STUDY MATERIAL
CLASS XII
CHEMISTRY (043)

SESSION 2025-26

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UNIT 1: SOLUTION

Competency-Based MCQs: Solutions

Q1. Which of the following solutions will have the highest boiling point?
a) 0.1 M NaCl
b) 0.1 M glucose
c) 0.1 M $MgCl_2$
d) 0.1 M urea

Q2. Which law states that the partial pressure of a volatile component is proportional to its mole fraction in solution?
a) Henry's Law
b) Raoult's Law
c) Dalton's Law
d) Boyle's Law

Q3. A 0.5 molal aqueous solution of NaCl freezes at –1.86°C. The freezing point depression constant (Kf) for water is 1.86 °C kg/mol. What is the van't Hoff factor (i) for NaCl?
a) 1
b) 2
c) 3
d) 0.5

Q4. The relative lowering of vapour pressure is equal to:
a) Mole fraction of solute
b) Mole fraction of solvent
c) Molarity of solution
d) Molality of solution

Q5. Which of the following is not a colligative property?
a) Boiling point elevation
b) Freezing point depression
c) Vapour pressure lowering
d) pH change

Q6. Azeotropes are:
a) Ideal solutions
b) Constant boiling mixtures
c) Colloidal solutions
d) Suspensions

Q7. If 1 mole of NaCl is dissolved in 1 kg of water, the depression in freezing point is: (Kf for water = 1.86 °C kg/mol)
a) 1.86°C
b) 3.72°C
c) 0.93°C
d) 2.79°

Q8. Which of the following statements is true for an ideal solution?
a) $\Delta H_{mix} \neq 0$
b) $\Delta V_{mix} = 0$
c) Shows positive deviation from Raoult's law
d) Strong solute-solvent interactions

Q9. Henry's law constant for a gas in water is high. It means:
a) Solubility of gas is high
b) Solubility of gas is low
c) Gas reacts with water
d) Temperature is low

Q10. In a dilute solution, the colligative properties depend on:
a) Nature of solute
b) Nature of solvent

c) Number of solute particles
d) Volume of solute

Assertion and Reason Question: Solution

Assertion and Reason Type Questions

In the following questions, a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct answer out of the following choices:

(a) Both Assertion and Reason are true and the Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true and the Reason is not the correct explanation of Assertion.

(c) Assertion is true but the Reason is not true.

(d) Assertion is not true but the Reason is true.

Q11 Assertion (A): Addition of a non-volatile solute to a solvent lowers the vapour pressure of the solution.

Reason (R): The number of solvent molecules at the surface decreases due to the presence of solute particles.

Q12. Assertion (A): In an ideal solution, $\Delta H_{mix} = 0$ and $\Delta V_{mix} = 0$.

Reason (R): Ideal solutions show strong solute-solvent interactions.

Q13. Assertion (A): Elevation in boiling point is a colligative property.

Reason (R): It depends on the number of solute particles, not on their nature.

Q14.Assertion (A): Azeotropes cannot be separated by simple distillation.

Reason (R): Azeotropes behave like a single substance and boil at a constant temperature.

Q15.Assertion (A): The freezing point of a solution is always lower than that of the pure solvent.

Reason (R): Solute particles disrupt the formation of the solid structure of the solvent.

Case Study: 1

Raoult's Law states that the partial vapour pressure of each volatile component in a solution is directly proportional to its mole fraction. In an ideal solution, the components obeys Raoult's Law over the entire composition range. Suppose a student mixes **acetone (CH_3COCH_3)** and **benzene (C_6H_6)** to form a binary solution at a constant temperature. The mole fraction of acetone is 0.4, and the vapour pressures of pure acetone and benzene at the given temperature are 200 mm Hg and 100 mm Hg respectively.

Using Raoult's Law:

- Partial pressure of acetone = $P_1 = X_1 \times P_1^o$
- Partial pressure of benzene = $P_2 = X_2 \times P_2^o$
- Total vapour pressure = Total = $P_1 + P_2$

The solution behaves ideally and follows Raoult's Law accurately.

Q1. What is the partial vapour pressure of acetone in the solution?

a) 40 mm Hg
b) 80 mm Hg
c) 120 mm Hg
d) 160 mm Hg

Q2. What is the mole fraction of benzene in the solution?

a) 0.2

b) 0.4
c) 0.6
d) 0.8

Q3. What is the total vapour pressure of the solution?
a) 120 mm Hg
b) 140 mm Hg
c) 160 mm Hg
d) 180 mm Hg

Q4. Which of the following statements is true for an ideal solution?
a) ΔHmix ≠ 0 and follows Raoult's Law
b) ΔHmix = 0 and ΔVmix = 0
c) Shows positive deviation from Raoult's Law
d) Forms azeotropes

Case Study: 2

Two students were investigating the behaviour of mixtures of liquids. One group studied a mixture of **ethanol and acetone**, while the other studied **ethanol and water**. Both mixtures were tested for deviations from Raoult's Law. The **ethanol-acetone mixture** was found to show **positive deviation**, while **ethanol-water** showed **negative deviation**. These deviations were explained based on the **intermolecular forces** between solute and solvent.

In **ideal solutions**, the enthalpy of mixing (ΔH_mix) and volume change (ΔV_mix) are zero, and the solution obeys Raoult's Law over the entire range of composition. In **non-ideal solutions**, either stronger or weaker intermolecular interactions cause **positive** or **negative** deviations from Raoult's Law.

Q1. Which of the following pairs forms an **ideal solution**?
a) Benzene and toluene
b) Water and HCl
c) Acetone and chloroform
d) Ethanol and water

Q2. A positive deviation from Raoult's Law indicates:
a) Strong solute-solvent interactions
b) Weaker solute-solvent interactions
c) ΔH_mix = 0
d) Formation of azeotropes with minimum boiling point only

Q3. Which of the following is **true** for a solution showing **negative deviation** from Raoult's Law?
a) ΔH_mix > 0
b) Intermolecular forces are weaker
c) Boiling point decreases
d) Vapour pressure is lower than expected

Q4. The ethanol-acetone mixture shows positive deviation because:
a) Acetone forms hydrogen bonds with ethanol
b) Hydrogen bonding in ethanol is broken on mixing
c) There is no interaction between molecules
d) Vapour pressure decreases after mixing

Case Study: 3

Riya is working in a pharmaceutical lab to prepare isotonic solutions for medical use. She learns that colligative properties—such as **relative lowering of vapour pressure**, **elevation of boiling point**, **depression of freezing point**, and **osmotic pressure**—are important for designing solutions that are safe for injection into the human body. During her study, she observes that glucose and sodium chloride, when dissolved in the same amount in water, show different effects on the freezing point and osmotic pressure. Her supervisor explains that ionic compounds dissociate in water, resulting in more particles in the solution, and hence greater colligative effects.

Q1. What are colligative properties and why do they depend only on the number of solute particles and not their nature?

Q2. Why does sodium chloride show a greater depression in freezing point than glucose at the same molar concentration?

Q3. How does the concept of van't Hoff factor help in understanding deviations in colligative properties for electrolytes?

Q4. Why is it important to study colligative properties while preparing medical solutions such as intravenous fluids?

Answers: MCQ

1. c) 0.1 M $MgCl_2$
2. b) Raoult's Law
3. b) 2
4. a) Mole fraction of solute
5. d) pH change
6. b) Constant boiling mixtures
7. b) 3.72°C
8. b) $\Delta V_{mix} = 0$
9. b) Solubility of gas is low
10. c) Number of solute particles

Answers: Assertion and Reason

1. **A and R are true, and R is the correct explanation of A.**
2. **A is true but R is false.**
3. **A and R are true, and R is the correct explanation of A.**
4. **A and R are true, and R is the correct explanation of A.**
5. **A and R are true, and R is the correct explanation of A**

Answers: CASE STUDY :1

A1. c) 120 mm Hg
(Partial pressure of acetone = $0.4 \times 200 = 80$ mm Hg) ← Correction: should be 80 mm Hg, correct option is **b**
A2. c) 0.6
(Mole fraction of benzene = $1 - 0.4 = 0.6$)
A3. d) 1
A4. b) $\Delta H_{mix} = 0$ and $\Delta V_{mix} = 0$

Answers: CASE STUDY :2

A1. a) Benzene and toluene
A2. b) Weaker solute-solvent interactions
A3. d) Vapour pressure is lower than expected

A4. b) Hydrogen bonding in ethanol is broken on mixing

Answers: CASE STUDY :3

Q1. Colligative properties are physical properties of solutions that depend on the **quantity (number)** of solute particles, not their identity. They include boiling point elevation, freezing point depression, vapour pressure lowering, and osmotic pressure. These properties change due to the presence of solute particles interfering with the solvent's properties, regardless of what those particles

Q2. Sodium chloride is an **electrolyte** and dissociates into two ions (Na^+ and Cl^-) in solution, effectively doubling the number of solute particles. Glucose, being a **non-electrolyte**, does not dissociate. More particles cause a greater disruption in the freezing process, leading to a larger freezing point depression for NaCl

Q3The **van’t Hoff factor (i)** accounts for the **number of particles** an electrolyte produces in solution. It corrects the calculated colligative properties by considering dissociation (or association) of solutes. For example, NaCl has a van’t Hoff factor of approximately 2, meaning it produces twice as many particles, increasing the effect of colligative properties

Q4 Studying colligative properties is crucial for preparing **isotonic medical solutions**, which must have the same osmotic pressure as body fluids. Incorrect concentrations can cause cells to shrink (hypertonic) or burst (hypotonic). Accurate understanding ensures **safe and effective medical treatments**.

CHAPTER - ELECTROCHEMISTRY

Q1. Which of the following situations describe a spontaneous redox reaction?

a) $\Delta G° > 0$ and $E°cell > 0$

b) $\Delta G° > 0$ and $E°cell < 0$

c) $\Delta G° < 0$ and $E°cell < 0$

d) $\Delta G° < 0$ and $E°cell > 0$

Q2. How much charge in terms of Faraday is required for the reduction 1 mole of alumina into aluminium metal

(aq) is an example of

a) 2 F

b) 1 F

c) 6 F

d) can't be calculated.

Q3. The anodic half-cell of lead-acid battery is recharged using electricity of 0.05 Faraday. The amount of PbSO4 electrolyzed in g during the process is [Molar mass of PbSO4 = 303 g mol–1]

(a) 15.2

(b) 11.4

(c) 7.575

(d) 22.8

Q4.The half-cell reactions with standard oxidation potential are as follows:

Zn → Zn2+ + 2e–

(E° = 0.76 V)

Fe → Fe2+ + 2e–

(E° = 0.44 V)

The emf of the cell reaction: Fe2+ + Zn → Zn2+ + Fe is

a) - 0.32 V

b) + 0.32 V

c) - 1.20 V

d) + 1.20 V

Q5.Conductivity (unit Siemen's S) is directly proportional to the area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel then the unit of the constant of proportionality is

(a) S cm mol-1

(b) S cm2 mol-1

(c) S-2 cm2 mol1

(d) S2 cm2 mol1

Q6.Which of the following statements about galvanic cells is true?

a)Electrons flow from the cathode to the anode through the external circuit.

b)The anode is the electrode where oxidation occurs.

c)The salt bridge allows electrons to flow between the two half-cells.

d)The cathode is always negative.

Q7. What is the standard cell potential (E°cell) for the reaction:

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

given $E°(Cu^{2+}/Cu) = +0.34V$ and $E°(Zn^{2+}/Zn) = - 0.76V$?

a) +1.10V

b) -1.10V

c) +0.42V

d) -0.42V

Q8. Consider the statements S1 and S2:

S1: Conductivity always increases with decrease in the concentration of electrolyte.

S2: Molar conductivity always increases with decrease in the concentration of electrolyte. The correct option among the following is

(a) both S1 and S2 are wrong

(b) both S1 and S2 are correct

(c) S1 is wrong and S2 is correct

(d) S1 is correct and S2 is wrong.

Q9. For a cell reaction involving a two-electron change, the standard e.m.f. of the cell is found to be 0.295 V at 25°C. The equilibrium constant of the reaction at 25°C will be

(a) 1×10^{-10}

(b) 29.5×10^{-2}

(c) 10

(d) 1×10^{10}

Q10. During the electrolysis of a solution of KI in water, what will be the products?

a) O_2 at the cathode and H_2 at the anode

b) H_2 at the cathode and O_2 at the anode

c) l_2 the cathode and H_2 at the anode

d) H_2 at the cathode and I_2 at the anode

Answers

Q1. (d) Q2. (c) Q3. (c) Q4. (b) Q5. (b)

Q6. (b) Q7.(a) Q8. (c) Q9. (d) Q10. (d)

ASSERTION- REASON TYPE QUESTIONS

DIRECTIONS:

These questions consist of two statements, each printed as Assertion and reason. While answering these questions, you are required to choose any one of the following four responses.

(A) if both Assertion and Reason are correct and Reason is a correct explanation of the Assertion.

(B)) if both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(C) If the Assertion is Correct but Reason is incorrect.

(D) If both the Assertion and Reason are incorrect

1. Assertion: When a copper wire is dipped in silver nitrate solution, there is no change in the colour of the solution.

Reason: Copper cannot displace silver from its salt solution.

2. Assertion: Kohlrausch law helps to find the molar conductivity of weak electrolyte at infinite dilution.

Reason: Molar conductivity of a weak electrolyte at at infinite dilution cannot be determined experimentally .

3. Assertion: To obtain maximum work from a galvanic cell charge has to be passed reversibly.

Reason:. The reversible work done by a galvanic cell is equal to decrease in its gibbs energy .

4. Assertion: The conductivity of a electrolytic solutions increases with increase of temperature.
Reason: Electronic conductance decreases with increase of temperature.

5. Assertion: In electrolysis , the quantity of electricity needed for depositing I mole of silver is
different from that required for 1 mole of copper.
Reason: The molecular weights of silver and copper are different .

Answer Key :

1. D 2. A 3. A 4. B 5. B

CASE BASED QUESTION

The lead-acid battery represents the oldest rechargeable battery technology. Lead acid batteries can be found in a wide variety of applications including small-scale power storage such as UPS systems, ignition power sources for automobiles, along with large, grid-scale power systems. The spongy lead act as the anode and lead dioxide as the cathode. Aqueous sulphuric acid is used as an electrolyte. The half-reactions during discharging of lead storage cells are: Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

Cathode: $PbO_2(s) + 4H^+(aq) + SO_4^{2-}(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O$

There is no safe way of disposal and these batteries end - up in landfills. Lead and sulphuric acid are extremely hazardous and pollute soil, water as well as air. Irrespective of the environmental challenges it poses, lead-acid batteries have remained an important source of energy.

Designing green and sustainable battery systems as alternatives to conventional means remains relevant. Fuel cells are seen as the future source of energy. Hydrogen is considered a green fuel. Problem with fuel cells at present is the storage of hydrogen. Currently, ammonia and methanol are being used as a source of hydrogen for fuel cell. These are obtained industrially, so add to the environmental issues.

If the problem of storage of hydrogen is overcome, is it still a “green fuel?” Despite being the most abundant element in the Universe, hydrogen does not exist on its own so needs to be extracted from the water using electrolysis or separated from carbon fossil fuels. Both of these processes require a significant amount of energy which is currently more than that gained from the hydrogen itself. In addition, this extraction typically requires the use of fossil fuels. More research is being conducted in this field to solve these problems. Despite the problem of no good means to extract Hydrogen, it is a uniquely abundant and renewable source of energy, perfect for our future zero-carbon needs. Answer the following questions:

(a) How many coulombs have been transferred from anode to cathode in order to consume one mole of sulphuric acid during the discharging of lead storage cell?

(b) How much work can be extracted by using lead storage cell if each cell delivers about 2.0 V of voltage? (1 F = 96500 C)

(c) Do you agree with the statement – "Hydrogen is a green fuel." Give your comments for and against this statement and justify your views.

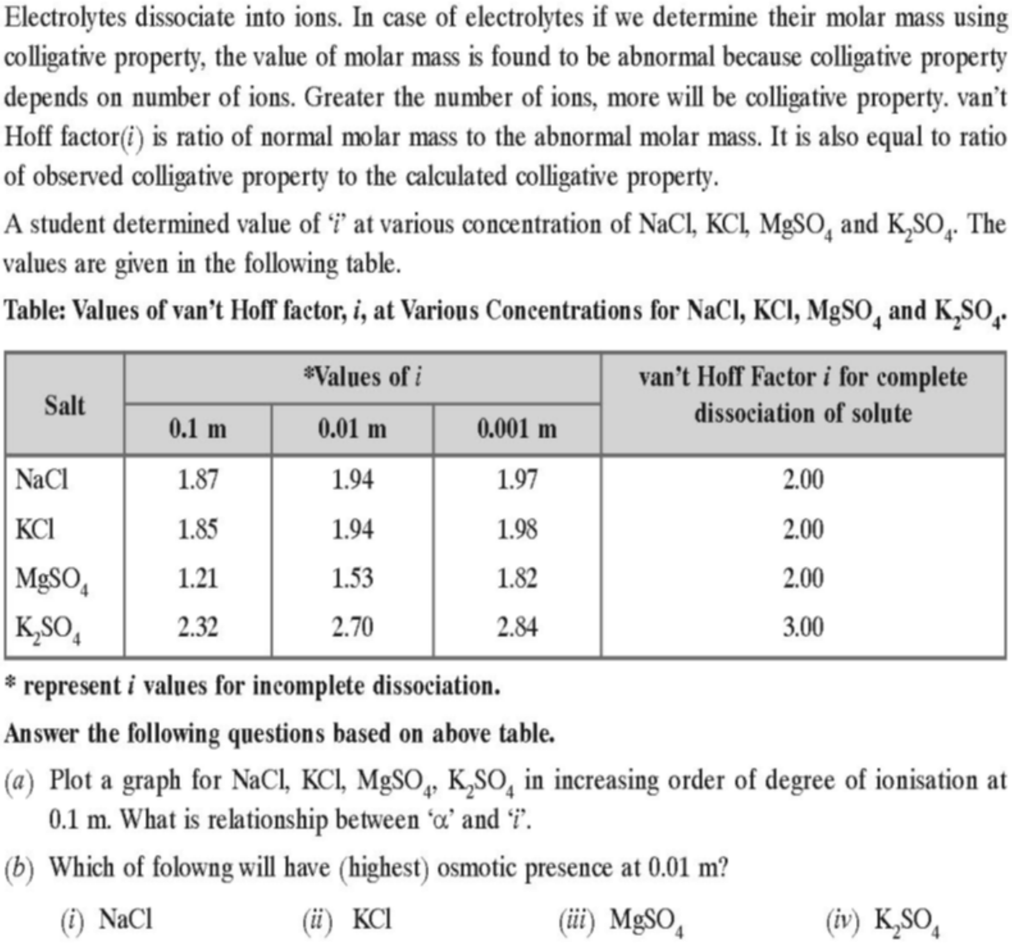
OR

Imagine you are a member of an agency funding scientific research. Which of the following projects will you fund and why?

i) safe recycling of lead batteries

(ii) extraction of hydrogen

2.



Electrolytes dissociate into ions. In case of electrolytes if we determine their molar mass using colligative property, the value of molar mass is found to be abnormal because colligative property depends on number of ions. Greater the number of ions, more will be colligative property. van't Hoff factor(i) is ratio of normal molar mass to the abnormal molar mass. It is also equal to ratio of observed colligative property to the calculated colligative property.

A student determined value of 'i' at various concentration of NaCl, KCl, $MgSO_4$ and K_2SO_4. The values are given in the following table.

Table: Values of van't Hoff factor, i, at Various Concentrations for NaCl, KCl, $MgSO_4$ and K_2SO_4.

Salt	*Values of i			van't Hoff Factor i for complete dissociation of solute
	0.1 m	0.01 m	0.001 m	
NaCl	1.87	1.94	1.97	2.00
KCl	1.85	1.94	1.98	2.00
$MgSO_4$	1.21	1.53	1.82	2.00
K_2SO_4	2.32	2.70	2.84	3.00

*** represent i values for incomplete dissociation.**

Answer the following questions based on above table.

(*a*) Plot a graph for NaCl, KCl, $MgSO_4$, K_2SO_4 in increasing order of degree of ionisation at 0.1 m. What is relationship between 'α' and 'i'.

(*b*) Which of folowng will have (highest) osmotic presence at 0.01 m?

(*i*) NaCl (*ii*) KCl (*iii*) $MgSO_4$ (*iv*) K_2SO_4

3. All chemical reactions involve interaction of atoms and molecules. A large number of atoms/ molecules are present in a few gram of any chemical compound varying with their atomic/ molecularmasses. To handle such large number conveniently, the mole concept was introduced. All electrochemical cell reactions are also based on mole concept. For example, a 4.0 molar aqueous solution of NaCl is prepared and 500 mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrode. The amount of products formed can be calculated by using mole concept.

   a) In electrolysis of aqueous NaCl solution when Pt electrode is taken, then which gas isliberated at cathode? OR
   Calculate the total number of moles of chlorine gas evolved.
   b) What will be the change in pH of solution ?
   c) If cathode is a Hg electrode, then calculate the maximum weight of amalgam formed fromthis solution.

Ans 1.

(a) 2mol e– (or 2F) have been transferred from anode to cathode to consume 2 mol of H 2SO4 therefore, one mole H 2SO4 requires one faraday of electricity or 96500 coulombs. (1)

(b) wmax = – nFE° = – 2× 96500 × 2.0 = 386000 J of work can be extracted using lead storage cell when the cell is in use. (1)

(c) Both yes and no should be accepted as correct answers depending upon what explanation is provided.

Yes, Hydrogen is a fuel that on combustion gives water as a byproduct. There are no carbon emissions and no pollutions caused. However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions. Inspite of the problems faced today in the extraction of hydrogen, we cannot disagree on the fact that hydrogen is a clean source of energy. Further research can help in finding solutions and greens ways like using solar energy for extraction of hydrogen. (2)

No. It is true that Hydrogen is a fuel that on combustion gives water as a byproduct. There are no carbon emissions and no pollutions caused. However, at present the means to obtain hydrogen are electrolysis of water which use electricity obtained from fossil fuels and increase carbon emissions. Hydrogen is no doubt a green fuel, but the process of extraction is not green as of today. At present, looking at the process of extraction, hydrogen is not a green fuel. (2)

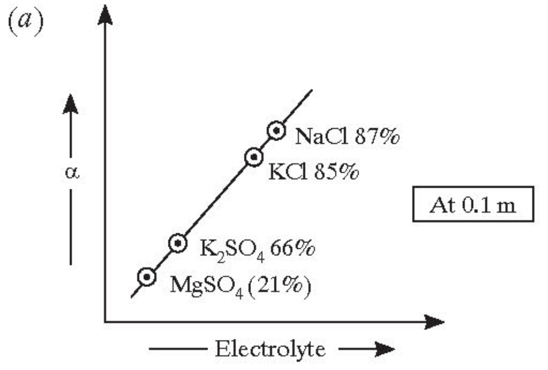
OR

Both answers will be treated as correct

(i) Lead batteries are currently the most important and widely used batteries. These are rechargeable. The problem is waste management which needs research and awareness. Currently, these are being thrown into landfills and there is no safe method of disposal or recycling. Research into safer method of disposal will reduce the pollution and health hazards caused to a great extent. (1 mark for importance, 1 for need for the research)

(ii) Fuel cell is a clen source of energy. Hydrogen undergoes combustion to produce water. The need of the hour is green fuel and hydrogen is a clean fuel. The current problem is obtaining hydrogen. Research that goes into this area will help solve the problem of pollution and will be a sustainable solution. (1 mark for importance, 1 for need for the research)

Ans. 2



'α' for NaCl— 87%, KCl — 85%, $MgSO_4$— 21%, K_2SO_4 — 66% at 0.1 m.

$$\alpha = \frac{i-1}{n-1}$$

.

(*b*) (*iv*) K_2SO_4 will have highest osmotic pressure

$\because$ '*i*' is highest.

(*c*) (*iii*) $K_4[Fe(CN)_6]\ (aq) \longrightarrow 4K^+ + [Fe(CN)_6]^{4-}$

OR

(*c*) (*iii*) $MgSO_4$ will have lowest $(\alpha) = 82\%$, $\alpha = \dfrac{1.82 - 1.00}{2 - 1} = 0.82$

Ans 3.

a. H_2 gas OR 1.0 mole

b. pH of solution increases

c. 446 g

CHAPTER – CHEMICAL KINETICS

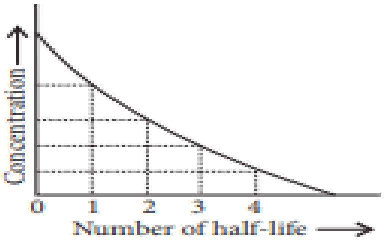
1. **Read the passage given below and answer the following questions :**

Case Study 1:The half-life of a reaction is the time required for the concentration of reactant to decrease by half,

$$i.e.,\ [A]_t = \frac{1}{2}[A]$$

$$\text{For first order reaction, } t_{1/2} = \frac{0.693}{k}$$

this means $t_{1/2}$ is independent of initial concentration. The figure shows a typical variation of concentration of reactant exhibiting first-order kinetics. It may be noted that though the major portion of the first-order kinetics may be over in a finite time, the reaction will never cease as the concentration of reactant will be zero only at infinite time.



(a) A **first-order reaction has a rate constant k = 3.01 × 10^{-3} /s. How long it will take to decompose half of the reactant?**
(a) 2.303 s (b) 23.03 s
(c) 230.3 s (d) 2303 s
Answer: (c) 230.3 s

(b)The rate constant for a first-order reaction is 7.0 × 10–4 s–1. If the initial concentration of reactant is 0.080 M, what is the half-life of the reaction?
(a) 990 s (b) 79.2 s
(c) 12375 s (d) 10.10 × 10^{-4} s
Answer : (a)

(c)For the half-life period of a first-order reaction, which one of the following statements is generally false?
(a) It is independent of initial concentration.
(b) It is dependent on the rate of the reaction.
(c) At t1/2, the concentration of the reactant is reduced by half.
(d) None of these

Answer: (b) It is dependent on the rate of the reaction.

(d) The rate of a first-order reaction is 0.04 mol L^{-1} s^{-1} at 10 minutes and 0.03 mol L^{-1} s^{-1} at 20 minutes after initiation. The half-life of the reaction is
(a) 4.408 min (b) 44.086 min
(c) 24.086 min (d) 2.408 min

Answer: (c) 24.086 min

MCQS

1.The term – dx/dt in a rate equation refers to :

(a) the conc. of a reactant

(b) the decrease in conc. of the reactant with time

(c) the velocity constant of reaction

(d) None of these

Answer: (b) the decrease in conc. of the reactant with time

2.Instantaneous rate of a chemical reaction is

(a) rate of reaction in the beginning

(b) rate of reaction at the end

(c) rate of reaction at a given instant

(d) rate of reaction between two specific time intervals

Answer: (c) rate of reaction at a given instant

3.A first order reaction has a rate constant $1.15 \times 10^{-3} s^{-1}$. Time taken for 5 g of this reactant to reduce to 3 g is

(a) 444 s

(b) 400 s

(c) 528 s

(d) 669 s

Answer: (a) 444 s

4.For the reaction $A + 2B \rightarrow C$, rate is given by $R = [A] [B]^2$ then the order of the reaction is

(a) 3

(b) 6

(c) 5

(d) 7

Answer: (a) 3

5.A catalyst increases the reaction rate by:

(a) decreasing enthalpy

(b) increasing internal energy

(c) decreasing activation enthalpy

(d) increasing activation enthalpy

Answer: (c) decreasing activation enthalpy

6.Which of the following influences the reaction rate performed in a solution?

(a) Temperature

(b) Activation energy

(c) Catalyst

(d) All of the above

Answer: (d) All of the above

7.For a second-order reaction, what is the unit of the rate of the reaction?
a) s^{-1}
b) mol $L^{-1}s^{-1}$
c) mol^{-1} L s^{-1}
d) mol^{-2} L^2 s^{-1}

Answer (c)

8. The rate constant of a reaction is $k=3.28 \times 10^{-4}$ s^{-1}. Find the order of the reaction.
a) Zero order
b) First order
c) Second order
d) Third order

Answer : (b)

9. What is the rate law for acid hydrolysis of an ester such as $CH_3COOC_2H_5$ in aqueous solution?
a) k $[CH_3COOC_2H_5]$
b) k $[CH_3COOC_2H_5]$ $[H_2O]$
c) k $[CH_3COOC_2H_5]^2$
d) k

Answer (a)

10. How many times will the rate of the elementary reaction $3X + Y \rightarrow X_2Y$ change if the concentration of the substance X is doubled and that of Y is halved?
a) $r_2= 4.5r_1$
b) $r_2= 5r_1$
c) $r_2= 2r_1$
d) $r_2= 4r_1$

Answer (d)

ASSERTION REASON TYPE QUESTIONS

Read the statements given as assertion & reason both and choose the correct option as per the following instructions.

(A) if both assertion & reason are correct statements and reason is the correct explanation of assertion.

(B) if both assertion & reason are correct statements and reason is not the correct explanation of assertion.

(C) if the assertion is the correct statement & the reason is an incorrect statement.

(D) if the assertion is incorrect statement and reason is the correct statement.

1. **Assertion:** The order of reaction can be zero or fractional.
   Reason: The order of a reaction cannot be determined from a balanced chemical reaction.
   Ans 1. B
2. **Assertion:** The order and molecularity of a reaction are always the same.
   Reason: Order is determined experimentally whereas molecularity by a balanced elementary reaction.
   Ans 2. D
3. **. Assertion:** Hydrolysis of methyl ethanoate is a pseudo-first-order reaction.
   Reason: Water is present in large excess and therefore its concentration remained constant throughout the reaction.
   Ans 3. A

4. **Assertion:** Increase in temperature increases the rate of reaction.
   Reason: More colliding molecules will have energy greater than threshold energy.
   Ans 4. A

5. **Assertion:** The slowest elementary step in a complex reaction decides the rate of the reaction.
   Reason: The slowest elementary step always has the smallest molecularity.
   Ans 5. C

CHAPTER : d and f-block Elements

Q1. Which of the following reasons is responsible for the formation of alloys by transition elements?

(a) They have same atomic number (b) They have same electronic configuration

(c) They have nearly same atomic size (d) None of the above

Q 2The pair in which both the elements generally show only one oxidation state is -

(a) Sc and Zn (b) Zn and Cu (c) Cu and Ag (d) Zn and Au

Q 3 Which one of the following characteristics of the transition metals is associated with higher catalytic activity?

(a) High enthalpy of atomisation (b) Paramagnetic behaviour

(c) Colour of hydrate ions (d) Variable oxidation states

Q 4 Which one of the following is diamagnetic ion?

(a) Co2+ (b) Ni2+ (c) Cu2+ (d) Zn2+

Q 5 Som poured some potassium chromate solution in test tube for qualitative analysis. The yellow colour of potassium chromate soon turned orange in colour. Som realised that this happened because the test tube was not clean and contained a few drops of some liquid.

Which of the following were the liquid drops most likely to be.

(a) Drops of water (b) methyl orange solution

(c) NaOH solution (d) HCl solution

Q 6 Which of the following are d-block elements but not regarded as transition elements?

(a) Cu, Ag, Au (b) Zn, Cd, Hg (c) Fe, Co, Ni (d) Ru, Rh, Pd

Q 7 Which of the following lanthanoids show +2 oxidation state besides the characteristic oxidation state +3 of lanthanoids?

(a) Ce (b) Eu (c) Tb (d) Dy

Q 8 Which of the following is amphoteric oxide?

Mn_2O_7 , CrO_3 , Cr_2O_3 , CrO, V_2O_5 , V_2O_4

(a) V_2O_5, Cr_2O_3 (b) Mn_2O_7, CrO_3 (c) CrO, V_2O_5 (d) V_2O_5 , V_2O_4

Q 9 Transition elements show variable oxidation states due to the loss of electrons from which of the following orbitals?

(a) ns and np (b) (n – 1) d and ns (c) (n – 1) d (d) ns

Q 10 On addition of small amount of $KMnO_4$ to concentrated $H_2 SO_4$, a green oily compound is obtained which is highly explosive in nature. Identify the compound from the following.

(a) Mn_2O_7 (b) MnO_2 (c) $MnSO_4$ (d) Mn_2O_3

Assertion and Reason Type Questions

In the following questions, a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct answer out of the following choices:
(a) Both Assertion and Reason are true and the Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true and the Reason is not the correct explanation of Assertion.
(c) Assertion is true but the Reason is not true.
(d) Assertion is not true but the Reason is true.

Q11.Assertion(A): Of the $3d^4$species Cr^{2+} is strongly reducing and Mn^{3+} is strongly oxidising.
Reason(R): Cr^{+3} state is stable due to half-filled t_2g set, Mn^{+2} is stable due to half- filled d orbitals

Q12 **Assertion(A):** Magnetic moment values of actinides are lesser than the theoretically predicted values.

Reason(R): Actinide elements are strongly paramagnetic.

Q13 **Assertion(A):** Of the 3d 4species Cr^{2+} is strongly reducing and Mn^{3+} is strongly oxidising.

Reason(R): Cr^{+3} state is stable due to half-filled t_2g set, Mn^{+2} is stable due to half- filled d orbitals

Q14 **Assertion(A):** $KMnO_4$ act as an oxidising agent in acidic, basic or neutral medium.

Reason(R): $KMnO_4$ oxidises ferrous sulphate to ferric sulphate.

Q15 **Assertion**(A): In the series Sc to Zn the enthalpy of atomisation of Zinc is the lowest.

Reason(R): Zinc has greater number of unpaired electrons

Case Study: 1

The D-block elements, known as transition elements, and the F-block elements, known as inner transition elements (lanthanides and actinides), play a crucial role in modern technology and industry. Transition metals like iron (Fe), copper (Cu), and zinc (Zn) are essential in construction, electronics, and biological systems. They show variable oxidation states, form colored compounds, and act as good catalysts due to the presence of unpaired d-electrons.

F-block elements, especially lanthanides like neodymium (Nd) and europium (Eu), are widely used in lasers, color televisions, and strong permanent magnets. Actinides like uranium (U) and plutonium (Pu) are radioactive and are primarily used as fuel in nuclear reactors. These elements have partially filled f-orbitals, which contribute to their complex chemical behavior.

Despite their utility, the separation of lanthanides is difficult due to their similar chemical properties, and the handling of actinides requires strict safety protocols due to their radioactivity.

Q1. Which of the following properties is **not** commonly shown by D-block elements?
a) Variable oxidation states
b) Colored compounds
c) High reactivity with water
d) Formation of complex ions

Q2. Lanthanides are difficult to separate from each other because:
a) They have similar atomic numbers
b) They show the lanthanide contraction
c) They have identical chemical properties due to similar ionic radii
d) They are all radioactive

Q3. Which F-block element is used in making strong permanent magnets?
a) Europium
b) Neodymium
c) Uranium
d) Plutonium

Q4. Why are transition metals commonly used as catalysts?
a) They are cheap and abundantly available
b) They have high melting points
c) They can donate electrons easily
d) They can change oxidation states and provide a surface for reactions

Case Study: 2

The D- and F-block elements exhibit a variety of colours and magnetic behaviours due to the presence of unpaired electrons in their d and f orbitals. In transition metals (D-block), the colour arises from **d-d electronic transitions**. These transitions occur when electrons in lower energy d-orbitals are excited to higher energy d-orbitals in the presence of ligands, as explained by **Crystal Field Theory**. For example, aqueous copper(II) ions appear blue due to such transitions.

F-block elements, particularly lanthanides, show colour due to **f-f transitions**. Although f-f transitions are less intense than d-d transitions, they are responsible for the unique colours of many lanthanide ions.

Magnetism in these elements arises due to unpaired electrons. Elements with unpaired electrons are **paramagnetic**, and their magnetic moment can be calculated using the formula:

μ=n(n+2) BM\mu = \sqrt{n(n+2)} \, \text{BM}

where nn is the number of unpaired electrons. D-block elements often show variable magnetic properties depending on their oxidation states, while F-block elements typically have strong magnetic moments due to poor shielding of f-orbitals.

Questions and Answers:

Q1. What is the main reason for the colour of transition metal ions in solution?
a) Charge transfer transitions
b) f-f transitions

c) d-d transitions
d) Electron pairing energy

Q2. Which of the following ions is **colourless** in aqueous solution?
a) Ti3+Ti^{3+}
b) Fe2+Fe^{2+}
c) Sc3+Sc^{3+}
d) Ni2+Ni^{2+}

Q3. The magnetic moment of a metal ion with 4 unpaired electrons is approximately:
a) 2.83 BM
b) 4.90 BM
c) 5.92 BM
d) 6.92 BM

Q4. What causes the magnetic properties of lanthanide ions?
a) Fully filled f-orbitals
b) Unpaired f-electrons
c) Movement of electrons in s-orbitals
d) Charge density of ions

CASE STUDY : 3

The d-block, which lies between s and p-blocks contains, elements of groups 3- 12, in which d- orbitals are progressively filled in each of four long periods of periodic table. These elements are also called transition elements or metals. The elements constituting the f-block are those in which 4 f and 5 f-orbitals are progressively filled. They are place in a separate panel at the bottom of the periodic table. The elements of f-block are also called inner-transition.

(a) Transition metal are very good catalyst. Why? (1)

(b) Transition metals form a large number of interstitial compounds. Give reason. (1)

(c) Why the paramagnetic characteristic in 3d- transition series increases up to Cr and then decreases?

OR

Out of $La(OH)_3$ and $Lu(OH)_3$, which is more basic and why? (2)

Answers: MCQ

Q.1	c
Q.2	a
Q.3	d
Q.4	d
Q.5	d
Q.6	b
Q.7	b
Q.8	a
Q.9	b
Q.10	a

Answers: Assertion and Reason

Q.11	d
Q.12	b
Q.13	a
Q.14	b
Q.15	c

Answers: CASE STUDY :1

1. C
2. B
3. A
4. D

Answers: CASE STUDY :2

Q1 Answer: c) d-d transition

Q2 c) Sc3+Sc^{3+}

Q3 b) 4.90 BM

Q4 : b) Unpaired f

Answers: CASE STUDY :3

(a) due to variable oxidation state and provides suitable surface area for the reactant molecule to adsorb on it.

(b) because small sized atom such C.H, N, O etc. occupy the interstitial site.

(c) because up to Cr the number of unpaired electrons increases and there after due to pairing in d orbital the number of unpaired electrons decreases. So magnetic character decreases. OR

$La(OH)_3$ is more basic, $Lu(OH)_3$ is less basic. Size of Lanthanoids ion decreases from La^{3+} to Lu^{3+}, tendency to give hydroxyl ion decreases so basic character decreases.

CHAPTER - COORDINATION COMPOUNDS

MCQs:-

Q-1-IUPAC name of $[Pt(NH_3)_3 (Br)(NO_2)Cl]Cl$ is :
1-Triamminebromidochloridonitroplatinum(IV)Chloride
2. Triamminebromonitrocholoroplatinum(IV)Chloride
3. Triamminechlorobromonitroplatinum(IV)Chloride
4. Triamminenitrochlorobromoplatinum(IV)Chloride

Q-2-The coordination number and oxidation number of Co in the complex $(NH_4)_2[CoF_4]$, respectively, are:
a. +2, 4 c. 4, +2
b. 6, +3 d. +3, 6

Q-3-The number of optical isomers shown by $[Pt(NH_3) (Br)(Cl)(Py)]$ is -
a. 3 b. 2
c. 1 d. 0

Q-4-A ligand among the following that cannot act as an ambidentate ligand is
a. CN^- b. NO_2
c. SCN^- d. NH_3

Q-5-The correct statement, among the following,regarding ethane-1,2-diamine as a ligand is
(a) It is a neutral ligand
(b) It is a bidentate ligand
(c) It is a chelating ligand
(d) It is a unidentate ligand
a. a,b b. b,c
c. a,b,c d. a,c,d

Q-6-If an excess of solution is added to 100 mLof a 0.024 M solution of dichlorobis (ethylenediamine)cobalt (III) chloride, the the number of moles of AgCl thatwill get precipitated is
1. 0.0012 2. 0.0016
3. 0.0024 4. 0.0048

Q-7-The type of isomerism exhibited $K_3[Co(NO_2)_6]$ andK3$[Co(ONO)_6]$:-
a. Linkage b. Co-ordination
c. Ionization d. Geometrical

Q-8-complex that shows magnetic moment of 1.73 BM,among the following, is
a. $[Ni(CN)_4]_{2-}$ b. $TiCl_4$
c. $[CoCl_6]^{4-}$ d. $[Cu(NH_3)_4]^{2+}$

Q-9-Vitamin B_{12} contains :
a. Fe(II) b. Co(III)
c. Zn(II) d. Ca(II)

Q.10-The correct electronic configuration of the central atom in $K_4[Fe(CN)_6]$ based on crystal field theory is-
a-e^4 t_2^2 b-t_{2g}^4,e_g^2
c-t_{2g}^6,e_g^0 d-e^3,t_2^3

ANSWER-

1-a 2-b 3-d 4-d 5-c 6-d 7-a 8-d 9-b 10-c

In the following questions one mark each.

A statement of **Assertion (A)** followed by a statement of **Reason (R)** is given. Choose the correct answer out of the following choices.

a) A and R both are correct statements and R is the correct explanation for A.

b) A and R both are correct statements and R is not correct explanation for A.
c) A is correct statement but R is wrong statement.
d) A is wrong statement but R is correct statement.

1. **Assertion (A):** In $[Ni(CO)_4]$, nickel is in the +2 oxidation state.
   Reason (R): CO is a neutral ligand.
2. **Assertion (A):** $[Co(NH_3)_6]^{3+}$ is more stable than $[CoF_6]^{3-}$.
   Reason (R): NH_3 is a stronger ligand than F^- according to the spectrochemical series.
3. **Assertion (A):** $[Fe(CN)_6]^{4-}$ is diamagnetic.
   Reason (R): CN^- is a strong field ligand and causes pairing of electrons.
4. **Assertion (A):** $[Ni(CN)_4]^{2-}$ has square planar geometry.
   Reason (R): CN^- causes dsp^2 hybridization in Ni^{2+}.
5. **Assertion (A):** $[Fe(H_2O)_6]^{2+}$ is high spin complex.
   Reason (R): H_2O is a strong field ligand.

Answer
1.(D) 2.(A) 3.(A) 4. (A) 5.(C)

Csae Based Questions

Read the given passage carefully and give the answer of the following questions-

In coordination compounds, metals show two types of linkages, primary and secondary. Primary valencies are ionisable and are satisfied by negatively charged ions. Secondary valencies are non-ionisable and are satisfied by neutral or negative ions having lone pair of electrons. Primary valencies are non-directional while secondary valencies decide the shape of the complexes.:

Q1. If PtCl2.2NH_3 does not react with $AgNO_3$, what will be its formula?

Q2. What is the secondary valency of [Co(en)]+?

Q3. Write the formula of Iron (III) Hexacyanidoferrate (II).

OR

Write the IUPAC name of $[Co(NH_3)_5)CI]Cl_2$

ANS- 1: If PtCl2.2NH3 does not react with $AgNO_3$, it means the chloride ions are not free and are part of the coordination sphere.

Thus, the formula of the compound is [Pt(NH3)2Cl2].

2. The secondary valency of $[Co(en)_3]^+$ is determined by the number of ligands attached to the central metal ion.Since there are three ethylenediamine (en) ligands, each donating two pairs of electrons. So the secondary valency is 6.

3. The formula of Iron (III) Hexacyanidoferrate (II) is $Fe_4[Fe(CN)_6]_3$

Haloalkanes and Haloarenes - Class 12 Chemistry (MCQs)

1. Which of the following is the correct order of reactivity of halides towards SN1 reaction?

   A) Methyl halide > Primary halide > Secondary halide > Tertiary halide

   B) Tertiary halide > Secondary halide > Primary halide > Methyl halide

   C) Primary halide > Tertiary halide > Secondary halide > Methyl halide

   D) Secondary halide > Tertiary halide > Methyl halide > Primary halide

2. Which of the following compounds undergoes nucleophilic substitution most easily?

   A) Chlorobenzene

   B) Benzyl chloride

   C) Vinyl chloride

   D) Chloroethene

3. The reaction of chlorobenzene with NaOH at high temperature and pressure forms:

   A) Phenol

   B) Benzyl alcohol

   C) Benzoic acid

   D) Aniline

4. Which one is the correct increasing order of bond strength of C-X bond?

   A) C-I < C-Br < C-Cl < C-F

   B) C-F < C-Cl < C-Br < C-I

   C) C-Cl < C-F < C-I < C-Br

   D) C-Br < C-I < C-F < C-Cl

5. Which of the following is not correct regarding chlorobenzene?

   A) It is less reactive than benzyl chloride

   B) It shows resonance

   C) It undergoes electrophilic substitution

   D) It undergoes nucleophilic substitution easily

6. Which reagent is used to convert alcohol to alkyl chloride?

A) NaCl

B) HCl

C) $SOCl_2$

D) NaOH

7. Wurtz reaction involves:

A) Formation of alcohol

B) Formation of alkene

C) Coupling of alkyl halides using sodium in dry ether

D) Oxidation of haloalkanes

8. Which one of the following is an example of allylic halide?

A) $CH_2=CH-CH_2Cl$

B) $C_6H_5CH_2Cl$

C) CH_3CH_2Cl

D) $CH_2=CHCl$

9. Which of the following can be used to distinguish between CH_3CH_2Cl and C_6H_5Cl?

A) Aqueous NaOH

B) Silver nitrate in ethanol

C) Ammonia

D) HCl

10. The major product of the reaction of 2-bromobutane with alcoholic KOH is:

A) Butane

B) But-1-ene

C) But-2-ene

D) Butanol

Answer Key:

1) B 2) B 3) A 4) A 5) D 6) C 7) C 8) A 9) B 10) C

Case Study 1: Use of Chloroform in Medicine

Paragraph:
Chloroform ($CHCl_3$) was once widely used as an anesthetic in surgeries. However, prolonged exposure was found to cause liver damage and is potentially carcinogenic. It is now replaced by safer alternatives like halothane. Chloroform can be oxidized by air to form phosgene ($COCl_2$), a highly poisonous gas, hence it is stored in dark bottles.

Questions:

1. What is the molecular formula of chloroform?
   Answer: $CHCl_3$
2. Why is chloroform stored in dark bottles?
   Answer: To prevent its oxidation to poisonous phosgene gas.
3. What safer alternative has replaced chloroform in medicine?
   Answer: Halothane
4. What harmful effect is associated with chloroform exposure?
   Answer: Liver damage and potential carcinogenic effects

Case Study 2: SN1 vs SN2 Reactions

Paragraph:
Tertiary haloalkanes undergo SN1 reactions due to the stable tertiary carbocation formed, while primary haloalkanes favor SN2 due to less steric hindrance. SN1 occurs in two steps and often in polar protic solvents, whereas SN2 is a one-step reaction preferred in polar aprotic solvents.

Questions:

1. What type of haloalkane favors SN1 reaction?
   Answer: Tertiary haloalkane
2. Which reaction mechanism involves a one-step process?
   Answer: SN2
3. What type of solvent favors SN1 reactions?
   Answer: Polar protic solvents
4. Why do primary haloalkanes undergo SN2 reactions?
   Answer: Due to minimal steric hindrance.

Case Study 3: Reactions of Chlorobenzene

Paragraph:
Chlorobenzene is less reactive towards nucleophilic substitution due to resonance and partial double bond character in the C–Cl bond. However, under high temperature and pressure or in presence of electron-withdrawing groups, it undergoes nucleophilic substitution more readily.

Questions:

1. Why is chlorobenzene less reactive towards nucleophilic substitution?
   Answer: Due to resonance and partial double bond character.
2. What can increase the reactivity of chlorobenzene?
   Answer: High temperature/pressure or electron-withdrawing groups.

3. What type of substitution is difficult for chlorobenzene?
   Answer: Nucleophilic substitution
4. What effect does resonance have on C–Cl bond in chlorobenzene?
   Answer: It makes the bond stronger and less reactive.

Case Study 4: Grignard Reagent Preparation

Paragraph:
Grignard reagents (RMgX) are prepared by reacting haloalkanes with magnesium in dry ether. They are highly reactive and react with water, alcohols, and CO_2. The presence of moisture can destroy the reagent, making dry conditions essential.

Questions:

1. What is the general formula of Grignard reagent?
   Answer: RMgX
2. What is the solvent used in Grignard reagent preparation?
   Answer: Dry ether
3. What happens if water is present during preparation?
   Answer: It destroys the Grignard reagent.
4. What metal is used to prepare Grignard reagents?
   Answer: Magnesium

Case Study 5: Finkelstein Reaction

Paragraph:
The Finkelstein reaction is a halogen exchange reaction, where alkyl chlorides or bromides are converted to alkyl iodides using NaI in acetone. Iodide ion is a better nucleophile, and NaCl or NaBr formed is insoluble in acetone, driving the reaction forward.

Questions:

1. What is the purpose of the Finkelstein reaction?
   Answer: To prepare alkyl iodides
2. What reagent is used in this reaction?
   Answer: Sodium iodide (NaI)
3. Why is acetone used as solvent?
   Answer: It precipitates NaCl/NaBr, driving the reaction forward.
4. Which halide is a better nucleophile: iodide or chloride?
   Answer: Iodide

Case Study 6: Reactions with Aqueous KOH

Paragraph:
Haloalkanes react with aqueous KOH to undergo nucleophilic substitution, forming alcohols. In contrast, alcoholic KOH induces elimination, forming alkenes. The nature of solvent and structure of alkyl halide determines the major product.

Questions:

1. What product forms when haloalkanes react with aqueous KOH?
   Answer: Alcohols
2. What happens when alcoholic KOH is used?
   Answer: Elimination occurs, forming alkenes.
3. What determines whether substitution or elimination dominates?
   Answer: Solvent and structure of haloalkane
4. Which reaction gives alkene as the main product?
   Answer: Elimination with alcoholic KOH

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ASSERSION AND REASION TYPE QUESTIONS:-

reason is given. Choose the correct answer out of the following choice.

(a) Both assertion and reason are Correct, and reason is the correct explanation

of the assertion.

(b) Both assertion and reason are True, but reason is not the correct explanation

of the assertion.

(c) Assertion is Incorrect, but reason is Correct.

(d) Both assertion and reason are Incorrect.

Assertion and Reasoning

1. Assertion : SN2 reaction proceeds with inversion of configuration.

Reason : SN2 reaction occurs in one step

2. Assertion : Treatment of chloroethane with saturated solution of KCN give ethyl

isocyanide as major product.

Reason : Cyanide ion is an ambident nucleophile.

3. Assertion : Aryl iodides can be prepared by reaction of arenes with iodide in the presence of an oxidizing agent.

Reason : Oxidizing agent oxidizes Iodine into HI.

4. Assertion : Presence of a nitro group at ortho or para position increases the reactivity of haloarenrs towards nucleophilic substitution.

Reason : Nitro group being an electron withdrawing group decreases the electron density over the benzene ring.

5. Assertion : Chloroform is generally stored in dark coloured bottles filled to the brim.

Reason : Chloroform reacts with glass in the presence of sunlight.

Answer : 1) B 2) D 3) C 4) A 5) C

CHAPTER - ALCOHOLS, PHENOLS AND ETHERS

Q1-Nucleophilic addition of Grignard reagent to ketones followed by hydrolysis with dilute acids forms

(A) Alkenes (B) Primary alcohol

(C) Tertiary alcohol (D) Secondary alcohol

. Q2- Phenol reacts with Br_2 in CS_2 at low temperature to give –

(A) o-Bromophenol (B) o-and p-Bromophenols

(C) p-Bromophenol (D) 2, 4, 6 –Tribromophenol

Q3- The compound which gives the most stable carbonium ion on dehydration is –

(A) $(CH_3)_2CHCH_2OH$ (B) $(CH_3)_3COH$

(C) $CH_3CH_2CH_2CH_2OH$ (D) $CH_3CH\ OH\ CH_2\ CH_3$

Q4.Which of the following cannot be made by using Williamson Synthesis –

(A)Methoxybenzene (B) Benzyl p-nitrophenyl ether

(C) tert. butyl methyl ether (D) Ditert. butyl ether

Q5.Among the following, the one which reacts most readily with sodium salt of ethanol is –

(A) p-Nitrobenzyl bromide (B) p-Chlorobenzyl bromide

(C)p-Methoxybenzyl bromide (D) p-Methyl benzyl bromide

Q6. Cyclohexene is best prepared from cyclohexanol by which of the following –

(A) Conc. H_3PO_4 (B) Conc. $HCl/ZnCl_2$

(C) Conc. HCl (D) Conc. HBr

Q7.Acetone reacts with Grignard reagent forms an intermediate which on hydrolysis gives

(A) 3° alcohol (B) 2° alcohol

(C) Ether (D) 1^0 alcohol

Q8- Which reagent can be used for preparation of primary Alcohol to Aldehyde -

(A) $KMnO_4/ H_2SO_4$ (B) $KMnO_4/ KOH$

(C) conc HNO_3 (D) PCC

Q9- Williamson's synthesis is used to prepare-

(A) Alcohol (B) Phenols

(C) Symmetrical ether only (D) Symmetrical and Unsymmetrical ethers

Q10- Lucas reagent is -

(A) $ZnCl_2$ anhydrous (B) $ZnCl_2$ anhydrous/ HCl

(C) $CuSO_4$ aq (D) HCl

2- ASSERTION-REASON TYPE QUESTIONS

A-R TYPE MCQ Instructions – In the following questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(A) Both assertion and reason are true and the reason is the correct explanation of assertion.

(B) Both assertion and reason are true but the reason is not the correct explanation of assertion.

(C) Assertion is true but reason is false.

(D) Assertion is false but reason is true.

1. Assertion – In case of phenol, bromination takes place even in absence of Lewis acid whereas bromination of benzene takes place in presence of Lewis acid like $FeBr_3$.

Reason – OH group attached to benzene ring is highly deactivating.

2. Assertion (A): Alcohols react both as nucleophiles and electrophiles.

Reason (R): The bond between C–O is broken when alcohols react as nucleophiles.

3. Assertion – With HI, anisole gives iodobenzene and methyl alcohol.

Reason – Iodide ion combines with smaller group to avoid steric hindrance.

4. Assertion – Phenol is more reactive than benzene towards electrophilic substitution reaction.

Reason – In the case of phenol, the ring is highly activated by OH group.

5. Assertion – p-nitrophenol is less acidic than phenol .(2024)

Reason – Nitro group is electron withdrawing band helps in the stabilization of p-nitrophenoxide ion.

Case Study question -1

Williamson's synthesis is important laboratory method for preparation of symmetrical and unsymmetrical ethers.By a proper choice of reagents, both symmetrical and unsymmetrical ethers can be prepared by Williamson synthesis which involves the reaction between an alkyl halide and and an alkoxide ion. The reverse process involves the cleavage of ethers to give back the original alkyl halide and the alcohol can be carried out by heating the ether with HI at 373 K.

1. The mechanism of Williamson synthesis involves –

(A)Nucleophilic substitution bimolecular (B)Nucleophilic substitution unimolecular (C)Electrophilic substitution bimolecular (D) Electrophilic substitution bimolecular

2. Benzyl ethyl ether reacts with HI to form –

(A)p-iodotoluene and ethyl alcohol
(B)Benzyl alcohol and ethyl iodide.
(C)Benzyl iodide and ethyl alcohol.
(D) Iodobenzene and ethyl alcohol.

3. Allyl phenyl ether can be prepared by heating –

(A)C6H5Br + CH2=CH-CH2ONa (B)CH2=CHCH2Br + C6H5ONa

(C)C6H5CH=CHBr + CH3ONa (D) CH2=CHBr + C6H5CH2ONa

4. Better results are obtained if the alkyl halide is primary. In caseof secondary and tertiary alkyl halides –

(A)Steric hinderance is more. (B)Elimination competes over substitution.

(C)C-X bond is stronger. (D) Generation of electrophile is difficult.

5. Which of the following ethers are not cleaved by HI?

(A)Dicyclohexyl ether (B) Ethyl phenyl ether

(C) Di – tert – butyl ether (D) Diphenyl ether

Case Study question -2

The reactions of phenol with metals(Na,Al) and Sodium hydroxide indicates the acidic nature of phenol.The OH group in phenol is directly attached to SP^2 hybridised Carbon of Benzene ring which act as electron withdrawing group. Due to this ,the charge distribution in phenol molecule oxygen develops the positive charge and Carbon negative charge and makes it unstable as compared to phenoxide ion in which there is no charge separation this favours the ionization phenolto make phenoxide ion . The reaction of phenol with aqueous Sodium hydroxide indicate that the phenol; is more acidic than alcohols because alkoxide ion is not stabilized by resonance as the negative charge is localized on oxygen atom. In substituted phenol presence of electron withdrawing group increases acidity but presence of electron donating group decreases the acidic character by destabilizing conjugate base phenoxide ion.

(a) Why Orhto- Nitrophenol is more acidic than Ortho- Methoxyphenol?

(b) Why phenol is more acidic than phenol?

(c) Write the reactions of phenol with Sodium hydroxide ,Why alcohol does not reacts with NaOH.

OR

(C) Why alcohol is weaker acid than water, arrange primary ,secondary and tertiary alcohols in increasing order of acidic character.

CASE BASED QUESTION-3

Alcohols are organic compounds in which a hydroxyl group (-OH) is attached to a saturated carbon atom. Common examples include ethanol (C_2H_5OH), methanol (CH_3OH), and isopropyl alcohol (C_3H_7OH). The physical properties of alcohols are influenced by the presence of the hydroxyl group, which can form hydrogen bonds. Boiling Points: Alcohols have relatively high boiling points due to hydrogen bonding between hydroxyl groups. Solubility: Alcohols with small carbon chains are highly soluble in water due to hydrogen bonding, but solubility decreases as the length of the carbon chain increases. -Density and

Viscosity: Alcohols are denser and more viscous than ethers due to the hydrogen bonding between molecules. Phenols are aromatic compounds containing a hydroxyl group attached to a benzene ring (e.g., phenol, C_6H_5OH). These compounds are slightly acidic and have unique physical properties when compared to alcohols. Boiling Points: Phenols typically have higher boiling points than alcohols of similar molecular weight due to the ability of the phenolic group to form hydrogen bonds with water and other molecules. Solubility: Phenols are slightly soluble in water due to their ability to form hydrogen bonds, but their solubility decreases as the size of the aromatic ring increases. Acidity Phenols are weak acids, and they dissociate to release H^+ ions, making them more acidic than alcohols

Questions Based on the Case Study:

1. Explain why alcohols have higher boiling points than ethers of similar molecular weight.

2. Why are phenols more acidic than alcohols?

3. How does the presence of the hydroxyl group affect the solubility of alcohols in water?

4. Compare the volatility of ethers, alcohols, and phenols. What factors contribute to their differences in volatility?

ANSWER OF MCQ

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	B	B	D	A	A	A	D	D	B

ANSWER (ASSERTION-REASON TYPE)

1-C 2- C 3- D 4- A 5-C

ANSWER OF CASE STUDY QUESTIONS

CASE BASED QUESTION-1

1- A 2- C 3- B , 4-A , 5-D

CASE STUDY QUESTION-2

(a) due to electron withdrawing effect of NO_2 group which stabilize the conjugate base.

(b) Because phenoxide ion the conjugate base of phenol is more stabilize by resonance.

(c) Because the Alcohol is weaker acid than water as alkoxide ion is very strong base.

OR

(C) primary is more than secondary is more than tertiary

CASE BASED QUESTION-3

Answer:

The hydroxyl group (-OH) in alcohols is highly polar and can form hydrogen bonds with water molecules. As a result, alcohols with shorter carbon chains are highly soluble in water because they can interact strongly with water molecules. However, as the carbon chain length increases, the hydrophobic (non-polar) part of the alcohol becomes more dominant, decreasing the solubility in water.

Answer:

Alcohols have higher boiling points than ethers because alcohols can form hydrogen bonds due to the presence of the hydroxyl (-OH) group. These hydrogen bonds require more energy to break, thus increasing the boiling point. In contrast, ethers, which lack hydroxyl groups, cannot form hydrogen bonds with each other. Therefore, the intermolecular forces in ethers are weaker, leading to lower boiling points.

Answer:

Phenols are more acidic than alcohols because the negative charge formed after deprotonation of the phenol’s hydroxyl group is delocalized over the aromatic ring, stabilizing the conjugate base. In contrast, alcohols do not have such resonance stabilization of their conjugate base, making them less acidic. Therefore, phenols can more readily release a proton (H^+), making them stronger acids than alcohols.

Answer:

Ethers are more volatile than alcohols and phenols because they have lower boiling points due to the lack of hydrogen bonding between ether molecules. Alcohols and phenols both exhibit hydrogen bonding, which requires more energy to overcome, resulting in higher boiling points and lower volatility. The strength of hydrogen bonding in alcohols and phenols significantly reduces their volatility compared to ethers, where only van der Waals forces are present.

CHAPTER - ALDEHYDES , KETONES AND CARBOXYLIC ACIDS

MULTIPLE CHOICE QUESTIONS:

1. .Which of the following does not show cannizzaro reaction:

a) Benzaldehyde

b) Acetaldehyde

c) Chloral

d) Formaldehyde

2. In Clemmensen reduction, carbonyl compound is treated with:

a) Zn amalgam + conc. HCl

b) Na amalgam + conc. HCl

c) Zn amalgam + conc. HNO_3

d) Na amalgam + conc. HNO_3

3.When ethanal is treated with Fehling' s solution , it gives precipitate of :

a) Cu

b) CuO

c) Cu_2O

d) $Cu_2O + Cu_2O_3$

4.Which of the following reagent can be used to prepare ketone from acid chloride:

a) Grignard regent

b) $LiAlH_4$

c) Dimethyl cadmium

d) Cadmium chloride

5.For distinguishing pentan-2-one and pentan-3-one the reagent to be employed is:

a) Acidified potassium dichromate

b) Zn-Hg/ Conc HCl

c) SeO_2

d) NaOH/Iodine

6. Calcium acetate when dry distilled gives :

(a) formaldehyde

(b) acetaldehyde

(c) acetone

(d) acetic anhydride

7. The weakest acid among the following is :

(a) $CHCl_2COOH$ (b) CH_3COOH (c) $CH_2ClCOOH$

(d) CCl_3COOH

8. The formation of cyanohydrin from propanone is which type of reaction ?

(a) Electrophilic substitution (b) Nucleophilic substitution

(c)Electrophilic addition (d) Nucleophilic addition

9. The acid formed when n-propyl magnesium bromide is treated with CO_2 is:

(a) C_3H_7COOH (b) C_2H_5COOH (c) both (d) None of these

10. Which of the following compound will not give $NaHCO_3$ test:

a) Formic acid b) acetic acid c) carbolic acid d) benzoic acid

REASON ASSERTION QUESTIONS

11.Assertion: Acetone is less reactive towards Nucleophilic addition than acetaldehyde

Reason: The alkyl groups hinder the nucleophilic attack on the carbonyl carbon atom.

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

12. Assertion: Most carboxylic acids exist as dimers in the vapour phase or in aprotic solvents.

Reason: Higher carboxylic acids are practically insoluble in water due to the increased hydrophobic interaction of hydrocarbon part .

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

13.Assertion: Pka of acetic acid is lower than that of phenol.

Reason: Phenoxide ion is more resonanace stabilised than acetate ion.

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

14.Assertion: α- Hydrogen atoms of carbonyl compounds are acidic in nature.

Reason: Strong electron donating effect of the carbonyl group and resonance destabilisation of conjugate base makes the α- hydrogen acidic.

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

15.Assertion: 2,2-Dimethypropanal undergoes cannizzaro reaction with conc.NaOH

Reason: Cannizzaro reaction is a disproportionation reaction .

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

ANSWER KEY

MCQ

1. (b)
2. (a)
3. (c)
4. (c)

5.(d)
6. (c)
7. (b)
8. (d)
9.(a)
10.(c)

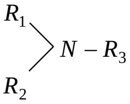
Reason Assertion

11.(a)
12. (b)
13. (c)
14.(c)
15.(b)

CHAPTER - AMINES

MCQ ON AMINES:-

1. The compound



forms nitroso amines when the substituents are

(a) $R_1 = CH_3, R_2 = R_3 = H$

(b) $R_1 = R_2 = H, R_3 = C_2H_5$

(c) $R_1 = H, R_2 = R_3 = CH_3$

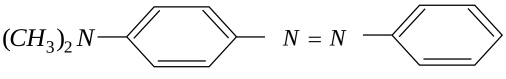
(d) $R_1 = CH_3, R_2 = C_2H_5, R_3 = H$

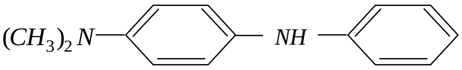
2. The action of nitrous acid on ethyl amine gives

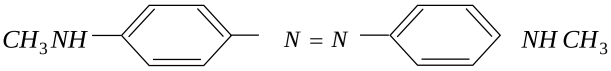
(a) Ethane (b) Ammonia

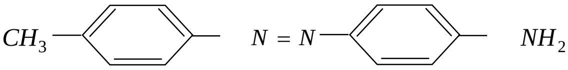
(c) Ethyl acohol (d) Nitroethane

3. Aniline when diazotized in cold and then treated with dimethyl aniline gives a coloured product. Its structure would be

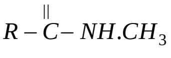
(a) 

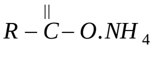
(b) 

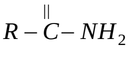
(c) 

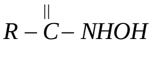
(d) 

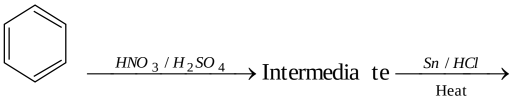
4. Indicate which nitrogen compound amongst the following would undergo Hofmann's reaction (i.e. reaction with Br_2 and strong KOH) to furnish the primary amine ($R - NH_2$)

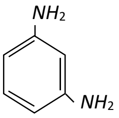
(a) 
$R - \overset{\overset{O}{\|}}{C} - NH.CH_3$

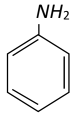
(b) 
$R - \overset{\overset{O}{\|}}{C} - O.NH_4$

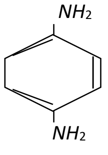
(c) 
$R - \overset{\overset{O}{\|}}{C} - NH_2$

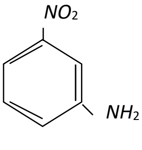
(d) 
$R - \overset{\overset{O}{\|}}{C} - NHOH$

5. 

(a) 

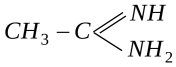
(b) 



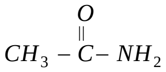


(c)   (d)

6. The correct order of basicities of the following compounds is


$CH_3-C\begin{smallmatrix}\nearrow NH \\ \searrow NH_2\end{smallmatrix}$ $CH_3-CH_2-NH_2$ $(CH_3)_2NH$

1   2   3


$CH_3-\overset{\overset{O}{\|}}{C}-NH_2$

4

(a) $2>1>3>4$ (b) $1>3>2>4$

(c) $3>1>2>4$ (d) $1>2>3>4$

7. Which of the following would be most reactive towards nitration

(a) Benzene   (b) Nitro benzene

(c) Toluene   (d) Chloro benzene

8. Aniline reacts with acetaldehyde to form

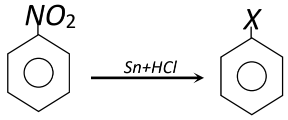
(a) Schiff's base   (b) Carbylamine

(c) Immine   (d) None of these

9. *p*-chloroaniline and anilinium hydrochloride can be distinguished by

(a) Sandmeyer reaction (b) $NaHCO_3$

(c) $AgNO_3$ (d) Carbylamine test

10. 

In the above reaction '*X*' stands fo

(a) NH_2 (b) $SnCl_2$

(c) *Cl*   (d) $NH_4^+Cl^-$

ANSWERS :

1	**c**	**2**	**c**	**3**	**a**	**4**	**c**	**5**	**b**
6	**b**	**7**	**b**	**8**	**a**	**9**	**c**	**10**	**a**

ASSERTION REASON TYPE QUESTIONS

In the Following questions a statement of Assertion(A) is followed by a statement of Reason(R). Select the most appropriate answer from the options given below:

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not the correct explanation of A.
c. A is true but R is false.
d. A is false but R is true.

The question given below consist of an assertion and a reason. Use the following key to

Choose.

1. Assertion(A): Primary aromatic amines cannot be prepared by Gabriel phthalimide Synthesis.

Reason (R): Aryl halides undergo nucleophilic substitution with anion formed by Phthalimide.

2. Assertion(A): Among isomeric amines, 30 amines have lowest boiling point.

Reason (R): Tertiary amines do not have intermolecular association due to absence of H- atoms linked to nitrogen.

3. Assertion(A): Aliphatic amines are stronger bases than ammonia.

Reason(R): Aromatic amines are weaker bases than ammonia.

4. Assertion(A): Very high amount of HCl is required in reduction of nitro compounds With iron scrap

Reason(R): $FeCl2$ formed gets hydrolysed to release HCl during the reaction.

5. Assertion(A): Aniline reacts with bromine water to give 2,4,6-tribromoaniline.

Reason(R): The $-NH2$ group is o-, p- directing and strongly activates the aromatic

Answer

1. C

2. A

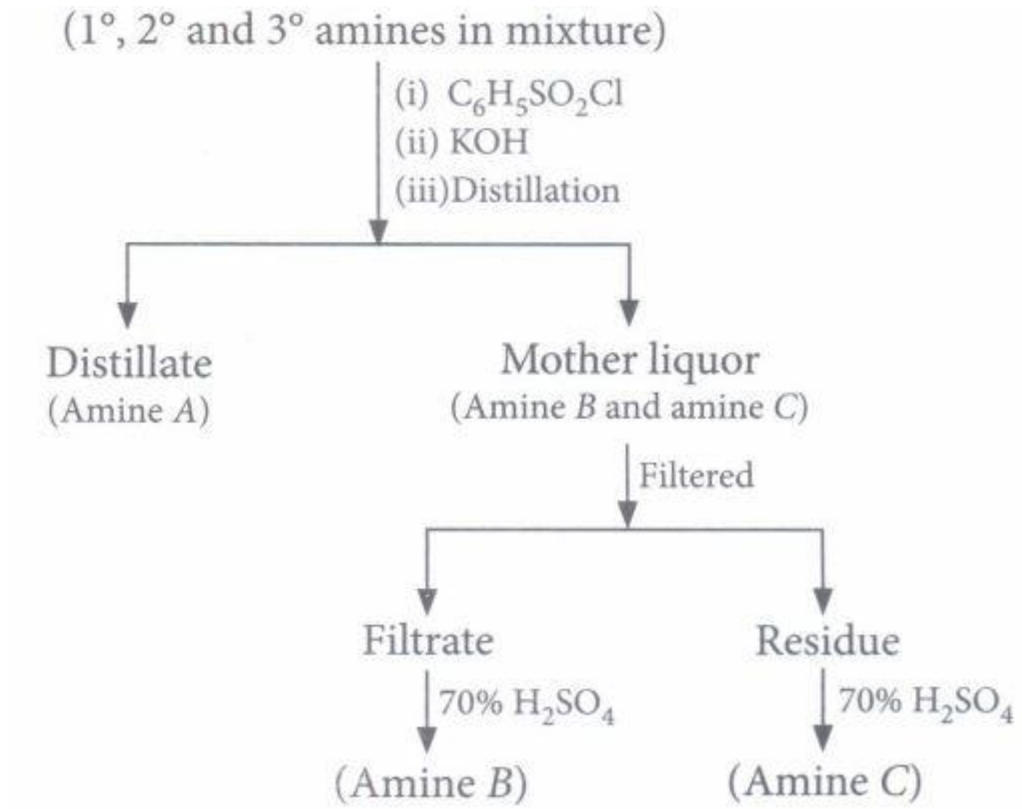
3. B

4. D

5. A

Case Based Questions: Amines

1. **Read the passage given below and answer the following questions:**
When the mixture contains the three amine salts (1°, 2° and 3°) along with quaternary salt, it is distilled with KOH solution. The three amines distill, leaving the quaternary salt unchanged in the solution. Then the mixture of amines is separated by fractional distillation, Hinsberg’s method and Hoffmann's method.



The following questions are multiple choice questions. Choose the most appropriate answer :

(i) Hinsberg reagent is

(a) aliphatic sulphonyl chloride (b) phthalamide
(c) aromatic sulphonyl chloride (d) anhydrous $ZnCl_2$ + conc. HCl.

(ii) Primary amine with Hinsberg's reagent forms

(a) N-alkyl benzene sulphonamide soluble in KOH solution
(b) N-alkyl benzene sulphonamide insoluble in KOH solution
(c) N, N-dialkyl benzene sulphonamide soluble in KOH solution
(d) N, N-dialkyl benzene sulphonamide insoluble in KOH solution.

(iii) To separate amines in a mixture Hoffmann's method is used. The Hoffmann's reagent is

(a) benzenesulphonyl chloride (b) diethyloxalate
(c) benzeneisocyanide (d) p-toulenesulphonic acid.

(iv) 3° amines with Hinsberg's reagent give

(a) no reaction (b) product which is same as that of 1^0 amine
(c) product which is same as that of 2° amine (d) products which is a quaternary salt.

2.

 Read the passage given below and answer the following questions:

The amines are basic in nature due to the presence of a lone pair of electron on N-atom of the -NH2 group, which it can donate to electron deficient compounds. Aliphatic amines are stronger bases than NH_3 because of the +1 effect of the alkyl groups. Greater the number of alkyl groups attached to N-atom, higher is the electron density on it and more will be the basicity. Thus, the order of basic nature of amines is expected to be 3° > 2° > 1°, however the observed order is 2° > 1° > 3°. This is explained on the basis of crowding on N-atom of the amine by alkyl groups which hinders the approach and bonding by a proton, consequently, the electron pair which is present on N is unavailable for donation and hence 3° amines are the weakest bases. Aromatic amines are weaker bases than ammonia and aliphatic amines. Electron -donating groups such as $-CH_3$, $-OCH_3$, etc. increase the basicity while electron-withdrawing substitutes such as $-NO_2$, -CN, halogens, etc. decrease the basicity of amines. The effect of these substituents is more at p than at m-positions.

The following questions are multiple choice questions. Choose the most appropriate answer

(i) Which one of the following is the strongest base in aqueous solution?

(a) Methyl amine (b) Trimethyl amine (c) Aniline (d) Dimethyl amine

(ii) Which order of basicity is correct?

(a) Aniline> m-toluidine > o-toluidine
(b) Aniline> o-toluidine > m-toluidine
(c) o-toluidine> aniline> m-toluidine

(d) o-toluidine < aniline < m-toluidine

(iii) What ts the decreasing order of basicity of primary, secondary and tertiary ethylamines and NH_3?

(a) $NH_3 > C_2H_5NH_2 > (C_2H_5)_2NH > (C_2H_5)_3N$
(b) $(C_2H_5)_3N > (C_2H_5)_2NH > C_2H_5NH_2 > NH_3$
(c) $(C_2H_5)_2NH > C_2H_5NH_2 > (C_2H_5)_3N > NH_3$
(d) $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

(iv) Choose the correct statement:

(a)Methylamine is slightly acidic.

(b)Methylamine is less basic than ammonia

(c)Methylamine is a stronger base than ammonia.

(d) All the statements are correct.

3.
☐ **Read the passage given below and answer the following questions:**
Amines are alkyl or aryl derivatives of ammonia formed by replacement of one or more hydrogen atoms. Alkyl derivatives are called aliphatic amines and aryl derivatives are known as aromatic amines. The presence of aromatic amines can be identified by performing dye test. Aniline is the simplest example of aromatic amine. It undergoes electrophilic substitution reactions in which - NH_2 group strongly activates the aromatic ring through delocalisation oflone pair of electrons of N-atom. Aniline undergoes electrophilic substitution reactions. Ortho and para positions to the $-NH_2$ group become centres of high electrons density. Thus, -NH_2 group is ortho and para-directing and powerful activating group. The following questions are multiple choice questions.

Choose the most appropriate answer:
(i) Cyclohexylamine and aniline can be distinguished by

(a) Hinsberg test (b) carbylamine test (c) Lassaigne test (d) azo dye test

(ii) Which of the following compounds gives-dye test?

(a) Aniline (b) Methyl amine (c) Diphenyl amine (d) Ethyl amine

(iii) Oxidation of aniline with manganese dioxide and sulphuric acid produces

(a) phenylhydroxylamine(b) nitrobenzene(c) p-benzoquinone (d) phenol.

(iv) Aniline when treated with conc, HNO_3 and H_2SO_4 gives

(a) phenylhydroxylamine (b) m-nitroaniline (c) p-benzoquinone (d) nitrobenzene.

******

CHAPTER - BIOMOLECULE

MCQ

1. **The non-essential amino acid among the following is:**

(A) Leucine (B) Valine
(C) Lysine (D) Alanine

2. **An alpha – helix is a structural feature of**

(A)Sucrose (B) Polypeptide
(C) Nucleotide (D) Starch

3. **Which one is the complementary base of cystosine in one strand to that in other strand of DNA?**

(A) Adenine (B) Guanine
(C) Thymine (D) Uracil

4. **Glucose with reaction with $(CH_3CO)_2O$ forms glucose pentaacetate which confirms the the presence of**

(A) Presence of 5 -OH group
(B) Straight chain structure
(C) Presence of 1 Primary – OH group
(D) Presence of aldehyde group

5. A disaccharide is formed when two monosaccharides are bonded together by a bond.

a) glycosidic b) peptide
c) ionic d) phosphodiester

6. Which of the following statements about starch is incorrect?

a) It gives blue colour with iodine
b) It is a polymer of α-D-glucose
c) It is a reducing carbohydrate
d) It consists of branched chains

7. The functional group which is found in amino acids is

(a) COOH (b) $-NH_2$ (c) $-CH_3$ (d) both (a) and (b).

8. **When converting a disaccharide to monosaccharides, which bond is hydrolyzed?**

a) Disulfide bond b) Glycosidic bond
c) Phosphodiester bond d) Hydrogen bond

9 Boiling of egg is an example of:

(a) breaking of peptide linkage (b) hydrolysis of lactose

(c) breaking of protein into amino acids (d) denaturation of protein

10**. Which of the following carbohydrates does not have the formula $C_{12}H_{22}O_{11}$?**

a) Galactose b) Sucrose
c) Allolactose d) Maltose

ANSWER KEY:

1.	**A**
2	**B**
3	**B**
4	**A**
5	**A**
6	**C**
7	(d) both (a) and (b).
8	**B**
9	**D**
10	**A**

ASSERTION AND REASON TYPE QUESTIONS:-

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

1. Assertion : Glycine is amphoteric in nature.
   Reason : Glycine contains both acid and basic groups.
2. Assertion :Hydrolysis of sucrose is known as inversion of cane sugar.
   Reason : Sucrose is a disaccharide.
3. Assertion :Proteins on hydrolysis produce amino acids.
   Reason : Amino acids contain $-NH_2$ and $-COOH$ groups.
4. Assertion :Fructose reduces Fehling's solution and Tollen's reagent.
   Reason : Fructose does not contain any aldehyde group.
5. Assertion :The specific rotation of a freshly prepared solution of $\alpha-$glucose decreases from + 112° to 52.7° while that of β glucose increase from + 19° to 52.7°.
   Reason : The change in specific rotation of an optically active compound with time to an equilibrium value is called mutarotation.

ANSWERS : -1.A 2.B 3. B 4. B 5. B

CASE BASED QUESTIONS

1. **The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each.**

Read the passage carefully and answer the questions that follow.

When a protein in its native form, is subjected to physical changes like change in temperature or chemical changes like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix gets uncoiled and protein loses its biological activity. This is called the denaturation of protein. The denaturation causes change in secondary and tertiary structures but primary structures remain intact. Examples of denaturation of protein are coagulation of egg white on boiling, curdling of milk, formation of cheese when an acid is added to milk.

(a) Phospholipids form a thin layer on the surface of an aqueous medium. Give reason.
(b) Which structure of proteins remains intact during the denaturation process?
(c) What type of structure is α -helix and β-pleated structures of proteins?

OR

Why do amino acids have high molar masses comparable to ionic solids?

2. **The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each.**

The activity of an enzyme can be affected by a change in the conditions which can alter the tertiary structure of the protein. These include temperature, pH, and change in substrate concentration or binding of specific chemicals that regulate its activity.Enzymes generally function in a narrow range of temperature and pH. Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and optimum pH. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat**.**

Concentration of Substrate With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first. The reaction ultimately reaches a maximum velocity (Vmax) which is not exceeded by any further rise in concentration of the substrate. This is because the enzyme molecules are fewer than the substrate molecules and after saturation of these molecules, there are no free enzyme molecules to bind with the additional substrate molecules.

(a) Name a chemical compound or molecule which is responsible for decreasing or stopping the enzyme activity by binding to an enzyme?
(b) Give reason – why do most of the enzymes get destroyed above optimum temperature? (c) Explain the relation between substrate concentration and enzymatic activity?

OR

What are co-enzyme and co-factor ?

Case based questions:

ANS 1 (a) Phospholipids form a thin layer on the surface of an aqueous medium due to the simultaneous presence of both polar and non-polar groups in the molecule. As a result, the phospholipid molecules may arrange themselves in a double-layered membrane in aqueous media.

(b). Primary structure remains intact during the denaturation process.

(c) secondary structure

OR

As they exist as Zwitter ion and have ionic species at lattice points which have electrostatic attraction between them.

ANS.2

(a) Inhibitor

(b) Enzymes are composed of one or several polypeptide chains. Almost all enzymes are protein. High temperature condition destroys enzymatic activity because proteins are denatured by heat.

(c) Concentration of Substrate With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first. The reaction ultimately reaches a maximum velocity (Vmax) which is not exceeded by any further rise in concentration of the substrate. This is because the enzyme molecules are fewer than the substrate molecules and after saturation of these molecules, there are no free enzyme molecules to bind with the additional substrate molecules.

OR

Cofactors are non-protein chemical compounds which are termed helper