

PART - II

1. Define an Heisenberg's uncertainty principle.

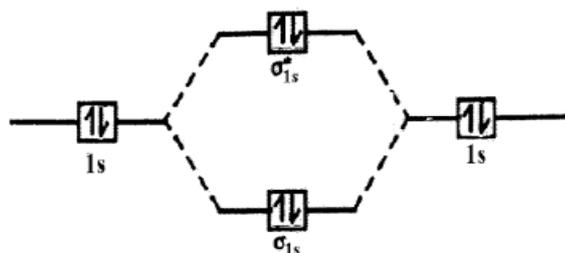
It is impossible to measure simultaneously both the position and velocity of a microscopic particle with absolute accuracy (or) certainty.

$$\Delta x \Delta p \geq \frac{h}{4\pi}$$

Δx - uncertainty in the position of the particle,

Δp - uncertainty in the momentum of the particle.

2. Why He₂ is not formed?



$$\text{Bond order} = \frac{1}{2} (N_b - N_a) = \frac{2-2}{2} = 0$$

3. Distinguish between particle and wave

Particle	Wave
1. A particle is localized in space	A wave is delocalized in space
2. Particle do not interfere	wave can interfere
3. Total number of particle in a space is equal to their sum.	The resultant wave can be larger or smaller than the individual wave.

4. Write about hybridisation.

Intermixing of orbital an atom having nearly the same energy to given exactly equivalent orbital's with same energy identical shape and symmetrical orientation in space

5. Define bond order.

Half the difference between the number of electron in bond molecular orbitals and the number of electron in antibond molecular orbitals.

$$\text{bond order} = \frac{1}{2} (N_b - N_a)$$

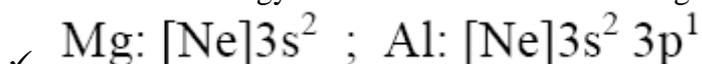
6. What is the signification of negative electron energy?

- ✓ The energy of an electron at infinity is arbitrarily assumed to zero
- ✓ The influence of nucleus it does some work and spends its energy in this process
- ✓ The energy of the electron decreases and it become less than zero.

7. Why electron affinity of fluorine is less than that of chlorine?

- ✓ Small size of fluorine atom.
- ✓ These occurs repulsion among electrons of the valency shell and also with electrons to be added.

8. Why the first ionization energy of Al is lower than that of Mg?



- ✓ One has to remove 3p electron in case of aluminium and 3S electron in the case of magnesium.

9. Disadvantage of Pauling and Mullikan's scale disadvantage of paulling of Paulling scale .

- ✓ It is that bond energies are not know with any degree of accuracy for many solid elements.

Mulliken's scale:

- ✓ It is that electron affinities with the exception of a few elements are not reliably know.

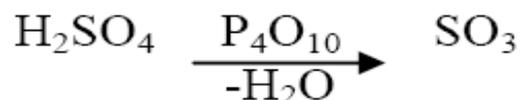
10. Why electron affinity of Be and N are zero?

- ✓ Be- $1s^2 2s^2$ fully filled orbital
- ✓ N- $1s^2 2s^2 2p^3$ half orbital
- ✓ They have two attain stable electronic configuration and do not have the tendency to accept electron.

11. Why ionization energy neon is higher than fluorine?

- ✓ Neon ($Z = 10$) has higher nuclear charge than fluorine ($Z = 9$).
- ✓ Neon attains the stable configuration. So the removal of electron from the outer shell is very difficult

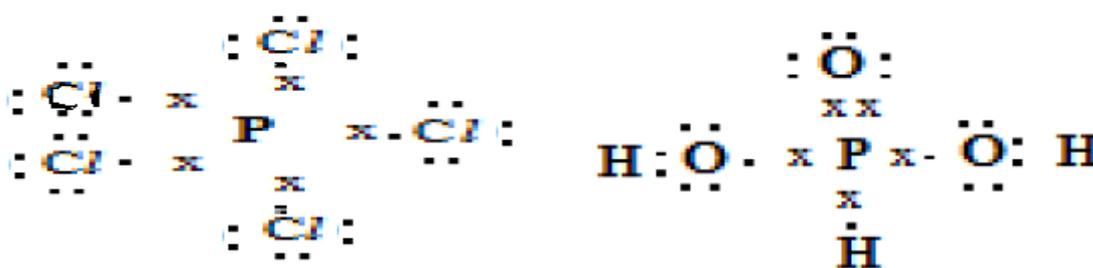
12. Prove that P_2O_5 is a powerful dehydrating agent.



13. What is inert pair effect?

- The electron in the ns orbital becomes inert and they are less available for bonding.

14. Draw the electron dot formula of PCl_5 and H_3PO_3



15. What is plumbo solvency?

Lead reacts with water containing dissolved air has a solvent action on lead due to the formation of lead hydroxide a poisonous compound. this Phenomenon is called plumbo solvency

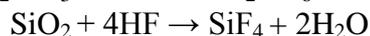
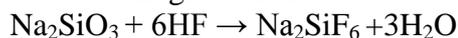


16. Mention the uses of neon?

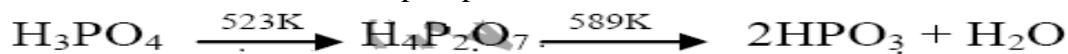
- ✓ It is used in discharge tubes and fluorescent bulbs
- ✓ It is used to protect electrical instrument from high voltage
- ✓ It is used in beacon lights for safety of air navigation as the light possesses fog.

17. Why HF do not stored in glass bottle?

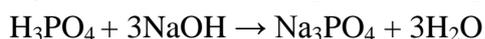
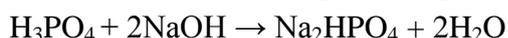
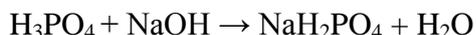
- It cannot be stored in glass or silica bottles as it attacks silicates or silica



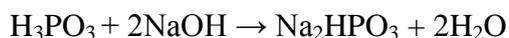
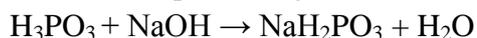
18. What is the action of heat on orthophosphoric acid?



19. H_3PO_4 is Tribasic acid Prove?



20. H_3PO_3 is Diprotic Why?



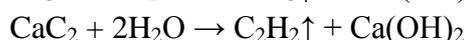
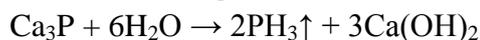
21. Discuss the oxidizing power of fluorine.

- Fluorine is the strong oxidizing agent
- It oxidises other halide ions into halogens.
- $F_2 + 2X^- \rightarrow 2F^- + X_2$ ($X^- = Cl^-, Br^-, I^-$)

22. How is potash alum prepared?

- Alunite or alum stone $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 4Al(OH)_3$
- It is finely powdered and boiled with dil H_2SO_4 .
- The forming of ammonium sulphate is combined with potassium sulphate, the alum is crystallized.

23. Write about the Holme's signal.



24. Why do d-block elements form complexes?

- Small size and high positive charge density.
- Presence of vacant (n-1)d orbital which are of appropriate energy to accept lone pair of electron from the ligands for bonding with them.

25. Explain Why d-block elements exhibit variable oxidation states?

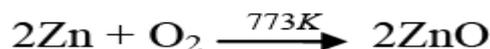
- Several (n-1)d and ns electrons.
- The energies of (n-1)d and ns orbitals are fairly close to each other.

26. Why are transition metal compounds colored?

- The presence of unpaired electrons
- The energy gap between two energy levels in the same subshell being small.
- One energy level to another can be provided by the visible light.

27. What is Philosopher's wool? How is it formed?

When Zinc is heated in air at 773K, it burns to form a white cloud of Zinc oxide which settles to form a woolly flock.



28. What is chrome plating?

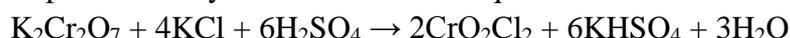
- Cathode : The articles to be plated
- Anode : A plate of lead
- Electrolyte : chromic acid + sulphuric acid
- First plated with: Nickel

29. What is spitting of silver? How is it prevented?

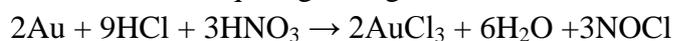
Molten silver absorbs 20 times its volume of oxygen which it again expels on cooling. Globules of molten silver are thrown off. This is called spitting of silver.

Prevention : By covering the molten with a layer of charcoal.

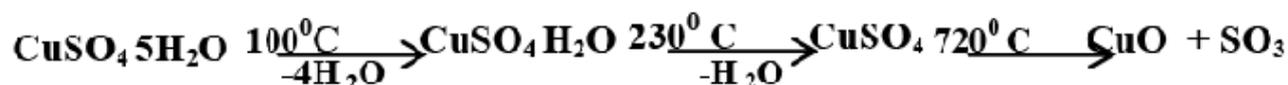
30. Explain Chromyl chloride test with equation.



31. Write the action of aqua regia on gold.

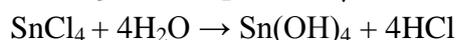
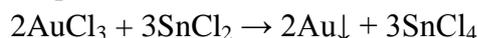


32. What is the action of heat on copper sulphate crystals?



33. What is Purple of Cassius? How is it prepared?

Purple of Cassius is colloidal Au + $Sn(OH)_4$

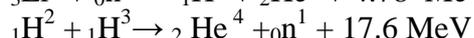
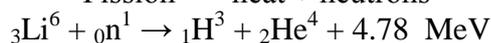


34. State uses of radio carbon dating?

- ✓ It is a great tool for correlating facts of historical importance.
- ✓ It is very useful in understanding the evolution of life and fall of civilizations.

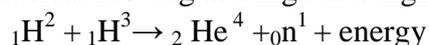
35. Explain the principle of hydrogen bonding

Fission \rightarrow heat + neutrons



36. What is nuclear fission reaction?

When lighter nuclear moving at a high at a high speed are fused to gether to form a heavy nucleus.



37. What is 'Q' value of a nuclear reaction?

The amount of energy absorbed or released during the nuclear reaction.

$$Q = (m_p - m_r) 931 \text{MeV}$$

m_p - sum of the masses of products, m_r - sum of the masses of reactants.

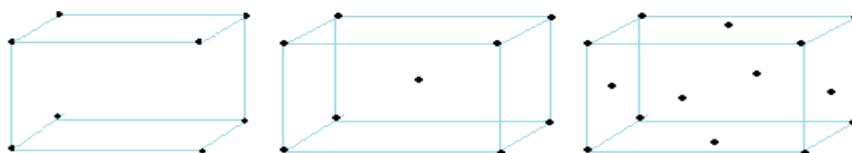
38. What are super-conductors?

- ✓ Superconductors are ultra cold substance that conduct electricity without resistance.
- ✓ These materials have virtually zero electrical resistance.

39. Write a note on molecular crystal?

- ✓ The lattice points in molecular crystal consists of Molecules which do not carry any charge.
- ✓ Dipole-dipole interaction eg. Ice
- ✓ Vander Waals forces eg. All kinds of molecular Solids.

40. Sketch the s.c, b.c.c and f.c.c structures



41. Define Bragg's equation?

$$n\lambda = 2d \sin\theta$$

n = order of reflection, λ = wave length of x-rays

d = interplaner distance in the crystal, θ = angle of reflection.

42. What is a vitreous state?

Glassy state or vitreous state is a condition in which certain substances can exist lying between solid and liquid state.

43. When does entropy increases in a process?

❖ In a chemical reaction, when a number of molecules of products are more than the number molecules of reactant entropy increases.

❖ In physical process, when a solid changes to liquid when a liquid to vapour when a solid changes to vapour entropy increases.

44. What is Gibb 's' free energy?

$$G = H - TS$$

H-enthalpy, T-temperature, S-entropy.

45. State trouton's' rule.

The heat of vaporisation is divided by the boiling point of the liquid is a constant.

$$\Delta S_{\text{vap}} = \frac{\Delta H_{\text{vap}}}{T_b} = 21 \text{cal.deg}^{-1} \cdot \text{mole}^{-1}$$

46. Which substance that deviate from the trouton rule?

- ❖ Hydrogen and helium are low boiling liquids. Their boiling point is slightly greater than 0K.
- ❖ Water and alcohol have intermolecular hydrogen bonding.

So they have high boiling points and they possess high ΔH_{vap} value.

❖ Acetic acid whose molecules are partially associated in vapor phase and possess very low entropy vaporization which

is very much less than 21 cal/mol/deg.

47. State Lechatelier's principle.

If a system at equilibrium is subjected to a disturbance or stress then the equilibrium shifts in the direction that tends to nullify the effect of the disturbance or stress.

48. What is reaction Quotient.

The ratio of the product of initial concentration of product to products of initial concentration of reactant under non-equilibrium conditions.

$$Q = \frac{[L]^l [M]^m}{[A]^a [B]^b}$$

49. Dissociation of PCl_5 Decreases in the presence of increase in Cl_2 Why?



- Increase of concentration of Cl_2 the equilibrium shift in the reverse direction i.e., more PCl_5 formed and dissociation of PCl_5 is decreased.

50. Write a note on parallel reactions.

The reactions in which one or more reactants react simultaneously in two or more pathways to give two or more products are known as parallel reactions.



51. What is activation energy?

Activation Energy = Threshold Energy - Energy of colliding molecules.

52. Write the Arrhenius equation and explain the terms?

$$K = Ae^{-E_a/RT}$$

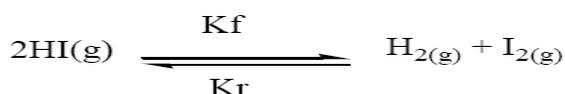
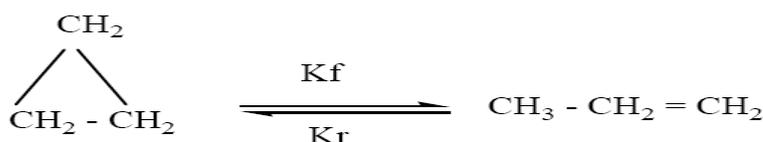
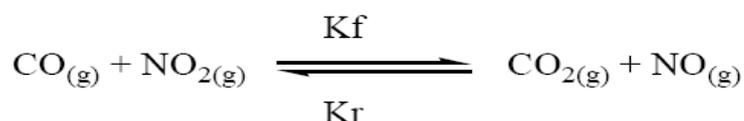
K- rate constant, E_a - activation energy,

A-frequency factor, R - gas constant, T-temperature in Kelvin.

53. Define Order of a reaction

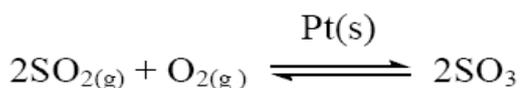
The sum of power of the concentration of reactants that involved in the rate equation .

54. Write three example of opposing reactions.



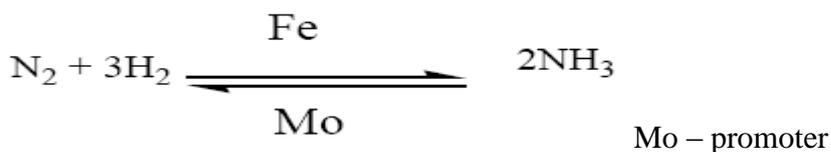
55. What is heterogeneous catalysis? Write the examples.

The catalytic process in which the reactant and catalyst are in the different phases.



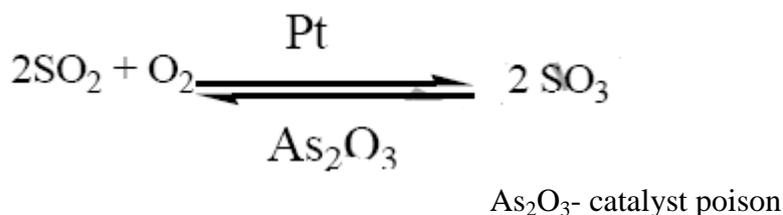
56. Write a note about promoters.

A substance which though itself not a catalyst it promotes the activity of a catalyst is called a promoter.



57. What are catalytic poison? Give an example

A substance which destroys the activity of the catalyst poison



58. What is electrophoresis.

The movement of sol particles under an applied electric potential.

59. What is active centre?

- The catalytic surface has unbalanced chemical bonds on it.
- These are crowded at the peaks, cracks and corner of the catalyst.
- The catalytic activity due to adsorption of reacting molecules is maximum at these spots.

60. Why is a colloidal system of gas in gas does not exist?

Gases are completely miscible and always form true solution.

61. What is brownian movement?

The continuous rapid zig-zag ,chaotic random and ceaseless movement executed by a colloidal particle in the dispersion medium is called

Reason: This is due to unbalanced bombardment of particle by molecules of dispersion medium.

62. State Kohlrausch's law

At infinite dilution where in the ionization of all electrolytes is complete each ion migrates independently and contributes a definite value to the total equivalent conductance of the electrolyte.

63. What are buffer solutions?

One which maintains its p^H fairly constant even upon the addition of small amount of acid or base.

e.g CH₃COOH + CH₃COONa

64. What is common ion effect?

The reduction of the degree of dissociation of a salt by the addition of a common ion.



NaCl is added to the AgCl solution. Here Cl⁻ ion is act as a common ion. So the dissociation of AgCl is decreased.

65. State Ostwald's dilution law

Ostwald's dilution law relates the dissociation constant of the weak electrolyte with the degree of dissociation and the concentration of the weak electrolyte.

$$K_a = \frac{C \alpha^2}{1 - \alpha}$$

66. Define Faraday first and second law of electrolysis?

FIRST LAW:-

The mass of the substance liberated at the electrodes during the electrolysis is directly proportional to the quantity of electricity that passes through the electrolyte.

SECOND LAW:

When the same quantity of electricity passes through solution of different electrolytes the amount of substances liberated at electrodes are directly proportional to chemical equivalent.

67. What are the condition for optical isomerism?

*The compounds should contain Asymmetric (or) chiral carbon atom.

*The compounds should have non-super imposable object and mirror image configuration.

68. Difference between Racemic form and Meso form.

Racemic form	Meso form
1. It is a mixture that can be separated into two optically active forms	It is a single compound and hence cannot be Separated
2. Optically inactive due to External compensation	optically inactive due to Internal compensation
3. Molecules are chiral	Molecules are achiral

69. Why meso tartaric acid is an optically inactive compound with chiral carbon atom?

*Two Asymmetric carbon atom the configuration of one carbon is the mirror image of the other is laevo rotatory.

*Symmetric plane divides the molecule into equal halves.

*super-imposable on its mirror image.

70. Define racemic mixture? Give an example.

✓ It is a mixture that contains equal amount of d-isomer and l-isomer.

✓ Optically inactive form due to external compensation.

e.g. Equal amount of d and l tartaric acid.

71. What are chromophores? Give two example.

An organic compounds appears colored due to the presence of certain unsaturated groups (the groups with multiple bonds) in it.

e.g. Nitro, Azo.

72. Why iodoform and phenolic solutions are called antiseptic?

✓ Iodoform, CHI_3 is used as an antiseptic and its 1% solution is a disinfectant.

✓ 0.2% solution of phenol acts as an antiseptic and its 1% solution is a disinfectant.

73. Give any three characteristics of dye?

✓ A dye should have a suitable colour.

✓ It should be able to fix itself or be capable of being fixed to the fabric.

✓ Resistant to the action of water, dilute acids and alkalis.

74. Write a note on anti oxidants.

The substance that act against oxidants are called antioxidants.

e.g. Vitamin - C, vitamin - E

75. What is antipyretics?

Lowering the body temperature to the normal

e.g. Aspirin, antipyrine.

76. What are Anaesthetics? Give two examples.

❖ The drugs which produce loss of sensation.

They are two type.

i) General anaesthetics

- ❖ They bring about loss of all modalities of sensation, particularly pain along with reversible loss of consciousness

ii. Local anaesthetics

- ❖ They prevent the pain sensation in localized areas without affecting the degree of consciousness

e.g Nitrous oxide, Diethyl ether, Chloroform.

PART - III

1. Derive de-Broglie's equation.

Planck's quantum theory

$$E = h\nu$$

ν - frequency of the wave, h - Planck's constant

Einstein equation

$$E = mc^2$$

m - mass of photon, c - velocity of light

$$h\nu = mc^2$$

$$h.c/\lambda = mc^2; \lambda = h/mc$$

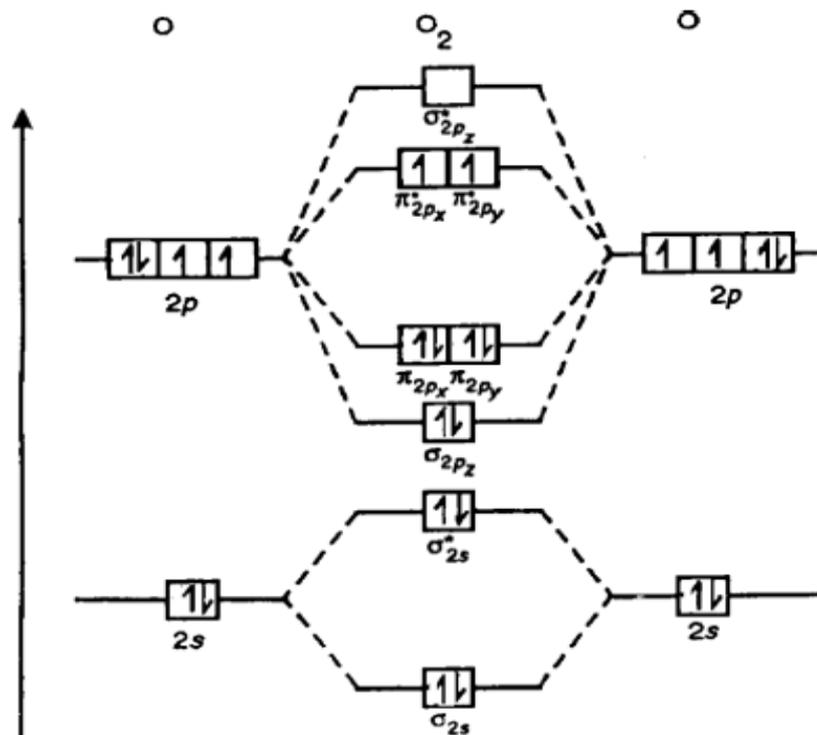
$$\lambda = h/mv \quad (\text{or}) \quad \lambda = h/p$$

$$\therefore v = c/\lambda$$

2. Explain the formation of O_2 molecule by molecular orbital theory.

Electronic configuration of O_2 ($Z=8$) $1s^2 2s^2 2p^4$

O_2 $(\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\sigma_{2pz})^2 (\pi_{2px})^2 (\pi_{2py})^2 (\pi^*_{2px})^1 (\pi^*_{2py})^1$

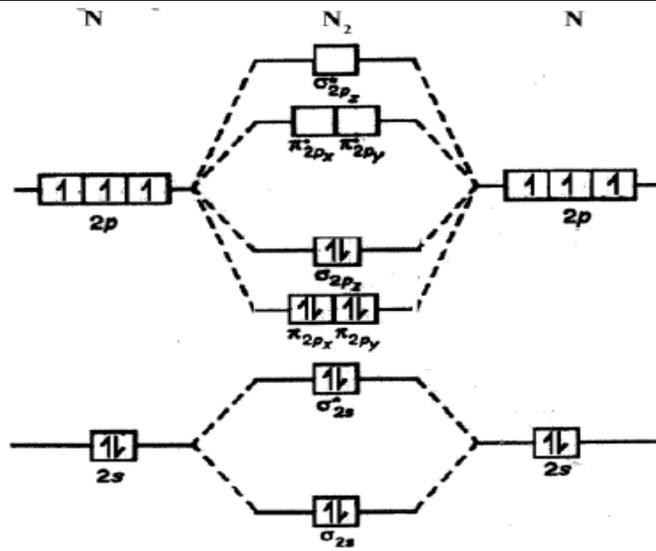


Bond order = $\frac{1}{2} (N_b - N_a) = 8 - 4/2 = 2$; Paramagnetic in nature.

3. Explain the formation of N_2 molecule by molecular orbital theory.

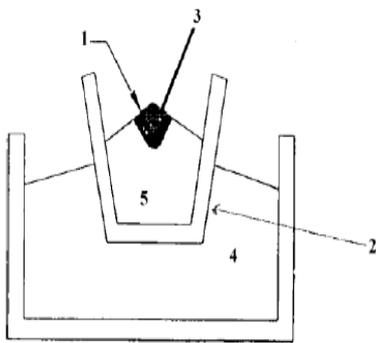
Electronic configuration of N_2 ($Z=7$) $1s^2 2s^2 2p^3$

N_2 $(\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\pi_{2px})^2 (\pi_{2py})^2 (\sigma_{2pz})^2$



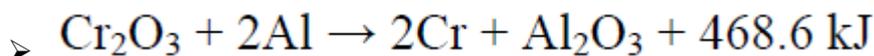
Bond order = $\frac{1}{2} (N_b - N_a) = \frac{8-2}{2} = 3$; Diamagnetic in nature.

4. Define aluminothermic process



1. BaO₂ + Mg powder, 2. Fireclay crucible,
3. Mg ribbon, 4. sand

- Cr₂O₃ + Al₂O₃ mixed in the ratio 3:1
- A mixture of BaO₂ + Mg powder is placed over this
- Ignited by a piece of Mg ribbon .
- During this process a large amount of heat is liberated which Cr₂O₃ is reduced to Cr.

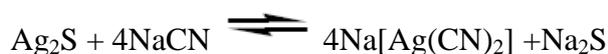


5. Briefly explain the extraction of zinc from zinc blende

- ✓ Ore : Zinc blende (ZnS)
- ✓ Concentration: By froth – floatation process
- ✓ Roasting : $2\text{ZnS} + 3\text{O}_2 \xrightarrow{1200\text{K}} 2\text{ZnO} + 2\text{SO}_2\uparrow$
- ✓ Reduction: $\text{ZnO} + \text{C} \xrightarrow{1673\text{K}} \text{Zn} + \text{CO}$
- ✓ Electrolytic refining
Anode – impure Zinc; Cathode – pure zinc
Electrolyte – ZnSO₄ solution + dil H₂SO₄.

6. How silver is extracted from ore?

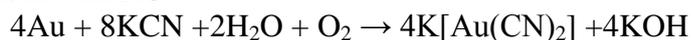
- ✓ Ore : Argentite (Ag₂S)
- ✓ Concentration: By froth floatation process.
- ✓ Treatment with NaCN



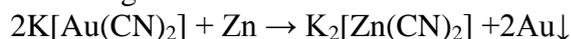
- ✓ Precipitation of gold
 $2\text{Na}[\text{Ag}(\text{CN})_2] + \text{Zn} \rightarrow \text{Na}_2[\text{Zn}(\text{CN})_4] + 2\text{Ag}\downarrow$
- ✓ Electrolytic refining
Anode - impure silver ; Cathode - pure silver
Electrolyte: 1% nitric acid + silver nitrite.

7. How gold is extracted from its ore?

- ✓ Ore-sulphide or telluride ore
- ✓ Concentration: By froth floatation process.
- ✓ Treatment with KCN



- ✓ Precipitation of gold



- ✓ Electrolytic refining

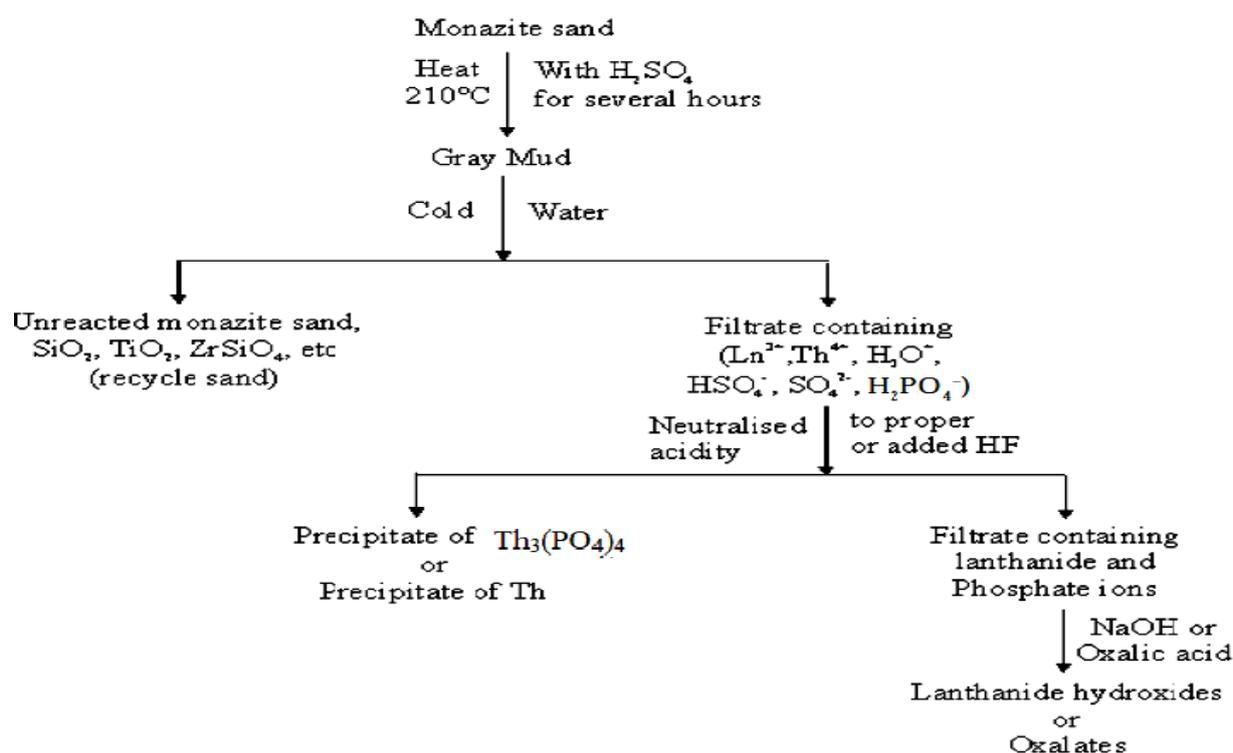
Anode: Impure Gold Cathode: pure gold

Electrolyte: 10-12%.HCl+AuCl₃

8. Compare and contrast the properties of lanthanides and actinides. Actinides

Lanthanides	Actinides
1. Binding energies of 4f are higher	Binding energies of 5f electron are lower
2. 4f electron have greater Shielding effect	5f electron have poor effect Shielding effect
3. Maximum oxidation state exhibited by lanthanide is +4	Maximum oxidation state exhibited by Actinides +6
4. They do not form oxocations	They form oxocations.
5. Except promethium they are non-radioactive	All of them are Radioactive.

9. Describe the extraction of lanthanides from monazite sand.

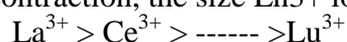


Anhydrous fluorides and Chlorides of lanthanides $\xrightarrow[\text{Ca/1270K}]{\text{Ar atmp here}}$ individual metals

Trifluorides of lanthanides $\xrightarrow[\Delta]{\text{Ca/Li}}$ pure metals

10. What is consequences of lanthanide contraction?

- ❖ Due to lanthanide contraction, the size Ln³⁺ ions decreases.



- ❖ There is regular decreased in their ionic radii.

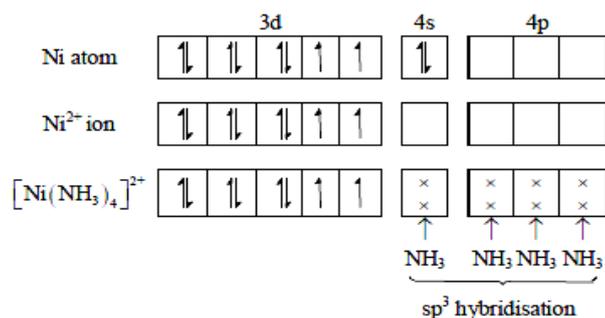
- ❖ Regular decrease in their tendency to act as reducing agent with increase in atomic number.
- ❖ Second and third rows of d-block elements are quite close their properties.
- ❖ The element occur together in natural minerals and are difficult to separate.

11. Write the uses of lanthanides and actinides.

- Ceria, Thoria – gas lamp materials
- Cerium salts – in dyeing cotton and lead storage batteries
- Lanthanido thermic process – yield pure Nb, Zr, Fe, Co, Ni, Y, W, B, Si.
- U^{235} – uses as fuel in nuclear power plant
- Pu^{238} – uses as a power source in long mission space probes.

12. Explain $[Ni(CN)_4]^{2-}$ Diamagnetic whereas $[Ni(NH_3)_4]^{2+}$ paramagnetic.

I. $[Ni(NH_3)_4]^{2+}$

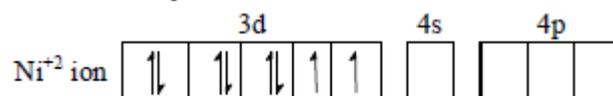


Number of unpaired electrons = 2

Magnetic character ⇒ Paramagnetic

Magnetic moment $\mu_s = \sqrt{n(n+2)} = \sqrt{2(2+2)} = 2.83 \text{ BM}$

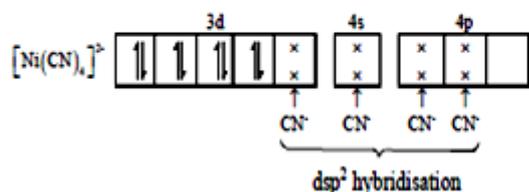
Geometry ⇒ tetrahedral



II. $[Ni(CN)_4]^{2-}$

The ligand CN⁻ is a powerful ligand. Hence it forces

unpaired electrons to pair up in 'd' orbitals.



Number of unpaired electrons ⇒ Zero

Magnetic property ⇒ diamagnetic

Geometry ⇒ square planar

13. For the complexes $K_4[Fe(CN)_6]$ mention

a) IUPAC name, b) central metal ion, c) ligand, d) co-ordination number, e) Geometry.

a) IUPAC name: potassium hexa cyano ferrate(II)

b) central metal ion: Fe²⁺ or Ferrous ion

c) Ligands: CN⁻

d) co-ordination number: 6

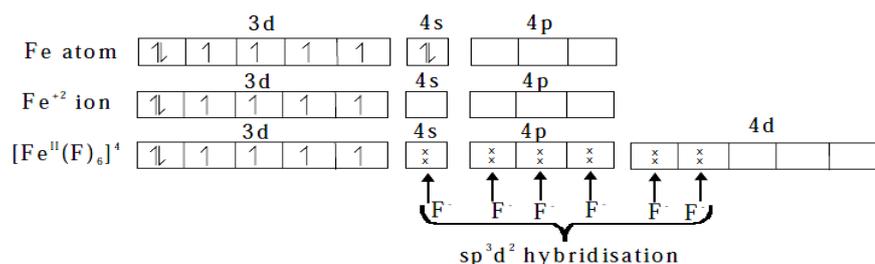
e) Geometry : Octahedral

14. Explain $[Fe(CN)_6]^{4-}$ Diamagnetic whereas $[Fe(F)_6]^{4-}$ paramagnetic.

1) Fe atom

Outer electronic configuration

3d⁶ 4s²



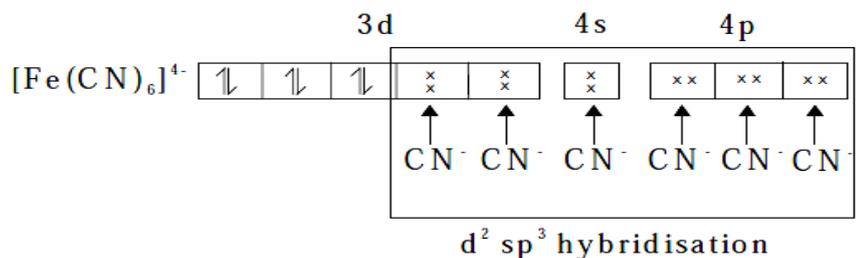
Number of unpaired electron = 4

∴ $\mu_s = \sqrt{4(4+2)} = \sqrt{24} = 4.90 \text{ BM}$

The molecule is paramagnetic. The geometry of the molecule is octahedral.

2) Fe^{+2} ionIn $[\text{Fe}(\text{CN})_6]^{4-}$ complex the CN^- ligand is a powerful ligand

The molecule is diamagnetic.



The molecular geometry is octahedral.

15. State the various statements of second law of thermodynamics?

- It is impossible to construct an engine which operated in a complete cycle will absorb heat from a single body and convert it completely to work without leaving some changes in the working system.
 - It is impossible to transfer heat from cold body to hot body by a machine without doing some work.
 - A process accompanied by increase in entropy tends to spontaneous.
 - Entropy is a measure of randomness (or) disorder of the molecule of a system.
 - Efficiency of a machine can never be cent percent.
 - The heat efficiency of any machine is given by the value of output to input energies
- $$\% \text{ efficiency} = \frac{\text{output}}{\text{input}} \times 100.$$

16. Explain characteristics of gibbs free energy?

- ✓ $G = H - TS$, G is a state function.
- ✓ G is an extensive property but ΔG is the intensive property
- ✓ G has a single value for the thermodynamic state of the system.
- ✓ $\Delta G < 0$ spontaneous and feasible, $\Delta G = 0$ equilibrium
- $\Delta G > 0$ non spontaneous and not feasible.
- ✓ $\Delta G = \Delta H + T\Delta S$ according to I law of thermodynamics

$$\Delta H = \Delta E + P\Delta V \quad \text{and} \quad \Delta E = q - w$$

$$\Delta G = q - w + P\Delta V - T\Delta S$$

$$\text{but } \Delta S = q/T \quad \text{and} \quad T\Delta S = q$$

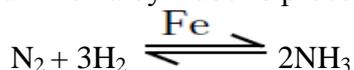
$$\Delta G = q - w + P\Delta V - q = -w + P\Delta V \quad (\text{or}) \quad \Delta G = w - P\Delta V = \text{network}$$

17. Write the characteristics of entropy?

- Entropy 'S' is state function.
- $\Delta S_{\text{rev}} = \Delta q_{\text{rev}} / T_{(k)}$
- Entropy is a measure of randomness of the molecule of a system. Entropy increases in all spontaneous process.
- For a spontaneous process, $\Delta S > 0$ equilibrium process ΔS is zero.
- for a non spontaneous process $\Delta S < 0$.
- ❖ Units of entropy

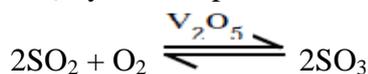
$$\text{Cgs unit CalK}^{-1} \quad \text{SI unit JK}^{-1}$$

18. Describe the synthesis of ammonia by Haber's process?



- ✓ Maximum ammonia to get 300- 500 atm pressure.
- ✓ A temperature of 500-550 $^{\circ}\text{C}$ is maintained.
- ✓ Formation reaction of NH_3 is exothermic reaction
- ✓ Catalyst is Fe(iron).
- ✓ Steam is passed to get maximum yield of NH_3 is nearly 37%

19. Write synthesis of SO₃ by contact process?



- ✓ Maximum SO₃ to get 700-1200 atm pressure.
- ✓ A temperature of 400°C -450 °C is maintained
- ✓ Catalyst is V₂O₅
- ✓ In this method (97%) SO₃ is obtained.

20. Derive the expression for K_c and K_p for decomposition of PCl₅



molar concentrations of PCl₅, PCl₃ and Cl₂ gases at equilibrium will be $\frac{a-x}{V}$, $\frac{x}{V}$ and $\frac{x}{V}$ respectively.

$$K_c = \frac{[\text{PCl}_3][\text{Cl}_2]_e}{[\text{PCl}_5]_e} = \frac{x/V \times x/V}{(a-x)/V} = \frac{x^2}{V^2} \times \frac{V}{(a-x)} \quad K_c = \frac{x^2}{(a-x)V}$$

$$x = \frac{\text{Number of moles dissociated}}{\text{Total number of moles present initially}}$$

$$K_c = \frac{x^2}{(1-x)V} = \frac{x^2 P}{(1-x)RT} \quad K_p = \frac{P_{\text{PCl}_3} \cdot P_{\text{Cl}_2}}{P_{\text{PCl}_5}} \text{ atm} \quad K_p = \frac{x^2 P}{(1-x^2)} \text{ atm}$$

$$\therefore K_c = \frac{x^2}{V} \quad (\text{or}) \quad x^2 = K_c \times V$$

$$x \propto \sqrt{V} \quad \text{But } V \propto \frac{1}{P} \quad x \propto \sqrt{\frac{1}{P}}$$

21. Derive the relation K_p = K_c(RT)^{Δ_{ng}} for a general chemical equilibrium.



$$K_p = \frac{P_L^l P_M^m P_N^n \dots}{P_A^a P_B^b P_C^c \dots}$$

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

$$C_i = \frac{P_i}{RT} \quad \text{since } p_i = \frac{n_i}{V} RT$$

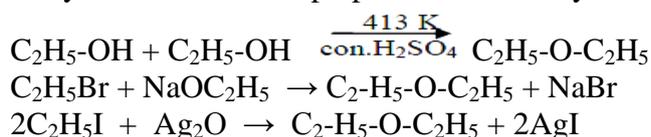
$$K_c = \frac{(P_L/RT)^l (P_M/RT)^m (P_N/RT)^n \dots}{(P_A/RT)^a (P_B/RT)^b (P_C/RT)^c \dots}$$

$$= \frac{P_L^l P_M^m P_N^n \dots}{P_A^a P_B^b P_C^c \dots} \left(\frac{1}{RT} \right)^{(l+m+n+\dots)-(a+b+c+\dots)}$$

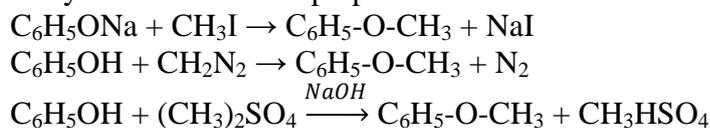
$$K_c = \frac{K_p}{(RT)^{\Delta n_g}} \quad \text{and} \quad \therefore K_p = K_c (RT)^{\Delta n_g}$$

Δ_{ng} = total number of stoichiometric moles of gaseous products - total number of stoichiometric moles of gaseous reactants.

22. Give any three methods of preparation of Diethyl ether.



23. Give any three methods of preparation of anisole.



24. Distinguish between aromatic and aliphatic ether?

Aromatic ethers (anisole)	Aliphatic ethers (diethyl ether)
1. It is high boiling liquid	volatile liquid
2. used in perfumery	used as an anaesthetic
3. Not used as solvent	used as a solvent
4. cannot be used as a substitute for petrol	Mixed with alcohol used as a substitute for petrol
5. With nitrating mixture forms nitro anisoles	nitration does not take place

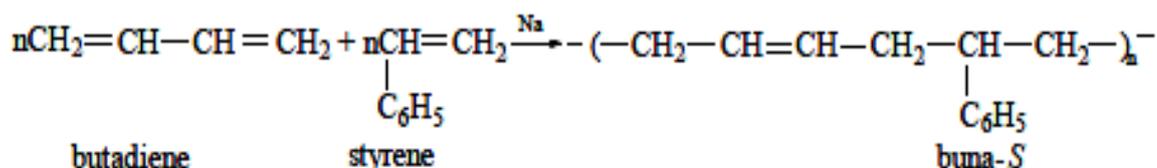
25. Explain briefly on characteristics of rocket propellants.

- The rocket engines powered by chemical propellants. They are called rocket propellants.
- Propellants are combustible compounds which on ignition undergo rapid combustion to release large quantities of hot gases. A Propellant is a combination of an oxidiser and a fuel.
- When a propellant is ignited it burns to produce a large quantity of hot gases. The passage of gases through the nozzle of the rocket motor, provides the necessary thrust for the rocket to move forward according to (Newton's Third Law of motion).

• e.g : hydrazine.

26. How are Buna-S, Nylon-66 and Buna-N prepared? Mention their uses?

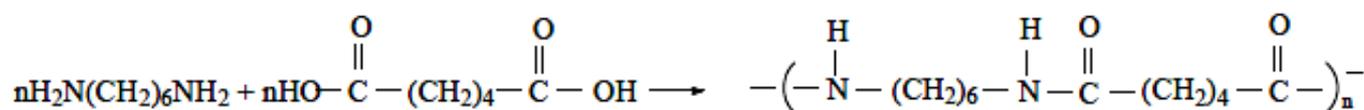
a) Buna - S



Use:

Manufacture of tyres and tubes.

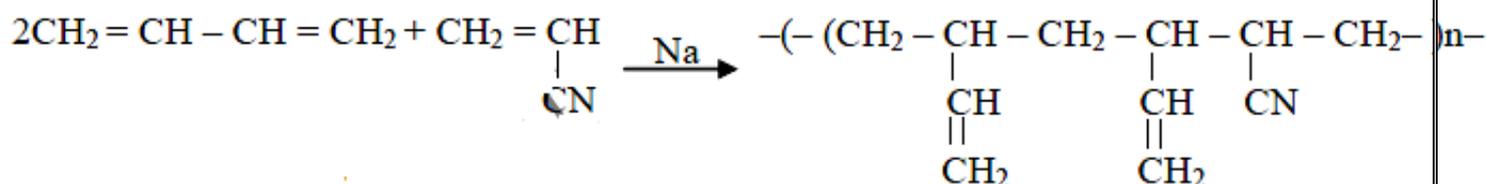
b) Nylon - 66



Use:

Manufacture of bristles for brushes, elastic hosiery and in textile.

c) Buna - N

Use:

Manufacture of storage tanks for the solvents.

PART - IV

1. Explain Pauling method to determine ionic radii?

In each ionic crystal the cations and anions are isoelectronic with inter gas configuration

NaF crystal: Na^+ -2,8 Ne type
 F^- -2,8

$$r(\text{C}^+) + r(\text{A}^-) = d(\text{C}^+ - \text{A}^-)$$

 $r(\text{C}^+)$ - radius of cation C^+ $r(\text{A}^-)$ - radius of anion A^- $d(\text{C}^+ - \text{A}^-)$ - Internuclear distance between C^+ and A^- ionsFor a given noble gas configuration, the radius of an ion is inversely proportional to its effective nuclear charge (Z^*).

$$r(\text{C}^+) \propto 1/Z^*(\text{C}^+)$$

$$r(\text{A}^-) \propto 1/Z^*(\text{A}^-)$$

 $Z^*(\text{C}^+)$ - The effective nuclear charge of cation (C^+) $Z^*(\text{A}^-)$ - The effective nuclear charge of anion (A^-)

$$\frac{r(\text{C}^+)}{r(\text{A}^-)} = \frac{Z^*(\text{A}^-)}{Z^*(\text{C}^+)}$$

2. Explain the various factors that affect electron affinity.

- Electron affinity $\propto 1/\text{atomic size}$
- Electron affinity $\propto \text{effective nuclear charge}$
- Electron affinity $\propto 1/\text{screening effect}$
- Electronic configuration:

An atom has fully filled or half filled orbital its electron affinity will be low or zero.

The stable $ns^2 np^6$ configuration in their valence shell of noble gases will be zero.

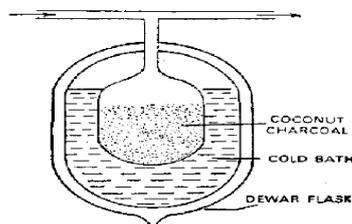
Electron affinity of Be, Mg & Ca is practically zero.

3. How do electronegativity values help to find out the nature of bonding between atoms.

Electro negativity	Nature of bond	e.g
$X_A = X_B = 0$	Non polar covalent	H_2
$X_A > X_B$ (small)	Polar covalent bond	H_2O
$X_A \gg X_B$ (very large)	Ionic bond	NaCl

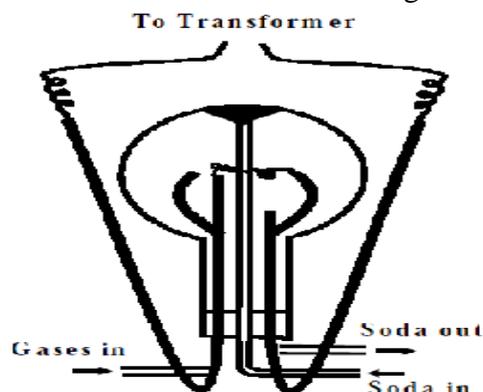
4. Describe in detail how noble gases are isolated from air by Dewar's method.

The mixture of noble gases is separated into individual constituents by the use of coconut charcoal which adsorbs different gases at different temperatures.

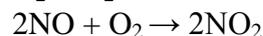
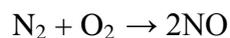


Temperature	Absorbed gases	Unabsorbed gases
173 K	Ar,Kr,Xe	He,Ne
93K	Ne	He
Liquid air temperature	Ar	Kr,Xe
183K	Xe	Kr

5. Describe in detail how noble gases are isolated from air in Ramsay-Raleigh method?



- i. A mixture of air and oxygen is constantly admitted into a glass globe of about 50 liters capacity.
- ii. Two platinum electrodes are introduced.
- iii. The transformer of about 6000-8000V volts is passed by the action of which N_2 and O_2 rapidly combine to form oxides of nitrogen.



Oxygen if any is removed by introducing alkaline pyrogallol in the globe.

6. Write the uses of silicones?

- silicones act as excellent insulators for electric motors.
- straight chain polymers of 20 to 500 units are used as silicon fluids. They are water repellent because of organic side group. These polymers are used in water proofing textiles.
- silicon rubber retain their elasticity at low temperature and resist chemical attack. They are mixed with paints.
- Silicon resins, a cross linked polymer used as non-stick coating for pans and used in paints and varnish.
- Silicon oil are highly stable and non-volatile even on heating. Hence used for high temperature oil bath, high vacuum pump etc.,

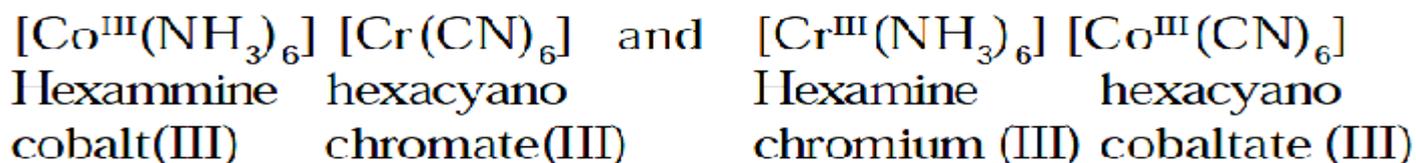
7. Define anomalous nature of fluorine ?

- ✓ Fluorine is the most reactive element among halogen. This is due to the minimum value of F-F bond dissociation energy.
- ✓ It can form two types of salt with metals NaF and $NaHF_2$.
- ✓ AgF is soluble in water but other AgX are insoluble.
- ✓ HF attack glass while others do not.
- ✓ Fluorine does not form polyhalides because of the absence of d-orbitals. we have I_3^- , Br_3^- , Cl_3^- ions but no F_3^- ions.

8. Write the co-ordination isomerism and ionization isomerism?

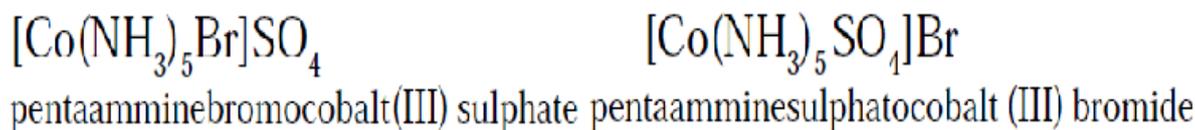
i) Co-ordination isomerism

In a bimetallic complex both complex, the distribution of ligands between the two co-ordination spheres can vary, giving rise to isomers



ii) Ionisation isomerism

Co-ordination compounds having the same molecular formula but forming differing ions in solution are called ionization isomerism.



9. Brief concepts of Werner's theory?

i. Primary valency (or) ionisable valency

ii. Secondary valency (or) non-ionisable valency.

- ✓ The primary valency corresponds to oxidation state of the metal ion. It is always satisfied by negative ions.
- ✓ Secondary valency corresponds to the co-ordination number the metal atom (or) ion. It may be satisfied by either negative ions (or) neutral molecules.
- ✓ The molecules or ion that satisfy secondary valencies are called ligands.
- ✓ The ligands which satisfy secondary valencies must project in definite directions in space.
 - Secondary valencies - directional in nature
 - Primary valencies - non directional in nature
- ✓ These unshared pair of electrons are donated to central metal ion or atom in a compound. Such compounds are called co-ordination compound

10. Explain the valence bond theory?

- The central metal atom or ion makes available a number of vacant orbitals equal to its co-ordination number.
- These vacant orbitals form covalent bonds with the ligand orbitals.
- A covalent bond is formed by the overlap of a vacant metal orbital and filled ligand orbitals.
- This complete overlap leads to the formation of metal – ligand (σ - bond)
- This maximum overlapping is possible only when the metal vacant orbitals undergoes a process called hybridization.
- A hybridised orbital has a better directional characteristics than an unbridised one.

Co-ordination number	hybridization	Geometry
2	sp	Linear

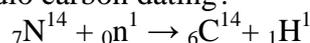
- The paramagnetic moment is calculated by the formula

$$\mu_s = \sqrt{n(n+2)} \text{ BM}$$

11. Mention the function of haemoglobin in natural process.

- ❖ Haemoglobin in the red blood cells carries oxygen from the lungs to the tissues.
- ❖ It delivers the oxygen molecule to myoglobin in the tissue.
- ❖ Haemoglobin loses its bright red colour and becomes purple.
- ❖ In then combines with the waste CO_2 produced by the cells deposits in the lungs.
- ❖ So that the gas can be exhaled.

12. Explain radio carbon dating?



- The C_{14} atoms thus produced are oxidised to CO_2 which in turn is incorporated in plant as result of photosynthesis.

$${}^6_6\text{C}^{14} \rightarrow {}^7_7\text{N}^{14} + {}^0_{-1}\text{e}^0$$
- Half life period of C_{14} – 5700 years. The number of β -particles emitted per minute per gram of carbon at the initial and final stage

$$t = \frac{2.303 \times t_{1/2}}{0.693} \log \frac{\text{Amount of } C^{14} \text{ in fresh wood}}{\text{Amount of } C^{14} \text{ in dead wood}}$$

13. Distinguish between chemical reactions and nuclear reactions.

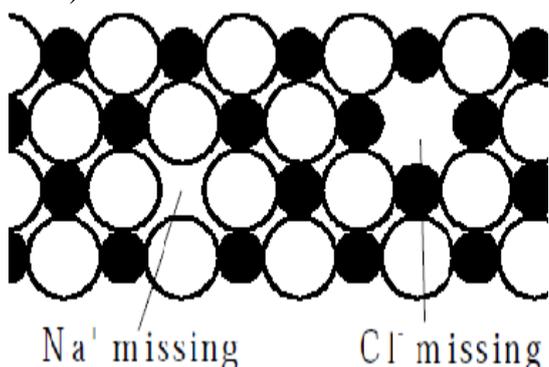
Chemical reactions	Nuclear reactions
1. Some loss, gain or overlap of outer orbital electrons of the reactant atoms.	Emission of α, β, γ , and particles.
2. Balanced in terms of mass only	Balanced in terms of both Mass & energy.
3. The energy changes in chemical reactions very much less than the nuclear reaction.	The energy changes are far greater in nuclear reaction
4. Unit - KJ/mole	Unit - MeV
5. No new element is produced.	New element / isotope may be produced

14. Write the medicinal use of radioactive isotope?

Isotope	Uses
Tritium	measure water content of the body
Carbon-11	brain scan
Carbon-14	radio immunology
Iodine-131	diagnosis of damaged heart muscles and hyperthyroidism
Mercury-197	kidney scan
Cobalt-60	treatment of cancer
Gold - 198	Curing of cancers.

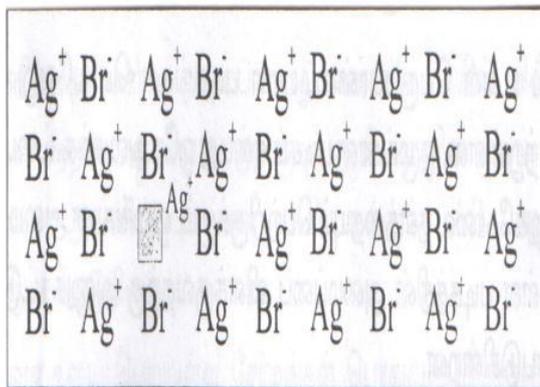
15. Explain Schottky and Frenkel defects:

1) SCHOTTKY DEFECTS



- This defect is caused if some of the lattice points are unoccupied. The points which are unoccupied are called lattice vacancies.
- The number of missing positive and negative ions is the same and thus the crystal remains neutral.
- This defect appears in which the positive and negative ions do not differ much in size.
- e.g: NaCl.

2)FRENKEL DEFECTS

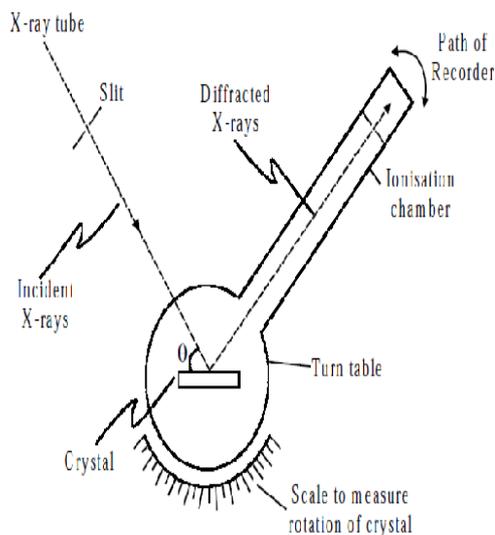


*This defects arises when an ion occupies an interstitial position between the lattice points.

*This defects occurs in ionic crystals in which the size of the anion is much larger than the cation.

*The crystals remains neutral since the number of positive ions is the same as the number of negative ions. e.g: AgBr.

16. Explain Bragg's Spectrometer Method.



1. Thus apparatus consists of a X- ray tube from which a narrow beam of X ray is allowed to fall on the crystal mounted on a rotating table.

2. The rotating table is provided with scale and vernier from which the angle of incidence θ can be measured.

3. An arm which is rotating about the same axis as the crystal table, carries ionization chamber. The rays reflected from the crystal enter into the ionization chamber and ionize the gas present inside

4. Due to the ionization, current is produced which is measured electrometer. The current of ionisation is a direct measure intensity of reflected beam from the crystal, the corresponding ionization current is measured from the electrometer. These values are plotted in the form of graph.

e.g NaCl

θ	5.9°	11.85°	18.15°
Sin	0.103	0.205	0.312
Ratio	1	2	3

17. Write the characteristics of ionic crystals:-

- ✓ They are hard and brittle.
- ✓ They have high melting and boiling points.
- ✓ The heat of vapourisation is high.
- ✓ They are insulators in the solid state.
- ✓ These crystals are soluble in water and insoluble in non polar solvents.

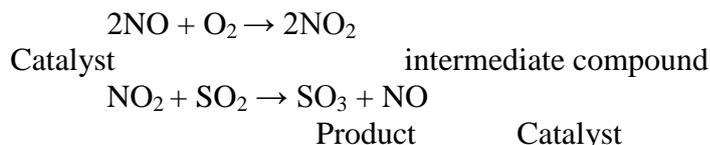
18. Characteristics the nature of glass.

- ✓ Hardness, rigidity and ability to withstand shearing stresses.
- ✓ Glasses are optically isotropic.
- ✓ On heating without any sharp transition passes into a mobile liquids.
- ✓ Glasses are regarded as amorphous solids or super cooled liquids.
- ✓ Thus , glassy or vitreous state is a condition in which certain substances can exist lying between the solid and liquid state.

19. Write briefly about the Intermediate compound formation theory of catalysis.

- This theory explains about homogeneous catalytic reactions.
- The catalyst forms an intermediate compound with one of the reactant.
- The compound is formed with less energy consumption than need for the actual reaction
- The intermediate compound being unstable combine with other reactant to form the desired product.

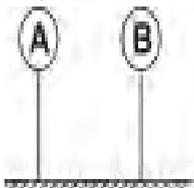
e.g



20. Write briefly about Adsorption theory of catalysis.

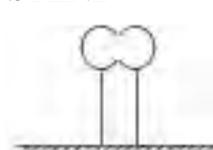
- This theory explains about heterogeneous catalytic reactions.

STEP:1



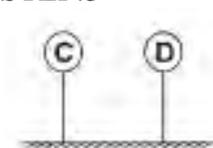
- The reactant molecules A and B strike the surface of the catalyst.
- They are held up at the surface by weak vander Waal's forces or by partial chemical bonds.

STEP:2



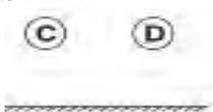
- The particles of the reactants adjacent to one another join to form an activated complex A-B.
- The activated complex is unstable.

STEP:3



- The activated complex breaks to form the products C and D.
- The separated particles of the products hold to the catalyst surface by partial chemical bonds.

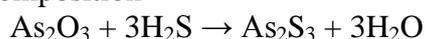
STEP:4



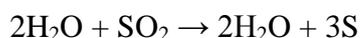
- The particles of the products are absorbed (or) released from the surface.

21. Write brief about the preparation of colloids by Chemical method?

a) Double decomposition



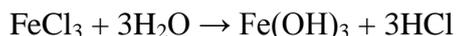
b) Oxidation



c) Reduction



d) Hydrolysis

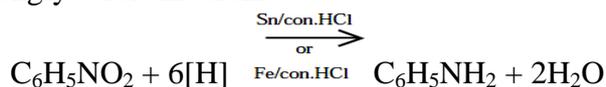


22. Write brief about the preparation of colloids by dispersion method?

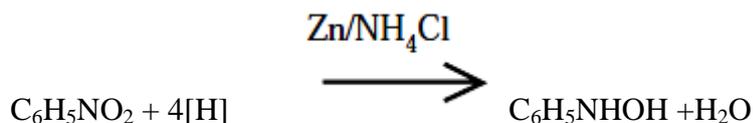
i) Mechanical dispersion:

24. Write notes on reduction of Nitro benzene under different conditions.

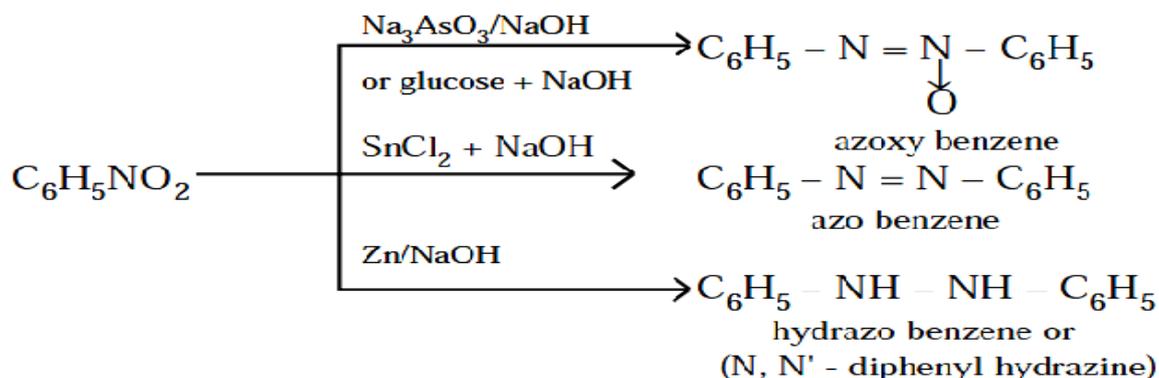
(a) Strongly acidic medium:



(b) Neutral medium:



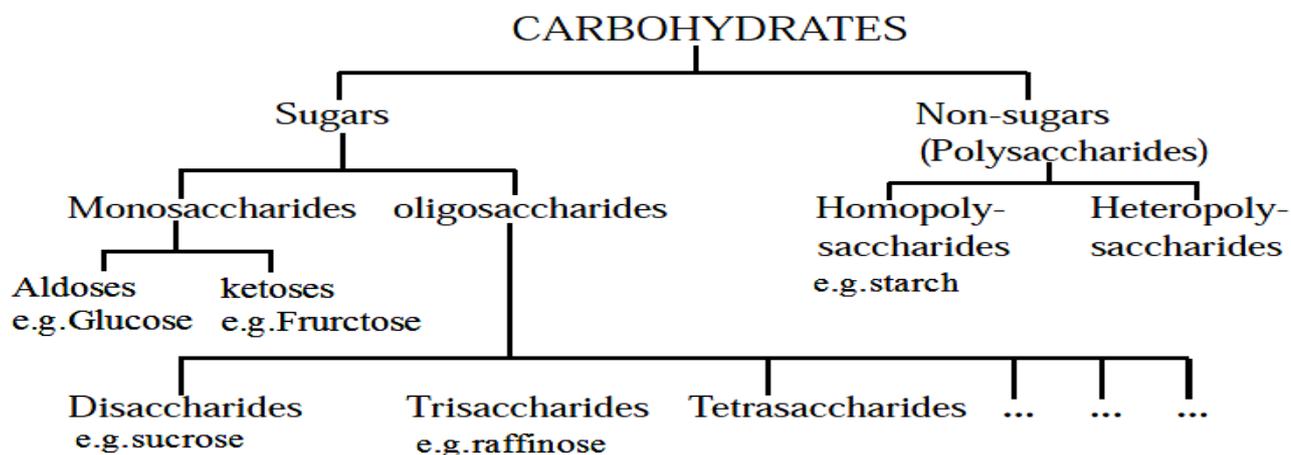
(c) Alkaline medium:



24. How will you distinguish 1^o2^o3^o amines?

1 ^o amine	2 ^o amine	3 ^o amine
1. With HNO ₂ forms	forms N-nitroso amine	forms salt
2. With CHCl ₃ /KOH forms Carbyamine	no reaction	no reaction
3. With acetyl Chloride forms N-alkyl acetamide	forms N,N-dialkyl acetamide	no reaction
4. With CS ₂ and HgCl ₂ alkyl isothiocyanate is formed.	no reaction	no reaction
5. With three molecules of alkyl halide, quarternary ammonium salt is formed.	with two molecules of alkylhalide, quarternary ammonium salt is formed	with only one molecule of alkyl halide quarternary ammonium salt is formed.

25. Out line the classification of carbohydrates giving example for each.



26. How is the structure of glucose determined?

✓ The molecular formula of glucose is $C_6H_{12}O_6$

✓ Glucose $\xrightarrow{HI/P}$ $CH_3CH_2CH_2CH_2CH_2CH_3$
n-hexane

✓ Glucose + $H_2O \rightarrow$ neutral solution

The molecular does not contain a COOH group.

✓ Glucose $\xrightarrow{Br_2/H_2O}$ gluconic acid

The presence of an aldehyde CHO group

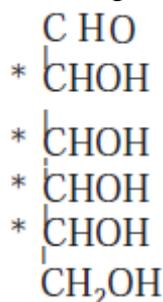
✓ gluconic acid $\xrightarrow{HNO_3}$ Saccharic acid

The presence of primary alcoholic group

✓ Glucose + acetic anhydride $\xrightarrow{pyridine}$ penta acetate

The presence of 5(-OH) group in a glucose molecular

✓ The structure of glucose



27. How is structure of fructose determined?

✓ The molecular formula of fructose is $C_6H_{12}O_6$

✓ Fructose $\xrightarrow{HI/P}$ $CH_3CH_2CH_2CH_2CH_2CH_3$
n-hexane

✓ Fructose + $H_2O \rightarrow$ neutral solution

The molecular does not contain a-COOH group

✓ Fructose + acetic anhydride $\xrightarrow{pyridine}$ penta acetate

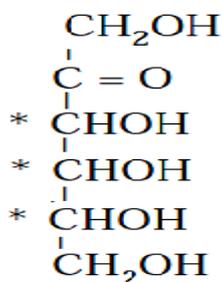
The presence of 5(-OH) group in a molecular

✓ Fructose $\xrightarrow{Br_2/H_2O}$ No oxidation occurs

This indicates the absence of (-CHO) group

✓ Fructose $\xrightarrow{HNO_3}$ tartaric acid + Glycollic acid

✓ The above evidence we conclude that the structure of fructose is



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