11 P

18.12.24

Register No. பா.கவியரசு

Half Yearly Examination- 2024

Time : 3.00 Hrs.

CHEMISTRY

Marks : 70

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PART - I

15 x 1 = 15

Choose the correct answer

1) Splitting of spectral lines in an electric field is called
a) Compton effect b) Zeeman effect c) Stark effect d) Shielding effect

2) Which one of the following is diamagnetic? a) O_2^{2-} b) O_2^{+} c) O_2 d) None of these

3) Tritium nucleus contains a) 1p + 2n b) 1p + 0n c) 1p + 1n d) 2p + 1n

4) Which of the following has highest hydration energy? a) $BaCl_2$ b) $MgCl_2$ c) $SrCl_2$ d) $CaCl_2$

5) Spodumene is the mineral source for which of the 7following alkali metal? I Volume Page No:126
a) Lithium b) Sodium c) Rubidium d) Potassium

6) 7.5g of a gas occupies a volume of 5.6 L at 0°C and 1 atm pressure. The gas is
a) CO b) NO c) CO_2 d) N_2O

7) The intensive property among the quantities below is a) enthalpy b) mass c) $\frac{\text{mass}}{\text{volume}}$ d) volume

8) Assertion : In monohaloarenes electrophilic substitution occurs at ortho and para positions.
Reason : Halogen atom is a ring deactivator
a) Assertion is true but reason is false.
b) Both assertion and reason are true and reason is the correct explanation of assertion.
c) Both assertion and reason are false.
d) Both assertion and reason are true but reason is not the correct explanation of assertion.

9) Match the following

1) $-NO_2$	i) propyl 3
2) $-OCH_3$	ii) Amino 4
3) $-CH_2CH_2CH_3$	iii) Methoxy 2
4) $-NH_2$	iv) Nitro 1

a) 1-(iii) 2-(ii) 3-(iv) 4- (i) b) 1-(iii) 2-(iv) 3-(i) 4-(ii) c) 1-(iv) 2-(iii) 3(i) 4(ii) d) 1-(ii) 2-(i) 3-(iv) 4-(iii)

10) $CH_2 - \underset{\underset{O}{\|}}{C} - CH_3$ and $CH_2 = \underset{\underset{O-}{|}}{C} - CH_3$ are
a) optical isomers b) resonating structures c) conformers d) tautomers

11) Which of the following is aliphatic saturated hydrocarbon? a) C_9H_{18} b) C_8H_{14} c) C_8H_{18} d) All of the above

12) Which one of the following is incorrect statement?
a) presence of catalyst affects both the forward reaction and reverse reaction to the same extent.
b) For a system at equilibrium Q is always less than the equilibrium constant.
c) equilibrium constant varies with temperature.
d) equilibrium can be attained from either side of the reaction

13) Equimolal aquecus solutions of NaCl and KCl are prepared. If the freezing point of NaCl is –2°C, the freeezing point of KCl solution is expected to be a) –1°C b) –2°C c) 0°C d) –4°C

14) A bottle of ammonia and a bottle of HCl connected through a long tube are opened simultaneously at both ends. The write ammonium chloride ring will be first formed a) near the ammonia bottle
b) at the centre of the tube c) throughout the length of the tube d) near the hydrogen chloride bottle

15) The correct relative order of +I effect of alkyl groups is
a) $-C(CH_3)_3 > -CH(CH_3)_2 > -CH_2CH_3 > -CH_3$ b) $-CH_3 > -CH_2CH_3 > -CH(CH_3)_2 > C(CH_3)_3$

1 mark:-
1. c
2. a
3. a
4. b
5. a
6. b
7. c
8. d
9. c
10. d
11. c
12. b
13. b
14. d
15. a

BB-12
Int-3
15

II volume Page No:167

c) $-CH_2CH_3 > -CH_3 > -C(CH_3)_3 > -CH(CH_3)_2$ d) $-CH(CH_3)_2 > -C(CH_3)_3 > CH_2CH_3 > -CH_3$

PART - II

II. Answer any six of the following. Q.No.24 is compulsory. **6 x 2 = 12**

16. Define eqwuivalent mass. F-4-3
17. Write the limitations of Bohr's atom model. F-22-3
18. Give the general electronic configuration of lanthanides and actinides. F-38-12
19. Why hydrogen peroxide is stored in plastic containers, not in glass container? F-56-21
20. What are ideal gases? In what way real gases differe from ideal gases. F-81-4
21. Write a balanced chemical equation for a equilibrium reaction for which the equilibrium constant is given by expression $K_c = \frac{[NH_3]^4 [O_2]^5}{[NO]^4 [H_2O]^6}$ F-122-10
22. Define Osmotic pressure. F-140-28
23. Write structure of the following compounds. a) NH_3 b) BF_3 F-164-16
24. Write Sand Mayer's reaction. F-248-22

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PART - III

Answer any six. Q.No.33 is compulsory. **6 x 3 = 18**

25. State Heisenberg's uncertainity principles. F-22-5
26. What is diagonal relationship? F-39-17
27. Distinguish ortho hydrogen and para hydrogen. F-54-1
28. What are the similarities between beryllium and aluminium. F-66-4
29. Give the general formula for the following class of organic compounds?
    a) alkane b) alkene c) alkyne F-178-2
30. Write short notes a) Resonance b) Hyperconjucation F-203-1
31. Explain Markownikoff's rule with suitable example. F-217-12
32. How is acid rain formed? Explain its effect. F-266-2
33. Calculate the entropy change during the melting of one mole of ice into water at 0°C and 1 atm pressure. Enthalpy of fusion of ice is 6008 J mol^{-1}. F-98-15 Ans: 22.007 $JK^{-1}mol^{-1}$

PART - IV

Answer all the questions. F-24-4 F-44-1 **5 x 5 = 25**

34. a) Explain quantum numbers. **(OR)** b) Explain Pauli's method of determining ionic radii.
35. a) (i) Write exchange reactions of Deutrium. (ii) Give the uses of heavy water. **(OR)** F-52-12 F-52-10
    b) (i) Write the preparation of plaster of paris. (ii) Write short notes on solvay process of preparing sodium carbonate. F-67-12 F-65-2
36. a) Derive critical constants from Vanderwalls equation (Tc, Pc, Vc) **(OR)** F-87-1
    b) (i) Define Hess law of constant heat summation. F-95-2
    (ii) List the characteristics of Gibbs free energy. F-106-8
37. a) (i) Explain environmental impact of ozone depletion. F-264-8
    (ii) Derive the relation between Kp and Kc **(OR)** F-126-2
    b) (i) Define i - molality ii - normality (ii) Draw the M.O diagram for oxygen molecule. Calculate its bond order and show that O_2 is paramagnetic. F-136-1 F-165-2
38. a) (i) Give the IUPAC names of the following.
    1) $CH_3 - O - CH_3$ 2) $CH_3 - CH_2 - CH - CHO$ 3) $CH_2 = CH - CH = CH_2$ F-179-8 → 1. Methoxy Methane 2. 2-hydroxy butanal 3. 1,3-butadiene
    ii) Define Inductive effect with example. **(OR)** F-209-4

    b) (i) Elucidate the structure of benzne. (ii) Explain E^1 reaction mechanism. F-231-7 F-247-20

18.12.24 Half yearly Exam - DEC-2024

Tiruppur +1 Chemistry Em Answer Key

Part-I

1 Marks: 15 × 1 = 15

1. c) Stark effect
2. a) O_2^{2-}
3. a) 1p + 2n
4. b) $MgCl_2$
5. a) Lithium
6. b) NO
7. c) Mass / Volume
8. d) Both Assertion and reason are true. but reason is not correct explanation
9. c) 1-(iv), 2-(iii), 3-(i), 4-(ii),
10. d) tautomers
11. c) C_8H_{18}
12. b) For a system at equilibrium Q is always less than the equilibrium constant
13. b) $-2^{\circ}C$
14. d) near the hydrogen chloride bottle
15. a) $-C(CH_3)_3 > -CH(CH_3)_2 > -CH_2(CH_3) > -CH_3$

Part-II

2 Marks: 6 × 2 = 12

16. **Equivalent mass:**

* Gram equivalent mass of an element, compound (or) ion is the mass that combines (or) displaces 1.008 g hydrogen (or) 8 g oxygen (or) 35.5 g chlorine. Equivalent mass has no unit. But it expressed as geq^{-1}.

17. **Limitations of Bohr's atomic model:**

* This model is applicable only to species having one e^- such as H_2, Li^{2+} and not applicable to multi e^- atoms.
* It was unable to explain the splitting of spectral lines in the presence of magnetic field (zeeman effect) or an electric field (Stark effect).
* Bohr's theory was unable to explain why the e^- is restricted to revolve around the nucleus in a fixed orbit in which the angular momentum of the e^- is equal to $nh/2\pi$

18. **General e^- configuration of**

Lanthanides : $[Xe]\ 4f^{1-14}\ 5d^{0-1}\ 6s^2$

Actinides : $[Rn]\ 5f^{0-14}\ 6d^{0-2}\ 7s^2$

19. H_2O_2 is not stored in glass container, because it dissolves the alkali metals from the glass, which catalyzes the disproportionation reaction.

$$H_2O_2 \longrightarrow H_2O + \tfrac{1}{2}O_2$$

20. 1. **Ideal gases**: Gases that obey the equation $PV = nRT$ (or) Gaseous laws under all conditions.

2. **Real gases**: Real gases have attractive forces between molecules and it occupy Larger Volume than Ideal gas.

21.

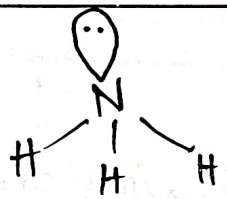
$$K_c = \frac{[NH_3]^4 [O_2]^5}{[NO]^4 [H_2O]^6}$$

Ans: $4NO + 6H_2O \rightleftharpoons 4NH_3 + 5O_2$

22. **Osmotic Pressure (π)**:-

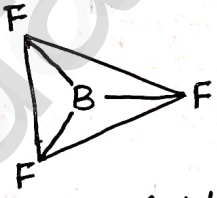
The pressure that must be applied to the solution to stop the influx of the solvent through the Semipermeable membrane

23. a) NH_3



Pyramidal

b) BF_3



Trigonal planar

24. [Compulsory]: **Sand Mayer's reaction:**

$$C_6H_5N_2Cl \xrightarrow[HCl]{Cu_2Cl_2} C_6H_5Cl + N_2$$

Part-III

3 Marks: $6 \times 3 = 18$

25. **Heisenberg's uncertainity Poinciple:**

"It is impossible to accurately determine both the position as well as the momentum of a microscopic particle Simultaneously".

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

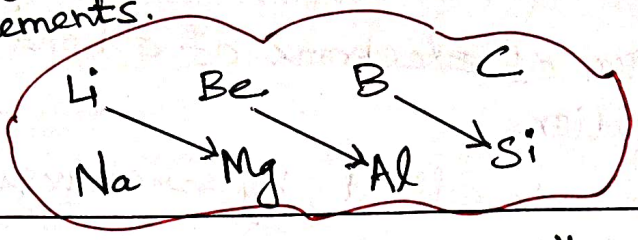
$\Delta p \Rightarrow$ uncertainities in determining the momentum

$\Delta x \Rightarrow$ uncertainities in determining the position.

26. Diagonal elationship:

* The Similarity in properties existing between the diagonally Placed elements is Called diagonal relation ship.
* on moving diagonally across the periodic table, the second and third period elements show similarities.
* Such diagonal relationships are predominant only among lighter elements.

eg:



27. Ortho and Para hydrogen are similar in Chemical properties but differs in physical properties.

Properties	Ortho hydrogen	Para hydrogen
Rotation of spin nuclei	Same direction	opposite direction
Melting point	13.95K	13.83K
Boiling point	20.39K	20.26K
Magnetic moment	Twice that of a proton	Zero.

28. Similarities between Be & Al :-

1. Be & Al ions have strong tendency to form Complexes eg: BeF_4^{2-}, AlF_6^{3-}
2. Both Be & Al hydroxides are amphoteric in nature.
3. Both Be & Al are rendered passive by nitric acid
4. Both are Soluble in organic solvents and strong Lewis acids
5. Carbides of beryllium (Be_2C) like Aluminium Carbide (Al_4C_3) give methane on hydrolysis.
6. Beryllium Chloride forms a dimeric structure like aluminium Chloride with Chloride bridges. It also forms polymeric Chain structure in addition to dimer.

29. General formula:

a) alkane → C_nH_{2n+2} b) alkene → C_nH_{2n} c) Alkyne : C_nH_{2n-2}

30. a) **Resonance:**

1. Certain organic compounds can be represented by more than one structure and they differ only in the position of bonding and lone pair of e⁻s. Such structures are called resonance structures and this phenomenon is called resonance.
2. This phenomenon is also called mesomerism (or) mesomeric effect

b) **Hyper Conjugation:**

1. The delocalisation of electrons of σ bond is called as hyper conjugation.
2. Unlike electromeric effect, hyperconjugation is a permanent effect.

31. **Markownikoff's rule:**

When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon that has more number of hydrogen and halogen add to the carbon having fewer hydrogen.

eg: In addition of HBr to propene two products are obtained

$$CH_3CH=CH_2 + HBr \longrightarrow \begin{cases} CH_3-\underset{Br}{CH}-CH_3 \text{ (major)} \\ CH_3CH_2CH_2Br \text{ (minor)} \end{cases}$$

32. **Formation of Acid Rain:**

1. Acid rain is a by product of a Variety of Sulphur and nitrogen oxides in the atmosphere. Acid rain consists of SO_2 and NO_2. They are Converted into H_2SO_4 & HNO_3 respectively by the reaction with Oxygen & H_2O.

$$2SO_2 + O_2 + 2H_2O \longrightarrow 2H_2SO_4$$
$$4NO_2 + O_2 + 2H_2O \longrightarrow 4HNO_3$$

Effect of Acid rain:

1. Acid rain causes extensive damage to buildings and structural materials of marbles. This attack on marble is termed as stone leprosy.

2. It affects plants and animal life in aquatic ecosystem.
3. It is harmful for agriculture, trees and plants as it dissolves and removes the nutrients need for their growth.
4. It corrodes water pipes resulting in the leaching of heavy metals such as iron, Pb, Cu into the drinking H_2O which have toxic effects.
5. It causes respiratory ailment in humans and animals.

33. [Compulsory] :- $T = 0^\circ c = 273K$

$$\Delta S_{fusion} = \frac{\Delta H_{fusion}}{T_{fusion}} = \frac{6008\ J\ mol^{-1}}{273K} = 22.007\ JK^{-1}mol^{-1}$$

5 Marks: Part-IV 5X5=25

34. a) Quantum Numbers:-

Quantum numbers are set of values that describes the state of an e⁻ including its distance from the nucleus, the orientation type of orbital where as likely to be found and its spin.

Types: 1. Principal quantum Number (n), 2. Azimuthal quantum number (l)
3. Magnetic quantum Number (m_l) 4. Spin quantum Number (m_s).

1. Principal quantum Number (n):-

1. It represents the energy level in which electron revolves around the nucleus and is denoted by the symbol 'n'. n = 1, 2, 3.... n=1, K shell, n=2 ⇒ L shell, n=3 ⇒ M shell. n=4,5 represent the N, O shells respectively.
2. The maximum number of e⁻s accomodated in a given shell is $2n^2$
3. 'n' gives the energy of e⁻ $E_n = \left(\frac{-1312.8}{n^2}\right) Z^2\ KJ\ mol^{-1}$
4. 'n' gives distance of the e⁻ from the nucleus $r_n = \frac{(0.529)\,n^2}{Z}\ \text{Å}$

2. Azimuthal (or) subsidiary quantum number (l):

* Each 'l' Value represents a Subshell (orbital).

2. It is represented by the letter 'l' and can take integral values from zero to (n-1). where n is the principal quantum number.

3. l=0, 1, 2, 3 and 4 represents the s, p, d, f and g orbitals respectively.

4. The maximum number of e⁻s that can be accomodated in a given subshell (orbital) is 2(2l+1).

5. It is used to calculate the orbital angular momentum using the expression. Angular momentum = $\sqrt{l(l+1)}\frac{h}{2\pi}$

3. Magnetic quantum number (m_l):

1. It is denoted by the letter (m_l). It takes integral values ranging from -l to +l through 0. i.e., If l=1

m = -1, 0, +1.

2. Different values of m for a given l value, represent different orientation of orbitals in space.

3. The Zeeman Effect provides the experimental justification for this quantum number.

4. The magnitude of the angular momentum is determined by the quantum number l while its direction is given by magnetic quantum number.

4. Spin quantum number (m_s):

1. The spin quantum number represents the spin of the electron and is denoted by the letter 'ms'.

2. The electron in an atom revolves not only around the nucleus but also spins. It is usual to write this as electron spins about its own axis either in a clockwise direction or in anti clockwise direction. The visualisation is not true. However spin is to be understood as representing a property that revealed itself in magnetic field.

* Corresponding to the clockwise and anticlockwise spinning of the e^-, maximum two values are possible for this Quantum number. The values of 'ms' is equal to $-\frac{1}{2}$ and $+\frac{1}{2}$.

(OR)

34. b) **Pauling method of determining ionic radii:-**

Ionic radius of uni-univalent crystal can be calculated using Pauli's method from the inter ionic distance between the nuclei of the cation and anion.

* Pauling assumed that ions present in a crystal lattice are perfect spheres and they are in contact with each other,

therefore, $d_{C^+A^-} = r_{C^+} + r_{A^-}$ ——— (1)

Where, $d_{C^+A^-}$ ⇒ distance between the centre of the nucleus of Cation C^+ and Anion A^-.

r_{C^+}, r_{A^-} ⇒ the radius of the Cation and anion respectively

* Pauling also assumed that the radius of the ion having noble gas electronic configuration is inversely proportional to the effective nuclear charge felt at the periphery of the ion.

$$r_{C^+} \propto \frac{1}{(Z_{eff})_{C^+}} \quad \text{——— (2)}$$

$$r_{A^-} \propto \frac{1}{(Z_{eff})_{A^-}} \quad \text{——— (3)}$$

Where, Z_{eff} ⇒ effective nuclear charge, $Z_{eff} = Z - S$

Dividing the equation (2) by (3)

$$\frac{r_{C^+}}{r_{A^-}} = \frac{(Z_{eff})_{A^-}}{(Z_{eff})_{C^+}} \quad \text{——— (4)}$$

On solving equ (1), (4) the values of r_{C^+} and r_{A^-} can be obtained.

35. a) (i) **Exchange reactions of Deutrium:-**

Deutrium can replace reversibly hydrogen in compounds either partially (or) completely depending upon the reaction conditions.

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$$CH_4 + 2D_2 \longrightarrow CD_4 + 2H_2$$

$$2NH_3 + 3D_2 \longrightarrow 2ND_3 + 3H_2$$

35. a) (ii) **Uses of Heavy H_2O (D_2O) :-**

* It is used as moderator in nuclear reactors
* It is used as a tracer to study organic reaction mechanisms and mechanism of metabolic reactions.
* It is also used as a Coolant in nuclear reactors.

(OR)

35. b) (i) **Preparation of Plaster of Paris :-**

Hemihydrate of Calcium Sulphate is called Plaster of Paris. It is obtained when Gypsum ($CaSO_4 . 2H_2O$) is heated to 393K.

$$2CaSO_4 . 2H_2O \longrightarrow 2CaSO_4 . \tfrac{1}{2}H_2O + 3H_2O$$

35. b) (ii) **Solvey process of preparing Na_2CO_3 :-**

In this process, NH_3 is converted into ammonium carbonate and again it converted into ammonium bicarbonate. It reacts with Nacl to give sodium bicarbonate. It is isolated and is heated to give Sodium Carbonate.

$$2NH_3 + H_2O + CO_2 \longrightarrow (NH_4)_2CO_3$$

$$(NH_4)_2CO_3 + H_2O + CO_2 \longrightarrow 2NH_4HCO_3$$

$$NH_4HCO_3 + Nacl \longrightarrow NH_4Cl + NaHCO_3$$

$$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O .$$

36. a) **Derivation of Critical Constants from Vanderwalls equation :-**

Vander Walls equation,

$$\left(P + \frac{a}{V^2}\right)(V - b) = RT \quad \text{---(1)}$$

Expanding this equation,

$$PV + \frac{a}{V} - Pb + \frac{ab}{V^2} - RT = 0 \quad \text{---(2)}$$

Multiply by $\frac{V^2}{P}$,

$$V^3 + \frac{aV}{P} - bV^2 + \frac{ab}{P} - \frac{RTV^2}{P} = 0 \quad \text{---(3)}$$

Rearranging this equation in the powers of 'V'

$$V^3 - \left(\frac{RT}{P} + b\right)V^2 + \left(\frac{a}{P}\right)V - \frac{ab}{P} = 0 \quad \text{---(4)}$$

At critical point, $V = V_c$, $V - V_c = 0$, $(V - V_c)^3 = 0$

Expanding this equation,

$$V^3 - 3V_c V^2 + 3V_c^2 V - V_c^3 = 0 \quad \text{---(5)}$$

Equate the equ(4) & (5),

$$3V_c = \frac{RT_c}{P_c} + b \quad \text{---(6)}$$

$$3V_c^2 = \frac{a}{P_c} \quad \text{---(7)}$$

$$V_c^3 = \frac{ab}{P_c} \quad \text{---(8)}$$

equ $\left(\frac{8}{7}\right)$ $\quad \frac{V_c^3}{3V_c^2} = \frac{ab}{P_c} \times \frac{P_c}{a} \Rightarrow \frac{V_c}{3} = b$, $\boxed{V_c = 3b}$ ---(9)

equ(9) Substitute in equ(8) $\rightarrow$

$$(3b)^3 = \frac{ab}{P_c} \Rightarrow 27b^3 = \frac{ab}{P_c} \Rightarrow 27b^2 = \frac{a}{P_c}$$

$$\boxed{P_c = \frac{a}{27b^2}} \quad \text{---(10)}$$

equ(9), (10) substitute in equ(6)

$$3(3b) = \frac{RT_c}{a} \times 27b^2 + b$$

$$9b - b = \frac{RT_c\, 27b^2}{a} \Rightarrow 8ab = 27Rb^2T_c$$

$$\boxed{T_c = \frac{8a}{27Rb}} \quad \text{---(11)}$$

From equ (7) $\rightarrow$ $\boxed{a = P_c \cdot 3V_c^2}$ ---(12)

From equ (9) $\rightarrow$ $\boxed{b = V_c/3}$ ---(13)

(OR)

36. b) (i) **Hess law of constant heat of Summation**:-

"The enthalpy change of a reaction either at constant Volume (or) Constant pressure is the same whether it takes places in a single (or) multiple steps. Provided the initial and final states are same".

36. b)(ii) **Characteristics of Gibbs free energy:**

* Free energy is defined as $G = H - TS$, 'G' is a state function.
* G is a extensive property. But ΔG is a intensive property. When mass remains constant between initial and final states.
* 'G' has a single value for the thermodynamic state of the system.
* G and ΔG values correspond to the system only.
* There are three cases of ΔG predicting the nature of process.

Process	Spontaneous	Equilibrium	Non-spontaneous
ΔG	-ve	0	+ve

* The decrease in free energy ($-\Delta G$) accompanying a process taking place at constant temperature and pressure is equal to the maximum obtainable work from the system other than work of expansion.

$$\Delta G = \Delta H - T\Delta S \quad \text{---(1)}$$

According to 1st law, $\Delta H = \Delta E + P\Delta V$, $\Delta E = q - W$

$$\therefore \Delta H = q - W + P\Delta V \quad \text{---(2)}$$

equ(2) Substitute in equ(1) $\Rightarrow$ $\Delta G = q - W + P\Delta V - T\Delta S$ ---(3)

According to second law, $\Delta S = \frac{q}{T}$, $q = T\Delta S$ ---(4)

equ(4) Substitute in equ(3) $\Rightarrow$ $\Delta G = T\Delta S - W + P\Delta V - T\Delta S$

$$\Delta G = -W + P\Delta V$$

Maximum Work $\therefore$ $\boxed{-\Delta G = W - P\Delta V}$

37. a)(i) **Environmental impact of ozone depletion:**

1. Depletion of ozone layer will allow more UV rays to reach the earth surface and layer would cause skin cancer and also decrease the immunity level in human beings
2. UV radiation affects plant proteins which leads to harmful mutation of cells.
3. UV radiation affects the growth of phytoplankton, as a result ocean food chain is disturbed and even damages the fish productivity.

37. a) (ii) **Relation between K_p & K_c :-**

$$xA + yB \rightleftharpoons lC + mD$$

$$K_c = \frac{[C]^l [D]^m}{[A]^x [B]^y} \quad \text{--- (1)} \qquad K_p = \frac{p_C^l \, p_D^m}{p_A^x \, p_B^y} \quad \text{--- (2)}$$

The Ideal gas equation is,

$$pV = nRT, \quad p = \left(\frac{n}{V}\right) RT$$

Active mass = molar Concentration $= n/V$

$$p = \text{active mass} \times RT$$

Based on this, $p_A^x = [A]^x [RT]^x$ $\quad p_C^l = [C]^l [RT]^l$

$p_B^y = [B]^y [RT]^y$ $\quad p_D^m = [D]^m [RT]^m$

on Substitution in equ(2)

$$K_p = \frac{[C]^l [RT]^l [D]^m [RT]^m}{[A]^x [RT]^x [B]^y [RT]^y}$$

$$K_p = \frac{[C]^l [D]^m [RT]^{l+m}}{[A]^x [B]^y [RT]^{x+y}}$$

$$K_p = K_c (RT)^{(l+m)-(x+y)}$$

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

$\therefore \Delta ng \rightarrow n_p - n_r$

(OR)

37. b)(i)

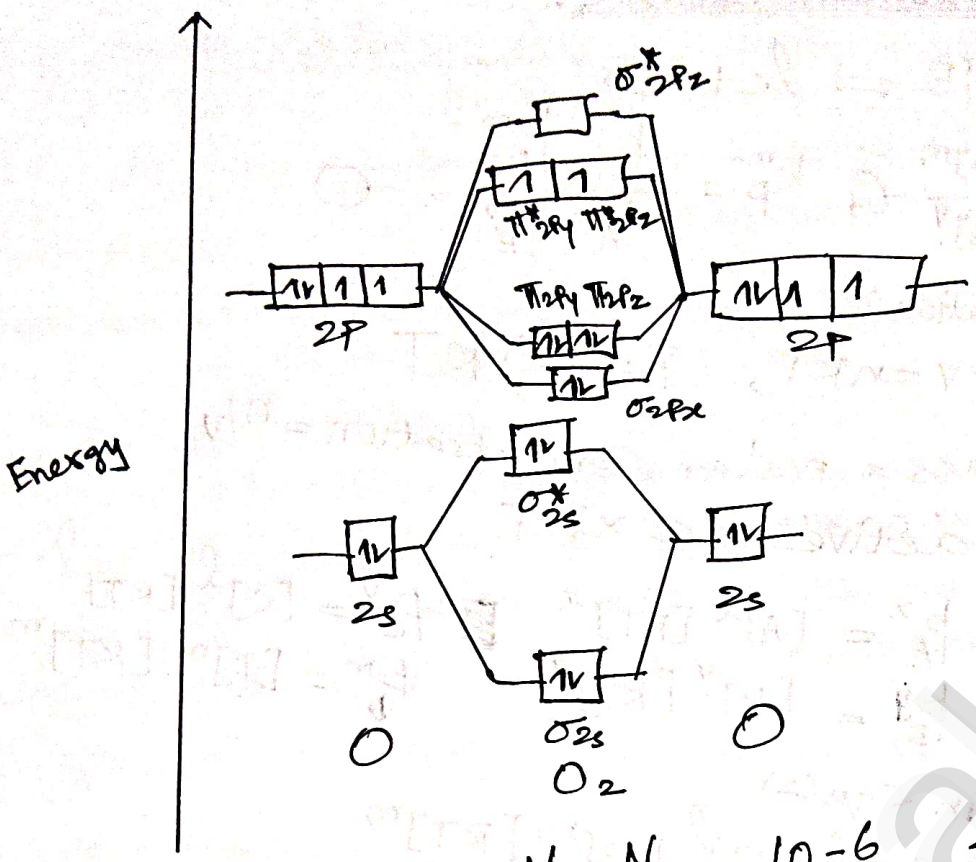
(i) **Molality (m)** $= \dfrac{\text{Number of moles of solute}}{\text{Mass of the solvent (in kg)}}$

(ii) **Normality (N)** $= \dfrac{\text{Number of gram equivalents of solute}}{\text{Volume of Solutions (in L)}}$

37. b) (ii) **M.O. diagram of O_2 :-**

$_8O \rightarrow 1s^2 2s^2 2p^4$

$O_2 \Rightarrow \sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \sigma_{2p_x}^2, \pi_{2p_y}^2 = \pi_{2p_z}^2, \pi_{2p_y}^{*1} = \pi_{2p_z}^{*1}.$



Bond order $= \frac{N_b - N_a}{2} = \frac{10-6}{2} = 4/2 = 2$ [$\because O=O$]

Magnetic property: Paramagnetic. [Molecule has 2 unpaired e⁻s]

38. a) (i) **IUPAC Names:**

1. CH_3OCH_3 → Methoxy Methane
2. $\overset{4}{C}H_3-\overset{3}{C}H_2-\overset{2}{C}H(OH)-\overset{1}{C}HO$ → 2-hydroxy butanal
3. $\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H=\overset{4}{C}H_2$ → 1,3-butadiene

38. a) (ii) **Inductive effect:**

= The change in polarisation of a covalent bond due to the presence of adjacent bonds, atoms (or) groups in the molecule" This is a permanent effect.

eg: Ethyl chloride $\overset{\delta\delta+}{C}H_3 \overset{(2)}{\rightarrow} \overset{\delta+}{C}H_2 \overset{(1)}{\rightarrow} \overset{\delta-}{Cl}$

(OR)

38. b) (i) **Structure of Benzene:-**

1. Molecular Formula → The molecular formula of Benzene is C_6H_6. This indicates

that benzene is a highly unsaturated compound.

2. Straight Chain structure not possible:
Benzene could be constructed as a straight Chain (or) ring compound but it not feasible. since it does not show the properties of alkenes (or) alkynes.

Benzene $\xrightarrow[KMnO_4 \text{ (Pink colour)}]{\text{acidified}}$ no decolouration ; Benzene $\xrightarrow[\text{(Red colour)}]{CCl_4/Br_2}$ no decolouration

3. Evidence of Cyclic structure: Benzene reacts with Br in the Presence of $AlCl_3$ to form monobromo benzene. Formation of only one monobromo compound indicates that all the 6 Hydrogen atoms in benzene were identical. This is possible only if it has a cyclic structure of 6 carbons each containing one hydrogen.

4. Benzene $\xrightarrow{3H_2/Ni}$ Cyclohexane This Confirms cyclic Structure of benzene and the presence of 3 -C=C- bond

5. Spectroscopic measurements:
* Benzene is planar and all of its Carbon - Carbon bonds are of equal length 1.40 Å. This Value lies between C-C single bond length 1.54 Å and C=C double bond length (1.34 Å).

6. Molecular orbital structure:
* All the 6 carbon atoms of benzene are sp^2 hybridised. 6 sp^2 hybridised orbitals of Carbon linearly overlap with 6 1s orbitals of hydrogen atoms to form 6 C-H Sigma bonds.
* overlap between the remaining sp^2 hybrid orbitals of Carbon forms 6 C-C sigma bonds.
* All the σ bonds in benzene lie in one plane with bond angle 120°. Each Carbon atom in benzene posses an unhybridised p-orbital Containing one electron.

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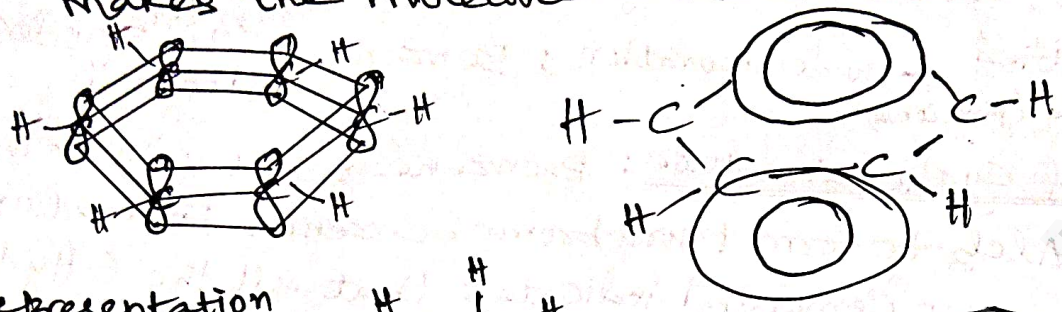
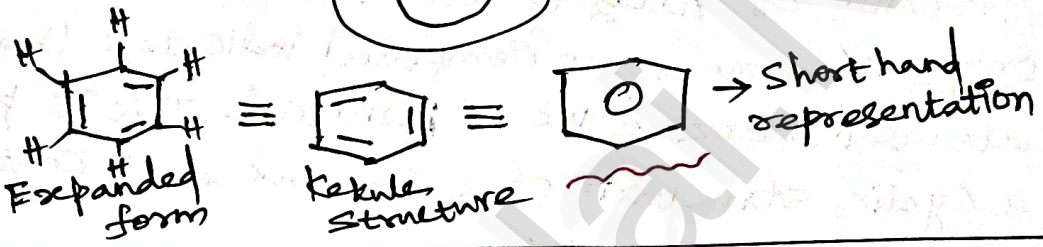
* The lateral overlap of their p-Orbital produces 3-π bond. The six electrons of p-orbitals cover all the six carbon atoms and are said to be delocalised. Due to delocalization, strong π-bond is formed which makes the molecule stable.

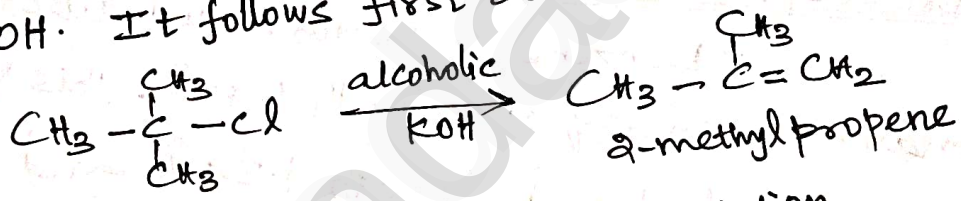


7. Representation of Benzene :



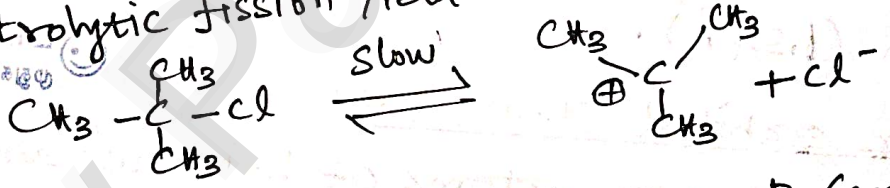
38. b) (ii) **E' reaction mechanism:**

Tertiary alkyl halide which undergoes elimination reaction by this mechanism in the presence of alcoholic KOH. It follows first order kinetics.

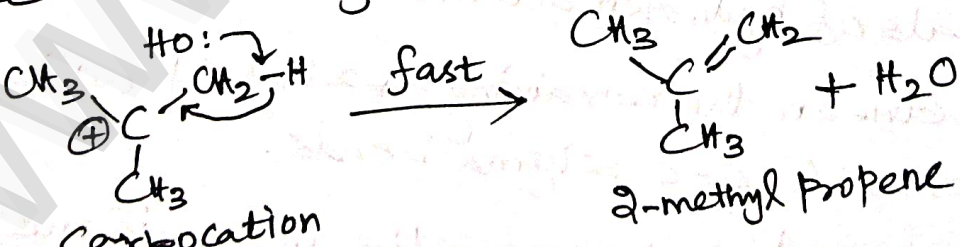


Mechanism:

Step 1: Hetrolytic fission yield a Carbocation



Step 2: Elimination of a proton form the β-Carbon to produce an 2-methyl propene.



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