+2

CHEMISTRY

This Material is prepared on the basis of Govt. Question paper Answer Key

Gem

5 Mark Question and Answers (Selected 17 lessons)

1. ATOMIC STRUCTURE

Q.No. 52

1. Derive de Broglie's equation.

(Sep-06, June-07, March-11)

If a photon is assumed to have wave character, its energy is given by,

$E = h\gamma$ (Planck's quantum theory) $\rightarrow (1)$

h = planck's constant

γ = frequency

If the photon is assumed to have particle character, its energy is given by,

$E = mc^2$ (Einstein equation) $\rightarrow (2)$

m = mass of photon

c = velocity of light.

From equation 1 & 2, we get.

$h\gamma = mc^2$ $\rightarrow (3)$

Substitute $\gamma = \dfrac{c}{\lambda}$ in equation (3)

$$h\frac{c}{\lambda} = mc^2$$

$$\frac{h\cancel{c}}{m\cancel{c}^2} = \lambda$$

$$\lambda = \frac{h}{mc}$$

The above equation is applicable to any material particle.

So, the mass of photon is replaced by the mass of any material particle.

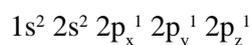The Velocity 'c' of the photon is replaced by the velocity 'v' of the material particle.

2

Thus, for any material particle like electron, we can write.

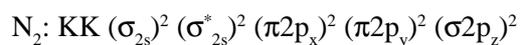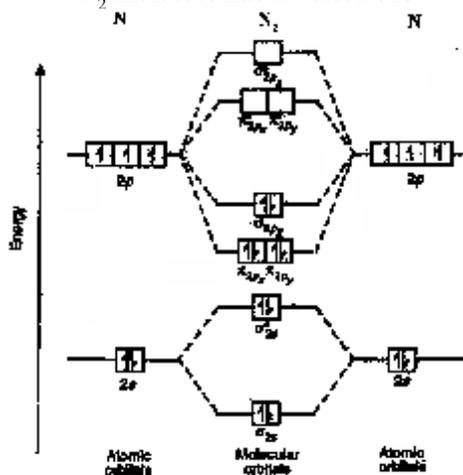$$\lambda = \frac{h}{mv} \quad (or) \quad \lambda = \frac{h}{p}$$

2. **Explain the formation of N_2 molecule using molecular orbital theory.**

(June-08, 08, 11, Sep-08, 10)

The electronic configuration of Nitrogen atom

$$1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^1$$

N_2 molecule has 14 electrons

N_2: KK $(\sigma_{2s})^2\ (\sigma^*_{2s})^2\ (\pi 2p_x)^2\ (\pi 2p_y)^2\ (\sigma 2p_z)^2$

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

$$= \frac{1}{2}(8-2) = \frac{1}{2}(6) = 3$$

Nature of bond = triple bond
Unpaired electrons = Nil
Magnetic nature = Diamagnetic

3

◀ Additional Questions ▶

3. Discuss Davisson and Germer Experiment. *[March-07]*

4. Discuss the shapes of s,p and 'd' orbitals.

5. Give any five postulates of molecular orbital theory.

[March-08, June & Sept-12]

6. Explain the formation of O_2 molecule using molecular orbital theory? *[March-06, 10, June-06, Sep-07, 11, March 13]*

2. PERIODIC CLASSIFICATION - II

Q.No.
64 a

1. Explain the various factors that affect electron affinity.

(March-07, 09, July-06, 07, Sep-06, June-12)

1. Electron affinity $\alpha \dfrac{1}{\text{size of atom}}$

2. Electron affinity $\alpha \dfrac{1}{\text{Shielding effect}}$

3. Electron affinity α Effective nuclear charge

4. Electronic Configuration:

If an atom has fully filled or half filled orbitals, its electron affinity will be low. Electron affinities of inert gases are zero. This is because their atom have stable $ns^2 \, np^6$ configuration.

Electron affinity of beryllium, magnesium and calcium is practically zero. This is due to extra stability of fully filled s-orbitals in them.

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

(March-11, Sep-07, July-07)

Electro negativity	Bond type of A – B	E.g
$X_A = X_B$ (or) $X_A - X_B = 0$	non polar covalent bond	H – H bond in H_2 molcule
$X_A > X_B$	polar covalent Ionic or polar bond	O – H bond in H_2O Represented by $O^{\delta-} - H^{\delta+}$
$X_A \gg X_B$	bond	Na – Cl bond in NaCl molecule $Na^+ \, Cl^-$

5

◄ Additional Questions ►

3.	How is atomic radii calculated from covalent bond length?

4.	Explain Pauling's method to determine ionic radii.
	[March-06, 10, 12, Sep-09, 10, July-10]

5.	Explain any three factors which affect the Ionisation energy.
	[July-08]

6.	Explain the pauling scale for the determination of electronegativity. Give the disadvantage of pauling scale.
	[March-08, Sept-12, March-13]

7.	Explain how electronegativity values help to find out the percentage of ionic character in polar covalent bond.*[Sep-08]*
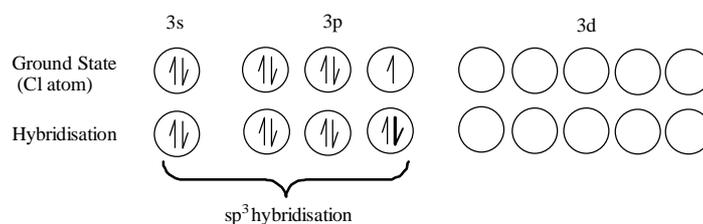
Gem

3. *p*-BLOCK ELEMENTS

Q.No.
64 b

1. **Discuss the structure of interhalogen compounds of AX, AX$_3$, AX$_5$ and AX$_7$ type (Any two type may be asked)**

    (Sep-07)

    1. AX Type

    (E.g) ClF

	3s	3p			3d

    Ground State (Cl atom): 3s ↑↓, 3p ↑↓ ↑↓ ↑, 3d ○ ○ ○ ○ ○

    Hybridisation: 3s ↑↓, 3p ↑↓ ↑↓ ↑↓, 3d ○ ○ ○ ○ ○

    sp^3 hybridisation

    Shape: Linear A   X

    2. AX$_3$ Type

    (E.g) ClF$_3$

    Ground State (Cl atom): 3s ↑↓, 3p ↑↓ ↑↓ ↑, 3d ○ ○ ○ ○ ○

    Excited State: 3s ↑↓, 3p ↑↓ ↑ ↑, 3d ↑ ○ ○ ○ ○

    Hybridisation: 3s ↑↓, 3p ↑↓ ↑↓ ↑↓, 3d ↑↓ ○ ○ ○ ○

    sp^{3}d hybridisation

7
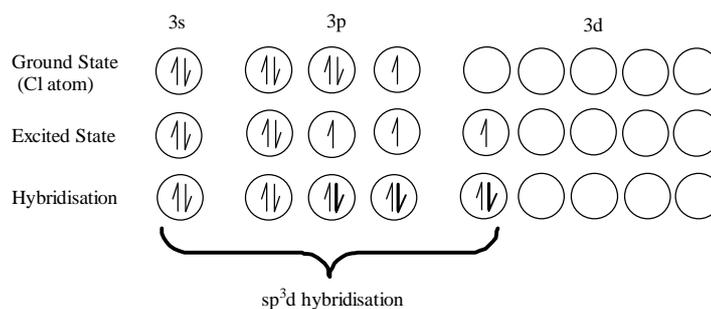
Shape:

Trigonal bipyramidal structure (without lone pair 'T' shaped)

3. AX$_5$ Type

(E.g) IF$_5$

$$sp^3d^2$$
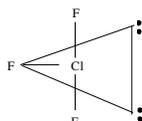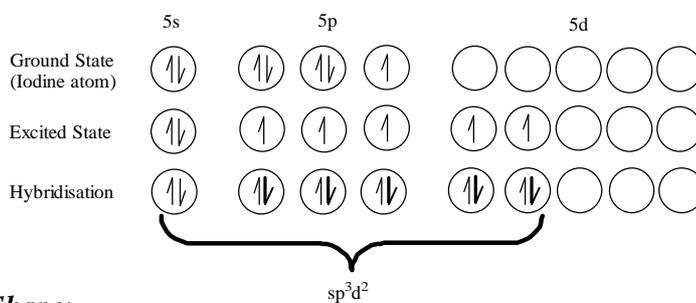
Shape:

Octahedral (without lone pair it is square pyramidal)

4. AX$_7$ Type

(E.g) IF$_7$

$$sp^3d^3$$

8
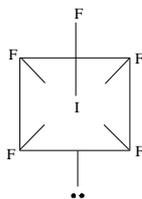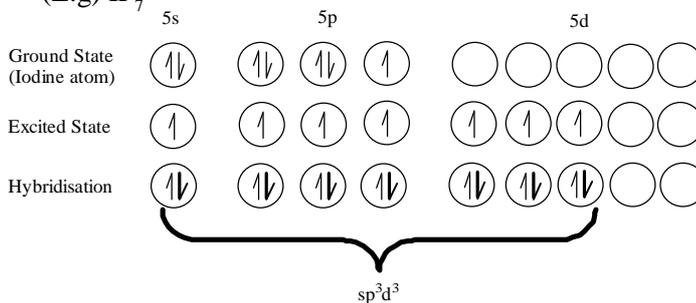
Shape: Pentagonal bipyramidal
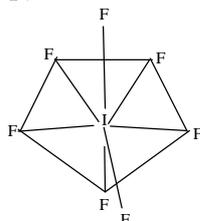
2.   **Describe in detail how noble gases are isolated by Dewar's process (or) Explain the Dewar's method of Separating the noble gases from its mixture.**

(Sep-06, March-10, 11, June-06, June 12)

Principle:

The mixture of noble gases is separated into individual constituents by the use of coconut charcoal which absorbs different gases at different temperatures.
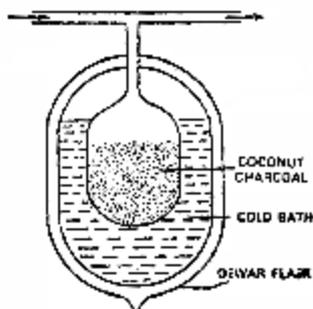
Temperature	Adsorbed	Unadsorbed
173 K	Xe, Kr, Ar	Ne, He
93 K	Ne	He
Liquid air temperature	Ar	Kr, Xe
183 K	Xe	Kr

9

◄ **Additional Questions** ►

3. What are silicones? How are they prepared?

4. Mention the uses of silicones.   *[March-07, 12, Sept-12]*

5. How is lead extracted from its ore?   *[July-08, Sep-11]*

6. Mention the uses of lead.

7. How are the following compounds prepared from phosphorus?
    a) P_2O_3 b) P_2O_5 c) PCl_3 d) PCl_5 e) PH_3

8. How does Fluorine differ from other halogens? (or) Discuss the Anamalous nature of fluorine.
    [March-08, 09, Sep-10, March 13]

9. How is florine isolated from their fluorides by Dennis method?
    [March-06, 11, Sep-08]

10. Describe how noble gases isolated from air?   *[June-06]*

11. Illustrate.   *[June 07]*
    (i) Tribasic nature of orthophosphoric acid
    (ii) Reducing property of phosphoms acid

12. Explain the following: *[Sep. 08]*
    (i) Dehydrating property of P_2O_5
    (ii) Oxidising power of fluorine

4. *d* - Block Elements

Q.No. 53

1. How is zinc extracted from its ore?

Mar 06, June 09, Mar 11, June 11, June 12

1. Ore : Zinc blende ZnS

2. Concentration : Froth floatation process

3. Roasting :

The concentrated ore is roasted in excess of air at about 1200 K.

$$2ZnS + 3O_2 \xrightarrow{1200 \text{ K}} 2ZnO + 2SO_2$$
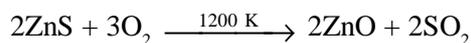
4. Reduction :

Zinc oxide is mixed with powdered coke and heated to 1673 K in which zinc oxide is reduced to zinc.

$$ZnO + C \xrightarrow{1673 \text{ K}} Zn + CO$$
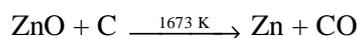
5. Purification : Anode : Impure zinc

Cathode : Pure zinc

Eletrolyte : Zinc sulphate solution + dilute sulphuric acid

On passing electric current, pure zinc gets deposited on the cathode.

◄ Additional Questions ►

2. Explain the extraction of silver from its chief ore?
    [June 06, Sep 07, June 08, March 13]

3. How is gold extracted from its ore?
    [Sep 06, Sep 09, June 07, Mar 08, June 10, Sept 12]

4. Explain how potassium dichromate is extracted from chromite ore?

5. Explain the extraction of chromium by Aluminothermic process? *[Sep-08, March-09]*

6. How silver is extracted from its silver coin?

7. Explain salient features of oxidation states of transition elements.

5. f - Block Elements

Q.No. 54

1. Describe the extraction of lanthanides from monazite sand?

Sep 06, June 07, Mar 10, June 11

Monazite sand

↓ Heat with H_2SO_4 for several hours at 210°C

Gray Mud

↓ Cold water

Un reacted monazite sand SiO_2, TiO_2, $ZrSiO_4$ etc., (recycle sand)

Filtrate containing $\left(Ln^{3+}, Tn^{4+}, H_3O^+, HSO_4^- \right.$ $\left. SO_4^{2-}, H_2PO_4^- \right)$

↓ Neutralised to proper to acidity   (or) Added HF

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

Filtrate containing Lanthanide and phosphate ions

↓ NaOH or oxalic acid

Lanthanide hydroxides (or) oxalates

1. The anhydrous fluorides and chlorides $\xrightarrow[\text{Calcium, 1270 K}]{\text{argon atmoshere}}$ individual metal

2. Triflurides of lanthanides $\xrightarrow[\text{Ca, Li}]{\Delta}$ Pure metal

◄ Additional Questions ►

2. What is lanthanide contraction? Discuss its causes and two consequences? (or) *[Sep 07]*

3. Discuss the Consequences of lanthanide contraction?
[June 06, Mar 07, Mar 09, June & Sept12, March 13]

4. Compare the points of similarities and differences between Lanthanides and Actinides?
[Mar 06, June 10, June 08, Mar 11]

5. Mention the oxidation state and any three uses of Lanthanides?
[Oct - 08, July &Sept 09]

6. Coordination Compounds and Bio-Coordination Compounds

Q. No. 55, 65a

1. Using VB theory explain why $\left[Ni(CN)_4 \right]^{2-}$ is diamagenic where as $\left[Ni(NH_3)_4 \right]^{2+}$ is paramagnetic?

(June-06, 08, 10, 12, March-07, 13, Sep-06)

1. *Nickel atom* $\left[Ni(NH_3)_4 \right]^{2+}$

Outer electronic configuration $3d^8\ 4s^2$
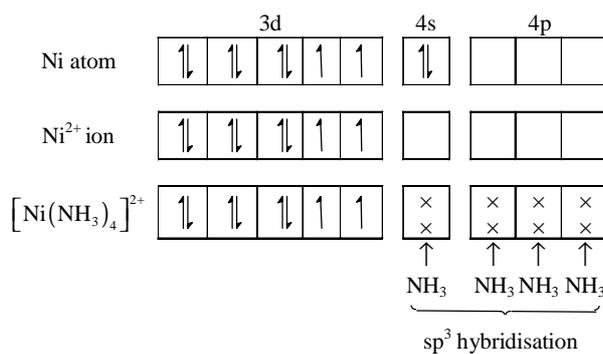
Number of unpaired electrons = 2

Magnetic character $\Rightarrow$ Paramagnetic

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

Geometry $\Rightarrow$ tetrahedral

2. $\left[Ni(CN)_4 \right]^{2-}$

15

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

◄ Additional Questions ►

2. For the complex $K_4\left[Fe(CN)_6\right]$, $\left[Cu(NH_3)_4\right]SO_4$ mention
    (a) IUPAC name   (b) Central metal ion
    (c) ligand   (d) Co-ordination number
    (e) Geometry of the complex (f) Charge on the complex ion.
    [Sep 08, Sep 07, Mar 07, Mar 11]

3. For the complex $\left[Co(NH_3)_6\right]Cl_3$ mention the following
    (a) IUPAC name   (b) Central metal ion
    (c) ligand   (d) Co-ordination number
    (e) Nature of complex
    [Sep 08, Sep 07, Mar 07, Mar 11]

4. Explain co-ordination and ionisation isomerism with suitable
    example?   *[June 07, 09, 12 Mar 08, 10, 13 Sep 08]*

5. Explain the postulates of werner's theory?
    [June 07, 09, Mar 06, 08, 10, Sep 08, 12]

6. What are the postulates of valence bond theory (or) VB theory?
    [Mar 09]

16

7. In what way $\left[FeF_6\right]^{4-}$ differ from $\left[Fe(CN)_6\right]^{4-}$ (or) Mention the type of hybridisation, magentic property and geometry of the following complexes using VB theory.
   (i) $\left[FeF_6\right]^{4-}$ (ii) $\left[Fe(CN)_6\right]^{4-}$
   [March-08, 09, June-11, Sep-11, 12]

8. Mention the function of haemoglobin in natural process.
   [March-10]

9. How is chlorophyll important in environmental chemistry?
   [Mar 08]

10. Explain the following terms.
    (i) Neutral ligand (ii) Chelates (iii) Co-ordination sphere
    [Sep 08]

11. Explain Hydrate and linkage isomerism with examples.
    [Mar 10]

17

7. Nuclear Chemistry

Q. No.
65 b

1. **How are radioactive isotopes useful in medicine?**
(March-06, June-09, 11)

S. No.	Isotope	Uses
1.	Tritium $_1H^3$	Measure of water content of the body
2.	Carbon – 11	Brain scan
3.	Carbon – 14	Radio immunology
4.	Cobalt – 60	Treatment of cancer
5.	Gold – 198	Curing of cancers
6.	Mercury – 197	Kidney scan
7.	Phosphorous – 32	Detection of eye tumours
8.	Iron – 59	Diagnosis of anemia
9.	Iodine – 131	Diagnosis of damaged heart muscles

◄ Additional Questions ►

2.   Give the differences between nuclear reactions and chemical reactions?   *[Mar 09, 11, 12, June 12]*

3.   Explain nuclear fission reaction with an example. *[June-08]*

4.   Explain nuclear fusion reaction?   *[Oct-09]*

5.   Explain the principle underlying the function of hydrogen bomb.
                    [Mar 06, 07, Sep 11]

6.   Write a note on Radio carbon dating?
                    [June 06, 10, Sep 06, 07, Mar 08, 10, 13]

7.   Explain the nuclear reactions that takes place is sun.
                    [June-07, Sep 12]

8.   Mention the uses of radio isotopes in the field of
      (i) Mechanism of photosynthesis in plants.
      (ii) Study of hydrolysis of ester.   *[Sep 08]*

9.   Give the differences between nuclear fusion and nuclear fisson reactions?   *[June 08, Oct 09]*

<center>

8. Solid State

Q. No. 66 a

</center>

1. **Explain Schottky and Frenkel defects.**

<center>

(March-06, 09, 12, 13, Oct-08, 12)

</center>

Schottky defects

- This defect is caused if some of lattice points are unoccupied.

- The unoccupied points are called lattice vacancies.

- The number of missing positive and negative ions is the same in this case, and thus crystal remains neutral.

- Schottky defects appear generally in ionic crystals in which the positive and negative ions do not differ much in size.

- In the given figure of NaCl crystal, one due to a missing of Na^+ ion and the other due to a missing of Cl^- ion.

Na⁺ missing   Cl⁻ missing
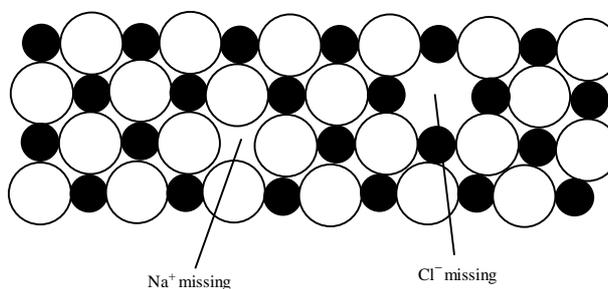
Frenkel Defects
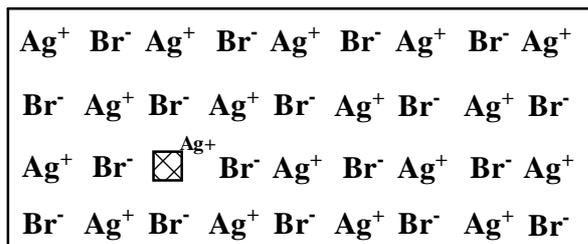
- This defect is caused when an ion occupies an interstial position between the lattice points.

- The number of positive ions is equal to the number of negative ions and thus the crystal remains neutral.

- This defect occurs in ionic crystals in which the anion is much larger in size than the cation.

<center>20</center>

☾ In the given figure, one of the Ag^+ ion occupies interstial position rather than its own appropriate site.

(E.g)   Ag Br

Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+
Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-
Ag^+	Br^-	⊠$^{Ag+}$	Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+
Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-	Ag^+	Br^-

◄ Additional Questions ►

2.   Explain Braggs spectrometer method.
[June-06, 09, Oct-07, 10 March-08, 10]

3.   Write a note on super conductors (or) What are superconductors? Write their uses.   *[June-08, 11, 12]*

4.   What are ionic crystals? Write the properties of ionic crystals.
[June 07, Mar 11]

5.   What is Bragg's equation? Give its significance.

6.   Explain the nature of glass (or) Explain the nature of amorphous solids?   *[March-07]*

7.   Explain AB and AB_2 type ionic crystals with one example for each.

21

9. Thermodynamics - II

Q. No. 56

1. **State the various statements of second law of thermodynamics.**
   (March-06, 08, 10, 13, June-06, 10, 11, Sep-06, 11)

1. 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.

2. Clausius statement

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

3. Entropy statement

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

4. Efficiency of a machine can never be cent percent.

5. Efficiency of machine = $\dfrac{\text{Output energy}}{\text{Input energy}} \times 100$

   % efficiency $= \dfrac{\text{Output energy}}{\text{Input energy}} \times 100$

In a heat engine, if $T_1 > T_2$, then some amount of heat is converted to work.

   % efficiency $= \left(\dfrac{T_1 - T_2}{T_1} \right) \times 100$

T_1 = Initial temperature of heat engine
T_2 = Final temperature of heat engine

22

◄ Additional Questions ►

2. What are the characteristics of entropy?

   [June-08, Sep-08, 12, March-09]

3. Write the characteristics of free energy G.

   [March-07, 11, June-07, 09, Sep-07]

4. What are spontaneous reactions? What are the conditions for the spontaneity, Equilibrium and Non-spontaneous process?

5. Define Trouton's Rule. What are the substances that deviated from this rule?   *[June 12]*
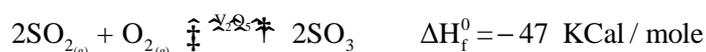
10. Chemical Equilibrium - II

Q. No. 57

1. **Apply Le chatelier principle to contact process of manufacture of SO$_3$.**

(Sep-07, June-08, March-09)

1. Manufacture: Contact process

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_3 \qquad \Delta H^0_f = -47 \ KCal / mole$$

2. Pressure: 700 – 1200 atm

Increase of pressure, forward reaction is favoured.

3. Temperature: 400 – 450°C

4. Catalyst: V$_2$O$_5$

5. Maximum yield: 97% SO$_3$

6. DH: –47 KCal/mole

7. Reaction Type: Exothermic

◀ Additional Questions ▶

2. Derive a relation between K$_p$ and K$_c$ (or) Derive the relation $K_p = K_c (RT)^{\Delta n_g}$ for a general chemical equilibrium reaction.
   [March-06, 10, 12, June-07, Oct-08]

3. Derive the expressions for K$_p$ and K$_c$ for decomposition of PCl$_5$.
   [March-07, 11, 13, Sep-11, June-12]

4. Derive expressions for K$_c$ and K$_p$ for the formation of HI.
   [Oct-09]

5. Discuss the effect of temperature and pressure of the following equilibrium.   *[June-09, Sep-12]*

6. State Le chatlier's principle. Apply Le-chatlier principle to Haber's process of manufacture of ammonia.

   [June-06, 10, 11, March-08]

11. Chemical Kinetics - II

Q. No. 58

1.   State the characteristics of order of reaction.

(Mar. 06, 10, 11, Sep. 08, June 10)

i)   The magnitude of order of a reaction may be zero or fractional or integral values.

ii)   Order of a reaction should be determined only by experiments. It cannot be predicted in terms of stoichimetry of reactants and product.

iii) Simple reactions possess low value of order like n = 0, 1, 2. Reactions with order greater than or equal to 3.0 are called complex reactions. Higher order reaction are rare.

iv)   Some reaction show fractional order depending on rate.

v)   Higher order reaction may be experimentally converted into simple order reaction by using excess concentrations of one or more reactants.

◄ Additional Questions ►

2.   Explain the experimental determination rate constant of acid hydrolysis of methyl acetate.   **[Mar 07, Sep 11]**

3.   Write an account of the Arrhenius equation for rates of chemical reactions.

4.   Write notes on (i) consecutive reactions, (ii) Parallel reactions and (iii) Opposing reaction (or) Explain various types of complex reactions and give an example for each.

[June 08, Mar 08]

5.   Explain the experimental determination of rate constant for decomposition of H_2O_2 in aqueous solution.

[June 06, Sep 07]

25

6. What are the characteristics of first of reaction.

7. Derive the rate constant equation for first order reaction.

   [Jun 09, 11]

8. State the differences between simple and complex reaction.

   [June 07, Sep 10]

9. Show that for a first order reaction the time required for 99.9% completion is about 10 times its half life period.   *[Mar 12]*

10. A first order reaction completes 75% of the reaction in 100 mins. What are rate constant and half life period?   *[Sep 09]*

11. Compound (A) follows first order reaction. At 25°C, the rate constant of a first order reaction is 0.45 sec^{-1}. Calculate is half life period of A at 25°C? What is the time required to have 12.5% unreacted 'A' for first order reaction?   *[March 09]*
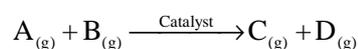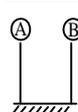
12. Surface Chemistry

Q. No. 56 b

1. Write briefly about the adsorption theory of catalysis.
*(March-06, 09, 13)*

This theory explains the mechanism of heterogeneous catalysis. There are four steps involved in the heterogeneous catalysis.

$$A_{(g)} + B_{(g)} \xrightarrow{\text{Catalyst}} C_{(g)} + D_{(g)}$$

Step: 1 Adsorption of reactant molecules

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

Step: 2 Formation of Activated Complex
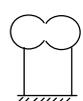
The particles of the reactants adjacent to one another join to form an unstable intermediate complex (A – B).

Step: 3 Decomposition of Activated Complex
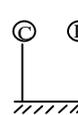
The activated complex breaks to form the products C and D. The separated particles of the products hold to the catalyst surface by partial chemical bonds.

Step: 4 Desorption of Products

The particles of the products are released from the surface.

◄ Additional Questions ►

2. Give any 5 main differences between physical adsorption and chemical adsorption.   *[July 09]*

3. Write notes on (i) Positive catalyst, (ii) Negative Catalyst.

4. Write notes on (i) Auto Catalyst, (ii) Induced Catalyst, (iii) Promoters.   *[Sep-09]*

5. Discuss the factors affecting adsorption.   *[Sep-12]*

6. Write briefly on intermediate compound formation theory of catalysis with an example.

    [June-07, 11, 12, Sep-08]

7. Explain chemical methods for the preparation of colloids (or) Explain condensation methods for the preparation of colloids.
    [Sep-06, 10, March-07, 10, 12 July-10]

8. How are colloids prepared by (i) mechanical dispersion and (ii) electro dispersion methods.

                              (or)

    Write any three methods for the preparation of colloids by dispersion methods.   *[March-08, June-06]*

9. What is electro-osmosis? Explain.   *[Sep-07, July-08]*

10. Write the application of catalysis.

11. Write the application of colloids.

12. How can colloidal solution be purified by dialysis (or) Write notes on dialysis.   *[March-11]*

13. Write the General Characteristics of catalytic reactions?
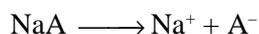
                                            [Sep. 11]

28

13. Electro Chemistry - I

Q. No.
67 a

1. **Derive Henderson equation (or) Derive Henderson, Hasselbalch equation.**

(Sep-08, June-07, March-08, March-11)

Let us consider an example for acid buffer HA and NaA.

NaA is a strong electrolyte. The dissociation expression is

$$NaA \longrightarrow Na^+ + A^-$$

The dissociation expression of a weak acid, HA is

$$HA \rightleftharpoons H^+ + A^-$$

$$K_a = \frac{[H^+][A^-]}{[HA]}$$

$$[H^+] = \frac{[HA]K_a}{[A^-]} \tag{1}$$

[HA] = Initial concentration of the acid

[A⁻] = Initial concentration of salt

$$[H^+] = K_a \frac{[Salt]}{[Acid]}$$

Take negative logs on both sides

$$-\log[H^+] = -\log K_a - \log \frac{[acid]}{[salt]}$$

$$-\log[H^+] = pH$$

$$-\log K_a = pK_a$$

Substitate (4) & (5) in equation (3)

$$pH = pK_a - \log \frac{[acid]}{[salt]}$$

29

$$pH = pK_a + \log \frac{[salt]}{[acid]}$$

The above equation is known as Henderson equation
For basic buffer

$$pH = pK_b + \log \frac{[salt]}{[base]}$$

◄ Additional Questions ►

2. Write the postulates of Arrhenius theory of electrolytic dissociation. **[June-09, 10, March-10, 12]**

3. Explain Ostwalst's dilution law. **[March-06, 07, 09, Sep-08, 11]**

4. Explain buffer action with example. **[Sep-09]**

5. Write notes on Ostwald's theory of indicators. **[June 06, 12]**

6. Write notes on Quinonoid theory of indicators.
[Sep 07, June 08, Mar 09, 13]

7. State and explain Kohlrausch's law.

8. Write the differences between metallic Conductors and electrolytic conductors (or) write the difference between electronic conductors and electrolytic conductors. **[June 11]**

9. Write the evidences in favour of Arrhenius theory of electrolytic dissociation. **[Mar 10]**

10. Define molar, equivalent and specific conductance.
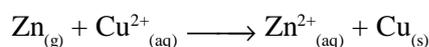
14. Electro Chemistry - II

Q. No. 59 & 67 B

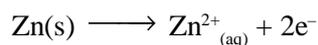**1. Describe Daniel cell.**

(June-07, Sep-09)

1. Daniel cell or galvanic cell is an example of electrochemical cell.

2. The overall reaction in the cell is the redox reaction.

    $$Zn_{(g)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$$

3. The oxidation half reaction occuring at the zinc electrode in contact with the aqueous Zn^{2+} solution.

    $$Zn(s) \longrightarrow Zn^{2+}_{(aq)} + 2e^-$$

4. The reduction half reaction occuring at the copper electrode in contact with the aqueous electrolyte containing Cu^{2+} ions.

    $$Cu^{2+} + 2e \longrightarrow Cu_{(s)}$$
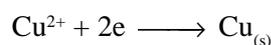
5. For continuous supply of current for a long period, the two half cells each comprising the metal electrode and its electrolyte kept in separate containers and connected externally by salt bridge.
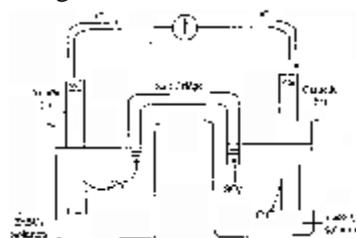
6. When the cell is set up, electrons flow form zinc electrode through the wire to the copper electrode.

7. Zinc dissolves in the cathode solution to form Zn^{2+} ions. The Cu^{2+} ions in the cathode cell pick up electrons.

31

◄ Additional Questions ►

1. Describe Daniel cell. *[June 07, Sep 09]*

2. Write the IUPAC convention of representation of a cell.
   [Mar 06, 07, 09, 10, 11, 13, Sep 11]

3. Establish a relation between free energy and e.m.f.
   [Sep 06, 07, July 09]

4. Derive Nernst equation.
   [June 06, 07, 10, 11, Sep 06, 08, 12, Mar 09, 12]

5. How is emf of a half cell determined?
   [Mar 08]

6. How is standard Hydrogen electrode (SHE) constructed? Explain its function?

7. Write an account on cell terminology?
   [June 09, Mar 12]

8. With the help of electrochemical series, how will you predict whether a metal will displace another metal from its salt solution or not? Give examples. *[June 12]*
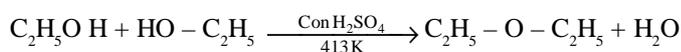
17. Ethers

Q. No. 60

1. **Give any three methods of preparing diethyl ether.**

(June-07, March-08, 10, 13)

1. When excess of alcohol is heated with con H_2SO_4, at 413K, give ether.

$$C_2H_5O\,H + HO - C_2H_5 \xrightarrow[413\,K]{Con\,H_2SO_4} C_2H_5 - O - C_2H_5 + H_2O$$

2. Williamson synthesis:

When ethyl bromide is heated with sodium ethoxide, gives diethyl ether

$$\underset{\text{methyl bromide}}{C_2H_5Br} + \underset{\text{sodium ethoxide}}{NaOC_2H_5} \longrightarrow \underset{\text{diethyl ether}}{C_2H_5 - O - C_2H_5} + NaBr$$
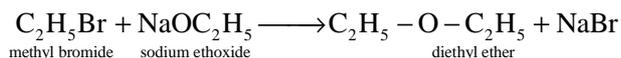
3. By heating ethyl iodide with silver oxide, diethyl ether is prepared

$$\begin{matrix}C_2H_5I\\C_2H_5I\end{matrix} + Ag_2O \xrightarrow{\Delta} \underset{\text{diethyl ether}}{C_2H_5 - O - C_2H_5} + 2AgI$$
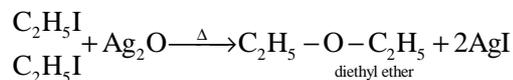
◄ Additional Questions ►

2. Discuss the isomerison in Ethers. *[June 06, Sep 07]*

3. How does diethyl ether react with the following reagents?
   (i) Cl_2 (ii) O_2 (iii) H_2SO_4 *[Mar 07]*

4. How does diethyl ether react with the following reagents?
   (i) dil H_2SO_4 (ii) with HI (iii) with excess HI   (iv) PCl_5
   [Mar 06, June 11]

5. Give any three methods of preparation of anisole and explain the reaction of HI with anisole.
   [June 08, 12 Mar 09, Sep 12]

33

6. Distinguish between anisole and diethyl ether. (or)
Distinguish between aromatic ethers and aliphatic ethers.
[Sep 06, 08, 11, June 09, Mar 11]

7. Write all possible isomers with molecular formula $C_4H_{10}O$ and name them.

8. Illustrate electrophilic substitution of anisole.

18. Carbonyl Compounds

Q. No. 61

1. **Explain the mechanism of aldol condensation of acetaldehyde.**
   (Sep-07, 11, March-07, 12, July-07)

Reaction:

Condensation of acetaldehyde in presence of NaOH, gives aldol.

$$CH_3 - \underset{\underset{O}{\|}}{\overset{\overset{H}{|}}{C}} + H - CH_2 - CHO \xrightarrow{NaOH} CH_3 - \underset{\underset{OH}{|}}{CH} - CH_2 - CHO$$

aldol
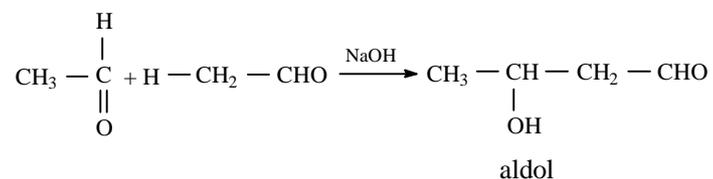
Reaction Mechanism:

Step 1: The carbanion is formed as the α-Hydrogen atom is removed as a proton by the base.

$$\overset{\frown}{H} - CH_2 - CHO \xrightarrow{OH^-} \overset{(-)}{C}H_2 - CHO + H_2O$$
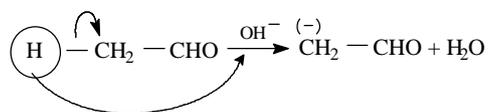
Step 2: The carbanion attacks the carbonyl carbon of another unionised aldehyde molecule.

$$CH_3 - \underset{\underset{O}{\|}}{\overset{\overset{H}{|}}{C}} + \overset{(-)}{C}H_2 - CHO \longrightarrow CH_3 - \underset{\underset{(-)}{\overset{O}{|}}}{\overset{\overset{H}{|}}{C}} - CH_2 - CHO$$
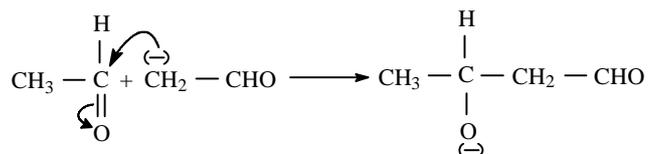
Step 3: The alkoxide ion formed is protonated by water to give 'aldol'

$$CH_3 - \underset{\underset{(-)}{\overset{O}{|}}}{\overset{\overset{H}{|}}{C}} - CH_2 - CHO \xrightarrow{H - OH} CH_3 - \underset{\underset{OH}{|}}{CH} - CH_2 - CHO$$

aldol

35
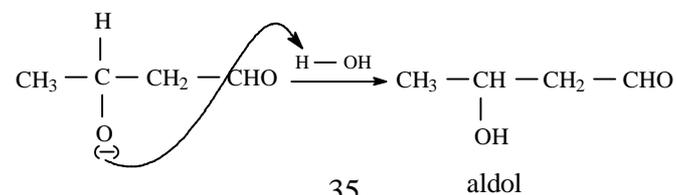
◄ Additional Questions ►

2. Write the mechanism of aldol condensation of acetone.
   [July 06, 10, Sep 08]

3. Explain the mechanism of crossed aldol condensation.
   [June 12]

4. Explain the mechanism of Cannizzaro reaction.
   [Mar 06, 10, July 08, 09]

5. Give the mechanism for claisen or claisen - schimidt reaction.
   [Sep 07, 10]

6. Write the difference between acetaldehyde and acetone.
   [Mar 08]

7. Explain Popott's rule with an example.
   [Mar 09]

8. How is acetone converted to
   (i) mesityl oxide   (ii) mesitylene   *[Mar 11]*

9. Write a note on (i) Stephen's Reaction (ii) Perkin's Reaction
   [Mar 09]

10. Write the differences between acetaldehyde and benzaldehyde.
    [Mar 13]

22. Chemistry in Action

Q. No. 63

1. **What are chromophores and auxochromes? Give two example for each. (or) Explain the colour and structure of dye. (or) Explain the Otto-Witt's theory about dyes with a suitable examples.** *(Sep-08, 09, June-11, 12)*

(i) Chromophores:

An organic compound appears coloured due to the presence of unsaturated groups. These groups are called as chromophores.

(E.g) Nitro – NO_2,   Azo –N = N–

(ii) Chromogen:

The compounds containing the chromophore group is called chromogen.

(E.g) $CH_2 = CH_2$ $CH_3 – (CH = CH)_6 – CH_3$
        Colourless   Yellow

(iii) Auxochrome:

It deepen the colour of the chromogen.

(E.g) –OH, $–NH_2$

The presence of an auxochrome in the chromogen molecule is essential to make it a dye.

(E.g) *p*-hydroxyazobenzene (a bright red dye)

$$\langle\bigcirc\rangle - N = N - \langle\bigcirc\rangle - OH$$

a) Chromogen: azobenzene

$$\langle\bigcirc\rangle - N = N - \langle\bigcirc\rangle$$

b) Chromophore: diazo group –N = N–
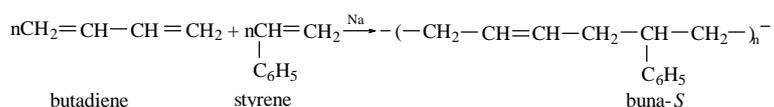*c) Auxochrome:*   hydroxyl group –OH

37

2. How are Buna-S and Nylon-66 prepared? Give their uses.

(March-08, 13)

a) Buna-S

It is obtained by the polymerisation of butadiene and styrene in presence of sodium metal.

$$nCH_2 = CH - CH = CH_2 + nCH = CH_2 \xrightarrow{Na} -(-CH_2 - CH = CH - CH_2 - CH - CH_2 -)_n^-$$

| |
| C₆H₅   C₆H₅

butadiene   styrene   buna-*S*
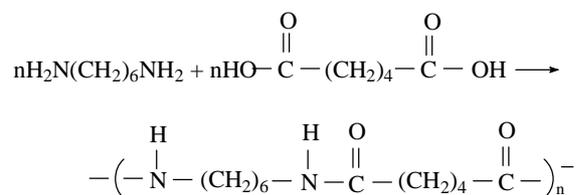
Properties:

Neoprene and Buna-S are extremely resistant towards wear and tear.

Use:

Manufacture of tyres and tubes.

b) Nylon-66

It is obtained by condensing adipic acid wih hexamethylene diamine with the elimination of water molecule.

$$nH_2N(CH_2)_6NH_2 + nHO-\overset{\overset{O}{\|}}{C}-(CH_2)_4-\overset{\overset{O}{\|}}{C}-OH \longrightarrow$$

$$-\left(-\overset{\overset{H}{|}}{N}-(CH_2)_6-\overset{\overset{H}{|}}{N}-\overset{\overset{O}{\|}}{C}-(CH_2)_4-\overset{\overset{O}{\|}}{C}-\right)_n^-$$

Use:

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

◄Additional Questions►

3.   Write a note on Anaesthetics.   *[Sep 06, Mar 10]*

4.   Give the characteristics of a dye.

                                          [June 09, Mar 11]

5.   Explain briefly the characteristics of rocket propellants.
          [Mar 06, 09, 11, June 06, 07, 08, 10, Sep 07, 11]

6.   Write briefly on Buna rubbers.

                                          [Mar 07]

- 1 & 3 Mark Questions & Answers
- 5 & 10 Mark Questions & Answers
- Q-70 Compulsory Problems
- Question Bank

For Gem Complete Material
Contact: Sumathi Gunaseelan, Trichy
È: 9080228421