# CEP Phase-2 (2024-25)

## CLASS : 11th

## Subject : CHEMISTRY

LEP SIMPLIFIED STUDY MATERIAL



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| 3. | Ch-3 Classification of elements and periodicity in properties | Charanjeet Kaur Lect Chem, SOE CHHAJLI. (9780536035) |
| 4. | Ch-4 CHEMICAL BONDING AND MOLECULAR STRUCTURE | Harkirat kaur Lect Chem SOE , NANGAL , Roopnagar Contact : (9464488177) |
| 5. | Ch-5 (CHEMICAL THERMODYNAMICS) | Shashi Bala, Lect Chem GSSS (Girls), Dhuri (8054918539) |
| 6. | Ch-6 Equilibrium | Meghna, Lect Chem, GSSS(BOYS), Nurpur Kalan, ROPAR (9463822988) |
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# Chapter 1 - Some Basic Concepts of Chemistry

**Important Definitions:**

1. **Law of Conservation of Mass**: It states that mass is neither created nor destroyed in a chemical reaction. The total mass of reactants equals the total mass of products.
2. **Law of Definite Proportions**: This law states that a given chemical compound always contains the same proportion of elements by mass, regardless of the amount or source of the compound.
3. **Law of Multiple Proportions**: This law states that when two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in ratios of small whole numbers.
4. **Gay-Lussac's Law of Gaseous Volumes**: This law states that when gases react together at constant temperature and pressure, the volumes of the reacting gases and the volumes of the products (if gaseous) are in simple whole number ratios.
5. **Limiting Reagent**: The reactant in a chemical reaction that is completely consumed first, limiting the amount of product formed. It determines the maximum amount of product that can be produced.
6. **Molarity**: A unit of concentration, defined as the number of moles of solute per liter of solution. It is commonly used in laboratory work to express solution concentration.
7. **Molality**: A unit of concentration, defined as the number of moles of solute per kilogram of solvent. Molality is often used in cases where temperature variations might affect the volume of a solution.

## MCQs (1 Mark Each)

**Question 1**: How many significant figures are there in the measurement 0.00345?
A) 2 B) 3 C) 4 D) 5

**Question 2:** The percentage composition of water ($H_2O$) is approximately:
A) 11.19% hydrogen, 88.81% oxygen B) 5.90% hydrogen, 94.10% oxygen
C) 50% hydrogen, 50% oxygen D) 10% hydrogen, 90% oxygen

**Question 3**: The law of conservation of mass holds true for all of the following except:
A) All chemical reactions B) Nuclear reactions
C) Endothermic reactions D) Exothermic reactions

**Question 4**: What is the molar mass of 0.1 mole of glucose ($C_6H_{12}O_6$)?
A) 16 g/mol B) 18 g/mol C) 20 g/mol D) 22 g/mol

**Question 5**: Stoichiometry is the study of:
A) Chemical kinetics B) Chemical equilibrium
C) Chemical reactions and their products D) Chemical composition and reactions

## 2 Marks Question Answers

**Question 1**: State the law of constant proportions and give an example.
**Question** 2: What is a limiting reactant in a chemical reaction?
**Question 3**: What is the mole concept?
**Question 4**: What are colligative properties? List two examples.

## 3 Marks Question Answers

**Question 1**: What is the law of conservation of mass? Give one example.
**Question 2**: What are the main postulates of Dalton's atomic theory?
**Question 3**. Calculate the number of Cu atoms in 0.635 g of Cu.

**Question** 4. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas?

**Question 5**. Calculate the number of atoms in each of the following

a) 52 moles of Ar b) 52 u of He and c) 52 g of He

## Chapter 2 :- Structure of Atom

**Important Topics:**

- **Discovery of Electron:** The electron is a low-mass, negatively charged particle. As such, it can easily be deflected by passing close to other electrons or the positive nucleus of an atom.
- **Types of Model of Atoms:**
- John Dalton's atomic model: Dalton's Billiard Ball (Solid Sphere) Model. ...
- J.J. Thomson's model: Plum Pudding model. ...
- Ernest Rutherford's model: Nuclear model. ...
- Niels Bohr's model: Planetary model. ...
- Erwin Schrodinger's model: Electron Cloud Model/Quantum Model. ...
- Wave mechanical model.
  **Quantum Number & types:**
  Principal Quantum Number (n)
  Azimuthal or Angular Momentum Quantum Number (l)
  Magnetic Quantum Number (m or ml)
  Spin Quantum Number (s or ms)

- **Filling of Orbitals**
  The energy of an orbital is calculated by the sum of the principal and the azimuthal quantum numbers. According to this principle, electrons are filled in the following order: 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p

**Multiple Choice Question each (1 Marks):**

1. The increasing order (lowest first) for the values of e/m (charge/mass) for
(a) e, p, n, α (b) n, p, e, α
(c) n, p, α, e (d) n, α, p, e

2.The magnetic quantum number specifies
(a) Size of orbitals (b) Shape of orbitals (c) Orientation of orbitals (d) Nuclear Stability

3. The electronic configuration of silver atom in ground state is
(a) [Kr]3d104s1 (b) [Xe]4f145d106s1 (c) [Kr]4d105s1 (d) [Kr]4d95s2

4. Which of the following element has least number of electrons in its M-shell?
(a) K b) Mn (c) Ni (d) Sc

5. In the ground state, an element has 13 electrons in its M-shell. The element is.....
(a) Copper b) Chromium (c) Nickel (d) Iron

6. In Hydrogen atom, energy of first excited state is – 3.4 eV. Then find out KE of same orbit of Hydrogen atom
(a) 3.4 eV (b) 6.8 eV (c) -13.6 eV (d) +13.6 eV

7. A sub-shell with n = 6 , l = 2 can accommodate a maximum of
(a) 12 electrons (b) 36 electrons (c) 10 electrons (d) 72 electrons

**Short Answer type Question each (2 Marks)**

1. **.** Arrange s, p and d sub-shells of a shell in the increasing order of effective nuclear charge ($Z_{eff}$) experienced by the electron present in them

2. Show the distribution of electrons in an oxygen atom (atomic number 8) using an orbital diagram

3. . Nickel atom can lose two electrons to form $Ni^{2+}$ ion. The atomic number of nickel is 28. From which orbital will nickel lose two electrons?

4. Which of the following orbitals are degenerate?
3dxy,4dxy,3dz2,3dyz,4dyz,4dz2

5. Calculate the total number of angular nodes and radial nodes present in the 3p orbital

**Short Answer type Question each (3 Marks)**

1.The electronic configuration of the valence shell of Cu is $3d^{10}\ 4s^1$ and not $3d^9\ 4s^2$. How is this configuration explained?

2. . What is the experimental evidence in support of the idea that electronic energies in an atom are quantized?

3. . Out of electrons and protons which one will have a higher velocity to produce matter waves of the same wavelength? Explain it.

4. What is the difference between the terms orbit and orbital?

**Short Answer type Question each (5 Marks).**

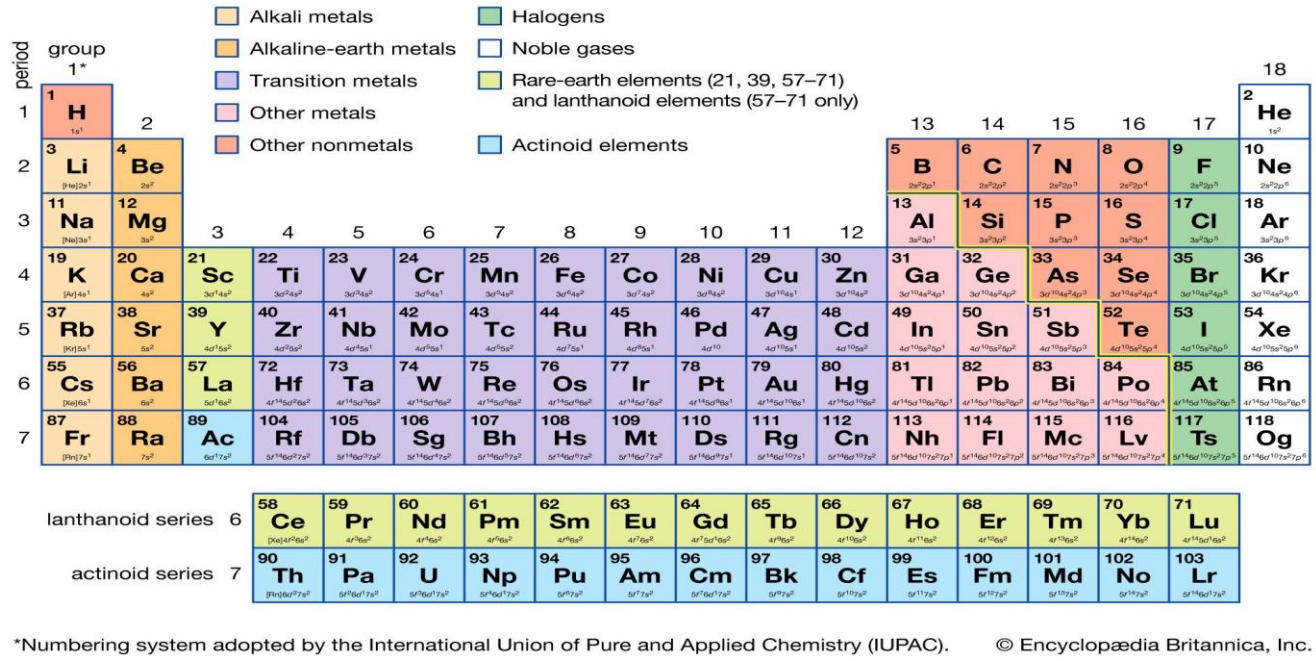
1.How did wave mechanical model of an atom overruled the circular orbits proposed by Bohr?

2.$Cu^{2+}$ is more stable than Cu+ in aqueous solution. Explain.

3. For which hydrogen like ion the wavelength difference between the first lines of the Lyman and Balmer series is equal to 59.3 nm ?

## Chapter 3: Classification of elements and periodicity in properties

**Periodic table with atomic number, symbol, and electron configuration**




*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC). © Encyclopædia Britannica, Inc.

**Comprehension-:**

1. There are different periodic trends with respect to atomic and ionic radii. Size of an atom non metallic element is to measure the distance between two atoms when they are bound together by a single bond in covalent molecule. Atomic radius refer to both covalent or metallic radius depending on whether the element is non metal or metal. The removal of an electron from an atom resulting in the formation of cation, where as gain of an electron leads to an anion. The ionic radii can be estimated by measuring the distance between cations and anions in ionic crystals.

**1.** Which of the following is the correct order of the size of given species ?

(A) $I > I^{+} > I^{-}$ (B) $I^{-} > I > I^{+}$ (C) $I^{+} > I > I^{-}$ (D) $I^{-} > I^{+} > I$

2. Which of the following has smallest size?
   (A) N (B) B (C) C (D) F

3. Which of the following order of ionic radii is correctly is represented ?
   (A) $O^{2-} > F^{-} > Na^{+} > Mg^{2+}$ (B) $Mg^{2+} > Na^{+} F^{-} > O^{2}-$
   (C) $F^{-} > O^{2-} > Mg^{2+} > Na^{+}$ (D) $Na^{+} > Mg^{2+} > O^{2}- > F^{-}$

4. The atomic radii of Be and Al respectively are
   (A) 143 pm and 111 pm (B) 111 pm and 111 pm
   (C) 111 pm and 143 pm (D) 143 pm and 143 pm

2. In the modern periodic table, element are arranged in order of increasing atomic number which is related to the electronic configuration. Depending upon the type of orbitals receiving the last electron, the element in which periodic table have been divided into four blocks, viz***, s, p, d and f.*** the modern periodic table consists of 7 periods and 18 groups. Each period begins with the filling of a new energy shell. In accordance with the Aufbau principal, the 7 periods (1to 7) have 2, 8, 8, 18, 18, 32 and 32 elements respectively. The seventh period is still incomplete. To avoid the periodic table being too long, the two series of ***f-***block elements, called lanthanoids and actinoids are placed at the bottom of the main body of the periodic table .

1. The element with atomic number 57 belong to
   *(a) S*-block
   *(b) P*-block
   *(c) d*-block
   *(d) f*-block

*2.* The last element of *p* block in $6^{th}$ period is represented by the outer most electronic configuration
   (a) $7s^{2}7p^{6}$
   (b) $5f^{14}6d^{10}7s^{2}7p^{0}$
   (c) $4f^{14}5d^{10}6s^{10}6p^{6}$
   (d) $4f^{14}5d^{10}6s^{2}6p^{4}$

3. Which of the elements whose atomic number are given below, cannot be accommodated in the present set up of the long form of the periodic table ?
   (a) 107
   (b) 118
   (c) 126
   (d) 102
4. The elements with atomic number 35, 53 and 85 are all _____
   (a) Noble gases
   (b) Halogens
   (c) Heavy metals
   (d) Light metals
5. Which of the following is correct order of increasing tendency to gain electrons;
   (a) A<C<B<D
   (b) A<B<C<D
   (c) D<B<C<A
   (d) D<A<B<C

## CHAPTER 4: CHEMICAL BONDING AND MOLECULAR STRUCTURE

INTRODUCTION : The attractive force which holds various constituent (atoms, ions , etc) together in different chemical species is called chemical bond . The chemical bonds can be classified into various types likes ionic bond , covalent bond , coordinate and metallic bond , hydrogen bond and vander waal forces. In this chapter , we will study about :

1. Kossel-Lewis approach to chemical bonding :Kossel – Lewis explain about cause of combination between atoms based upon understanding of electronic configuration of noble gases.
2. Octet rule : The principle of attaining maximum of eight electrons in the valence shell of atoms is called octet rule .
3.Formation of different types of bonds : There are two main types of bonds (i) Ionic bond : The electrostatic force of attraction which holds the oppositely charged ions together is known as ionic bond . (ii) Covalent bond : The bond formed by mutual sharing of electrons between combining atoms of same or different elements is called covalent bond .
4. VSEPR theory: The basic idea of this theory is that bonded atoms in molecule adopt that particular arrangement in space around the central atom which keeps them on average as far apart as possible .
5.Valence bond theory: It is based on the knowledge of atomic orbital and electronic configuration of elements , overlap criteria of atomic orbitals and stability of molecules .
6. Molecular orbital theory : The basic idea of molecular orbital theory is that atomic orbitals of individual atoms combine to form molecular orbitals .
7.Different types of hybridization involving s, p and d-orbitals: sp , $sp^2$ , $sp^3$ , and draw shapes of simple covalent molecules.
8.Concept of hydrogen bond and metallic bond.

## MCQs

1 Which one of the following has the shortest carbon bond length?
a.Benzene b.Ethene c.Ethyne d.Ethane

2 The molecule which has zero dipole moment is :
a.$CH_2Cl_2$ b.$BF_3$ c.$NF_3$ d.$ClO_2$

3 Linear combination of two hybridized orbitals belonging to two atoms and each having one electron leads to a :
a.Sigma bond b. Double bond c.co-ordinate covalent bond d.pi bond

4 Which statement is NOT correct?
a. A sigma bond is weaker than a π- bond b. A sigma bond is stronger than a π bond
c. A double bond is stronger than a single bond d. A double bond is shorter than a single bond

5. Fluorine molecule is formed by :
a. the axial p-p orbital overlap b. the sideways p-p orbital overlap
c. the s-s orbital overlap d. the s-p orbital overlap

6. Which of the following structures is expected to have three bond pairs and one lone pair?
a. tetrahedral b. trigonal planar c.pyramidal d.octahedral

7. Which of the following molecules do not have a linear arrangement of atoms?
a. $H_2S$ b. $C_2H_2$ c. $BeH_2$ d. $CO_2$

8. The angle between the overlapping of one s- orbital and p-orbital is :
a. $180^0$ b. $120^0$ c. $109^0$ d. $104^0$

9. The bond angle between H-O-H in ice is closest to :

a. $109^0$ b. $60^0$ c. $90^0$ d. $105^0$

10. Find the molecule with maximum dipole moment :
a. $CH_4$ b. $NH_3$ c. $CO_2$ d. $NF_3$

## TWO MARKS QUESTIONS :

1. Why do atoms combine?
2. Why two helium atoms do not combine to form $He_2$?
3. Write Lewis dot symbols for atoms of the elements Mg,Na,B.
4. Why sodium chloride is a solid where as carbon tetrachloride is a liquid ?
5. Why NaCl gives a white precipitate with $AgNO_3$ solution but $CCl_4$ does not ?
6. Why sigma bond is stronger than pi-bond?
7. How many sigma and pi bonds are present in a molecule of tetracyanoethylene?
8. Explain why $BeH_2$ molecule has a zero dipole moment although the Be-H bonds are polar?
9. Why all P-F bonds in $PF_5$ molecule are not of the same length?
10. Why HF has higher boiling point than HCl?

## FIVE MARKS QUESTIONS

21.Using a molecular orbital diagram , predict the bond order , stability and magnetic character of $O_2^-$,$O_2^+$ and $O_2^{2-}$ ions . Also write their electronic configuration .
22. Draw the molecular orbital energy diagram for oxygen molecule ($O_2$) and show that :
(i) it has a double bond
(ii) it has paramagnetic character.
23. Use LCAO method for the formation of molecular orbitals in case of homonuclear diatomic hydrogen molecule.

## CHAPTER: 5 (CHEMICAL THERMODYNAMICS)

**DEFINITION**:Thermodynamics is branch of science which deals with study of different forms of energy and their interconversion.
**BASICS TERMS**:
●**SYSTEM :** A part of universe which is under observation. A system which can exchange matter as well energy with surroundings is open system eg. chemical reaction carried out in beaker.A system which can exchange energy but not matter with surroundings is closed system eg. Chemical reaction carried in sealed test tube. A system which can neither exchange energy nor matter with surroundings is isolated system eg. Chemical reactions carried out in closed containers insulated from surroundings.
● **ISOTHERMAL PROCESS:** A process during which temperature of system remains constant.
● **ADIABATIC PROCESS:** A process in which no heat enters or leaves the system.
●**REVERSIBLE PROCESS**:A process in which direction may be reversed at any stage by small change in variable like temperature, pressure.
**EXTENSIVE PROPERTIES** : Properties of system whose value depends upon the amount of substance present in system like enthalpy, internal energy,entropy,free energy.These properties are state functions because their values depend upon the state of the system and is independent of path or manner by which state is reached.
**ENTHALPY:**Enthalpy change is heat absorbed or evolved at constant temperature and constant pressure and we always consider enthalpy change(-ve during exothermic and +ve during endothermic reaction) because atmospheric pressure is considered constant. There are different forms of enthalpies depending upon types of reaction( combustion,hydration,neutralisation,sublimation).
**BOMB CALORIMETER**:Bomb Calorimeter is used to calculate internal energy.
**HESS LAW:** This law is also known as law of constant heat summation.It states that heat absorbed or evolved in a particular reaction is same whether reaction takes place in one step or in a number of steps.
**BORN HABER CYCLE**:Lattice enthalpy is heat evolved when one mole of an ionic compound is formed from its ions is sum of enthalpy of sublimation,enthalpy of atomisation,ionisation enthalpy,electron gain enthalpy .
**FIRST LAW OF THERMODYNAMICS**:First law of thermodynamics (law of conservation of energy) does not provide any information about spontaneous nature of reaction (why reaction can take place by

itself?).Negative enthalpy and positive entropy (degree of randomness) are driving forces which make process spontaneous.

**GIBBS HELMHOLTZ EQUATION:** ▲G=▲H-T▲S which combines enthalpy and entropy in single equation.For spontaneous process ▲G (change in free energy which is a measure to do useful work,must be negative).That's why endothermic processes are favourable at high temperature and exothermic processes are favourable at low temperature.

**SECOND LAW OF THERMODYNAMICS :**Entropy of the universe always increase during spontaneous process.

**THIRD LAW OF THERMODYNAMICS**:At absolute zero entropy of a perfectly crystalline substance is taken as zero.

**MCQS**

1.A Thermodynamic state function is a quantity :
(A) Use to determine heat changes.
(B) Whose value is independent of path
(C) Use to determine pressure volume work
(D) Whose values depends in temperature only.

2.The work done in case of isothermal free expansionis
(A) Maximum (B) Minimum (C) Zero (D) Positive

3.The enthalpies of all elements in their standard state are equal to:
(A) Unity (B) Zero (C) <0 (D) Different for each element

4.Thermodynamics is not related to:
(A).Energy changes evolved in a chemical reaction
(B) The extent to which a chemical reaction proceeds
(C) The rate at which a reaction proceeds
(D).The feasibility of a chemical reaction

5.Which of the following is extensive property ?
(A) Molar heat capacity (B) Temperature (C) Enthalpy (D) All of these

6.The enthalpies of elements in their standard states are taken as Zero. The Enthalpy of formation of a compound
(A) Is always negative (B) Is always positive
(C) May be positive or negative (D) Is never negative

7.Enthalpy of sublimation of a substance is equal to:
(A) Enthalpy of fusion+ Enthalpy of vapourisation (B) Enthalpy of fusion
(C) Enthalpy of vapourisation (D) Twice the Enthalpy of vapourisation

8. If the volume of gas is reduced to half of its original volume then the specific heat will be _____.
(A) reduce to half (B) be doubled (C) remain constant (D) increase four times

9.A well stoppered thermos flask contain some ice cubes. This is an example of
(A) Closed system (B) Open system (C) Isolated system (D) Non Thermodynamics system

10.The Enthalpy of vaporisation of a substance is 8400 J mol-1 and its boiling point is -173°C. The entropy change for vaporisation is :
(A) 84 mol-1 k-1 (B) 21 mol-1 k-1 (C) 49 mol-1 k-1 (D) 12 mol-1 k-1

11.A system absorbs 10 KJ of heat at constant volume and its temperature rises from 270 to 370 C . The volume of delta U is
(A) 100 KJ (B) 10 KJ (C) 0 KJ (D) 1 KJ

**2 MARKS QUESTIONS**

Q. 1 Name the different types of system.
Q.2 What will happen to internal Energy if work is done by the system ?
Q. 3 State second law of thermodynamics?

Q.4 Define enthalpy
Q. 5 Give the mathematical expression of first law of thermodynamics.
Q.6 Define Hess law. Why this law is called law of constant heat summation.
Q.7 Under what conditions enthalpy change and internal energy change of system remains same?

**3 MARKS QUESTIONS**

1.Calculate the work done when 2 moles of an ideal gas expands reversibly and isothermally from a volume of 500 ml to a volume of 2L at 25 degree C and normal pressure.
2. What is the equilibrium constant K eq for the following reaction at 400K.
$2NOCl \rightleftharpoons 2NO_{(g)} + Cl_{2(g)}$
given that $\Delta H^{o} = 77.2\ kJ\ mol^{-1}$ ; and $\Delta S° = 122\ JK^{-1}\ mol^{-1}$

**5 MARKS QUESTIONS**

1.Calculate enthalpy formation of ethane from the following data:
C + O2→CO2 (∆ = −393.5KJ /mol)
H2+O2→H2O(∆=-285.8kJ/mol)
C2H6+O2→2CO2+3H2O(∆=-1560KJ/mol)

2. Define the following terms:

a) Internal energy
b) entropy
c) adiabatic process
d) isochoric process

## CHAPTER 6: Equilibrium

At equilibrium, aA+bB ⇌ cC+dD

Rate of forward reaction = Rate of backward reaction

$$K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

equilibrium Constant in terms of Partial Pressure

$$K_P = \frac{P_C^c P_D^d}{P_A^a P_B^b}$$

Relation between Kp and Kc
$Kp = Kc\ (RT)^{\Delta n}$
Le Chatelier's Principle : A change in one of the variable s that describe a system at equilibrium produces a shift in the position of the equilibrium that counteracts the effect of this change.
**pH Calculation**
**pH = -log[H+]**
**pOH = -log[OH-]**
**pH + pOH = 14**

**BUFFER Solution**: calculating the pH of buffer solutions., pH = pKa + log [Salt] / [Acid]

Solubility Product

$$K_{SP} = (xs)^x\ (ys)^y = x^x.y^y.(s)^{x+y}$$

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**MCQS**

1. State of Chemical Equilibrium of a reversible reaction is not influenced by:
(a) Pressure (b) Catalyst

(c) Concentration of reactant (d) Temperature

2. $10^{-6}$ M HCl is diluted to 100 times its pH is:
(a) 6.0 (b)8.0
(c) 6.95 (d) 9.5

3. In a chemical reaction **A ⇌ B**, the system will be known in equilibrium when:
(a) A completely changes to B
(b) 50% of A changes to B
(c) The rate of change of A to B and B to A on both the sides are same
(d) Only 10% of A changes to B

4. On a given condition, the equilibrium concentration of HI, $H_2$ and $I_2$ are 0.80, 0.10 and 0.10 mol/L respectively .The equilibrium constant for the reaction $H_2 + I_2 \rightleftharpoons 2HI$ will be
(a) 64 (b) 12
(c) 8 (d) 0.8

5. A+B ⇌ C+D, If finally the concentration of A and B are both equal but at equilibrium ,concentration of D will be twice of that of A, then what will be the equilibrium constant of reaction.
(a) 4/9 (b) 9/4
( c)1/9 (d) 4

6. An aqueous solution of sodium carbonate is alkaline because sodium carbonate is a salt of
(a) Weak acid and weak base
(b) Strong acid and weak base
(c) Weak acid and strong base
(d) Strong acid and strong base

10. What do you mean by common ion effect? Explain.
11. State and explain Le-chatelier's principle.
12. What will be pH of 0.001M NaOH solution?
13. The equilibrium constant expression for a gas reaction is

$$K_c = [NH_3]^4 [O_2]^5 / [NO]^4 [H_2O]^6$$

Write the balanced chemical equation corresponding to this expression.
14. The solubility of $A_2X_3$ is Y mol $dm^{-3}$. Calculate its solubility product

## CHAPTER 7: REDOX REACTION

## SOME KEY POINTS:

1. (**Oxidation number:** Charge on atom which appears on it when it is present in the combined state.
2. Sum of the oxidation states in a compound/ion should be equal to the zero or to the net charge on the ion.
3. Some elements show variable oxidation states.
4. **Oxidation:** The process in which electrons are lost.
5. **Reduction:** The process in which electrons are gained.
6. **Oxidizing agent:** A substance which oxidize the other.
7. **Reducing agent:** A substance which reduces the other.
8. **Redox reaction:** When oxidation and reduction take place together is known as redox reaction.

9. **Disproportionation reaction:** The reaction in which same species is simultaneously oxidized as well as reduced.
10. The change in oxidation state of any element in a compound is useful in calculating the equivalent weight.
11. **Electrochemical series:** Arrangement of E° red of different electrodes in increasing order of electrode potential.
12. **Electrode Potential:** The tendency of an electrode to lose or gain electrons is called electrode potential.

## MULTIPLE CHOICE QUESTIONS:

1. The oxidation number of Fe in $K_4$ [Fe $(CN)_6$] is

a) 3 b) 4 c) 2 d) zero

2. Pure water is bad conductor of electricity because

a) It has high boiling point
b) It is almost unionized
c) Its molecules are associated with H-bond
d) Its pH is 7 at 25 degree C

3. The ionic mobility of alkali metal ions in aqueous solution is maximum for

a) Li+ b) Na+ c) K+ d) Rb+

4. The oxidation number of Xe in $BaXeO_6$ is

a) 8 b) 6 c) 4 d) 10

5. A standard hydrogen electrode has zero electrode potential because.

a) Hydrogen is easiest to oxidize
b) This electrode potential is assumed to be zero
c) Hydrogen atom has only one electron
d) Hydrogen is the lightest element

## TRUE / FALSE:

1. When a substance is oxidized, it loses electrons.
2. Oxidation is loss of oxygen atom or gain of hydrogen atom.
3. The reducing agent is oxidized.
4. The oxidizing agent is reduced.
5. Reduction can also be defined as the gain of oxygen atoms or the loss of hydrogen atoms.

## VERY SHORT QUESTION:

1. Define oxidation reaction.
2. Define oxidation in terms of electron transfer.
3. Define reduction reaction.
4. What is the oxidation number of manganese in $KMnO_4$?
5. Define an oxidizing agent. Name the best reducing agent.

## LONG QUESTIONS:

1. Explain electrochemical cell and electrolytic cell with the help of diagrams.
2. Oxidation cannot occur without reduction. Justify.
3. Explain standard hydrogen electrode (SHE) with diagram.
4. Explain oxidation and reduction according to electronic concept. Give two examples.
5. Discuss redox reactions on the basis of oxidation number.

## CHAPTER : 8 Organic Compounds

Organic Compounds: Carbon-containing compounds (with few exceptions like carbonates and oxides)
- Tetravalency of Carbon: Carbon has 4 valence electrons, allowing formation of diverse molecular structures
- Catenation: Carbon's unique ability to form stable bonds with other carbon atoms, creating long chains and complex structures
- Homologous Series: Sequence of compounds with same functional group, differing by $CH_2$ unit
- Functional Groups: Specific atomic arrangements determining compound's chemical characteristics
- IUPAC Nomenclature: Systematic naming method based on:
  - Longest carbon chain - Position of functional groups - Prefixes and suffixes indicating structure
- Structural Formulas: Showing exact arrangement of atoms
- Condensed Formulas: Simplified representation of molecular structure
- Skeletal Formulas: Showing carbon skeleton and functional group
- Hybridization: Carbon forms bonds through $sp^3$, $sp^2$, and sp hybridization
- Single Bonds ($sp^3$): Tetrahedral structure- Double Bonds ($sp^2$): Trigonal planar structure- Triple Bonds (sp): Linear structure
- Types of Organic Reactions: - Substitution - Addition - Elimination - Rearrangement
- Structural Isomers: Same molecular formula, different structural arrangement
- Stereoisomers: Same molecular formula, different spatial orientation

1. What is the IUPAC name of the compound CH3-CH2-CH2-CH3?
   a) Propane b) Butane c) Pentane d) Hexane
2. The functional group -COOH is known as:
   a) Alcohol b) Aldehyde c) Carboxyl d) Ketone
3. What is the hybridization of the carbon atom in methane (CH4)?
   a) sp b) sp2 c) sp3 d) sp3d
4. Which of the following compounds is an example of an alkene?
   a) Ethane b) Ethene c) Ethyne d) Methane
5. Which of the following reactions is not possible in organic chemistry?
   a) Addition reaction b) Substitution reaction
   c) Combustion reaction d) Nuclear reaction
6. Which type of isomerism is exhibited by 1-butene and 2-butene?
   a) Structural isomerism b) Geometrical isomerism
   c) Optical isomerism d) Functional isomerism
7. The presence of which element is confirmed by the Lassaigne's test?
   a) Hydrogen b) Nitrogen c) Carbon d) Oxygen
8. What is the hybridization of carbon in ethyne (C2H2)?
   a) sp b) sp2 c) sp3 d) sp3d
9. Which of the following is not a characteristic of homologous series?
   a) Same general formula b) Gradation in physical properties
   c) Similar chemical properties d) Different functional groups

10. What is the IUPAC name of CH3-CH2-OH?
    a) Methanol b) Ethanol c) Propanol d) Butanol
11. In which of the following compounds is hydrogen bonding the strongest?
    a) Methanol b) Ethanol c) Water d) Ammonia
12. Which of the following is an electrophile?

a) OH- b) NH3 c) NO2+ d) CH4

13. Which of the following compounds shows geometrical isomerism?
a) Propene b) 1-Butene c) 2-Butene d) Butane

14. Which of the following is a primary alcohol?
a) CH3CH2OH b) (CH3)2CHOH c) (CH3)3COH d) C6H5OH

15. What is the general formula for alkanes?
a) CnH2n+2 b) CnH2n c) CnH2n-2 d) CnHn

16. Which of the following is a saturated hydrocarbon?
a) Ethene b) Ethyne c) Benzene d) Propane

**2 Marks Questions**

1. Define hybridization and give an example.
2. What are isomers? Provide an example of structural isomerism.
3. Explain the term "functional group" with an example.
4. Describe the significance of homologous series in organic chemistry.
5. How does the inductive effect influence the properties of organic compounds?
6. What is the difference between a nucleophile and an electrophile? Give an example of each.
7. What is a free radical? How is it different from an ion?

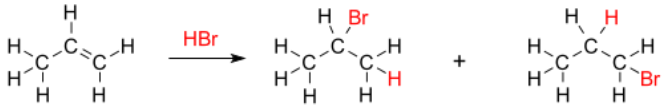
**5 Marks Long Questions**

1. Discuss the different types of structural isomerism with suitable examples.
2. Explain the concept of resonance in organic chemistry. Provide examples and discuss the conditions necessary for resonance to occur.

## CHAPTER 9: HYDROCARBONS

**KEY POINTS:**

* Hydrocarbons are the compounds of carbon and hydrogen only.
* Conformations or Conformers are the different arrangements in a molecule which can be obtained due to rotation around carbon-carbon single bond.
* Staggered conformations of ethane and propane are more stable than their eclipsed conformations.
* Geometrical isomers: The compounds which have same structural formula but differ in the spatial arrangement of atoms or groups of atoms around a double bond.
* Markovnikov's rule. During electrophilic addition across unsymmetrical double bond, the negative part of the adding molecule goes to that carbon atom which has lesser number of hydrogen atoms.




**MCQS.**

1. Which represents an alkane?
   a) $C_5H_8$ b) $C_8H_6$ c) $C_9H_{10}$ d) $C_7H_{16}$

2. The shape of methane molecule is?
   a) Linear b) Trigonal planar c) Square planar d) Tetrahedral

3. The alkane that yields two isomeric monobromo derivatives is?
   a) Neopentane b) Ethane c) Methane d) Propane

4. Isomers of a compound must have ?
   a) Same physical properties b) Same chemical properties
   c) Same structural properties d) Same molecular weight

5. When isomers have the same structural formula but differ in relative arrangement of atoms or groups are called?
   a) Mesomers b) Stereo isomers c) Optical isomers d) Geometrical isomers

6. Find the correct order for relative energies of butane confermations?
   a) Staggered<skewed<eclipsed b) Skewed<staggered<eclipsed
   c) Skewed<eclipsed<staggered d) Staggered<eclipsed<skewed

7. The bond angle between H-C-C bonds in ethane is?
   a) 120 degree b) 180 degree c) 109 degree d) 109.5 degree

8. Paraffin wax is?
   a) Saturated hydrocarbon b) Unsaturated hydrocarbon
   c) Alcohol d) Ester

9. Chloroethane reacts with Na in presence of dry ether. The product is?
   a) Ethane b) Propane c) Butane d) Ethane

10. Halogenation of alkane is an example of?
    a) Electrophilic substitution b) Nucleophilic substitution
    c) Free radical substitution d) Addition reaction

11. Which represents the general formula of an alkane?
    a) $C_nH_{2n+2}$ b) $C_nH_{2n}$ c) $C_nH_{2n-1}$ d) $C_{2n}H_{2n+1}$

12. Which alkane is known as marsh gas?
    a) $CH_4$ b) $C_2H_6$ c) $C_3H_8$ d) $C_4H_{10}$

13. Hydrocarbons are organic compounds with elements?
    a) Hydrogen b) Oxygen c) Carbon d) Both hydrogen and carbon

14. The step in which Cl-Cl bond hemolysis occurs is called?
    a) Initiation step b) Propagation step
    c) Intermediate step d) Termination step

15. The hybridization of carbon atoms in alkanes is?
    a) Sp b) $Sp^2$ c) $Sp^3$ d) $Sp^3d$

**Two marks questions:**

1. Write the structures of the products A and B in the following reaction:
   $HC{\equiv}CH \xrightarrow{Na} A \xrightarrow{CH3Br} B$
2. What effect does branching have on the boiling point of an alkane and why?
3. What is the difference between isomers and conformers?
4. Draw New man projection formula for conformations of ethane?
5. Wurtz reaction cannot be used for the preparation of unsymmetrical alkanes. Give reaons.
6. Melting point of cis-but-2-ene is lower than that of trans-but-2-ene. Give reason.
7. Draw the structures of cis and trans hex-2-ene.
8. Give a chemical test to distinguish between ethane and ethene.
9. What do you understand by peroxide effect(kharasch effect)?
10. Arrange ethane, ethene and ethyne in the order of increasing acidity.

**Five marks questions:**

1. Define isomerism. Write all the structural isomers of hexane and arrange them in increasing order of boiling points.
2. Write short note on:
   a) Wurtz reaction
   b) Kolbe's electrolysis reaction
   c) Ozonolysis
   d) Friedel craft's acylation reaction
   e) Corey house reaction

3. Alkenes show geometrical isomerism while alkanes do not. Give a suitable explanation.
4. Discuss the structure of benzene with an emphasis on resonance and orbital pictures.

ALL CHAPTERS ANSWERS (MCQ)

CH-1 1C, 2A,3B,4B, 5D CH-2 1D, 2C, 3C, 4A, 5B, 6A, 7C
CH-3 PART-I 1B, 2D, 3A, 4C, PART-II 1C, 2C, 3B, 4A, 5A
CH-4 1C, 2B, 3A, 4A, 5A, 6A, 7A, 8A, 9D, 10B CH-5 1B, 2C,3B, 4C, 5C, 6C, 7A, 8C, 9C, 10A,11B
CH-6 1B, 2C, 3C, 4A, 5D,6C, CH-7 1C, 2B, 3D, 4D, 5B, T/F 1T, 2F, 3T, 4T, 5F
CH-8 1B, 2C, 3C, 4B, 5D, 6B, 7B, 8A, 9D, 10B, 11C, 12C, 13C, 14A, 15A, 16D
CH-9 1D, 2D, 3D, 4D, 5B, 6A, 7D, 8A, 9C, 10C, 11A, 12A, 13D, 14A, 15C

## CLASS 11TH

Times: 3 Hrs **Subject- Chemistry** M.M:70

## Section (A) ( One Mark Questions)

Q1

(i) Which of the following is dependent of temperature?
a) Molarity b) Molality c) Mole fraction d) Mass Percentage

(ii) 4g of NaOH is dissolved in 100ml of solution. Molarity of the solution is:
a) 1 M b) 10 M c) 0.1 M d) 4 M

(iii) The number of moles in 32g of Methane is:
a) $3.0 \times 10^{23}$ b) $12.04 \times 10^{23}$ c) $6.02 \times 10^{23}$ d) $2.4 \times 10^{23}$

(iv) The molecule that has a linear structure is :
a) $SO_2$ b) $CO_2$ c) $NO_2$ d) $SiO_2$

(v) Which of the following compounds have highest covalent character:
a) LiCl b) LiBr c) LiF d)LiI

(vi) In an open system for maximum work, the process must be:
a) Reversible b) Irreversible c) both d) None

(vii) For a buffer solution which of the following is true?
a) pH does not changes at all on addition of acid or base.
b) pH change is very little on addition of acid or base.
c) It is mixing of strong acid and its salt.
d) It is mixing of strong base and its salt.

(viii) $\frac{K_P}{K_C}$ for the reaction $CO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons CO_{2(g)}$ is
a) 1 b) RT c) RT/2 d) $(RT)^{-1/2}$

(ix) Oxidation involves:
a) Gain of Electron
b) Addition of Hydrogen
c) Decrease in Oxidation number
d) Loss of Electron

(x) The common name of 2-Butanone is :
a) Acetone b) Butyraldehyde
c) Acetaldehyde d) Ethyl methyl ketone

## Comprehension:

The f-Block. element are called Inner transition elements because in the transition elements of d-block, the elements are filled in (n-1)d subshell while in the inner trans1tIon element of f-block, the filling of electrons takes place in (n -2)f sub shell which happens to be one inner sub shell there are two series of such elements each having fourteen elements. In the first series, the filling of electrons takes place in the 4f sub shell It is known as lanthanoid series Since it follows Lanthanum of d block and also a member of group 3 Similarly, in the second series the filling takes place In the 5f subshell It is called actinoid series as it follows actinium of d-block also belonging to group 3.

(xi) Which block elements are known as inner transition elements?
(xii) In d-block elements, the electrons are fil led in which sub shell?
(xiii) Which series is known as Lanthanoid series?
(xiv) What do you mean by transition elements?
(xv) What are actinoids?

## True or False

(xvi) During isothermal expansion of an ideal gas there is no change in internal energy.
(xvii) For a spontaneous process $\Delta S_{system}$ = +ve
(xviii) Fluorine cannot have +1 oxidation state

(xix) Cis and trans isomers have different dipole moments.
(xx) Resonance brings down the stability of the molecule.

## Section-B (2 Mark Question)

Q2. Calculate the percentage composition of various elements in $CaCO_3$.

OR

Calculate the mole fraction of ethanol in a sample of rectified spirit which contains 92% ethanol by mass.

Q3. State and explain Aufbau's principle?

Q4. Find the energy of photon which-
(i) Corresponds to light of frequency $3 \times 10^{15}$ $H_2$
(ii) Have wavelength of 0.50 °A

Q5. Noble gasses have high ionization enthalpy in their respective period. Why?

Q6. Give differences between sigma and pi bond.

Q7. State and explain first law of thermodynamics.

Q8. Derive relationship between Cp and Cv

Q9. Write down the expression for Kp and Kc for the reaction:
$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$
Also, write relation between Kp and Kc for the given reaction.

Q10. Write formula of conjugate acids of
(i) $^-OH$ (ii) $HCO_3^-$ (iii) $CO_3^{-2}$ (iv) $HCOO^-$

Q11. Determine Kc for the reaction:
$2SO_2(g) \rightleftharpoons O_2(g) + 2SO_3(g)$
Kp= 3.4 $bar^{-1}$ at 1000° C

OR

Calculate the pH value of $10^{-4}$ M $HNO_3$ solution.

Q12. Give difference between valency and oxidation no.

OR

Identify the oxidizing and reducing agent in the following reaction:
$2Zn_{(s)} + O_2(g) \rightarrow 2ZnO_{(s)}$

Q13. Explain tetra covalency of carbon

OR

Define geometrical isomerism with example.

Q14. Out of n-pentane and n-hexane, which has higher melting paint and why?

Q15. State and explain Markovnikov's rule with example.

## Section-C (3 Marks Questions)

Q16. A compound contains carbon, hydrogen and oxygen. Gave the following analytical data.
C = 40.0% H = 6.67% O = 53.3%
Calculate the molecular formula of the compound if its molecular mass is 180.

Q17. How many photons of light with a wavelength 4000 pm are necessary to provide 1 J energy.

OR

The uncertainty in the momentum of a particle is $2.2 \times 10^{-8}$ $kgms^{-1}$. With what accuracy can its position be determined? Planck's constant
h = $6.626 \times 10^{-34}$ Js

Q18. Calculate the oxidation state of each sulphur atoms in the following compounds.
(i) $Na_2S_2O_3$ (ii) $Na_2SO_3$ (iii) $Na_2SO_4$

OR

What do you mean by Redox Reactions? Explain briefly.

Q19. What are carbocations? Explain the order of stability of various carbocations.

## Section-D (5 Marks Questions)

Q20. A) On the basis of VSEPR theory. Discuss the shape of $PCl_5$ molecule.
B) Which out of $NH_3$ and $NF_3$ has higher dipole moment and why?

OR

Draw the molecular orbital diagram of $F_2$ molecule and write its
i) Molecular orbital electronic configuration. ii)Bond order