .

(b) Account for the following :

(i) Although Fluorine has less negative electron gain enthalpy yet F_2 is strong oxidizing agent.

(ii) Acidic character decreases from N_2O_3 to Bi_2O_3 in group 15.

Sol:-

(a) (i) Sulphur in vapor state exists as S_2 which has two unpaired electrons in the pi-

antibonding molecular orbital and is paramagnetic

(ii) Due to small size of N, there is strong interelectronic repulsion of the non-bonding electrons and as a result the N-N single bond is weaker than P-P single bond. (iii) Decomposition of ozone into oxygen results in the liberation of heat ($\Delta H < 0$) and an increase in entropy ($\Delta S>0$) resulting in a large negative Gibb's energy change. Hence, ozone is thermodynamically less stable than oxygen.

(b) (i) With dil. HNO₃ \rightarrow Nitrogen monoxide (NO)

$$3Cu+8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$$

(dil.)

(ii) With Conc. HNO₃ \rightarrow Nitrogen dioxide (NO₂)

 $Cu+4HNO_3 \rightarrow Cu(NO_3)_2+2NO_2+2H_2O$

(conc.)

OR

(a) (i) $4H_3PO_3 \rightarrow 3H_3PO_4 + PH_3$



(b) (i) Due to small size, fluorine has less negative electron gain enthalpy. The oxidizing power is dependent upon hydration energy, bond dissociation energy as well as electron gain enthalpy. Due to small size, fluorine has very high hydration energy, therefore F_2 acts as strong oxidising agent.

(ii) As electronegativity of atom decreases, acidic strength of oxide decreases, hence acidic character decreases from N_2O_3 to Bi_2O_3

(c) $5SO_2 + 2MnO_4^- + 2H_2O \rightarrow 5SO_4^{2-} + 4H^+ + 2Mn^{2+}$