PART- II

Answer any six questions and Question no - 24 is compulsory

16. The higher the nuclear charge of protons in the nucleus, the higher is the ionization energy. Because of the higher nuclear charge, the electrons are bound with more force and hence higher energy will be required for their removal.

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17. **Oxidation states**

These elements shows the oxidation states of +2, +3, +4, +5 and +6. Out of these, +4 oxidation state is most common state.

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18. **Mechanism of photosynthesis**

$$6C\dot{O}_2 + 6H_2O \rightarrow C_6H_{12}\dot{O}_6 + 6O_2$$

O_2 produced comes from water and not from carbondioxide.

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19. **Vitreous state**

Glassy or vitreous state is a condition in which certain substance can exist, lying between the solid and liquid states.

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20. **Reduction** of Glucose $\xrightarrow{HI/P}$ $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$ (n - hexane)

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21. O/W emulsions - proteins, gums, natural and synthetic soaps,

W/O emulsions - heavy metal salts of fatty acids, long chain alcohols, lampblack,

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22. **'glycerose'** -a mixture of glyceraldehyde and **dihydroxy acetone.**

Mild oxidation of Glycerol $\xrightarrow{Br_2/H_2O}$ glyceraldehyde + dihydroxy acetone.

Fenton's reagent [$FeSO_4 + H_2O_2$]
or sodium hypobromite

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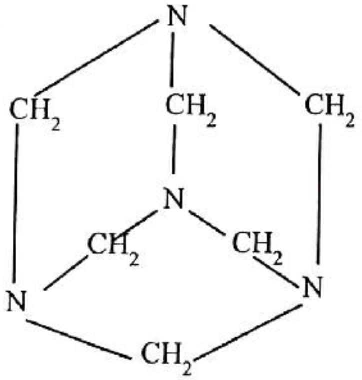
23. **'Urotropine'**

This is used as Urinary antiseptic in medicine, in the name of 'Urotropine'.



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24. Potential energy diagram II is correct.

Reason : Presence of any catalyst and Lower E_a - value , so reaction will go faster

PART- III

Answer any six questions and Question no - 33 is compulsory

25. Electronegativity of fluorine= $\frac{(IP)_F + (EA)_F}{2\times 2.8} = \frac{17.4+3.62}{5.6} = 3.75$

26.

Lanthanides		Actinides	
i)	Binding energies of 4f electrons are higher.	i)	Binding energies of 5f electrons are lower.
ii)	Maximum oxidation satate exhibited by lanthanides is +4 e.g. Ce^{4+}	ii)	Due to lower binding energies they show higher oxidation states such as +4. +5 and −6. Uranium exhibits −6 oxidation state in UF_6 and UO_2Cl_2
iii)	4f electrons have greater shielding effect.	iii)	5f electrons have poor shielding effect.

27. Number of α - particle emitted = 6
Number of b - particles emitted = 4

28. **Reaction Quotient (Q)**
'Q' is defined as the ratio of product of initial concentrations of products to the product of initial concentrations of reactants under nonequilibrium conditions.

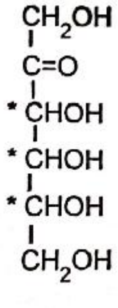
29. **Characteristics of dyes**
(i) It should have a suitable colour.
(ii) It should be able to fix itself or be capable of being fixed to the fabric.
(iii) It should be fast to light.

30. **Standard emf**
Defined as the emf of a cell with 1 M solutions of reactants and products in solution measured at 25° C. Standard emf of a cell is represented by the symbol E°. For gases 1 atm. pressure is a standard condition instead of concentration.

31. **racemic mixture**
When equal amounts of d-isomer and l-isomer are mixed one gets a "racemic mixture" and this process is called racemisation. A racemic mixture becomes optically inactive.

32. **Structure of fructose** (1, 3, 4, 5, 6, pentahydroxy-2-hexanone)

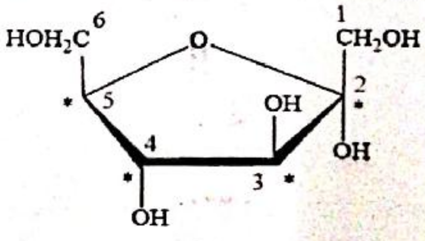
i)



$$CH_2OH-C{=}O-\overset{*}{C}HOH-\overset{*}{C}HOH-\overset{*}{C}HOH-CH_2OH$$

ii) 3 Chiral carbon in open structure of fructose iii) $2^3 = 8$

ii) 4 Chiral carbon in cyclic structure of fructose iii) $2^4 = 16$



α-D-Fructose

33. $$\log\frac{k_1}{k_2} = \frac{Ea}{2.303R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$$

$$\log\frac{k_1}{k_2} = \frac{100000J / mol}{2\ 303\times\ 8\ 314JK^{-1}J / mol}\left[\frac{1}{308} - \frac{1}{298}\right] = -0.5745$$

$$\log\frac{k_1}{k_2} = anti\log(-0.5745) = 0.2664$$

$$k_2 = \frac{1}{0.2664} = 3.75$$

k_1 = 3.75 times k_1.

k_2, the rate constant at 35°C will be 3.75 times the rate constant at 25°C.

PART- IV

Answer all the questions. **5 x 5 = 25**

34. a) i) Hybridisation

A) CO_2 - sp
B) NO_2^- - sp^2
C) ClO^- - sp^3
D) XeF_2 - sp^3d

ii) "it is impossible to measure simultaneously both the position and velocity (or momentum) of a microscopic particle with absolute accuracy or certainty."

OR

b) i) One of the familiar characteristic of p-block elements is to show inert pair effect i.e. the tendency of being less availability for ns electron in bonding.The inert pair effect increases down the group with the increase in atomic number.

ii) **Uses of Silicones**

1) Silicones act as excellent insulators for electric motors and other appliances as they can withstand high temperatures.

2) Straight chain polymers of 20 to 500 units are used as silicone fluids. They are water repellent because of the organic side group. These polymers are used in waterproofing textiles, as lubricants and as polish.

3) Silicone rubber retain their elasticity even at low temperatures and resist chemical attack. They are mixed with paints to make them damp-resistant.

4) Silicone resins, a cross-linked polymer used as non-stick coating for pans and are used in paints and varnish.

5) Silicone oils are highly stable and non-volatile even on heating. Hence used for high temperature oil bath, high vacuum pump etc.

35. a) i) $[Ti(H_2O)_6]^{3+}$ is coloured (d- d transition) beause of Ti^{3+} ion has presence of un paired electron ($3d^1$)

$[Sc(H_2O)_6]^{3+}$ is colourless beause of Sc^{3+} ions are also colourless because of the absence of d-electrons.

Chrome plating

ii) Anode(+) : Lead

Cathode (-) : Nickel coated article Electrolyte : Chromic acid and sulphuric acid

OR

b) Postulates of Werner's theory

1) Every metal atom has two types of valencies

i) Primary valency or ionisable valency

ii) Secondary valency or non ionisable valency

2) The primary valency corresponds to the oxidation state of the metal ion. The primary valency of the metal ion is always satisfied by negative ions.

3) Secondary valency corresponds to the coordination number of the metal ion or atom. The second ary valencies may be satisfied by either negative ions or neutral molecules.

4) The molecules or ion that satisfy secondary valencies are called ligands.

5) The ligands which satisfy secondary valencies must project in definite directions in space. So the secondary valencies are directional in nature whereas the primary valencies are non-directional in nature.

6) The ligands have unshared pair of electrons. These unshared pair of electrons are donated to central metal ion or atom in a compound. Such compounds are called coordination compounds.

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36. a) i)**Molecular Crystals**

The lattice points in molecular crystals consist of molecules which do not carry any charge. The forces binding the molecules together are of two types

(i) Dipole-dipole interaction and

(ii) Vanderwaal's forces.

Dipole-dipole forces occur in solids which consists of polar molecules e.g., ice. The Vanderwaal's forces are more general and occur in all kinds of molecular solids.

ii) Characteristics of ionic crystal

1. The heats of vapourisation of ionic crystals are high.
2. The vapour pressure of ionic crystals at ordinary temperature are very low.
3. The melting and boiling points of ionic crystals are very high.
4. Ionic crystals are hard and brittle.
5. Ionic crystals are insulators in the solid state.
6. Ionic crystals are soluble in water and also in other polar solvents.
7. Ionic solids are good conductors when dissolved in water.

b) Relationship between Kp and Kc

Consider a general chemical equilibrium reaction in which the reactants and products are in gaseous phases,

$aA + bB + cC + \dots\dots \rightleftharpoons lL + mM + nN + \dots\dots$

$$K_p = \frac{p_L{}^l \cdot p_M{}^m \cdot p_N{}^n \cdots}{p_A{}^a \cdot p_B{}^b \cdot p_C{}^c \cdots\cdots}$$ where **'p'** is the partial pressure of the respective gases.

$$K_C = \frac{[L]^l[M]^m[N]^n}{[A]^a[B]^b[C]^c}$$

For any gaseous component 'i' in a mixture, its partial pressure 'pi' is related to its molar concentration 'Ci' as

$$\begin{array}{c|c} p_i = n_i RT & p_i = \dfrac{n_i}{V}RT \\ C_i = \dfrac{n_i}{V} & p_i = C_i RT \\ C_i = \dfrac{p_i}{RT} & \end{array}$$

$$K_c = \frac{\left(\frac{p_L}{RT}\right)^l \left(\frac{p_M}{RT}\right)^m \left(\frac{p_N}{RT}\right)^n \ldots}{\left(\frac{p_A}{RT}\right)^a \left(\frac{p_B}{RT}\right)^b \left(\frac{p_C}{RT}\right)^c \ldots} \qquad K_C = \frac{p_L^{\,l} \cdot p_M^{\,m} \cdot p_N^{\,n} \cdots}{p_A^{\,a} \cdot p_B^{\,b} \cdot p_C^{\,c} \cdots} \left(\frac{1}{RT}\right)^{(l+m+n)-(a+b+c)}$$

Δn= (n_p) total number of products - (n_r) total number of reactants

$$\Delta n_g = n_p - n_r$$

$$K_c = K_p \times \left(\frac{1}{RT}\right)^{\Delta n_g}$$

$$\boxed{K_p = K_c \times (RT)^{\Delta n_g}}$$

37.a) i)	**DM in DP**	**Name**
A) Paint	- Solid in Liquid	Sol
B) Froths of air	- Gas in Liquid	Foam

ii) **Catalytic Poisons**

A substance which destroys the activity of the catalyst is called a poison and the process is called catalytic poisoning. Some of the examples are

(i) The platinum catalyst used in the oxidation of SO_2 in contact process is poisoned by arsenious oxide.

$$SO_2 + O_2 \overset{Pt/As_2O_3}{\rightleftharpoons} 2SO_3$$

OR

b) i) A buffer solution is one which maintains its pH fairly constant even upon the addition of small amounts of acid or base.

In other words, a buffer solution resists (or buffers) a change in its pH.

That is, we can add a small amount of an acid or base to a buffer solution and the pH will change very little. Two common types of buffer solutions are :

1. Acid buffers. (e.g.,) $CH_3COOH + CH_3COONa$.
2. Basic buffers. (e.g.,) $NH_4OH + NH_4Cl$.

ii) Ka of propionic acid = 1.34×10^{-5}

$$pH = pK_a + \log\frac{[\text{salt}]}{[\text{Acid}]} \qquad pH = 4.87 + \log\frac{0.5}{0.5} \qquad pH = 4.87$$

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38. a) i)

$$(CH_3)_3\,COH \xrightarrow[\text{anhyd. ZnCl}_2]{\text{con.HCl}} (CH_3)_3\,C{-}Cl + H_2O$$

3° alcohol (Turbidity appears immediately)
at room temperature

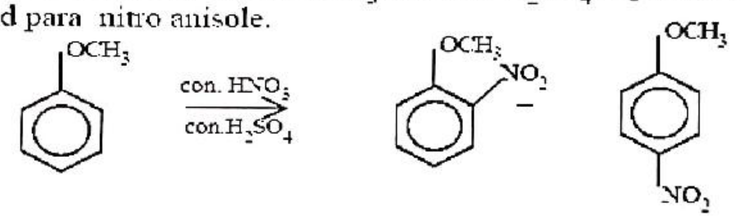
$$(CH_3)_2\,CHOH \xrightarrow[\text{anhyd. ZnCl}_2]{\text{con.HCl}} (CH_3)_2CHCl - H_2O$$

2° alcohol (Turbidity appears after 5-10 minutes)
at room temperature

$$CH_3CH_2OH \xrightarrow[\text{anhydrous ZnCl}_2]{\text{Conc. HCl}} CH_3CH_2Cl + H_2O$$

1° alcohol (No turbidity appears easily)
but only on heating

Similar to –OH group. –OMe. group increase the reactivity of the **benzene ring** with respect to electrophilic attack and is **ortho, para - directing.** With a mixture of con.HNO_3 and con. H_2SO_4 it gives a mixture of ortho and para nitro anisole.



b) i) **Reducing property of formic acid**

Formic acid is unique because it contains both an aldehyde group and carboxyl group also. Hence it **can act as a reducing** agent. It reduces Fehling's solution, Tollens reagent and decolourises pink coloured KMnO4 solution.

(a) Formic acid reduces ammoniacal silver nitrate solution (Tollen's reagent) to metallic silver.

b) Formic acid reduces Fehling's solution. It reduces blue coloured cupric ions to red coloured cuprous ions.

ii) **Carbylamine reaction**

$$C_6H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_6H_5NC + 3KCl + 3H_2O$$

(phenyl isocyanide)

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