MINIMUM MATERIAL TO GET PASS MARK – By K.N.SUBRAMANI.M.Sc.B.Ed.,

MOST IMPORTANT 3 MARKS:

1. ***State Heisenberg's uncertainty principle.***

"It is **impossible to measure simultaneously both the position and velocity of a microscopic particle with accuracy**."

$\Delta x . \Delta p \geq h/4\pi$

2. ***Define Hybridizations?***

Intermixing of the orbital's of an atom having nearly the **same energy to give exactly equivalent orbitals with same energy, identical shapes and symmetrical orientations** in space.

3. ***Define Bond order.***

Bond order = ½ (N_b- N_a)

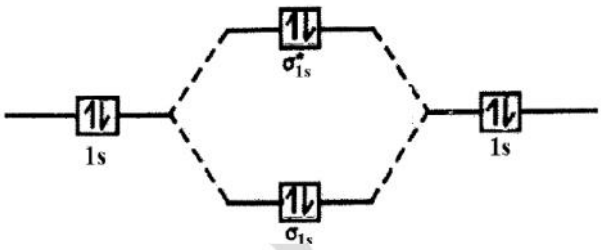
(N_b) = no.of e^- in bonding molecular orbitals.

(N_a) = no.of e^- in anti-bonding molecular orbitals**.**

4. ***He_2 molecule does not form why?***

(Z = 2), (or) $1s^2$ & He = $2e^-$

He_2: $(\sigma_{1s})^2 (\sigma^*_{1s})^2$ & He_2 = $4e^-$



Bond order =(N_b - N_a) / 2=(2-2)/2

Bond order = 0

5. ***What is the significance of negative electronic energy?***

Energy of an **electron at infinity is arbitrarily assumed to be zero** is **called zero-energy state**.

Electron moves and **comes under the influence of nucleus, it does some work and spends its energy in this process**.

Energy of the electron decreases and it becomes less than zero ie., it **acquires a negative value.**

6. **What is the essential condition of effective hydrogen bonding**?

- **High electronegativity** of the atom bonded to **H**.
- **Small size of the atom** bonded to **H**

7. **Distinguish between waves and particle.**

PARTICLE	WAVE
1).**Localized** 2).**Donot interfere**. 3).**Total value is equal to their sum.**	1).**Delocalized** 2).**Interfere**. 3).**Resultant wave can be larger or Smaller** than the individual waves.

8. **Define –Orbital.**

***Orbital*:**

An orbital is the **region of space around the nucleus** within which the **probability of finding an electron of given energy is maximum**.

9. **Define molecular orbital**.

Molecular orbital:

In molecules atomic orbitals lose their identity and the **electrons in molecules are present in new orbitals** called molecular orbitals.

10. What do you mean Dual nature of matter?

Louis de Broglie, a French Physicist, in 1924, advanced the idea that like photons, **all material particles such as electron, proton, atom, molecule, a piece of chalk, a piece of stone or iron ball possessed both wave character as well as particle character**. The wave associated with a particle is called a matter wave.

11. What is plumbo solvency?

$$2Pb + O_2 + 2H_2O \rightarrow 2Pb(OH)_2$$

lead hydroxide

(Poisonous substance)

12. Explain the dehydrating property of P_2O_5?

$$H_2SO_4 \xrightarrow{P_4O_{10}} SO_3 + H_2O$$

$$2HNO_3 \xrightarrow{P_4O_{10}} N_2O_5 + H_2O$$

13. H_3PO_3 is diprotic-Explain?

$$H_3PO_3 + NaOH \rightarrow NaH_2PO_3 + H_2O$$

$$H_3PO_3 + 2NaOH \rightarrow Na_2HPO_3 + 2H_2O$$

14. H_3PO_4 is a tri basic acid-Explain.

$$H_3PO_4 + NaOH \rightarrow NaH_2PO_4 + H_2O$$

$$H_3PO_4 + 2NaOH \rightarrow Na_2HPO_4 + 2H_2O$$

$$H_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + 3H_2O$$

15. Give any three uses of Neon.

- **In discharge tubes**
- **(Ne + He) - protect electrical instruments from high Voltages.**
- **In beacon lights**

16. Give any three uses of Helium.

- **In balloons for meteorological observations.**
- **Used in Aeroplane tyres.**
- **(O_2 + He) - Treatment of asthma**

17. Write a note on etching on Glass (OR) HF is not stored in glass bottle why?

- **It attacks silicates and silica.**
- $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$

18. Why do d-block elements exhibit variable oxidation state?

- **Several (n – 1) d and ns electrons.**
- **Energies of (n – 1) d and ns orbital** are **fairly close to each other.**

19. Why do d-block elements form more complexes?

- **Small size, high +ve charge density.**
- **Presence of vacant (n-1)d orbitals.**

20. What is chrome plating?

Anode: **Lead plate.**

Cathode: **Article to be plated.**

Electrolytes: **Chromic acid + con. H_2SO_4.**

Chromium deposits on cathode.

Articles first **plated with nickel.**

21. What is aqua regia? Give the reaction of gold with aqua regia?

- It **is 3:1 of Conc.(HCl & HNO_3)**

$$2Au + 9\,HCl + 3HNO_3 \rightarrow 2AuCl_3 + 6H_2O + 3NOCl$$

22. Write a note on chromyl chloride test.

$$K_2Cr_2O_7 + 4KCl + 6H_2SO_4 \rightarrow 2CrO_2Cl_2 + 6\,KHSO_4 + 3H_2O$$

23. Define reaction Quotient.

Ratio of **product of <u>initial</u> <u>concentrations</u> of products** to the product of **<u>initial</u> <u>concentrations</u> of reactants** under **non equilibrium** conditions.

24. Sate Le chatelier'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.**

25. **Define-Equilibrium constant.**

Ratio of **product of <u>molar concentrations</u> of products** to the product of **<u>molar</u> <u>concentrations</u> of reactants** under **equilibrium** conditions.

26. Dissociation of PCl_5 decreases in the presence of increase in Cl_2 why?

According to **Le-chatelier's principle, Increase Cl_2** in dissociation of PCl_5 is **favour for backward reaction (formation of PCl_5)**. Hence, dissociation of PCl_5 is decreases.

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

27. Why chemical equilibrium is referred to as dynamic equilibrium?

Because forward and reverse reactions take place **endlessly and simultaneously with equal rates**.

28. What is activation energy?

Activation energy = (threshold energy – Energy of colliding molecules)

29. Write the Arrhenius equation and explain the terms.

$$k = A\, e^{-Ea/RT}$$

k = rate constant, Ea = activation energy, A = frequency factor, R = gas constant, T = temperature

30. Define order of a reaction.

The **sum of the powers of the exponential powers to which each concentration term is raised in the experimentally determined rate law of a chemical reaction.**

31. What is Pseudo first order reaction? Give example.

In **2nd order** reaction, one of the **reactants concentration is in excess** (10 to 100 times) of the other reactant, then its follows **1st order** kinetics.

<u>Example: (Hydrolysis of ester)</u>

32. What is opposing reaction? Give Eg.

Products formed **react back simultaneously to form the reactant**.

$$HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$$

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

$$N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$$

33. What is Consecutive reaction? Give example.

Reactant forms an intermediate and the intermediate forms the product in one or many subsequent reactions.

<u>Example:</u> Saponification of a diester in presence of an alkali

34. What is parallel reaction? Give Eg.

One or more reactants react simultaneously in two or more pathways to give two or more products.

Example – Bromination of Bromobenzene.

35. What are simple and complex reactions.

Single step reaction are simple reaction.
Multi step reaction are complex reactions.

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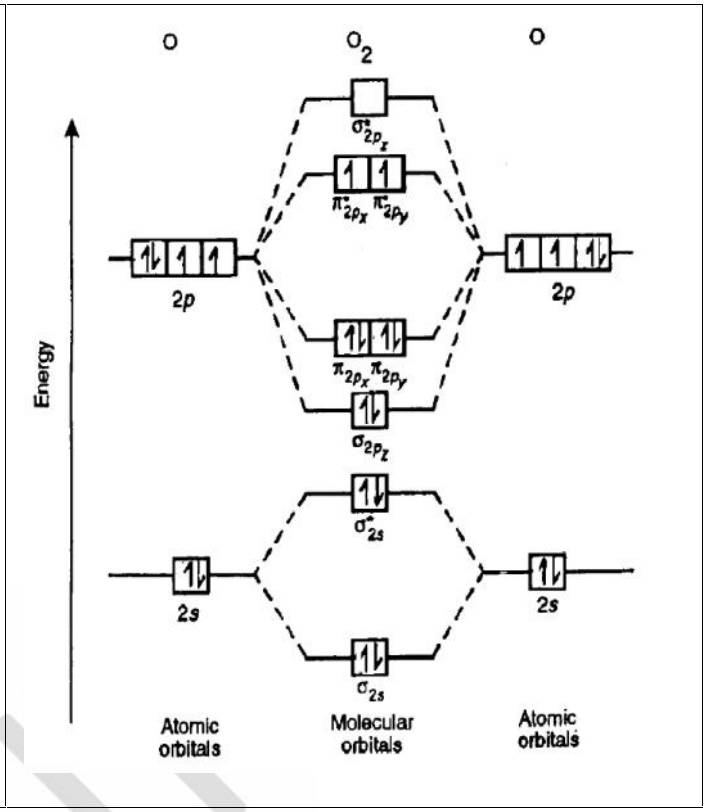
1. ATOMIC STRUCTURE – I (Q.No.52)

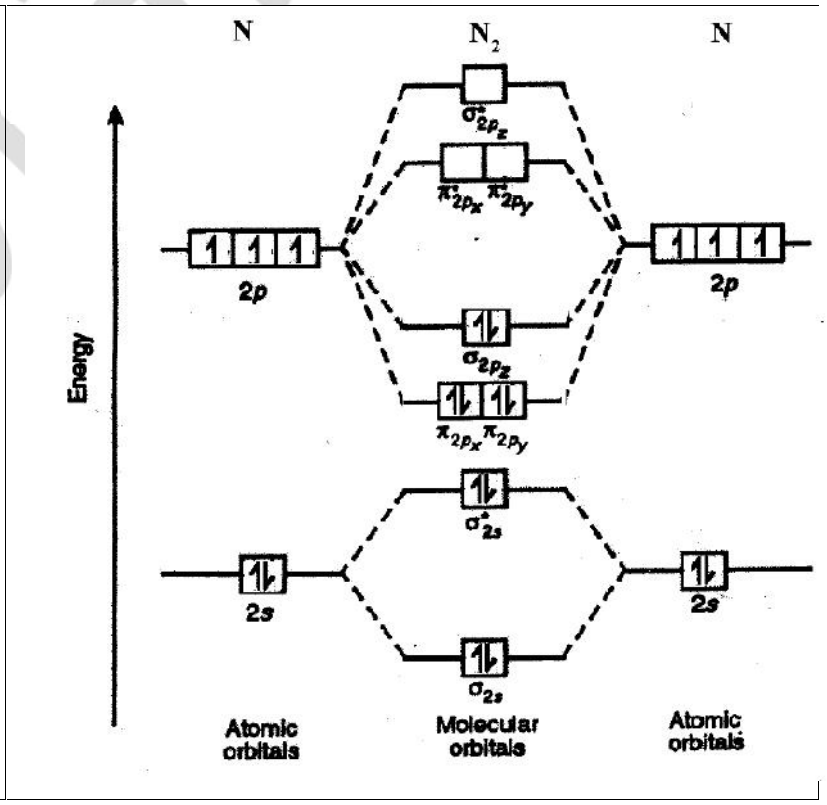
1. Explain the molecular orbital theory for Oxygen (O_2) molecule.

1) O= $1s^2\ 2s^2\ 2p^4$.
2) O_2= 16 electrons.
3) O_2 :KK$(\sigma_{2S})^2(\sigma^*_{2S})^2(\sigma_{2pz})^2$ $(\pi_{2Px})^2=(\pi_{2Py})^2\ (\pi^*_{2Px})^1=(\pi^*_{2Py})^1$
4) Bond order = 2
5) Paramagnetic



2. Explain the molecular orbital theory for Nitrogen (N_2) molecule.

1) N = $1s^2\ 2s^2\ 2p^3$
2) N_2 = 14 electrons
3) N_2 : KK $(\sigma_{2S})^2\ (\sigma^*_{2S})^2$ $(\pi_{2Px})^2= (\pi_{2Py})^2\ (\sigma_{2pz})^2$.
4)Bond order = 3
5) Diamagnetic



3. Give the postulates of molecular orbital theory (MOT).

Postulates Molecular orbital theory (MOT).

- Molecular orbital - In a molecule, **electrons** are present **in new orbital**.
- **Equal or comparable energy** of atomic orbital's combined to form Molecular orbital's.
- **Molecular orbital's equal to Number of atomic orbitals** undergoing combination.
- **Shapes** of molecular orbitals **depend upon the shapes of combining atomic orbitals.**
- **Bonding molecular orbitals** are represented by **σ, π,δ .**
  Anti-bonding molecular orbitals are represented by **σ^*, π^*,δ*.**

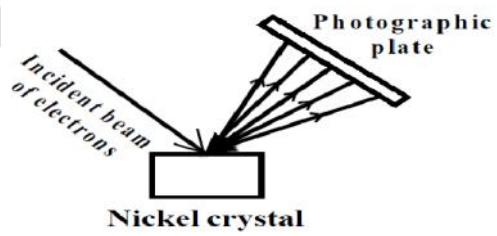
4. Derive De-Broglie equation. Give its significance.

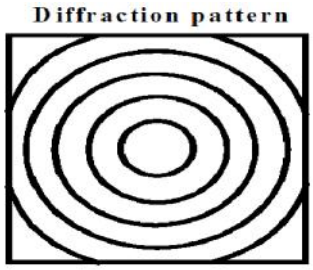
$E = h\nu$ (Planck's quantum theory
$E = mc^2$(Einstein equation
$h\nu = mc^2$ But $\nu = c / \lambda$
$h.c / \lambda = mc^2$
$\lambda = h / mc$ (or) $\lambda = h / mv$ (or) $\lambda = h / p$
Where, mv = p is the momentum of the particle.

Significance : **Significant only for sub-microscopic particle associated with wave character**

5. Explain Davisson and Germer's experiments.

- A beam of electrons obtained from **a heated tungsten filament** is accelerated by using **a high positive potential.**
- Which **fall on a large nickel crystal** , and **scattered in different directions.**
- **Diffraction pattern similar to diffraction of X-rays.**





- Since **X-rays have wave character**, therefore, **electrons must have wave** character
- The wave length of the electrons as determined **by the diffraction experiments were found to be in agreement with the values calculated from de-Broglie equation.**

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2. PERIODIC CLASSIFICATION-II { Q.No.64 (a) }

1. **Explain Pauling's method of determination of ionic radii.**

Pauling's Method:

It is basis of the observed **internuclear distances** in four crystals namely **NaF, KCl, RbBr** and **CsI.**

In each ionic crystal **the cations and anions are isoelectronic with inert gas configuration.** **Example: in NaF,** **Na^+ 2,8** **F^- 2,8** } **Ne (2, 8)**

Following two assumptions are made to assign the ionic radii.

(i) $\mathbf{r(C^+) + r(A^-) = d\,(C^+–A^-)}$ …….. (1) where,

$r(C^+)$ - radius of cation and $r(A^-)$ - radius of anion

$d\,(C^+–A^-)$ - internuclear distance between C^+ and A^- ions

(ii). For a given noble gas configuration,

$\mathbf{r\,(C^+) \alpha\ 1/\,Z^*\,(C^+)}$ …….. (2)

$\mathbf{r\,(A^-) \alpha\ 1/\,Z^*\,(A^-)}$ …….. (3) Where,

$Z^*(C^+)$ & $Z^*(A^-)$ are the effective nuclear charges of cation (C^+) and anion (A^-) respectively. On combining (2) & (3),

$\mathbf{r\,(C^+)\ /\ r\,(A^-) = Z^*\,(A^-)\ /\ Z^*\,(C^+)}$ …….. (4)

Hence the above two equations (1) & (4) can be used to evaluate the values of $r(C^+)$ and $r(A^-)$ provided that the values of $d(C^+–A^-)$, $Z^*(C^+)$ and $Z^*(A^-)$ are known.

2. **Explain the Pauling's scale to determine the Electro negativity? Give its disadvantage.**

Pauling's scale (1932)

This **scale is based on an empirical relation between the energy of a bond and the electro negativities** of bonded atoms.

E_{A-A} – Bond energy A-A , E_{B-B} – Bond energy B-B, E_{A-B} – Bond energy A-B

$$E_{A-B} > \sqrt{E_{A-A} \times E_{B-B}}$$

$$\Delta = E_{A-B} - \sqrt{E_{A-A} \times E_{B-B}}$$

$$= (X_A - X_B)^2$$

(or)

$$0.208\sqrt{\Delta} = X_A - X_B$$

Factor 0.208 arises from the conversion of Kcals to electron volt.

Disadvantage: **Bond energies are not known for many solid elements.**

3. Explain the various factors that affect electron affinity.

Factors affecting electron affinity (E.A)

1) E.A α 1 / Size of atom
2) E.A α Effective nuclear charge.
3) E.A α 1 / Shielding effect.
4) E. A of noble gases are zero, because stable ns^2np^6 configuration.
   No possibility for addition of an extra electron in their valance shell.
5) E.A of half- filled elements are zero.

4. Explain the various factors affecting Ionization energy.

Factors affecting Ionization energy (I.E)

1) I.E α 1 / Size of atom
2) I.E α Effective nuclear charge.
3) I.E α 1 / Shielding effect.
4) I.E of (s > p > d > f) . As s-electrons remain closer to the nucleus than p,d, and f-electrons.
5) As the noble gases have the stable electronic arrangements, they show maximum ionization energy.

5. How electronegativity values help to find out the nature of bonding between atoms?

No.	Electro negativity	Nature of Bond	Example
1.	$X_A = X_B$ (or) $X_A - X_B = 0$	Covalent	H-H bond in H_2
2.	$X_A > X_B$, (or) $X_A - X_B$ is small	polar covalent	O-H bonds in H_2O ($O^{\delta-}$-$H^{\delta+}$) Since ($X_O - X_H$ is small)
3.	$X_A >> X_B$ (or) $X_A - X_B$ is very large	Ionic	Na-Cl bond in Na Cl (Na^+Cl^- (Here Cl = A and Na = B).

6. How electronegativity values help to find out the percentage of ionic character in a polar covalent bond?

S.No	Electro negativity	Ionic Character	Covalent Character	Bond type
1.	$(X_A - X_B) = 1.7$	50%	50%	Polar covalent ($A^{\delta-}$ - $B^{\delta+}$)
2.	$(X_A - X_B) < 1.7$	Less than 50%	Greater than 50%	Covalent (A-B)
3.	$(X_A - X_B) > 1.7$	Greater than 50%	Less than 50%	Ionic (A^-- B^+)

5. f – BLOCK ELEMENTS {Q.No.55}

1. Compare lanthanides with actinides.

S.No.	*LANTHANIDES*	*ACTINIDES*
1.	Ions are colourless.	Ions are coloured U^{3+}(red),
2.	Do not form complexes.	Form complexes.
3.	Except **Pm**, they are non-radioactive.	All are radioactive.
4.	Compounds are less basic	More basic
5.	Do not form oxocations.	Form oxocations. (UO^+)

2. How are lanthanides extracted from monazite sand?

Flow sheet: Extraction of lanthanide from monazite sand:

Monazite Sand

↓ **Δ (at 210⁰C)/ H_2SO_4** for several hours

Gray mud

↓ Cold water

unreacted monazite sand (TiO_2,SiO_2,$ZrSiO_4$) (recycle sand)

Filtrate (Ln^{3+},Th^{4+},H_3O^+,SO_4^{2-},$H_2PO_4^-$,HSO_4^-)

↓ Neutralised to proper to acidity (or) **added HF**

Precipitate of Th (or) $Th_3(PO_4)_4$

Filtrate (Ln^{3+},PO_4^{3-})

↓ **NaOH** (or) oxalic acid

$Ln(OH)_3$ (or) oxalates

Lanthanides are extracted from suitable physical method:

Anhydrous F^- & Cl^- $\xrightarrow[\text{Ca / 1270K}]{\text{Ar – atmosphere}}$ Individual metals

LnF_3 $\xrightarrow[\text{Ca,Li}]{\Delta}$ Pure metals

2. Explain the lanthanide contraction its causes and consequences.

Lanthanide Contraction -

Steady decrease in ionic radii of M^{3+}cations in the lanthanide series.

Causes : (i) **Imperfect shielding of one 4f electron** by another in the same sub shell.

(ii) **Increases effective nuclear charge in lanthanide series**.

***Consequences of lanthanide contraction*:**

i) Basicity of ions

According to Fajan's rule, decrease in size of Ln^{3+} ions increase the covalent character and decreases the basic character between Ln^{3+} and OH^- ion in $Ln(OH)_3$. $Ln^{3+} > Ce^{3+} > \ldots\ldots\ldots > Lu^{3+}$

ii) Regular **decrease in their ionic radii**.

iii) Regular **decrease in their tendency to act as reducing agent, with increase in atomic number.**

iv) 2nd & 3rd rows of d-block elements are quite close in properties.

v) Lanthanides **occur together in natural minerals and are difficult to separate.**

4. Give the uses of lanthanides and actinides.

Use of lanthanides:

1. **Pyrophoric** alloy - **cigarette lighters** 2. **Ceria - gas lamp materials**.
3. **Cerium salts - dyeing cotton**
4. Lanthanides used in **metallothermic reactions due to extraordinary reducing property. To get pure metals such a Fe,Co, Ni.**
5. **Mish metals – stainless steel & instrumental steels.**

Uses of Actinides: **U^{235}** – in **nuclear power plants**
Pu^{238} - long mission space probes.

9.THERMODYNAMICS-II{Q.NO.56}

1. **Give the various statements of II-law of thermodynamics.**

i) Kelvin- Planck statement

"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".

ii) Clausius statement:

"It is impossible to transfer heat from a **cold body to a hot body** by a machine without doing some work".

iii) Entropy statement:

'A process accompanied by **increase in entropy tends to be spontaneous**".

iv) "**Efficiency** of a machine can **never be cent percent**".

v) It is **impossible to** have a machine which **converts** the **input energy completely into output energy.**

$$\% \text{ Efficiency} = \frac{(T_1 - T_2)}{T_1} \times 100,$$

By II law, $T_2 < T_1$ % efficiency less than 100.

2. Give any five characteristics of Entropy.

1) **Entropy (S) is a state function, its from II law of thermodynamic.**
2) **Entropy is a measure of 'disorder ' of the molecules of the system. Entropy increase in all spontaneous process.**
3) **Energy of the universe remains constant although the entropy of the universe tends to be maximum.**
4) **$\Delta S > 0$ – Spontaneous; $\Delta S = 0$ - equilibrium; $\Delta S < 0$ – Non-spontaneous**.
5) **Units of entropy: cgs units - $cal.K^{-1}$ and SI unit - JK^{-1}**

3. Give the characteristics of Gibb's free energy.

1) **Free energy is defined as G = (H-TS). 'G' is a state function.**
2) **G-Extensive property. ΔG-intensive property , when $\Delta G = (G_2 - G_1)$**
3) G has a **single value for the thermodynamic state of the system**.
4) **$\Delta G<0$ - spontaneous , $\Delta G = 0$ – equilibrium, $\Delta G > 0$ - non- spontaneous**
5) **$\Delta G = \Delta H - T\Delta S$. $\Delta H = \Delta E + P\Delta V$ and $\Delta E = q - w$. But $T\Delta S = q$**
$\Delta G = q - w + P\Delta V - q$. $\Delta G = - w + P\Delta V$ = network.

4. What are spontaneous reactions? What are the essential conditions for spontaneity.

- ***Spontaneous reactions:*** All the natural processes are spontaneous. **It occur its own and does not need to be induced.**
- ***Essential conditions :*** **$\Delta G < 0$, $\Delta H < 0$, $\Delta S > 0$**

5. State Trouton's rule. What are the substances deviate from this rule?

The heat of vaporisation (ΔH_{vap}) in calories per mole divided by the boiling point of the liquid in Kelvin is a constant equal to 21 cal deg^{-1} mole^{-1} and is known as the entropy of vapourisaiton

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

Substances deviate from this rule:

- **Low boiling liquids** (**H and He)** which boil only a **little above 0K.**
- Polar substances like **water, alcohol** which form **hydrogen bonded liquids** and exhibit very **high boiling points as well as high ΔHvap.**
- **Acetic acid - partially associated in the vapour phase** and possess very **low entropy vaporization** which is very much **less than 21 cals/ mol/deg.**

10.CHEMICAL EQUILIBRIUM –II {Q.No.57}

1. Derive the values of K_P & K_C for the formation of HI.

For equilibrium of HI

$H_{2(g)} + I_{2(g)} \rightleftharpoons HI_{(g)}$, Where, **($\Delta_{ng} = 0$ and $K_p = K_c$)**

$$K_c = \frac{[HI]^2}{[H_2]\,[I_2]}$$, where

$[H_2] = (a-x) / V$, $[I_2] = (b-x) / V$ and $[HI] = 2x / V$

$$= \frac{(2x/V)^2}{\frac{(a-x)}{V} \times \frac{(b-x)}{V}} = \frac{4x^2}{V^2} \times \frac{V^2}{(a-x)(b-x)}$$

$$= \frac{4x^2}{(a-x)(b-x)} = K_p$$

x is extend of reaction.

2. Derive the relation $K_p = K_C (RT)^{\Delta ng}$.

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

$$aA + bB + cC + \ldots\ldots \rightleftharpoons lL + mM + nN + \ldots..$$

then $$K_p = \frac{p_L^l p_M^m p_N^n \ldots..}{p_A^a p_B^b p_C^e \ldots\ldots}$$

where p is the partial pressure of the respectivée gases. In terms of mol concentrations of reactants and products

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

For any gaseous component 'i' in a mixture, its partial pressure 'p_i' is relat to its molar concentration 'C_i' as

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

where $\frac{n_i}{V} = C_i$ = number of moles of i per litre. V = volume in litres.

Substituting, concentration terms by partial pressures,

$$K_c = \frac{(p_L/RT)^l (p_M/RT)^m (p_N/RT)^n \ldots}{(p_A/RT)^a (p_B/RT)^b (p_C/RT)^c \ldots}$$

$$= \frac{p_L^l p_M^m p_N^n \ldots..}{p_A^a p_B^b p_C^e \ldots\ldots} \left(\frac{1}{RT}\right)^{(l+m+n+\ldots.)-(a+b+c+\ldots)}$$

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

where Δn_g – total number of stoichiometric moles of gaseous products - total number of stoichiometric moles of gaseous reactants.

3. Derive the expression of K_C & K_P for decomposition of PCl_5.

The dissociation equilibrium of PCl_5 in gaseous state is written as

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

Let 'a' moles of PCl_5 vapour be present in 'V' litres initially. If x moles of PCl_5 dissociate to PCl_3 and Cl_2 gases at equilibrium at constant 'V' litres, then

$[PCl_5] = (a-x) / v$ $[PCl_3] = x / v$ $[Cl_2] = x / v$

$$K_c = \frac{[PCl_3][Cl_2]_e}{[PCl_5]_e}$$

$$= \frac{x/V \times x/V}{(a-x)/V} = \frac{x^2}{V^2} \times \frac{V}{(a-x)}$$

$$K_c = \frac{x^2}{(a-x)V}$$

x is also known as the degree of dissociation which represents the fraction of total moles of reactant dissociated.

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

If initially 1 mole of PCl_5 is present then

$$K_c = \frac{x^2}{(1-x)V} = \frac{x^2P}{(1-x)RT}$$

In terms of partial pressures of PCl_5, PCl_3 and PCl_2 then

$$K_p = \frac{p_{PCl_3} \cdot p_{Cl_2}}{p_{PCl_5}} \text{ atm}$$

and $$K_p = \frac{x^2P}{(1-x^2)} \text{ atm}$$

4. Explain the favorable conditions for getting maximum yield of NH_3 in Haber's process.

$N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$; $\Delta H^0_f = -22.0$ kcal/mole

Pressure(atm)	Temperature	Catalyst	Ratio	Reaction type	Yield
300 – 500	500^0C-550^0C	Iron (Fe)	1:3 (N_2: H_2)	Exothermic	37%

- **Steam is passed to remove away the ammonia.**
- **High pressure and low temperature – Favour for forward reaction & more yields.**

5. Explain the favorable conditions for getting maximum yield of SO_3 in Contact process.

$2SO_{2\,(g)} + O_{2\,(g)} \rightleftharpoons 2SO_{3\,(g)}$; $\Delta H^0_f = -47.0$ kcal/mole

Pressure(atm)	Temperature	Catalyst	Ratio	Reaction type	Yield
700 – 1200	400^0C–450^0 C	V_2O_5 (porous)	2:1 (SO_2 : O_2)	Exothermic	97%

- **It is used in the manufacture of H_2SO_4 & oleum.**
- **High pressure and low temperature –Favour for forward reaction & more yield.**

MINIMUM MATERIAL TO GET PASS MARK – By K.N.SUBRAMANI.M.Sc.B.Ed.,

7. NUCLEAR CHEMISTRY [Q.No.65 (b)]

1. Distinguish between Chemical and Nuclear reaction.

S.No	Chemical Reaction	Nuclear Reaction
1.	**loss, gain or overlap of outer orbital electrons** of the reactant atoms.	**Emission of α, β and γ** from the nucleus
2.	Balanced by **mass**	Balanced by **mass and energy**
3.	**Less energy changes**	**More energy changes**
4.	Energy in **KJ/mole**	Energy in **MeV**
5.	**No new element** is formed	**New element** is formed

2. Write a note on Radio carbon dating.

***RADIO CARBON DATING*:**

1) . $_7N^{14} + {}_0n^1$ (from cosmic ray) → $_6C^{14} + {}_1H^1$

2). $_6C^{14} \rightarrow {}_7N^{14} + {}_{-1}e^0$

3). The C^{14} atoms thus produced are rapidly oxidized to $^{14}CO_2$ which in turn is incorporated in plants as result of photosynthesis.

4). Half life period of fossil is **5700.**

5). Amount of C^{14} or the number of β-particles emitted per minute per gram of carbon at the initial and final stages, the **Age of carbon material** is

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

6) Great tool for correlating facts of historical importance.

4. Give the uses of radioactive isotope in medicine.

S.No	Isotope	Uses
1.	Tritium ($_1H^3$)	**Measure water content of the body**
2.	Carbon – **11**	**Brain scan**
3.	Carbon – **14**	**Radio immunology**
4.	Iron – **59**	**Diagnosis of anemia**
5.	Cobalt – **60**	**Treatment of cancer**

3. Explain nuclear fusion reactions in star & sun.

Sun is giving out energy equally in all possible directions at the rate of 3.7×10^{33} ergs/sec

Proton - proton chain reaction:

$$_1H^1 + {}_1H^1 \xrightarrow{\text{fusion}} {}_1H^2 + {}_{+1}e^0 + \text{energy}$$

positron

$$_1H^2 + {}_1H^1 \xrightarrow{\text{fusion}} {}_2He^3 + \text{energy}$$

$$_2He^3 + {}_1H^1 \xrightarrow{\text{fusion}} {}_2He^4 + {}_{+1}e^0 + \text{energy}$$

The overall reaction, therefore, may be written as:

$$4\,{}_1H^1 \xrightarrow{\text{fusion}} {}_2He^4 + 2\,{}_{+1}e^0 + \text{energy}$$

8.SOLID STATE-II { Q.No.66 (a) }

1. Mention the properties of Ionic crystals.

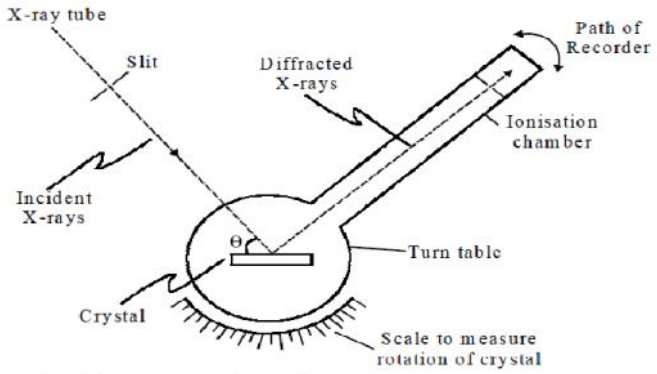
Properties Ionic Crystals:

1. **Melting and boiling points** are **very high.** 2. **Hard and brittle**.
1. **Insulators in the solid state**. 4. **Soluble in water** & **polar solvents**.
2. **Good conductors** when dissolved **in water**.

2. Explain the Bragg's spectrometer method.

Bragg's spectrometer method:

- **Studying crystals using X-rays**.
- Apparatus consists of a X-ray tube
- **X-rays is allowed to fall on the crystal** mounted on a rotating table **with scale and vernier**,
- From which the **angle of incidence, θ** can be measured.



X-ray spectrometer

- **Crystal table carries an ionisation chamber**. **ionize the gas present inside**.
- Due to the ionisation, current is produced, which is **direct measure of intensity of reflected beam from the crystal.**
- **current is measured from the electrometer.**
- These **values are plotted in the form of graph**

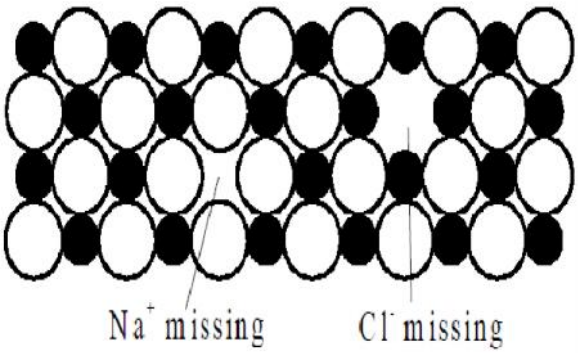
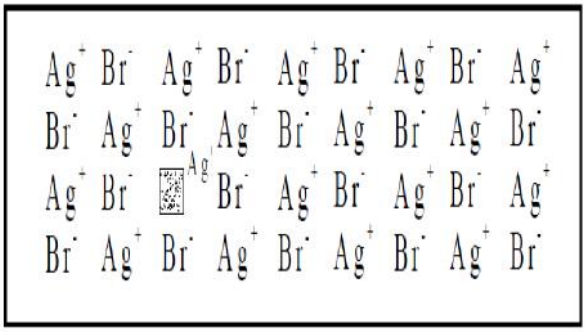
For **NaCl** , the maximum reflection for **100 plane**

Order of reflection (n)	Angle of reflection (θ)	Sine values	Ratio 1:2:3
1	**5.9°**	**0.103**	
2	**11.85°**	**0.205**	
3	**18.15°**	**0.312**	

The **ratio confirms the correctness of Bragg's equation.**

3. Explain Schottky&Frenkel defects.

S. NO	**Schottky defects:** *Example:(*NaCl*) Ionic crystal*	**Frenkel defects:** *Example:(*AgBr*) Ionic crystal*
1.	**Lattice points are unoccupied**. It is **called lattice vacancies**.	An ion **occupies an interstitial position** between the lattice points.
2.	**Crystal remains neutral (missing no.ofcation = missing no.of anion)**.	**Crystal remains neutral. (no. of cation = no.of anion)**

3.	**Positive and negative ions do not differ much in size.**	**Anion is much larger in size than the Cation.**
4.		

4. Explain the nature of Glass.

Nature of Glasses:

When **certain liquids are cooled rapidly there is no formation of crystals at a definite temperature, such as occurring on slow cooling. The viscosity of the liquid increases steadily and finally a glassy substance is formed.**

Chief characteristics:

- **Hardness, rigidity and ability to withstand shearing stresses.**
- **Optically isotropic**
- At a **high temperature glasses undergo phase transition.**
- Crystals separate first as they do **form super cooled liquid or Amorphous solids.**
- **Vitreous state** - Substance **lying between the solid and liquid states.**

5. What is super conductivity and give its applications.

Super conductors:

Certain **ultra-cold substances to conduct electricity without resistance is called super conductivity.** Substance having this property are called super conductors

Application of superconductors:

- Super conducting ~~magnets~~ generators **- It consumes low energy and save more energy.**
- Super conducting magnets **- High efficiency ore separating machines**.
- Superconducting solenoids – used in **NMRI (whole body) scan equipment**.

*****All the Best*****

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