
OMQ
SOLUTIONS

1. SOLUTIONS

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following concentration term is independent of temperature? [**2**]

1. Molarity
2. Molality
3. Mass-Volume percentage
4. Volume –Volume percentage

2. The boiling point of an azeotropic mixture of water and ethanol is less than that of water. This mixture shows [**2**]

1. negative deviation from Raoult's law
2. positive deviation from Raoult's law
3. no deviation from Raoult's law
4. deviation which cannot be predicted

3. The van't Hoff factor for 0.1 m $Ba(NO_3)_2$ solution is 2.74. Its degree of dissociation (α) is [**3**]

1. 0.74 2. 0.92 **3. 0.87** 4. 0.78

4. The solubility of gases in liquids increases with [**4**]

1. increase in pressure and increase in temperature
2. decrease in pressure and decrease in temperature
3. decrease in pressure and increase in temperature
4. increase in pressure and decrease in temperature

5. Which of the following is an example of an ideal solution? [**3**]

1. $CS_2+CH_3COCH_3$
2. $C_6H_5OH+C_6H_5NH_2$
3. $C_6H_6+C_6H_5CH_3$
4. $C_2H_5OH+CH_3COCH_3$

6. The mole fraction of benzene in solution containing 30% by mass in CCl_4 is [**3**]

1. 0.5611 2. 0.9102 **3. 0.4586** 4. 0.0214

7. Which of the following solutions has the highest boiling point? [**2**]

1. 0.1 M KNO_3 **2. 0.1 M Na_3PO_4** 3. 0.1 M $BaCl_2$ 4. 0.1 M K_2SO_4

8. For a dilute solution containing non-volatile solute Raoult's law states that [**1**]

1. the relative lowering of vapour pressure is equal to the mole fraction of the solute
2. the relative lowering of vapour pressure is equal to the mole fraction of the solvent
3. the lowering of vapour pressure is equal to the mole fraction of the solute
4. the lowering of vapour pressure is equal to the mole fraction of the solvent

9. 45 g of ethylene glycol molar mass (62 g mol^{-1}) is mixed with 600 g of water. The freezing point depression is (K_f = 1.86 K kg mol^{-1}) [**3**]

1. 5.66 K 2. 8.33 K **3. 2.25 K** 4. 4.81 K

10. Which law explains the solubility of gases in liquids ? [**3**]

1. Boyle's law 2. Charles' law **3. Henry's law** 4. Raoult's law

11. At 283 K, the osmotic pressure of 2% (w/v) solution of a substance X is 7.87×10^4 N.m^{-2}. The molar mass of X (in g mol^{-1}) is [**3**]

1. 280 2. 660 **3. 598** 4. 300

12. The vapour pressure of an aqueous solution obtained by adding 18 g of glucose to 180 g of water at 373 K is (Vapour pressure of pure water at 373 K is 760 mm Hg) [**1**]

1. 752.4 mm Hg 2. 741.4 mm Hg 3. 759 mm Hg 4. 745.3 mm Hg

13. The value of Henry's law constant, K_H is [**4**]

1. greater for gases with higher solubility 2. constant for all gases
3. not related to the solubility of gases **4. greater for gases with lower solubility**

14. The mass of solute (in g) required to be added to 100 g of water so as to observe an elevation of boiling point of 0.052 °C is [**4**]
(Given: K_b (H_2O) = 0.52 K kg mol^{-1} molar mass of solute = 100 g mol^{-1})

1. 0.30 2. 0.05 3. 2.00 **4. 1.00**

15. P^o_A and P^o_B are the vapour pressures of two pure liquids A and B respectively of an ideal solution. If X_A is the mole fraction of liquid A, the total pressure of the solution will be [**1**]

1. $P^o_B + X_A (P^o_A - P^o_B)$ 2. $P^o_A + X_A (P^o_B - P^o_A)$
3. $P^o_A + X_A (P^o_A - P^o_B)$ 4. $P^o_B + X_A (P^o_B - P^o_B)$

II. FILL IN THE BLANKS(FIB)

1. The units of boiling point elevation constant K_b are **K kg mol^{-1}** .
2. Solubility of a gas in liquid **increases** with increase in pressure.
3. For an ideal solution, $\Delta_{mix}H$ is equal to **Zero**.
4. Desalination plants work on the basis of the phenomenon called **reverse osmosis**.
5. Human blood is isotonic with **0.9% (w/v) NaCl**. solution (or) Saline.

III. ONE WORD ANSWER Q'S

1. What is the term used for a solution that does not follow Raoult's law?

A: **Non-ideal solution** does not follow the Raoult's law.

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2. In which type of a solution, dynamic equilibrium exists between the dissolved solute and undissolved solute?

A: In **saturated solution** dynamic equilibrium exists.

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3. What is the name given to binary liquid mixtures which have same composition in liquid and vapour phase and boil at a constant temperature?

A: **Azeotropic mixtures** have same composition in liquid and vapour phase .

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4. In the expression $\Delta T_f = K_f m$, what is the name given to the constant K_f?

A: K_f is called **Cryoscopic constant** (or) Molal depression constant.

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5. What is the name given to the solutions, when they have same osmotic pressure at a given temperature?

A: **Isotonic solutions** have same osmotic pressure at a given temperature.

HINTS FOR MCQ

1. **(2)** Molality depends on mass (temperature independent)
2. **(2)** Lower boiling point→mixture vaporizes more easily. This means intermolecular forces are weaker than ideal. So vapour pressure is higher than expected.
3. **(3)** $\alpha = \frac{i-1}{n-1} = \frac{2.74-1}{3-1} = \frac{1.74}{2} = 0.87$ $[Ba(NO_3)_2 \rightarrow Ba^{+2} + 2NO_3 \ \therefore \ n=3]$
4. **(4)** Gas solubility follows: Increase in Pressure→ more gas dissolves (Henry's law)
   Increase in Temperature → gas escapes→ solubility decreases
5. **(3)** $C_6H_6 + C_6H_5CH_3$ is an ideal solution.
6. **(3)** 30% by mass of benzene means 30 g of benzene is present in 100g of solution.
   Mass of benzene = 30 g; Mass of CCl_4= 100–30=70g;
   Molar mass of benzene = 78, Molar mass of CCl_4=154

   GMM of CCl_4
   $(1\times12)+(4\times35.5)=154$
   GMM of C_6H_6
   $(6\times12)+(6\times1)=78$

   No. of moles of benzene $(n_1) = \frac{\text{weight}}{\text{GMM}} = \frac{30}{78} = 0.385$

   No. of moles of CCl_4 $(n_2) = \frac{70}{154} = 0.455$

   Mole fraction of Benzene $= \frac{n_1}{n_1+n_2} = \frac{0.385}{0.385+0.455} = \frac{0.385}{0.84} = 0.458$
7. **(2)** **Formula : Elevation of boiling point** $\Delta T_b = iK_b \times m$;
   ΔT_b is directly proportional to Van't Hoff factor (i) . If i is more ΔT_b is more.
   From the given options we have
   1) $KNO_3 \rightarrow K^+ + NO_3^-$; i=2
   2) $Na_3PO_4 \Rightarrow 3Na^+ + PO_4^{-3}$; i = 4
   3) $BaCl_2 \rightarrow Ba^{+2} + 2Cl^-$; i=3
   4) $K_2SO_4 \rightarrow 2k^+ + SO_4^{-2}$; i=3
   Na_3PO_4 has higher boiling point
8. **(1)** For dilute solutions with non-volatile solute: $\frac{P^o - P}{P^o} = \chi_{\text{solute}}$.
   RLVP = mole fraction of solute
9. **(3)** Given mass of ethylene glycol = 45 g. Given molar mass of ethylene glycol = 62 g
   Mass of water = 600g, Molar mass of water =18
   Freezing point constant K_f = 1.86 K $kgmol^{-1}$ The freezing point depression ΔT_f = ?
   We know that $\Delta T_f = K_f \times m$, m= molality

   $\Delta T_f = 1.8 \times \frac{\text{Mass of solute}}{\text{GMM of solute}} \times \frac{1000}{\text{Mass of solvent (in g)}} = 1.8 \times \frac{45}{62} \times \frac{1000}{600} = 2.32 \text{ K}$
10. **(3)** Henry's law explains the solubility of gases in liquids.

11. **(3)** Given T=283K, Osmotic pressure Π= 7.87×10^4 Nm^{-2}

2%(w/v) means 2 g of solute present in 100 mL of solution,

w_s=2g, V= 100 mL =$10^{-4}m^3$, Molar mass of solute (M_s)=?

Formula: Osmotic pressure $\Pi = CRT$

$$\Pi = \frac{w_s RT}{M_s V} \Rightarrow M_s = \frac{w_s RT}{\Pi V} = \frac{2\times8.314\times283}{7.87\times10^4\times10^{-4}} = 597.9 = 598\ g$$

12. **(1)** Given P^o=760 mm, we have to find P^s

Mass of glucose (w_s)= 18 g, Molar mass of glucose (M_s)=180 $g.mol^{-1}$
Mass of water (w_o) = 180 g, Molar mass of water (M_o) = 18 $g.mol^{-1}$

According to Raoult's law $\frac{P^o - P^s}{P^o} = \frac{w_s}{M_s}\times\frac{M_o}{w_o}$

$$\Rightarrow \frac{760 - P^s}{760} = \frac{18}{180}\times\frac{18}{180} \Rightarrow 1 - \frac{P^s}{760} = \frac{1}{100} \Rightarrow 1 - \frac{1}{100} = \frac{P^s}{760}$$

$$\Rightarrow 1 - 0.01 = \frac{P^s}{760} \Rightarrow P^s = 0.99\times760 = 752.4$$

13. **(4)** Henry's law: Higher $K_H \rightarrow$ gas is less soluble (needs more pressure).

So solubility $\propto 1/K_H$. Greater for gases with lower solubility

14. **(4)** Given Molar mass of solute M_s= 100, Mass of solvent H_2O=100

ΔT_b= 0.052 °C, K_b=0.52 K kg mol^{-1} , Mass of solute w_s=?

Elevation in boiling point $\Delta T_b = K_b \times m$, m= molality

$$\Rightarrow 0.052 = 0.52\times\frac{w_s}{M_s}\times\frac{1000}{\text{Mass of solvent(g)}} \Rightarrow 0.052 = 0.52\times\frac{w_s}{100}\times\frac{1000}{100}$$

$$0.052\times10 = 0.52\times w_s \Rightarrow w_s = 1$$

15. **(1)** $P_{total} = P_A + P_B = x_A P^o_A + x_B P^o_B$

$= x_A P^o_A + (1 - x_A) P^o_B$

$= x_A P^o_A + P^o_B - P^o_B x_A$

$= P^o_B + x_A(P^o_A - P^o_B)$

$x_A + x_B = 1$
$\Rightarrow x_B = 1 - x_A$

2. ELECTRO CHEMISTRY

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. During electrolytic refining of metals the refined metal is obtained at (on) the [**2**]

1) anode **2) cathode** 3) surface of the electrolyte 4) Both 1 & 2

2. A device that converts the energy of combustion of H_2 and CH_4 directly into electrical energy is known as [**4**]

1) Electrolytic cell 2) Concentration cell 3) Leclanche cell **4) Fuel cell**

3. The electrode potential of a standard hydrogen electrode is [**1**]

1) 0.0V 2) 1.0V 3) 2.0V 4) 3.0V

4. The standard cell potential of a Daniel cell is [**4**]

1) 1.6 V 2) 1.9 V 3) 0.6 V **4) 1.1V**

5. Units of specific conductance are [**2**]

1) S m **2) S m^{-1}** 3) S^{-1} m^{-1} 4) Ohm m

6. Consider the following cell reaction [**1**]

$Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{+2}(0.1M) + 2\,Ag(s)$

of E^{o}_{cell} is 3.17 V, the approximate value of E_{cell} will be

1) 2.96V 2) 3.52V 3) 4.11V 4) 8.61V

7. The molar conductivity of a solution increases with [**2**]

1) decrease in temperature **2) decrease in concentration**

3) increase in concentration 4) decrease in ionic mobility

8. In a dry cell which of the following is the electrolyte? [**1**]

1) $NH_4Cl + ZnCl_2$ 2) H_2SO_4+NaOH 3) NaOH+KOH 4) NaOH+HCl

9. Which of the following is correct about cathode in an electro chemical cell? [**3**]

1) Oxidation occurs 2) Electrons loss occur **3) Reduction occurs** 4) No reaction occurs

10. During the electrolysis of aqueous NaCl solution using platinum electrodes, the product obtained at the cathode is [**2**]

1) Cl_2 **2) H_2** 3) O_2 4) Na

11. If a current of 0.5 amperes flows through a metallic wire for 2 hours, then how many electrons would flow through the wire? [**3**]

1) 1.50×10^{21} 2) 3.75×10^{23} **3) 2.25×10^{22}** 4) 1.10×10^{23}

12. A lead storage battery is mainly used in [**4**]

1) watches 2) automobiles 3) inverters **4) Both 2 & 3**

13. The standard electrode potential for Daniel cell is 1.1 V. The standard Gibbs energy for the following reaction is (IF = 96500 C mol^{-1}) [**1**]

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

1) –212.3 kJ/mol 2) –444.4 kJ/mol 3) –101.3 kJ/mol 4) –323.8 kJ/mol

14. The electrical conductance of a metallic conductor is due to [**1**]

1) flow of free electrons only 2) flow of ions only

3) Both by flow of electrons and ions 4) Neither by flow of electrons nor by ions

15. Which of the following metals listed in the options is least reactive? [**3**]

1) Fe 2) Mg **3) Au** 4) Cu

II. FILL IN THE BLANKS(FIB)

1. 1 Faraday value is equal to **96487 (or) 96500** C mol^{-1}

2. Corrosion of iron is mainly due to **water** and **air**

3. The units of molar conductivity are **$S cm^2 mol^{-1}$ (or) $S\ m^2 mol^{-1}$**

4. Lead storage battery is an example of **secondary** cell.

5. In Daniell cell the oxidation half reaction occurs at **anode**

III. ONE WORD ANSWER Q'S

1. Write an expression showing the relation between E^{o}_{cell} and Gibbs energy change.

A: $\Delta G^{o} = -nFE^{o}_{(cell)}$ is the relation between E^{o}_{cell} and Gibbs energy change.

Here n is the no. of electrons involved in oxidation (or) reduction, E^{o}_{cell} = standard EMF

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2. Give an example of an inert electrode.

A: **Gold / Platinum / Graphite** are the examples of an inert electrode.

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3. What is the charge of an electron in coulombs?

A: Charge of an electron in coulombs is $\mathbf{-1.602 \times 10^{-19}}$ **coulombs**

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4. In a galvanic cell chemical energy is converted to electrical energy by which reaction?

A: In a galvanic cell chemical energy is converted to electrical energy by **Spontaneous redox reaction.**

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5. What happens to the colour of a solution when a zinc wire is dipped in $CuSO_4$ solution?

A: **Blue colour** of $CuSO_4$ **disappears** when a zinc wire is dipped in $CuSO_4$ solution.

HINTS FOR MCQ

1. **(2)** In electrolytic refining, the impure metal is made **anode** and pure metal is deposited on **cathode**.
Oxidation at anode → metal ions go into solution→ reduction at cathode→ pure metal deposits.

2. **(4)** A fuel cell is a device that converts combustion energy of fuel directly into electrical energy.

3. **(1)** Standard Hydrogen Electrode (SHE) is used as a **reference electrode**.
By convention, its potential is taken as zero for all calculations.

4. **(4)** Daniel Cell: $Zn \mid Zn^{2+} \parallel Cu^{2+} \mid Cu$

$$E^o = E^o_{Cathode} - E^o_{Anode} = 0.34 - (-0.76) = 1.10V$$

5. **(2)** Specific conductance (k) = conductance × cell constant $\Rightarrow S \times \frac{1}{m}$

SI unit = Siemens per meter. S/m

6. **(1)** The cell is represented as $Mg \mid Mg^{2+}$ (0.130M) $\parallel Ag^{+}$(0.0001M)|Ag

$$E_{(cell)} = E^{-}_{(cell)} - \frac{RT}{2F}\ln\frac{[Mg^{2+}]}{[Ag^{+}]^2} = 3.17\ V - \frac{0.059V}{2}\log\frac{0.130}{(0.0001)^2} = 3.17V - 0.21V = 2.96\ V.$$

7. **(2)** Molar conductivity (Λ_m) depends on **mobility of ions**.
On dilution→ ions are far apart→ less interaction →higher mobility.

So Λ_m m increases as concentration decreases. $\Lambda_m = \frac{k \times 1000}{M}$ $\Lambda_m \propto \frac{1}{M}$

8. **(1)** Dry cell uses a paste electrolyte, not liquid.
Composition: $NH_4Cl + ZnCl_2 + MnO_2$ (depolariser)

9. **(3)** **At cathode:**
Reduction = gain of electrons always occurs (in both electrolytic & galvanic cells).

10. **(2)** **Ionisation:** $2NaCl \rightarrow 2Na^{+} + 2Cl^{-}$

At anode : $2Cl^{-} \rightarrow Cl_2 + 2e^{-}$

At cathode: $2H_2O + 2e^{-} \rightarrow 2OH^{-} + H_2\uparrow$

$2Na^{+} + 2OH^{-} \rightarrow 2NaOH$

11. **(3)** Given i = 0.5 amp, t= 2×60×60s

Q=it = 0.5×7200=3600C

96000C= 1 mole electrons = 6.022×10^{23}

3600C=_____No.of electrons?

$$\therefore \text{No.of electorns} = \frac{3600 \times 6.022 \times 10^{23}}{96500} = 2.25 \times 10^{22} \text{ electrons}$$

12. **(4)** Lead storage battery is used where **large current + rechargeability** is needed.

Common uses: automobiles & inverters.

13. **(1)** $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

From above equation n=2, F=96500C, $E^0_{Cell} = 1.1V$

$$\Delta G^0_F = -nFE^0_{Cell}$$

$$\Delta G^0_F = -2 \times 96500 \times 1.1 = -21200 J.mole^{-1} = -212.3\ KJ.mole^{-1}$$

14. **(1)** In metals, current is carried by **free electrons**, not ions.

No ionic movement in solid metals.**Flow of free electrons only**

15. **(3)** Least reactive metal = most **noble metal**.

Reactivity order: Mg > Fe > Cu > Au Gold is least reactive.

3. CHEMICAL KINETICS

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The unit of rate of a chemical reaction is generally expressed as: [**1**]

1. mol L^{-1} s^{-1} 2. mol L^{-1} 3. mol 4. s^{-1}

2. The instantaneous rate of reaction can be determined by using [**3**]

1. average time 2. total time

3. slope of the concentration-time curve 4. product concentration and time

3. Which of the following does not affect the rate of reaction? [**4**]

1. Temperature 2. Catalyst 3. Pressure **4. Color of reactants and products**

4. The rate law for a given reaction is determined from [**3**]

1. balanced chemical equation 2. thermodynamic data

3. experimental data 4. catalyst used

5. Molecularity of a reaction can be [**2**]

1. zero **2. always integer** 3. negative 4. fractional

6. What is the overall order of a reaction which has the rate expression rate = $k[A]^2[B]$? [**3**]

1. One 2. Two **3. Three** 4. Zero

7. Radioactive decay is an example of which order kinetics? [**2**]

1. Zero **2. First** 3. Second 4. Third

8. What is the slope of the ln[A] vs. t graph for a first order reaction? [**1**]

1. –k 2. k 3. –1/k 4. ln k

9. The unit of rate constant of a first order reaction is [**1**]

1. s^{-1} 2. L $mol^{-1}s^{-1}$ 3. mol L^{-1} s^{-1} 4. mol s^{-1}

10. The half-life of a first-order reaction is given by [**3**]

1. $t_{1/2} = 1/k$ 2. $t_{1/2} = [A]_o/ 2k$ **3. $t_{1/2} = 0.693/k$** 4. $t_{1/2} = k/0.693$

11. The hydrolysis of methyl acetate in aqueous acid is considered as pseudo first-order reaction because [**2**]

1. acid acts as catalyst **2. water is in large excess**

3. methyl acetate is in excess 4. reaction occurs slowly

12. With the rise in temperature by 10 °C, the rate constant of a reaction [**3**]

1. decreases by 2 or 3 times 2. remains same

3. increases by 2 or 3 times 4. increases by 10 times

13. Which of the following represents Arrhenius equation? [**3**]

1. $k = A/T$ 2. $k = A + E_a/RT$ **3. $k = Ae^{-Ea/RT}$** 4. $k = \ln A - E_a$

14. Catalyst increases the rate of a reaction by [**1**]

1. decreasing activation energy 2. increasing temperature

3. increasing activation energy 4. increasing concentration

15. Identify the correct statements among the following. [**2**]

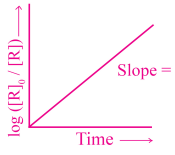
a. A catalyst does not alter Gibbs energy b. A catalyst does not change equilibrium constant

c. A catalyst can catalyze a nonspontaneous reaction

1. a only **2. a & b only** 3. b & c only 4. a & c only

II. FILL IN THE BLANKS(FIB)

1. The sum of powers of the concentration terms in the rate law expression is called **order** of that chemical reaction.
2. The overall rate of the reaction is controlled by the slowest step of the reaction and is called the **rate determining step**
3. The number of collisions per second per unit volume of the reaction mixture is known as **collision frequency**
4. $k = A\ e^{-Ea/RT}$ where A is called **Arrhenius factor or frequency factor**
5. For a first order reaction the following graph is obtained.
   From this graph slope is equal to **k/2.303**



III. ONE WORD ANSWER Q'S

1. What is the molecularity of the elementary reaction: A + B → Products?

A: Molecularity of the given elementary reaction is **2 (two)**

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2. Which reactions takes place in one step?

A: **Elementary reactions** takes place in one step.

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3. In a zero - order reaction, if initial concentration of reactant is 0.4 mol/L and rate constant is 0.1 mol $L^{-1}s^{-1}$, what is its $t_{1/2}$?

A: Given that $[A_0]$=0.4 m/L, K=0.1 m.L^{-1} s^{-1} .

For Zero order reaction $t_{1/2} = \frac{[A_0]}{2K} = \frac{0.4}{2\times 0.1} = 2$ s

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4. What is the unit of rate constant for a zero-order reaction?

A: Unit of rate constant for a zero-order reaction is **mol L^{-1} s^{-1}**

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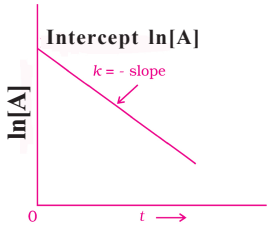
5. Collision theory is based on which theory of gases?

A: Collision theory is based on **Kinetic molecular theory of gases.**

HINTS FOR MCQ

1. **(1)** Rate = change in concentration / time
Unit = mol L^{-1} / s = mol L^{-1} / s^{-1} (or) mol L^{-1} / s^{-1}

2. **(3)** Instantaneous rate = rate at a particular moment
It is given by the **slope of tangent** to concentration–time graph
Slope of the concentration-time curve
3. **(4)** Rate depends on physical conditions like temperature, pressure, catalyst
Color has no effect on rate of reaction. **Color of reactants and products**
4. **(3)** Rate law cannot be predicted from equation. It must be determined experimentally
Experimental data
5. **(2)** Molecularity = No. of atoms, ions or molecules in rate determine step.
It is always a whole number (never fraction/zero)**. Always integer**
6. **(3)** Overall order = sum of powers in rate law. $k[A]^2[B]^1=2+1=3$
7. **(2)** Radioactive decay rate depends on only one nucleus at a time.
So it follows first-order kinetics



8. **(1)** For first order: $\ln[A] = \ln[A_0] - kt$
Slope of graph = –k
$\ln[A] = \ln[A_0] - kt$
9. **(1)** For first order: rate = k[A]. So k must have unit s^{-1}
10. **(3)** Standard half-life formula for first order reaction: $t_{1/2} = \frac{0.693}{k}$
11. **(2)** In pseudo first-order reactions, one reactant is in **large excess**.
Its concentration remains almost constant. Here water is in excess
12. **(3)** Rule of thumb in kinetics: For every 10°C rise, rate constant **roughly doubles or triples**.
This is due to more molecules crossing activation energy. **Increases by 2 or 3 times**
13. **(1)** Arrhenius equation relates rate constant with temperature and activation energy:
$\mathbf{k = Ae^{-Ea/RT}}$ Only option matching exponential form is correct.
14. **(1)** Catalyst provides an **alternative pathway** with lower energy barrier. It does NOT change temperature or concentration. **Decreasing activation energy**
15. **(2)** (a) Catalyst does NOT change $\Delta G \rightarrow$ True
(b) Catalyst does NOT change equilibrium constant$\rightarrow$ True
(c) Cannot make non-spontaneous reaction spontaneous $\rightarrow$ x False
Catalyst only speeds up equilibrium attainment. **a & b only**

4. The d- AND f- BLOCK ELEMENTS

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

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1. The elements in which the differentiating electron enter into the penultimate energy level are [**3**]

1. s-block elements 2. p-block elements **3. d-block elements** 4. f-block elements

2. Which of the following represents the general electronic configuration of d-block elements? [**1**]

1. $(n-1)d^{1-10}\ ns^{1-2}$ 2. $(n-1)d^{1-9}\ ns^{0-1}$ 3. $(n-1)d^{1-8}\ ns^{1-2}$ 4. $(n-2)d^{1-10}\ ns^{1-2}$

3. The correct electronic configuration of Cr is [**2**]

1. $[Ar]3d^4\ 4s^2$ **2. $[Ar]3d^5\ 4s^1$** 3. $[Ar]3d^6\ 4s^o$ 4. $[Ar]3d^3\ 4s^2$

4. Which of the following is not regarded as a transition element? [**4**]

1. Cr 2. Mn 3. Fe **4. Zn**

5. Which block elements in the periodic table have high ductility and malleability? [**3**]

1. s-block 2. p-block **3. d-block** 4. f-block

6. The common oxidation state of d-block elements is [**2**]

1. +3 **2. +2** 3. +1 4. +4

7. Which of the following is the only element of 3d series with positive standard electrode potential(M^{2+}/M)? [**4**]

1. Mn 2. Cr 3. Co **4. Cu**

8. The transition metal which shows the highest oxidation state in its compounds is [**1**]

1. Mn 2. Cr 3. V 4. Co

9. Identify the option in which the given species is correctly arranged in the increasing order of oxidizing power. [**3**]

1. $VO_2^+ < MnO_4^- < Cr_2O_7^{2-}$ 2. $Cr_2O_7^{2-} < VO_2^+ < MnO_4^-$

3. $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$ 4. $Cr_2O_7^{2-} < MnO_4^- < VO_2^+$

10. The spin only formula used for calculation of magnetic moment of a substance is [**4**]

1. $\mu = \sqrt{n(n+1)}$ 2. $\mu = \sqrt{(n+2)}$ 3. $\mu = \sqrt{n(n+0)}$ 4. $\boldsymbol{\mu = \sqrt{n(n+2)}}$

11. Which of the following set of elements represent coinage metals? [**1**]

1. Cu, Ag, Au 2. Cu, Fe, Zn 3. Ag, Fe, Cr 4. Au, Fe, Zn

12. Transition metals form large number of complex compounds. This is due to [**4**]

1. small size 2. high nuclear charge

3. presence of vacant d-orbitals **4. All the above**

13. The catalyst used in Haber's process is [**2**]

1. Ni **2. Fe** 3. Pt 4. Mo

14. Which of the following element is not involved in the formation of interstitial compounds with transition elements? [**4**]

1. H 2. C 3. N **4. Cl**

15. In long form of periodic table which elements have high melting and boiling points? [**2**]

1. Representative elements **2. Transition elements**

3. Lanthanides 4. Actinides

II. FILL IN THE BLANKS(FIB)

1. The atomic radii of 5d series of elements is same as that of **4d series** series of elements.

2. In aqueous solution the colour of the Cu^{2+} ion is **blue**

3. Ce^{4+} is a strong **oxidizing** agent.

4. Most of the radioactive elements are present in **5f series / f-block** series/ block of periodic table.

5. The common oxidation state of lanthanides is **+3**

III. ONE WORD ANSWER Q'S

1. Name the transition element which does not exhibit variable oxidation states?

A: **Sc (Scandium)**does not exhibit variable oxidation states.

---

2. Which substances are attracted very strongly by applied magnetic field?

A: **Ferro Magnetic substances** are attracted **very strongly**.

---

3. What is the other name of f-block elements?

A: **Inner transition elements** is the other name of **f-block elements.**

---

4. What is the catalyst used in the manufacture of high-density polythene?

A: **Zeigler - Natta Catalyst** is used in the manufacture of **high-density polythene.**

---

5. Which metals are involved in the formation of an alloy called Brass?

A: **Cu and Zn** are used in the formation of **Brass.**

HINTS FOR MCQ

1. **(3)** Differentiating electron enters **(n-1)d orbital**, not outer shell.
   That's the key identity of d-block elements.
2. **(1)** d-block involves filling of **(n-1)d and ns orbitals**.General form: d^{1}–d^{10} and s^{1}–s^{2}.
   $(n-1)d^{1-10}\ ns^{1-2}$
3. **(2)** Chromium shows **exception due to half-filled stability**.
   One electron shifts → stable $3d^5$ Cr 24 : [Ar] $4s^1\ 3d^5$
4. **(4)** Transition elements must have **partially filled d-orbitals**.
   Zn = d^{10} (fully filled)→not transition. Zn 30 : [Ar] $4s^2\ 3d^{10}$
5. **(3)** Strong metallic bonding + delocalized electrons→ ductility & malleability.
   Seen strongly in transition metals.
6. **(2)** ns electrons are lost first→ gives +2 oxidation state commonly.
7. **(4)** Positive E^o→ metal is less reactive (noble).Only Cu shows this in 3d series.
   S.E.P of Cu is +0.34 V
8. **(1)** Highest oxidation state depends on total valence electrons.
   Mn 25 : [Ar] $4s^2\ 3d^5$ →+7 maximum.
9. **(3)** Oxidizing power order (strong → weak):
   $\overset{+7}{MnO_4^-} > \overset{+6}{Cr_2O_7^{2-}} > \overset{+5}{VO_2^+}$
   Reverse for increasing order. $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
10. **(4)** Magnetic moment depends on unpaired electrons (n):
    $\mu = \sqrt{n(n+2)}$
11. **(1)** Coinage metals = Group 11 metals used in coins.Cu, Ag, Au
12. **(4)** Complex formation depends on:
    Small size→ strong attraction; High charge→ strong bonding
    Vacant d-orbitals → accept lone pair of electrons from ligands . All contribute.
13. **(2)** Haber process uses **iron catalyst**. With promoters like K_2O, Al_2O_3 .
14. **(4)** Interstitial compounds form with small atoms like H, C, N.
    Cl is too large→cannot fit.
15. **(2)** High melting/boiling points due to strong metallic bonding.
    Maximum in transition elements.

5. COORDINATION COMPOUNDS

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following coordination compound contains cobalt metal? [3]

1. Chlorophyll 2. Hemoglobin **3. Vitamin B_{12}** 4. Myoglobin

2. According to Werner theory of coordination compounds, the secondary valence of metal ion in $CoCl_3.4NH_3$ is [1]

1. 6 2. 4 3. 3 4. 7

3. Which of the following complex produces 2 moles of AgCl as precipitate, when 1 mole of complex reacts with excess of $AgNO_3$? [2]

1. $CoCl_3.4NH_3$ **2. $NiCl_2.6H_2O$** 3. $PtCl_2.2NH_3$ 4. $CoCl_3.6NH_3$

4. Which of the following is not a double salt? [3]

1. $FeSO_4.(NH_4)_2SO_4.6H_2O$ 2. $KCl.MgCl_2 6H_2O$

3. $PtCl_4.2HCl$ 4. $KAl(SO_4)_2.12H_2O$

5. Lewis acid in the complex ion $[CoCl(NH_3)_5]^{2+}$ is [4]

1. Cl^- 2. NH_3 3. Co^{2+} **4. Co^{3+}**

6. Which among the following is a combination of ambidentate ligand and neutral ligand? [1]

1. CN^- & CO 2. EDTA & CO

3. H_2O & OH^- 4. Ethylene diamine (en) & oxalato

7. Which among the following is a homoleptic complex with primary valence of 3 and secondary valence of 6? [1]

1. $CoCl_3.6NH_3$ 2. $NiCl_2.6H_2O$ 3. $PdCl_2.4NH_3$ 4. $CoCl_3.4NH_3$

8. Which ligand gives a stable complex? [4]

1. SCN^- 2. Cl^- 3. H_2O **4. Ethylene diamine(en)**

9. The correct formula for the given IUPAC name: tris (ethane-1,2-diamine) cobalt (III) sulphate is [4]

1. $[Co(NH_3)_6]_2(SO_4)_3$ 2. $[Co(NH_3)_4(H_2O)Cl]Cl_2$

3. $[Co(H_2NCH_2CH_2NH_2)_3](SO_4)_2$ **4. $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$**

10. Which complex shows both linkage and optical isomerism? [3]

1. $[Co(en)_3]Cl_3$ 2. $[CoCl_2(en)_2]Br$ **3. $[Co(en)_2(NO_2)Cl]Cl$** 4. $[PdCl_2(NH_3)_2]$

11. Which of the following shows colour? [3]

1. $K_3[Cu(CN)_4]$ 2. $[Ti(H_2O)_6]^{4+}$ **3. CuF_2** 4. $[Cu(CH_3CN)_4]BF_4$

12. Which complex shows geometrical, optical and also structural isomerism? [**2**]

1. $[Co(en)_3]Cl_3$ **2. $[CoCl_2(en)_2]Br$** 3. $[Co(en)(NH_3)_2Cl_2]Cl$ 4. $[PdCl_2(NH_3)_2$

13. Which among them has highest magnetic moment? [**3**]

1. $[Co(NH_3)_6]Cl_3$ 2. $[NiCl_4]^{2-}$ **3. $[CoF_6]^{3-}$** 4. $[Ni(CO)_4]$

14. Among them, which complex shows $\Delta_o > P$, (Δ_o = relative magnitude of the crystal field splitting, P = pairing energy) [**2**]

1. $[Co(H_2O)_6]^{3+}$ **2. $[Co(NH_3)_6]^{3+}$** 3. $[MnF_6]^{3-}$ 4. $[CoF_6]^{3-}$

15. In which of the following metal ion is with 5 unpaired electrons ? [**3**]

1. $[Co(CN)_6]^{3-}$ 2. $[Co(NH_3)_6]^{3+}$ **3. $[MnF_6]^{4-}$** 4. $[Ni(en)Cl_4]^{2-}$

II. FILL IN THE BLANKS(FIB)

1. According to Werner's theory of coordination compounds primary valences of metal ion are satisfied by **negative ions**
2. Mohr's salt formula is **$FeSO_4(NH_4)_2SO_4.6H_2O$**
3. The coordination sphere in potassium ferrocyanide complex is **$[Fe(CN)_6]^{4-}$**
4. The IUPAC name of $K_2[PdCl_4]$ is **Potassium tetrachloridopalladate (II)**
5. M-CO bond in metal carbonyls is very strong due to **Synergic** effect. (or) π-back bonding.

III. ONE WORD ANSWER Q'S

1. Which platinum complex can effectively inhibit the growth of tumors?

A: **Cis-platin** can effectively inhibit the growth of tumors. **Ex:** Cis $[Pt(NH_3)_2Cl_2]$

---

2. Facial and Meridional isomers come under which category of isomerism?

A: Facial and Meridional isomers show **Geometrical isomerism.**

---

3. What is the geometry of $Fe(CO)_5$ complex?

A: Geometry of $Fe(CO)_5$ is **Trigonal bipyramidal.**

---

4. Which complex ion is formed when undecomposed AgBr of the film dissolves in hypo solution.

A: $\mathbf{[Ag(S_2O_3)_2]^{3-}}$ is formed when AgBr film dissolves in hypo solution.

---

5. How many unpaired electrons are there in $[NiCl_4]^{2-}$ ion?

A: **Two unpaired electrons** are present in $[NiCl_4]^{2-}$ ion.

Ni^{2+} : $[Ar]4s^0 3d^8$ 

HINTS FOR MCQ

1. **(3)** Check biological molecules containing metals:
   Chlorophyll → Mg, Hemoglobin/Myoglobin →Fe.
   Vitamin B_{12} contains Co (cobalt)
2. **(1)** Secondary valence = coordination number (ligands attached). $[Co(NH_3)_4\ Cl_2]\ Cl$
   In $CoCl_3.\ 4NH_3$ is Co is bonded to 4 NH_3 & $2Cl^-$. Here coordination number is 4 + 2 = 6
3. **(2)** $[Ni(H_2O)_6]Cl_2 \rightleftharpoons [Ni(H_2O)_6] + 2Cl^-$. It gives 2 chloride ions.
4. **(3)** Double salt dissociates completely into simple ions.
   $PtCl_4 \cdot 2HCl$ does NOT behave like a double salt → complex nature. $PtCl_4 \cdot 2HCl$
5. **(4)** Lewis acid →Electron pair acceptor. Metal ion accepts electron pairs from ligands.
   So Co^{3+} acts as Lewis acid.
6. **(1)** Ambidentate ligand = can bind through different atoms (**Ex:** CN). It can bind through C &N.
   Neutral ligand = no charge (**Ex:** CO).CN^- (ambidentate) + CO (neutral).
7. **(1)** Homoleptic = only one type of ligand.
   Primary valence = oxidation state, secondary = coordination number.
   In $CoCl_3.6NH_3$ Primary valence is 3 & secondary valency is 6.
8. **(4)** Chelating ligands (multidentate) form most stable complexes.
   Ethylene diamine (en) is bidentate → forms chelate rings.Ethylene diamine (en)
9. **(4)** Charge of complex ion is +3. Charge of SO_4^{2-} is –2. Balance by Criss-cross method.
10. **(3)** Optical isomerism requires non-superimposable mirror images.Typically seen in octahedral complexes with bidentate ligands. $[Co(en)_3]^{3+}$ shows optical isomerism
11. **(3)** Due to the presence of unpaired electrons.
12. **(2)** Geometrical → cis/trans possible .Optical →chiral (no plane of symmetry)
    Structural →ionisation $[CoCl_2(en)_2]$ Br satisfies all cis/trans (geometrical), optical (due to en ligands), ionisation isomerism possible
13. **(3)** Co^{+3} - $[Ar]4s^0 3d^6$
    More no.of unpaired electrons.

⇅	1	1	1	1

14. **(2)** Strong field ligands → large Δ_0 → pairing occurs NH_3 is stronger ligand than H_2O, F^- , NH_3 - strong field ligand.
15. **(3)** In $[MnF_6]^{4-}$, Mn shows +2 oxidation state. E.C of Mn^{+2} is $[Ar]4s^0 3d^5$
    More no.of unpaired electrons. (n=5)

1	1	1	1	1

6.HALOALKANES (R-X) & HALOARENES (Ar-X)

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

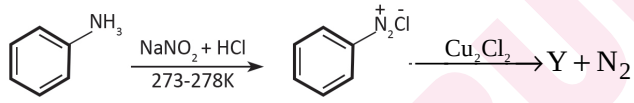
1. What is the general formula for haloalkanes? (X=halogen atom, n=1, 2, 3...) [**2**]

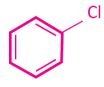
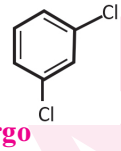
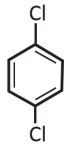
1) $C_nH_{2n}X$ 2) **$C_nH_{2n+1}X$** 3) $C_nH_{2n-1}X$ 4) $C_nH_{2n-3}X$

2. Which of the following reagents is used for replacement of -OH group in an alcohol by -Cl group? [**3**]

1) SO_2Cl_2 2) Aqueous HCl 3) **$PCl_3, SOCl_2$** 4) NaCl

3. Identify the compound Y in the following reaction sequence. [**1**]



1)  2)  3)  4) 

4. A primary alkyl halide would prefer to undergo [**2**]

1) S_N1 reaction **2) S_N2 reaction** 3) α–elimination 4) racemization

5. Which of the following is the suitable medium for preparing Grignard reagents? [**2**]

1) Dry acetone **2) Dry ether** 3) Concentrated HCl 4) Alcoholic KOH

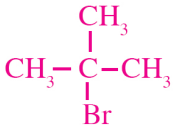
6. Compared to haloalkanes, the reactivity of haloarenes towards nucleophilic substitution reactions is [**1**]

1) low 2) high 3) very high 4) equal

7. Chlorobenzene is formed by the reaction of chlorine with benzene in the presence of anhydrous $AlCl_3$. Which of the following species attacks the benzene ring in this reaction? [**2**]

1) Cl^- **2) Cl^+** 3) $AlCl_3$ 4) $[AlCl_4]^-$

8. Arrange the following compounds in increasing order of their boiling points. [**3**]

(a)  (b) $CH_3CH_2CH_2CH_2Br$ (c) 

1) (b) < (a) < (c) 2) (a) < (b) < (c) **3) (c) < (a) < (b)** 4) (c) < (b) < (a)

9. Which of the following alkyl halide will undergo S_N1 reaction most readily? [**4**]

1) $(CH_3)_3C—F$ 2) $(CH_3)_3C—Cl$ 3) $(CH_3)_3C—Br$ **4) $(CH_3)_3C—I$**

10. Which reagent will you use for the following reaction? [**1**]

$$CH_3CH_2CH_2CH_3 \longrightarrow CH_3CH_2CH_2CH_2Cl + CH_3CH_2CHClCH_3$$

1) Cl_2/UV light 2) $NaCl + H_2SO_4$

3) Cl_2 gas in dark 4) Cl_2 gas in the presence of iron in dark

11. Which of the following represents the correct name of the compound, CH_3CHCl_2? [**1**]

1) Ethylidene chloride 2) Ethylene dichloride

3) 1, 2-Dichloroethane 4) Vic-dichloride

12. In alkyl halides, carbon-halogen bond is polarized due to [**1**]

1) greater electronegativity of halogen atom than carbon

2) greater electronegativity of carbon than halogen atom

3) partial positive charge on halogen atom and a partial negative charge on carbon

4) tendency of halogen atom to donate electrons

13. Chlorobenzene is [**1**]

1) less reactive than benzyl chloride

2) more reactive than ethyl bromide

3) nearly as reactive as methyl chloride

4) more reactive than isopropyl chloride

14. The set of compounds in which the reactivity of halogen atom in the ascending order is [**4**]

1) Vinyl chloride, chloroethane, chlorobenzene

2) Vinyl chloride, chlorobenzene, chloroethane

3) Chloroethane, chlorobenzene, vinyl chloride

4) Chlorobenzene, vinyl chloride, chloroethane

15. The Wurtz-Fittig reaction involves [**3**]

1) two molecules of aryl halides

2) two molecules of alkyl halides

3) **one molecule each of aryl halide and alkyl halide**

4) one molecule each of aryl halide and phenol

II. FILL IN THE BLANKS(FIB)

1. Our body produces an iodine containing hormone, thyroxine, the deficiency of which causes a disease called **Goiter**
2. Alkyl iodides are often prepared by the reaction of alkyl chlorides/ bromides with NaI in dry acetone. This reaction is known as **Finkelstein** reaction.
3. Groups like cyanides and nitrites possess two nucleophilic centers and are called **ambident nucleophiles**
4. The compounds which rotate the plane polarized light are called **Optically active or Chiral**
5. The compounds which are obtained by the reaction of haloalkanes with magnesium metal in dry ether are called **Grignard Reagents**

III. ONE WORD ANSWER Q'S

1. Preservation of the spatial arrangement of bonds to an asymmetric center during a chemical reaction or transformation is called

A: Preservation of the spatial arrangement of bonds is called **Retention of Configuration.**

---

2. Diazonium salt with cuprous chloride or cuprous bromide results in the replacement of the diazonium group by –Cl or –Br. This reaction is called

A: **Sandmeyer reaction** is the replacement of the diazonium group by –Cl or –Br.

---

3. Synthesis of alkyl fluorides by heating an alkyl chloride/bromide in the presence of a metallic fluoride such as AgF is named as

A: **Swarts reaction** is the synthesis of alkyl fluorides by heating an alkyl chloride/bromide.

---

4. If the compound rotates the plane of plane polarized light to the right, i.e., clockwise direction, it is called

A: **Dextro rotatory** compound rotates the plane polarized light to the right.

---

5. The stereoisomers which are related to each other as non- superimposable mirror images are called

A: **Enantiomers** are non- superimposable mirror images

HINTS FOR MCQ

1. **(2)** Haloalkanes are derived from alkanes by replacing one H with X.
   Alkane formula = C_nH_{2n+2}→ replace one H →?$C_nH_{2n+1}X$
2. **(3)** Converting alcohol (–OH) → alkyl chloride (–Cl) needs chlorinating agents.
   Best reagents: PCl_3, $SOCl_2$
   $3R–OH + PCl_3 \rightarrow 3R–Cl + H_3PO_3$
   $R–CH + SOCl_2 \rightarrow R–Cl + SC_2+HCl$
3. **(1)** Reaction sequence:Aniline → diazonium salt → Sandmeyer reaction (Cu_2Cl_2/ HCl).
   Gives chlorobenzene.
4. **(2)** Primary alkyl halides favor backside attack (less steric hindrance).So SN^2 dominates.
5. **(2)** Grignard reagents are destroyed by water/protic solvents.
   Need dry, aprotic medium→Dry ether
6. **(1)** Haloarenes are less reactive due to:resonance stabilization
   partial double bond character So substitution is difficult. Answer: Low
7. **(2)** Electrophilic substitution→ attacking species must be electrophile.
   Cl^+ is the actual attacking species.
8. **(3)** Boiling point depends on: molecular mass branching (more branching→ lower BP)
   Arrange accordingly. Answer: (c) < (a) < (b)
9. **(4)** SN^1 favors tertiary carbocation stability. $(CH_3)_3C–I$ forms most stable carbocation + best leaving group.
10. **(1)** Reaction shows free radical substitution → needs UV light
    Chlorination of alkanes occurs under UV.
11. **(1)** $CH_3–CHCl_2$ has both Cl atoms on the same carbon (geminal dihalide).
    Common name: Ethylidene chloride (not ethylene dichloride).
12. **(1)** Halogens are more electronegative than carbon.
    So they pull electron density→ C becomes δ^+ and X becomes δ^-.
    Greater electronegativity of halogen atom than carbon
13. **(1)** Chlorobenzene is less reactive due to: resonance stabilization. partial double bond character of C–Cl.
    So it reacts slower than alkyl halides. Less reactive than benzyl chloride
14. **(4)** **Reactivity order:** Aryl halide (least) < Vinyl halide < Alkyl halide (most)
    Because: aryl: strong resonance, vinyl: sp^2 (C–X), alkyl: sp^3 (C–X) (easiest to break)
    Chlorobenzene < Vinyl chloride < Chloroethane
15. **(3)** Wurtz – Fittig reaction couples: aryl halide + alkyl halide → alkylbenzene
    (in presence of Na/dry ether). One molecule each of aryl halide and alkyl halide

7. ALCOHOLS, PHENOLS, ETHERS

(R–OH) (Ar–OH) (R–O–R')

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Glycerol is a: [4]

1) dihydric alcohol 2) monohydric alcohol 3) hexahydric alcohol **4) trihydric alcohol**

2. Primary and secondary alcohols on action of red-hot copper give [1]

1) aldehydes and ketones respectively 2) ketones and aldehydes respectively

3) only aldehydes 4) only ketones

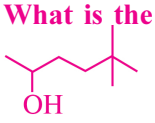
3. Which of the following can work as a dehydrating agent for alcohols? [4]

1) Conc. H_2SO_4 2) Anhydrous Al_2O_3 3) H_3PO_4 **4) All of these**

4. Which of the following shows strong hydrogen bonding? [3]

1) Ethyl amine 2) Ammonia **3) Ethyl alcohol** 4) Diethyl ether

5. What is the IUPAC name of the compound given below? [1]



1) 5, 5–dimethyl–hexan–2–ol 2) 5, 5, 5–trimethyl–pentan–2–ol

3) 2, 2–dimethyl–hexan–5–ol 4) 2, 2–dimethyl–pentan–5–ol

6. Sodium phenoxide on reaction with carbon dioxide followed by acidification gives [2]

1) benzoic acid **2) salicylic acid** 3) phenylacetic acid 4) phthalic acid

7. What is the major product formed when ethanol is dehydrated with concentrated H_2SO_4 at 413K? [4]

1) Ethene 2) Methoxymethane 3) Methoxyethane **4) Ethoxyethane**

8. The reaction between tert-Butyl chloride and sodium ethoxide gives [**3**]

1) tert-butyl ethyl ether 2) tert-butyl methyl ether

3) 2-methylprop-1-ene 4) butene

9. One molecule of dialkyl ether produces how many molecules of alkyl halides with excess of halogen acid? [**2**]

1) 1 **2) 2** 3) 3 4) 4

10. On heating aqueous solution of benzene diazonium chloride, which of the following is formed? [**3**]

1) benzene 2) chlorobenzene **3) phenol** 4) aniline

11. When phenol is treated with excess bromine water it gives [**4**]

1) m-bromophenol 2) o- and p-bromophenol

3) 2,4-dibromophenol **4) 2,4,6-tribromophenol**

12. The compound obtained by the reaction of ethene with diborane followed by hydrolysis with alkaline H_2O_2 is [**1**]

1) ethanol 2) propanol 3) ethanal 4) triethyl bromide

13. Which of the following is formed when phenol is exposed to air? [**1**]

1) Benzoquinone 2) Benzyl quinone 3) Acetophenone 4) Benzene

14. The alcohol which does not react with Lucas reagent at room temperature is [**2**]

1) isobutyl alcohol **2) n-butanol** 3) tert-butyl alcohol 4) sec-butyl alcohol

15. Which statement from the following is true? [**3**]

1) During dehydration reaction H_2O molecule is added to reactant.

2) Lucas test is used for detection of ethers.

3) During esterification OH^- from acid molecule and H^+ from alcohol are removed.

4) During esterification H^+ from acid molecule and OH^- from alcohol are removed.

II. FILL IN THE BLANKS(FIB)

1. Isopropyl benzene is commonly called **cumene.**
2. Boiling points of alcohols and phenols are higher in comparison to other classes of compounds due to **intermolecular hydrogen bonding**
3. Alcohols and phenols react with carboxylic acids to form **esters**
4. Lucas reagent is **Conc. HCl/$ZnCl_2$** (anhydrous)
5. On treating phenol with chloroform in the presence of sodium hydroxide, salicylaldehyde is formed. This reaction is known as **Reimer-Tiemann reaction**

III. ONE WORD ANSWER Q'S

1. Phenol on heating with zinc dust gives a compound X. What is X?

A: Phenol on heating with zinc dust gives **Benzene (C_6H_6)**

---

2. When an alkyl halide is allowed to react with sodium alkoxide, ether is formed. What is the name given to this reaction?

A: **Williamson synthesis:** Alkyl halide + sodium alkoxide→ Ether

(R'–X + R–O–Na → R–O–R' + NaX)

---

3. In the preparation of phenol from cumene, what is the byproduct obtained?

A: The byproduct obtained in the preparation of phenol from cumene is **Acetone (CH_3COCH_3)**

---

4. What is the IUPAC name of glycerol?

A: IUPAC name of glycerol is **Propane-1,2,3-triol.**

---

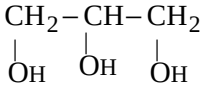
5. Which class of compounds are obtained when alkenes react with water in the presence of acid as catalyst?

A: Alkenes when react with water in the presence of acid as catalyst gives **Alcohols.**

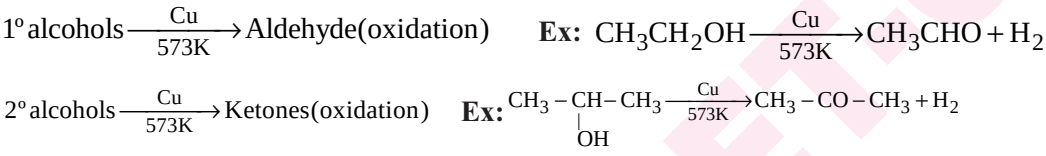
$$CH_2 = CH_2 + H_2O \xrightarrow{H^+} CH_3CH_2OH$$

HINTS FOR MCQ

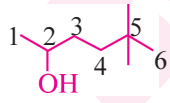
1. **(4)** Count number of –OH groups in glycerol. It has three –OH groups attached to different carbons.Alcohol classification depends on number of –OH groups. Trihydric alcohol



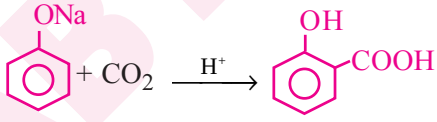
2. **(1)** Red-hot Cu causes dehydrogenation (removal of H_2).
Primary alcohol → aldehyde. Secondary alcohol → ketone. Because of different carbon environments. Aldehydes and ketones respectively



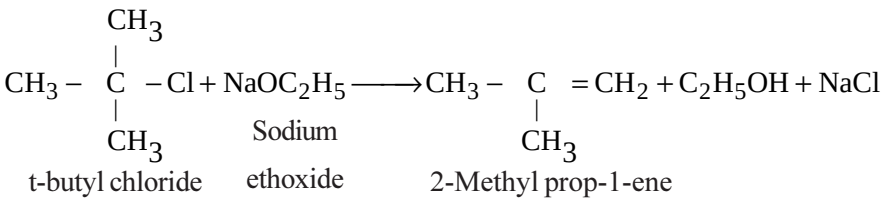
3. **(4)** Dehydrating agents remove water . Conc. H_2SO_4, Al_2O_3, and H_3PO_4 all promote elimination of water. So all act as dehydrating agents.
4. **(3)** Strong hydrogen bonding requires –OH group (more polar than –NH).
Alcohols form stronger H-bonds than amines/ethers.
5. **(1)** Choose longest chain containing –OH. Number from end nearest to –OH.
Identify substituents correctly. Applying rules → hexane backbone, –OH at C-2, two methyl at C-5.
5,5-dimethyl-hexan-2-ol



6. **(2)** Sodium phenoxide + CO_2 →Kolbe's reaction.
CO_2 attaches at ortho position → after acidification → salicylic acid



7. **(4)** Dehydration of alcohol depends on temperature: 413 K → ether formation (intermolecular)
443 K → alkene. So ethanol gives Ethoxyethane at 413 K .
8. **(3)** tert-butyl chloride forms stable carbocation→ elimination favored.
Strong base (ethoxide) → E_2 elimination → alkene formation
Gives most substituted alkene. 2-methylprop-1-ene



9. **(2)** Ether + excess HX → cleavage of both C–O bonds (2 molecules)

$$R-O-R' \xrightarrow[\Delta]{HX} R-X+R'OH$$

$$R'-OH \xrightarrow[\Delta]{HX} R'-X+H_2O$$

10. **(3)** Benzene diazonium salt + water (heat) → hydrolysis.

N_2^+ replaced by –OH group. Forms phenol

11. **(4)** Phenol is strongly activating (–OH group). Directs substitution to ortho & para positions. Excess Br_2 → substitution at 2, 4, 6 positions. 2, 4, 6-tribromophenol

12. **(1)** Reaction is hydroboration–oxidation: Alkene + diborane→ alcohol (anti-Markovnikov addition)

Ethene gives ethanol (–OH adds to less substituted carbon).

13. **(1)** Phenol on exposure to air gets oxidized slowly. Forms quinone (benzoquinone).

14. **(2)** Lucas test: 3° alcohol → immediate reaction. 2° alcohol → slow. 1° alcohol→ no reaction at room temp. n-butanol is primary alcohol.

15. **(3)** **Esterification:** Acid + Alcohol → Ester + Water. Water is formed by removal of: OH from acid. H from alcohol. Check options carefully OH^- from acid and H^+ from alcohol are removed

8. ALDEHYDES, KETONES & CARBOXYLIC ACIDS

(R–CHO) R–(C=O)–R' (R–COOH)

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. With which of the following reagents both ethanal and propanone react? [4]

1) Tollens' 2) Schiff's 3) Fehling **4) Grignard**

2. Cannizzaro reaction is not given by [1]

1) CH_3CHO 2) PhCHO 3) HCHO 4) $(CH_3)_3C–CHO$

3. A new C–C bond is formed in [4]

1) Cannizzaro reaction 2) Rosenmund reduction

3) Clemmensen reduction **4) Aldol condensation**

4. Fehling reagent oxidised an aliphatic aldehyde to carboxylic acid. The compound responsible for reddish brown precipitate is [2]

1) CuO **2) Cu_2O** 3) $Cu(OH)_2$ 4) $(R–COO)_2Cu$

5. Clemmensen and Wolff-Kishner reductions are used to convert [3]

1) R–Cl → R–H 2) R–CHO→R–CH_2OH

3) >C=O → $\rangle CH_2$ 4) R–COOH → R–CH_2OH

6. Which of the following is a dicarboxylic acid? [1]

1) oxalic acid 2) benzoic acid 3) salicylic acid 4) picric acid

7. CH_3CHO and $C_6H_5CH_2–CHO$ can be distinguished chemically by [2]

1) Benedict test **2) Iodoform test** 3) Tollens' reagent 4) Fehling's reagent

8. Conversion of CH_3COOH to CH_3COCl cannot be achieved by [4]

1) $SOCl_2$ 2) PCl_5 3) PCl_3 **4) Cl_2/ red P**

9. Common reagent used to detect aldehydes and ketones is [2]

1) Lucas reagent **2) 2, 4-DNP** 3) Baeyer's reagent 4) Tollens' reagent

10. Benzaldehyde can be prepared from toluene by reacting with [1]

1) CrO_2Cl_2 / CS_2 2) $KMnO_4$ / KOH 3) Pd / $BaSO_4$ 4) CO+HCl / $AlCl_3$

11. Choose the weakest acid among the following [4]

1) FCH_2COOH 2) Cl_2CCOOH 3) CH_3COOH **4) CH_3CH_2COOH**

12. Which one of the following is not correctly matched? [4]

1) Formic acid - methanoic acid 2) acetic acid - ethanoic acid

3) malonic acid - propanedioic acid **4) adipic acid - ethanedioic acid**

13. $NaHSO_3$ forms an adduct with all compounds except [**4**]

1) CH_3CHO 2) H_3CCOCH_3 3) PhCHO **4) glucose**

14. Which one of the following is more reactive towards nucleophilic addition? [**1**]

1) CH_3CHO 2) CH_3CH_2CHO 3) CH_3COCH_3 4) $H_3CCH_2COCH_3$

15. The correct trend of boiling point is [**4**]

1) $CH_3COOH > CH_3COCH_3 > CH_3CH_2OH > CH_3CH_2Cl$

2) $CH_3CH_2OH > CH_3COOH > CH_3COCH_3 > CH_3CH_2Cl$

3) $CH_3CH_2OH > CH_3COOH > H_3CCH_2Cl > CH_3COCH_3$

4) $CH_3COOH > CH_3CH_2OH > H_3CCOCH_3 > CH_3CH_2Cl$

II. FILL IN THE BLANKS(FIB)

1. IUPAC name of formaldehyde is **methanal (HCHO)**

2. Chromium trioxide (CrO_3) in acidic (H_2SO_4) media is called **Jones** reagent

3. Tollens' reagent is **freshly prepared ammonical silver nitrate solution**

4. Carboxylic acids having an α-hydrogen are halogenated at the α-position on treatment with chlorine or bromine in presence of small amount of phosphorus to give α- halocarboxylic acids. This reaction is known as **Hell-Volhard-Zelinsky reaction (HVZ reaction)**

5. IUPAC name of Mesityl oxide is **4-methylpent-3-en-2-one**

III. ONE WORD ANSWER Q'S

1. What is name of the product formed when benzene is reacted with CO and HCl in the presence of anhydrous $AlCl_3$?

A: **Benzaldehyde** is obtained when benzene is reacted with CO and HCl.

---

2. What is Rochelle salt?

A: **Rochelle salt:** Sodium potassium tartarate ($KNaC_4H_4O_6.4H_2O$) .

(A double salt of Tartaric acid)

---

3. Which acid is used as solvent in food industry as vinegar?

A: Vinegar: **Ethanoic acid (CH_3COOH or acetic acid).**

---

4. Aldehydes and ketones undergo what type of addition reactions?

A: Aldehydes and ketones undergo **Nucleophilic addition reactions.**

---

5. Phthalic acid on reaction with ammonia followed by strong heating gives a compound 'X' along with elimination of NH_3. What is the name of that compound 'X'?

A: **phthalimide**

HINTS FOR MCQ

1. **(4)** Tollens', Fehling, Schiff '→ react mainly with **aldehydes**
   Grignard reacts with **both aldehydes & ketones** (adds to C=O) **Grignard reagent**
2. **(1)** Cannizzaro reaction occurs only with **aldehydes without α-hydrogen.**
   CH_3CHO has α–H does not give Cannizzaro
3. **(4)** New C–C bond formation happens when molecules combine.
   Aldol condensation forms C–C bond between two aldehydes/ketones.
4. **(2)** Fehling's solution contains Cu^{2+} ions. On reduction → Cu_2O (reddish-brown ppt).
5. **(3)** Clemmensen & Wolff–Kishner reduce carbonyl group
   >C=O → – CH_2–
6. **(1)** Dicarboxylic acid = 2 COOH groups.Oxalic acid = HOOC–COOH
7. **(2)** Iodoform test detects $–COCH_3$ group. CH_3CHO gives iodoform, $C_6H_5CH_2CHO$ does not.
8. **(4)** Carboxylic acid → acid chloride requires chlorinating agent.
   Cl_2/red P forms PCl_3 in situ→ converts COOH →COCl
9. **(2)** 2,4-DNP reacts with carbonyl group (C=O).Gives yellow/orange ppt → common test.
10. **(1)** Controlled oxidation of toluene gives benzaldehyde.
    Chromyl chloride (CrO_2Cl_2)→Etard reaction.
11. **(4)** Electron-donating groups decrease acidity. Alkyl group (+I effect) →weakest acid.
    Propionic acid weakest here. CH_3CH_2COOH
12. **(4)** Adipic acid formula = hexanedioic acid, not ethanedioic. So mismatch.
    adipic acid – ethanedioic acid
13. **(4)** $NaHSO_3$ forms addition compounds with aldehydes/ketones.
    Glucose is not typical carbonyl (exists mainly cyclic).
14. **(1)** Reactivity in nucleophilic addition depends on: +I effect (alkyl groups)→decreases reactivity
    Steric hindrance → decreases reactivity. Order: Aldehyde > Ketone, and smaller
    alkyl groups → more reactive. CH_3CHO has: only one alkyl group. less steric hindrance
15. **(4)** **Boiling point depends on intermolecular forces:**Carboxylic acid → strongest (H-bonded dimers)
    Alcohol → H-bonding. Ketone→dipole–dipole. Alkyl halide → weak van der Waals
    So order: Carboxylic acid > Alcohol > Ketone > Alkyl halide
    Acid > Alcohol > Ketone > Alkyl chloride

9. AMINES

(Amines, Diazonium Salts, Cyanides and Isocyanides)

($R-NH_2$) ($Ar-N_2^+ Cl^-$) (R–CN) (R–NC)

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following amines cannot be prepared by Gabriel phthalimide reaction?

1) Benzylamine **2) Aniline** 3) Ethylamine 4) Methylamine[**2**]

2. Which of the following reaction does not produce amine? [**3**]

1) Gabriel phthalimide synthesis 2) Hoffmann bromamide degradation reaction

3) Carbylamine reaction 4) Reduction of nitriles

3. Classification of amines into 1°, 2°, 3° is based on the [**3**]

1) number of amino groups 2) nature of carbon atom

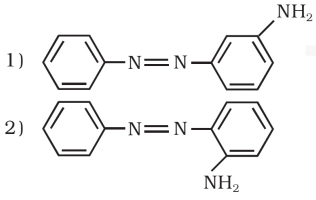
3) degree of substitution at nitrogen 4) degree of unsaturation

4. Which of the following amines does not react with Hinsberg reagent? [**3**]

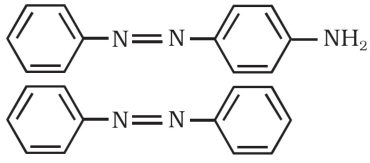
1) $CH_3CH_2NH_2$ 2) $(CH_3CH_2)_2NH$ **3) $(CH_3CH_2)_3N$** 4) all will react

5. Identify the product Y in the given reaction sequence. [**3**]

$$C_6H_5NO_2 \xrightarrow{Sn+HCl} X \xrightarrow[OH]{C_6H_5N_2^+Cl^-} Y \text{ (Yellow coloured compound)}$$

1) 

2)

3) 

4)

6. Propanoic acid on reaction with NH_3 followed by heating gives a compound X, which on reaction with Br_2 and aqueous KOH gives. [**2**]

1) Propylamine **2) Ethanamine** 3) Ethanenitrile 4) Propanenitrile

7. Benzene diazonium chloride salt solution is heated at about 283 K the salt gets hydrolysed to compound "A": A can be identified with [**2**]

1) Lucas reagent **2) Neutral ferric chloride** 3) Tollens' reagent 4) Hinsberg reagent

8. The number of primary amines possible for a compound with molecular formula $C_4H_{11}N$ are

1) 1 2) 2 3) 3 **4) 4** [**4**]

9. Which of the following is most volatile? [**2**]

1) $CH_3CH_2CH_2NH_2$ **2) $(CH_3)_3N$** 3) $CH_3CH_2-\underset{\underset{CH_3}{|}}{N}-H$ 4) CH_3OH

10. Aliphatic primary amine on heating with chloroform and ethanolic KOH gives [**3**]

1) an alcohol 2) an alkanediol **3) an alkyl isocyanide** 4) an alkyl cyanide

11. Which of the following does not reduce $C_6H_5NO_2$ to $C_6H_5NH_2$? [**3**]

1) Fe/ HCl 2) Zn/ HCl **3) $LiAlH_4$** 4) $SnCl_2$ in HCl

12. The end product in the given reaction sequence is [**4**]

$$CH_3CN \xrightarrow[ii)\,H_2O]{i)\,DIBAL\text{-}H} \times \xrightarrow[ii)\,H_2O]{i)\,LiAlH_4} Y$$

1) $CH_3–CH_2–NH_2$ 2) CH_3CONH_2 3) $CH_3–NH–CH_3$ **4) CH_3CH_2OH**

13. Which among the following has the lowest pK_b value in aqueous medium? [**3**]

1) NH_3 2) CH_3NH_2 **3) $(CH_3)_2NH$** 4) $(CH_3)_3N$

14. Formation of benzene from benzene diazonium chloride can be carried out with [**3**]

1) H_3PO_3 2) H_3PO_4 **3) H_3PO_2** 4) HPO_3

15. Aniline reacts with the following to give benzanilide [**3**]

1) Benzyl chloride 2) Benzal chloride **3) Benzoyl chloride** 4) Benzo tri chloride

II. FILL IN THE BLANKS(FIB)

1. The shape of trimethyl amine is **pyramidal**
2. Benzenesulphonyl chloride ($C_6H_5SO_2Cl$), is also known as **Hinsberg's reagent**
3. Carbylamine reaction or isocyanide test is used for the identification of **primary amines or 1° amines**
4. The conversion of primary aromatic amines into diazonium salts is known as **diazotisation**
5. Coupling reaction of aryl diazonium salts with phenols or aryl amines gives rise to the formation of **azodyes**

III. ONE WORD ANSWER Q'S

1. What is the IUPAC name of ethyl methyl amine?

A: IUPAC name of ethyl methyl amine is **N–methyl ethanamine.**

---

2. The process of cleavage of the C–X bond of alkyl halides by ammonia molecule is known as

A: **Ammonolysis** is the cleavage of the C–X bond of alkyl halides by ammonia molecule.

---

3. Aniline and other arylamines are usually colourless but get coloured on storage why?

A: Aniline and other arylamines get coloured on storage due to **Atmospheric oxidation.**

---

4. Tertiary amines like trimethylamine are used as

A: Tertiary amines are used to **attract flies or insects.**

---

5. A molecule that has both positive and negative regions of charge is called

A: **Zwitter ion** is the molecule that has both positive and negative regions of charge.

HINTS FOR MCQ

1. **(2)** Gabriel synthesis gives only aliphatic primary amines.

   Aromatic amines (like aniline) cannot be prepared.

2. **(3)** Gabriel, Hofmann, Reduction → all give amines.

   Carbylamine reaction is only a test (does not prepare amine)

3. **(3)** Classification (1°, 2°, 3°) depends on how many groups are attached to nitrogen.

   Not number of $-NH_2$ groups. Degree of substitution at nitrogen

4. **(3)** Hinsberg reagent reacts with: 1° amine → soluble product

   2° amine →insoluble product; 3° amine → no reaction $(CH_3CH_2)_3N$

   Tertiary amines do not react.

5. **(3)** $C_6H_5NO_2 \xrightarrow{Sn+HCl} C_6H_5NH_2 \xrightarrow{C_6H_5N_2^+Cl^-}$ 

   Sequence: Nitrobenzene→ (Sn/HCl) → aniline (X)

   Aniline → diazonium salt → coupling with phenol (in basic medium)
   Gives azo dye (–N=N–) with –OH group on ring.
   Azo compound with –OH substituted benzene ring

6. **(2)** Propanoic acid + NH_3 → amide

   Amide + Br_2/KOH→ Hofmann bromamide reaction

   Gives amine with one less carbon → ethylamine

   $$CH_3CH_2COOH \xrightarrow[\Delta]{NH_3} CH_3CH_2CONH_2 \xrightarrow[aq.KOH]{Br_2} CH_3CH_2NH_2$$

7. **(2)** Diazonium salt + water (heat) →phenol
   Phenol gives violet color with $FeCl_3$ Neutral ferric chloride

8. **(4)** Count possible structures of primary amines ($-NH_2$) for $C_4H_{11}N$
   Different carbon skeletons give multiple isomers. Total = 4

   $CH_3-CH_2-CH_2-CH_2-NH_2$ (n–butyl amine)

   $CH_3-CH_2-\underset{\displaystyle NH_2}{\underset{|}{CH}}-CH_3$ (sec-butyl amine)

   $CH_3-CH-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2NH_2$ (Isobutyl amine)

   $CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-NH_2$ (t-butyl amine)

9. **(2)** Volatility ∝ lower intermolecular forces. H-bonding decreases volatility

Tertiary amine has no N–H→ least H-bonding → most volatile $(CH_3)_3N$

10. **(3)** Reaction with $CHCl_3$ + alcoholic KOH → Carbylamine reaction.

Only primary amines give isocyanides (foul smell). Alkyl isocyanide

11. **(3)** Reduction of nitrobenzene to aniline is done by metal + acid (Fe/HCl, Zn/HCl, $SnCl_2$/HCl).

$LiAlH_4$ generally reduces different functional groups, not used here.

12. **(4)** $CH_3CN \xrightarrow[ii)\,H_2O]{i)\ DIBAL\text{-}H} CH_3CHO \xrightarrow[ii)\,H_2O]{i)\ LIAlH_4} CH_3CH_2OH$

13. **(3)** Basicity in aqueous medium depends on +I effect + solvation.

Secondary amines are most basic due to balance of both.

Order: $2° > 1° > 3° > NH_3$ $(CH_3)_2NH$

14. **(3)** Benzene diazonium salt → benzene requires reduction.

H_3PO_2 acts as reducing agent (replaces N_2^+ with H)

15. **(3)** Aniline + acyl chloride → benzoylation (Schotten–Baumann reaction).

Gives benzanilide. Benzoyl chloride

10.BIOMOLECULES

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following does not come under biomolecules? [**3**]

1) Cellulose 2) Lactose **3) Nylon** 4) Lipid

2. The carbohydrate which does not undergo hydrolysis is [**3**]

1) Sucrose 2) Starch **3) Ribose** 4) Cellulose

3. The number of asymmetric carbons present in the open chain structure of D–(+)– glucose is [**2**]

1) 3 **2) 4** 3) 2 4) 5

4. Which of the following is not an example of a hormone? [**3**]

1) Insulin 2) Estrogen **3) Pyridoxine** 4) Androgen

5. α–D–(+)–Glucopyranose and β –D–(+)– Glucopyranose are [**1**]

1) anomers 2) enantiomers 3) epimers 4) All of these

6. Which of the following produces only glucose units on complete hydrolysis? [**2**]

1) Lactose **2) Maltose** 3) Raffinose 4) Sucrose

7. Which reagent does not react with -CHO group of glucose? [**2**]

1) NH_2OH **2) $NaHSO_3$** 3) Br_2 in Water 4) HCN

8. Which compound inverts its optical rotation on hydrolysis? [**2**]

1) Glucose **2) Sucrose** 3) Maltose 4) Fructose

9. Which of the following amino acid is optically inactive? [**3**]

1) Alanine 2) Lysine **3) Glycine** 4) Valine

10. Which Polysaccharide contains β-D-glucose as its building unit? [**3**]

1) Lactose 2) Arabinose **3) Cellulose** 4) Starch

11. Which amino acid is basic in nature? [**2**]

1) Glutamic acid **2) Lysine** 3) Tyrosine 4) Leucine

12. Albumin is an example of [**3**]

1) Fibrous Protein 2) Carbohydrate **3) Globular Protein** 4) Lipid

13. Enzymes in the living systems [**4**]

1) provide immunity 2) provide energy 3) transport oxygen **4) catalyze biological reactions**

14. Which vitamin deficiency causes convulsions? [**4**]

1) Vitamin C 2) Vitamin D 3) Vitamin E **4) Vitamin B_6**

15. Which nitrogen base is not the part of RNA? [**3**]

1) Uracil 2) Cytosine **3) Thymine** 4) Guanine

II. FILL IN THE BLANKS(FIB)

1. In sucrose molecule, glucose and fructose are connected between **C_1 and C_2** atoms respectively.
2. Curdling of milk is an example of **denaturation of protein.**
3. Complementary base for the adenine present in DNA is **thymine.**
4. Rickets disease is caused by the deficiency of vitamin **D** .
5. Hormones are molecules that act as **intercellular messengers.**

III. ONE WORD ANSWER Q'S

1. Which linkage connects two monosaccharide units?

A: **Glycosidic linkage** connects two monosaccharide units.

---

2. Which non-essential amino acid is optically inactive?

A: **Glycine** is optically inactive non-essential amino acid .

---

3. What type of bonding helps in stabilizing the α-helix structure of proteins?

A: **Hydrogen bonding** helps in stabilizing the α-helix structure of proteins

---

4. Name the disease that occurs due to deficiency of ascorbic acid.

A: **Scurvy (bleeding gums)** occurs due to deficiency of ascorbic acid.

---

5. Increased level of which hormone causes hyperthyroidism ?

A: Increased level of **Thyroxine** causes hyperthyroidism.

HINTS FOR MCQ

1. **(3)** Biomolecules are naturally occurring in living systems.

   Nylon is a **synthetic polymer**, not biological.

2. **(3)** Monosaccharides cannot be hydrolyzed further.Ribose is a monosaccharide

3. **(2)** Open-chain glucose has **4 chiral (asymmetric) carbons**.All except C_1 and C_6.

4. **(3)** Hormones are chemical messengers (insulin, estrogen, androgen).

   Pyridoxine is a **vitamin (B_6)**, not a hormone.

5. **(1)** α and β forms differ at **anomeric carbon (C)**. So they are **anomers**.

6. **(2)** Maltose = glucose + glucose. On hydrolysis → only glucose units

7. **(2)** Glucose has –CHO group → reacts with most reagents.

   $NaHSO_3$ does NOT react with glucose (due to cyclic form dominance).

8. **(2)** Inversion of rotation occurs when hydrolysis changes optical rotation.

   Sucrose → glucose + fructose → inversion.

   Dextrorotatory sucrose gives a mixture of dextro glucose laevo fructose in which proportion of laevo is more.

9. **(3)** Optical inactivity occurs when no chiral center. Glycine has **no chiral carbon**.

10. **(3)** Cellulose is polymer of **β-D-glucose**. Starch is α-D-glucose. **Cellulose**

11. **(2)** Basic amino acids have extra $–NH_2$, groups. Lysine is strongly basic.

12. **(3)** Albumin is soluble protein → globular type. **Globular protein**

13. **(4)** Enzymes are biological catalysts. They speed up biochemical reactions.

    Catalyze biological reactions

14. **(4)** Vitamin B_6 deficiency affects nervous system → convulsions.

15. **(3)** RNA contains U, C, A, G. Thymine is present only in DNA [A, G, C, T]