

Table of Contents

1. Detection of Extra Elements (N, S, Halogens)
2. Detection of Organic Functional Groups
3. Preparation of Organic Compounds
4. Volumetric Analysis
5. Acid-Base Titration
6. Redox Titrations
7. Enthalpy of Solution
8. Preparation of Lyophilic and Lyophobic Sols
9. Kinetic Study of Iodide Ion with Hydrogen Peroxide

Prepzy

Detection of Extra Elements (N, S, Halogens)

Preparation of Lassaigue's Extract

- Heat small sodium piece in ignition tube till molten.
- Add 50-60 mg organic compound, heat strongly 2-3 min to fuse.
- Cool, break tube in distilled water, crush fused material.
- Boil mixture; sodium salts (NaCN , Na_2S , NaX , NaSCN) dissolve.
- Excess sodium reacts with water forming NaOH ; solution is Lassaigue's extract.
- Lithium and potassium not used due to slow reaction and handling issues.

Detection of Nitrogen

- Nitrogen and carbon form NaCN in Lassaigue's extract.
- Unreacted sodium reacts with water: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$.
- $\text{NaCN} + \text{FeSO}_4$ forms sodium ferrocyanide; Fe^{3+} reacts to give Prussian blue (ferric ferrocyanide).
- $\text{FeSO}_4 + 2\text{NaOH} \rightarrow \text{Fe}(\text{OH})_2 + \text{Na}_2\text{SO}_4$
- $\text{Fe}(\text{OH})_2 + 6\text{NaCN} \rightarrow \text{Na}_4[\text{Fe}(\text{CN})_6] + 2\text{NaOH}$
- $4\text{Fe}^{3+} + 3\text{Na}_4[\text{Fe}(\text{CN})_6] \rightarrow \text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ (Prussian blue)
- Test fails if nitrogen present without carbon (e.g., hydrazine).
- If N and S both present, blood red colour due to ferric thiocyanate ($\text{Fe}(\text{CNS})_3$).
- Excess sodium decomposes sodium thiocyanate: $2\text{Na} + \text{NaCNS} \rightarrow \text{Na}_2\text{S} + \text{NaCN}$.

Detection of Sulphur

- Sulphur converts to sodium sulphide (Na_2S) in Lassaigue's extract.
- $\text{Na} + \text{S} \rightarrow \text{Na}_2\text{S}$ (on heating)
- $\text{Na}_2\text{S} + \text{sodium nitroprusside} \rightarrow \text{sodium thionitroprusside}$ (violet colour).
- $\text{Na}_2\text{S} + \text{lead acetate} \rightarrow \text{PbS}$ (black precipitate).

Detection of Halogens

- Beilstein test: Copper wire flame test shows halogens (except fluorine).
- Lassaigne's test: Halogens form sodium halides; treated with HNO_3 and AgNO_3 gives precipitates:
 - AgCl : white, soluble in NH_4OH (chlorine)
 - AgBr : pale yellow, sparingly soluble (bromine)
 - AgI : yellow, insoluble (iodine)
- Chlorine water test: Lassaigne's extract + Cl_2 + CS_2 shows orange (Br_2) or violet (I_2) colour.

Solved Examples

- **Ex 1:** Identify nitrogen in organic compound using Lassaigne's test.
 - Fuse compound with sodium, prepare extract.
 - Add FeSO_4 , observe Prussian blue colour.
- **Ex 2:** Detect sulphur using lead acetate.
 - Prepare Lassaigne's extract.
 - Add lead acetate, observe black PbS precipitate.
- **Ex 3:** Confirm halogen by Lassaigne's test.
 - Boil extract with HNO_3 , add AgNO_3 .
 - Observe precipitate colour and solubility.

Practice Set

- Q1: Which element forms NaCN in Lassaigne's extract?
 - A. Sulphur
 - B. Nitrogen
 - C. Halogen
 - D. Oxygen
- Q2: What colour indicates presence of nitrogen in Lassaigne's test with FeSO_4 ?
 - A. Blood red
 - B. Prussian blue
 - C. Violet
 - D. Black
- Q3: Which precipitate confirms iodine presence in Lassaigne's test?
 - A. White AgCl

- B. Pale yellow AgBr
- C. Yellow AgI
- D. Black PbS

Answer Key

- Q1: B - Nitrogen forms NaCN in Lassaigne's extract.
- Q2: B - Prussian blue indicates nitrogen presence.
- Q3: C - Yellow AgI precipitate confirms iodine.

Memory Aids

- Lithium & potassium not used in Lassaigne's test.
- Prussian blue = nitrogen test.
- Blood red = nitrogen + sulphur.
- AgCl white, AgBr pale yellow, AgI yellow for halogens.

Detection of Organic Functional Groups

Alcoholic Group (-OH)

- Sodium metal test: Alcohol + Na → sodium alkoxide + H₂ (effervescence).
- Ester test: Alcohol + carboxylic acid + H₂SO₄ → sweet smelling ester.
- Ceric ammonium nitrate test: Alcohol + ceric ammonium nitrate → pink/red complex.
- Acetyl chloride test: Alcohol + acetyl chloride → ester + HCl; HCl + NH₃ → white fumes (NH₄Cl).

Distinction between Primary, Secondary and Tertiary Alcohols

- Lucas test: Alcohol + Lucas reagent (HCl + ZnCl₂) → alkyl halide (cloudiness).
 - Order of reactivity: Tertiary > Secondary > Primary.
 - Primary alcohols react slowly or require heat.
- Victor Meyer's test: Series of reactions producing color changes to identify alcohol type.

- Primary: blood red
- Secondary: blue
- Tertiary: no color
- Catalytic dehydrogenation:
 - Primary alcohol $\rightarrow$ aldehyde + H_2
 - Secondary alcohol $\rightarrow$ ketone + H_2
 - Tertiary alcohol $\rightarrow$ alkene + H_2O (dehydration)

Phenolic Group

- Litmus test: Phenols turn blue litmus red; no effervescence with Na_2CO_3 .
- Ferric chloride test: Phenol + $FeCl_3 \rightarrow$ coloured complex (varies with phenol type).
- Liebermann's nitroso test: Phenol + $NaNO_2$ + conc. $H_2SO_4 \rightarrow$ blue colour, changes to red on dilution.

Carbonyl Group (Aldehydes and Ketones)

- 2,4-Dinitrophenyl hydrazine test: Carbonyl + DNP $\rightarrow$ yellow-orange precipitate.
- Sodium bisulphite test: Aldehydes/methyl ketones + $NaHSO_3 \rightarrow$ crystalline addition product.
- Tollens' test: Aldehydes + Tollens' reagent $\rightarrow$ silver mirror.
- Fehling's test: Aldehydes + Fehling's solution $\rightarrow$ red Cu_2O precipitate.
- Benedict's test: Similar to Fehling's test.
- Schiff's test: Aldehydes + Schiff's reagent $\rightarrow$ pink/red colour.
- Ketone tests:
 - m-Dinitrobenzene test: Violet colour confirms ketone.
 - Sodium nitroprusside test: Ketones + nitroprusside $\rightarrow$ red complex.

Carboxylic Acid Group

- Litmus test: Turns blue litmus red.
- Ester test: Carboxylic acid + ethyl alcohol + $H_2SO_4 \rightarrow$ fruity smelling ester.
- Sodium bicarbonate test: Carboxylic acid + $NaHCO_3 \rightarrow$ brisk effervescence (CO_2).

Amino Group

- Litmus test: Amines turn red litmus blue.
- Solubility: Amines dissolve in mineral acids forming salts.
- Carbylamine test: Primary amines + chloroform + alcoholic KOH → isocyanide (offensive smell).
- Azo-dye test: Primary aromatic amines + nitrous acid + phenol → coloured azo dye.
- Nitrous acid test:
 - Primary amines liberate N_2 gas.
 - Secondary amines form yellow oily nitrosoamines.
 - Tertiary amines form water-soluble salts.
- Hinsberg test:
 - Primary and secondary amines react with benzene sulphonyl chloride to form sulphonamides.
 - Primary amine sulphonamide soluble in NaOH; secondary insoluble.
 - Tertiary amines do not react.

Solved Examples

- **Ex 1:** Identify primary alcohol using Lucas test.
 - Mix alcohol with Lucas reagent at room temp.
 - No cloudiness indicates primary alcohol.
- **Ex 2:** Confirm aldehyde by Tollens' test.
 - Warm compound with Tollens' reagent.
 - Silver mirror confirms aldehyde.
- **Ex 3:** Detect amino group by carbylamine test.
 - Mix amine with chloroform and alcoholic KOH.
 - Offensive smell confirms primary amine.

Practice Set

- Q1: Which test gives pink/red colour with alcohol?
 - A. Lucas test
 - B. Ceric ammonium nitrate test
 - C. Tollens' test
 - D. Fehling's test

- Q2: Which test distinguishes primary, secondary, tertiary alcohols by cloudiness?
 - A. Victor Meyer's test
 - B. Lucas test
 - C. Carbylamine test
 - D. Schiff's test
- Q3: Which test confirms ketones?
 - A. Schiff's test
 - B. Sodium nitroprusside test
 - C. Tollens' test
 - D. Carbylamine test

Answer Key

- Q1: B - Ceric ammonium nitrate gives pink/red with alcohols.
- Q2: B - Lucas test shows cloudiness order for alcohol types.
- Q3: B - Sodium nitroprusside test is specific for ketones.

Memory Aids

- Lucas test: Tertiary reacts fastest, primary slowest.
- Tollens' test positive only for aldehydes.
- Carbylamine test positive only for primary amines.
- Ketones give violet in m-dinitrobenzene test.

Preparation of Organic Compounds

Acetanilide

- Prepared by acetylation of aniline with acetic anhydride in glacial acetic acid.
- Reaction: Aniline + Acetic anhydride $\rightarrow$ Acetanilide + Acetic acid.
- Boil mixture with reflux, cool in ice water to get crude white precipitate.
- Purify by recrystallisation.
- Zinc added to prevent aniline oxidation and reduce impurities.
- Acetanilide protects amino group in reactions.

Nitration of Acetanilide (p-Nitroacetanilide)

- Mix powdered acetanilide with glacial acetic acid and conc. H_2SO_4 , cool below 5°C .
- Add nitrating mixture (conc. HNO_3 + conc. H_2SO_4) below 25°C with stirring.
- Pour into crushed ice to get crude product.
- Recrystallise in ethanol; p-nitroacetanilide crystallises out.
- Direct nitration of aniline not possible due to oxidation; acetylation protects $-\text{NH}_2$.

Aniline Yellow (p-Aminoazobenzene)

- Prepared by coupling benzenediazonium chloride with aniline in acidic medium.
- Forms yellow solid dye.
- Not used as dye due to acid sensitivity.

Iodoform

- Prepared from acetone or ethyl alcohol (better yield from acetone).
- React acetone/ethyl alcohol + KI + NaOH + sodium hypochlorite.
- Yellow precipitate of iodoform (CHI_3) formed, crystallised from spirit.
- Detects $\text{CH}_3\text{-CH-OH}$ or $\text{CH}_3\text{-CO-}$ groups.
- Used as antiseptic.

Solved Examples

- **Ex 1:** Prepare acetanilide.
 - Mix aniline, acetic anhydride, glacial acetic acid.
 - Boil with reflux, cool, filter precipitate.
 - Recrystallise for pure product.
- **Ex 2:** Prepare p-nitroacetanilide.
 - Mix acetanilide, glacial acetic acid, conc. H_2SO_4 , cool.
 - Add nitrating mixture below 25°C .
 - Isolate and recrystallise product.
- **Ex 3:** Perform iodoform test.
 - Mix acetone/ethyl alcohol with KI, NaOH, sodium hypochlorite.

- Observe yellow precipitate.

Practice Set

- Q1: Which reagent is used for acetylation of aniline?
 - A. Acetic acid
 - B. Acetic anhydride
 - C. Acetyl chloride
 - D. Both B and C
- Q2: p-Nitroacetanilide is major product due to?
 - A. Ortho directing effect
 - B. Para directing effect
 - C. Meta directing effect
 - D. No directing effect
- Q3: Iodoform test detects?
 - A. Alcohols with $\text{CH}_3\text{-CH-OH}$ group
 - B. Ketones with $\text{CH}_3\text{-CO-}$ group
 - C. Both A and B
 - D. None

Answer Key

- Q1: D - Both acetic anhydride and acetyl chloride are used.
- Q2: B - Acetamido group is para directing.
- Q3: C - Iodoform test detects both methyl alcohol and methyl ketone groups.

Memory Aids

- Acetanilide protects -NH_2 during nitration.
- p-Nitroacetanilide is major due to para directing acetamido group.
- Iodoform test positive for $\text{CH}_3\text{-CH-OH}$ and $\text{CH}_3\text{-CO-}$ groups.

Volumetric Analysis

Overview

- Measures concentration of a chemical by volume of its solution in a reaction.
- Main process is titration.
- Types: acid-base, redox, iodine, complexometric titrations.

Important Terms

- **Analyte (titre):** Substance being analyzed.
- **Titrant:** Substance added to analyte.
- **Equivalence point:** Reaction completion point; sudden change in indicator color, pH, conductivity, or absorbance.
- **Indicator:** Compound changing color near equivalence point to signal endpoint.
- **Standard solution:** Solution with known concentration.
- **Standardization:** Process to determine reagent concentration using a known reagent.
- **Primary standard:** Pure reagent for direct standard solution preparation (e.g., oxalic acid, anhydrous Na_2CO_3 , Mohr's salt).
- **Secondary standard:** Reagent not pure enough for direct standard solution (e.g., KMnO_4 , NaOH , KOH).

Law of Chemical Equivalence

- Equivalents of analyte react with equal equivalents of titrant.
- Number of equivalents = Normality (N) $\times$ Volume (V in L).
- Normality equation: $N_1V_1 = N_2V_2$.
- Molarity equation (for dilution): $M_1V_1 = M_2V_2$.
- Normality = Molarity $\times$ valency factor (n).
- General form: $M_1V_1n_1 = M_2V_2n_2$.

Theory of Titration

- Known volume (usually 20 mL) of one solution in conical flask with indicator.

- Other solution in burette added dropwise with stirring.
- Sudden change in property (color) indicates endpoint.
- Volume of titrant used is noted.

General Calculations

- Apply law of chemical equivalence: $N_1V_1 = N_2V_2$.
- Calculate unknown normality or molarity.
- Strength (g/L) = Normality $\times$ Equivalent weight or Molarity $\times$ Molecular mass.
- Percentage purity = (Strength of pure sample / Strength of given sample) $\times$ 100.

Solved Examples

Ex 1

- Given volume and normality of titrant, calculate normality of analyte using $N_1V_1 = N_2V_2$.
- Calculate strength using strength formula.

Practice Set

- Q1: What is the equivalence point in titration?
 - A. Start of reaction
 - B. Point of color change
 - C. Point where reactants are in stoichiometric ratio
 - D. Point of maximum volume
- Q2: Which is a primary standard?
 - A. KMnO_4
 - B. NaOH
 - C. Oxalic acid
 - D. KOH
- Q3: Normality is related to molarity by?
 - A. Normality = Molarity / n
 - B. Normality = Molarity $\times$ n
 - C. Normality = Molarity + n
 - D. Normality = Molarity - n

Answer Key

- Q1: C - Equivalence point is where reactants react in stoichiometric ratio.
- Q2: C - Oxalic acid is a primary standard.
- Q3: B - Normality = Molarity $\times$ valency factor.

Memory Aids

- Primary standards: Pure, stable, non-hygroscopic (e.g., oxalic acid).
- Normality equation: $N_1V_1 = N_2V_2$.
- Use indicators that change color near equivalence point.

Acid-Base Titration

Concepts

- Neutralization reaction: $H^+ + OH^- \rightarrow H_2O$.
- End point: Sudden pH change with small titrant addition.
- Indicators: Weak acids/bases changing color at specific pH.
- Examples: Phenolphthalein (colorless to pink), Methyl orange (red to yellow).
- Indicator $pK_a \approx$ pH at half-equivalence point.
- Indicator choice depends on acid/base strength.

Titration Types

- **Strong acid + strong base:** Equivalence pH = 7; salt neutral.
- **Weak acid + strong base:** Buffer before equivalence; pH > 7 at equivalence due to salt hydrolysis.
- **Weak base + strong acid:** Buffer before equivalence; pH < 7 at equivalence due to salt hydrolysis.
- **Weak acid + weak base:** No sharp endpoint; pH $\approx$ 7 at equivalence.
- **Diacidic base (Na_2CO_3) + monoprotic acid:** Two equivalence points; use phenolphthalein and methyl orange.

- **Diprotic acid (oxalic acid) + strong base:** Two equivalence points; stepwise neutralization.

Solved Examples

Ex 1

- Titration of strong acid (HCl) with strong base (NaOH): pH at equivalence = 7.
- Reaction: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$.

Ex 2

- Titration of weak acid (CH_3COOH) with strong base (NaOH): buffer forms before equivalence; pH > 7 at equivalence.

Practice Set

- Q1: pH at equivalence point of strong acid-strong base titration is?
A. 0
B. 7
C. 14
D. Depends on indicator
- Q2: Which indicator is best for weak acid-strong base titration?
A. Methyl orange
B. Phenolphthalein
C. Methyl red
D. Thymol blue
- Q3: In titration of Na_2CO_3 with HCl, number of equivalence points are?
A. 1
B. 2
C. 3
D. 0

Answer Key

- Q1: B - pH = 7 for strong acid-strong base titration.
- Q2: B - Phenolphthalein suitable for weak acid-strong base.
- Q3: B - Two equivalence points due to diacidic base.

Memory Aids

- Strong acid + strong base: pH = 7 at equivalence.
- Weak acid + strong base: pH > 7 at equivalence.
- Weak base + strong acid: pH < 7 at equivalence.
- Use phenolphthalein for weak acid-strong base titrations.

Redox Titrations

Concepts

- Permanganometric titrations use KMnO_4 as oxidizing agent in acidic medium.
- Reducing agents: Mohr's salt, H_2O_2 , oxalic acid, etc.
- KMnO_4 acts as self-indicator: colorless to pink at endpoint.
- Redox reaction: KMnO_4 reduced to Mn^{2+} , reducing agent oxidized.
- Equivalent mass of KMnO_4 in acidic medium = $158/5 = 31.6$.

Experiment 1: Oxalic Acid vs KMnO_4

- Indicator: KMnO_4 self-indicator.
- End point: Colorless to permanent pink.
- Oxalic acid heated to 60-70°C to speed reaction.
- Reaction: $2\text{MnO}_4^- + 16\text{H}^+ + 5\text{C}_2\text{O}_4^{2-} \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 10\text{CO}_2$.
- 2 moles KMnO_4 react with 5 moles oxalic acid.

Experiment 2: Mohr's Salt vs KMnO_4

- Indicator: KMnO_4 self-indicator.
- End point: Colorless to light pink.
- Reaction: $\text{MnO}_4^- + 8\text{H}^+ + 5\text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + 5\text{Fe}^{3+} + 4\text{H}_2\text{O}$.
- 1 mole KMnO_4 reacts with 5 moles Mohr's salt.

Calculations

- Use normality equation: $N_1V_1 = N_2V_2$.
- Molarity relation: $M_{\text{KMnO}_4}V_{\text{KMnO}_4} / M_{\text{Mohr}}V_{\text{Mohr}} = 1/5$.
- Strength = Normality $\times$ Equivalent mass or Molarity $\times$ Molecular mass.

Solved Examples

Ex 1

- Calculate normality of KMnO_4 given volume and normality of oxalic acid using $N_1V_1 = N_2V_2$.

Practice Set

- Q1: KMnO_4 acts as what in permanganometric titrations?
A. Titrant only
B. Indicator only
C. Self-indicator
D. Reducing agent
- Q2: Equivalent mass of KMnO_4 in acidic medium is?
A. 158
B. 31.6
C. 79
D. 63

- Q3: In titration of Mohr's salt with KMnO_4 , mole ratio is?
A. 1:1
B. 1:2
C. 1:5
D. 5:1

Answer Key

- Q1: C - KMnO_4 acts as self-indicator.
- Q2: B - Equivalent mass = $158/5 = 31.6$.
- Q3: C - 1 mole KMnO_4 reacts with 5 moles Mohr's salt.

Memory Aids

- KMnO_4 reduced from MnO_4^- to Mn^{2+} by gaining 5 electrons.
- Oxalic acid reacts with KMnO_4 in 5:2 mole ratio.
- Mohr's salt reacts with KMnO_4 in 5:1 mole ratio.

Enthalpy of Solution

Concepts

- Enthalpy of solution: Heat change when 1 mole of substance dissolves in excess solvent.
- Heat of solution can be endothermic (+) or exothermic (-).
- Measured using calorimeter (polythene bottle).
- Formula: $\Delta H = (W + m) \times \Delta t \times 4.2 \times M / w$ (J/mol) or without 4.2 in cal/mol.
- W = water equivalent of calorimeter, m = mass of water, Δt = temperature change, M = molecular mass, w = mass of solute.
- Water equivalent: Heat required to raise calorimeter temperature by 1°C equals that for equivalent water mass.

Chemical Principle

- Dissolution involves lattice energy (energy to dissociate solid) and hydration energy (energy released on hydration).
- If lattice energy > hydration energy: endothermic dissolution.
- If lattice energy < hydration energy: exothermic dissolution.
- Example: Anhydrous CuSO_4 dissolution is exothermic; KCl dissolution is endothermic.
- Hydrated salts dissolution is endothermic (e.g., $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$).

Solved Examples

Ex 1

- Calculate enthalpy of solution using temperature change and known masses.

Practice Set

- Q1: Enthalpy of solution is heat change when?
 - A. 1 mole solute dissolves
 - B. 1 mole solvent evaporates
 - C. 1 mole solute reacts
 - D. 1 mole solute melts
- Q2: If lattice energy > hydration energy, dissolution is?
 - A. Exothermic
 - B. Endothermic
 - C. Neutral
 - D. Spontaneous
- Q3: Water equivalent of calorimeter is?
 - A. Mass of water
 - B. Heat capacity of calorimeter
 - C. Equivalent heat to raise temperature by 1°C
 - D. Heat of solution

Answer Key

- Q1: A - Heat change when 1 mole solute dissolves.
- Q2: B - Endothermic if lattice energy > hydration energy.
- Q3: C - Heat required to raise calorimeter temperature by 1°C equals that for equivalent water mass.

Memory Aids

- Endothermic dissolution: lattice energy > hydration energy.
- Exothermic dissolution: hydration energy > lattice energy.
- Hydrated salts usually dissolve endothermically.

Preparation of Lyophilic and Lyophobic Sols

Colloids

- Intermediate state between true solutions and suspensions.
- Particle size: 1-1000 nm.
- Two phases: dispersed phase (solute equivalent) and dispersion medium (solvent equivalent).
- Dispersed phase distributed in dispersion medium.
- Types based on affinity:
 - **Lyophilic sols:** High affinity, stable, reversible, prepared by direct mixing (e.g., gum, gelatin, starch).
 - **Lyophobic sols:** Low affinity, unstable, irreversible, prepared by special methods (e.g., metal sols, hydroxides).

Theory of Preparation

- Lyophilic sols: prepared by mixing dispersed phase with medium (e.g., starch in boiling water).
- Lyophobic sols: prepared by hydrolysis of chlorides (e.g., FeCl_3 , AlCl_3).
- Hydrolysis reactions produce insoluble hydroxides and HCl, which is removed by dialysis.

- Arsenious sulphide sol prepared by hydrolysis of As_2O_3 and passing H_2S gas.

Methods of Preparation

- **Condensation methods:** Combine atomic/molecular particles to form colloidal size aggregates via chemical or physical means.
- Chemical methods: double decomposition, oxidation, reduction, hydrolysis.
- Physical methods: solvent exchange, excessive cooling.
- Dispersion methods: mechanical dispersion, electrical disintegration (Bredig's arc), peptization.

Solved Examples

Ex 1

- Prepare ferric hydroxide sol by hydrolysis of FeCl_3 .
- Prepare arsenious sulphide sol by hydrolysis of As_2O_3 and H_2S gas.

Practice Set

- Q1: Lyophilic sols are?
 - A. Unstable
 - B. Reversible
 - C. Irreversible
 - D. Insoluble
- Q2: Bredig's arc method is used for?
 - A. Lyophilic sols
 - B. Lyophobic sols
 - C. True solutions
 - D. Suspensions
- Q3: Peptization involves?
 - A. Precipitate to sol conversion
 - B. Sol to precipitate
 - C. Mixing two sols
 - D. Heating sols

Answer Key

- Q1: B - Lyophilic sols are reversible.
- Q2: B - Bredig's arc prepares lyophobic sols.
- Q3: A - Peptization converts precipitate to sol.

Memory Aids

- Lyophilic = love solvent, stable, reversible.
- Lyophobic = fear solvent, unstable, irreversible.
- Bredig's arc for metal sols.

Kinetic Study of Iodide Ion with Hydrogen Peroxide

Reaction Rate

- Rate = change in concentration per unit time.
- For $A + B \rightarrow C + D$, rate = $-\Delta[A]/\Delta t = -\Delta[B]/\Delta t = +\Delta[C]/\Delta t = +\Delta[D]/\Delta t$.
- Negative sign: concentration decreases; positive: increases.

Reaction Theory

- H_2O_2 oxidizes I^- to I_2 in acidic medium (slow reaction).
- Reaction: $H_2O_2 + 2I^- + 2H^+ \rightarrow I_2 + 2H_2O$.
- I_2 reacts with sodium thiosulphate ($Na_2S_2O_3$) to form iodide ions and tetrathionate ions.
- When thiosulphate is consumed, I_2 reacts with starch to form blue complex.
- Time before blue color appears indicates reaction rate.
- Rate increases with KI concentration.

Chemical Principle

- Rate law: $\text{Rate} = k[X]^a[Y]^b$, where a, b are experimental orders.
- Order = $a + b$; molecularity = $x + y$ (stoichiometric coefficients).
- Rate depends on concentration, temperature, catalyst, surface area, light.

Solved Examples

Ex 1

- Calculate rate from concentration changes over time.

Practice Set

- Q1: Rate of reaction is change in?
A. Volume
B. Concentration
C. Mass
D. Temperature
- Q2: In rate law $\text{Rate} = k[X]^a[Y]^b$, a and b are?
A. Stoichiometric coefficients
B. Experimental orders
C. Rate constants
D. Concentrations
- Q3: Molecularity is?
A. Sum of experimental orders
B. Sum of stoichiometric coefficients
C. Rate constant
D. Concentration

Answer Key

- Q1: B - Rate is change in concentration per unit time.
- Q2: B - a and b are experimentally determined orders.

- Q3: B - Molecularity is sum of stoichiometric coefficients.

Memory Aids

- Rate law exponents are experimental, not always stoichiometric.
- Molecularity is always an integer.
- Higher concentration → faster reaction.

Prepzy