GUJARAT TECHNOLOGICAL UNIVERSITY

BE-3 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:
Applied Chemistry (3130506)

Unit 1 – Physical Properties and Chemical Constitution of Matter

Repeated Questions:

1. **Define: Molarity, Molality, Normality, Mole Fraction**
   - Appeared in: W22 (Q1a, 03 marks), S25 (Q1a, 03 marks), S24 (Q1a, 03 marks), S23 (Q1a, 03 marks)
2. **Explain: Viscosity, Depression in Freezing Point, Elevation in Boiling Point, Osmosis, Osmotic Pressure**
   - Appeared in: W24 (Q1c, 07 marks), S24 (Q1c, 07 marks), S25 (Q1a, 03 marks)
3. **Show that Depression in Freezing Point / Elevation in Boiling Point is a colligative property**
   - Appeared in: W25 (Q1c, 07 marks), S24 (Q1c, 07 marks)
4. **Define: Optical Activity, Specific Rotation, Enantiomers, Diastereomers**
   - Appeared in: W25 (Q1b, 04 marks), S24 (Q2b, 04 marks), W24 (Q1b, 04 marks)
5. **Write a short note on Magnetic Properties of substances**
   - Appeared in: W25 (Q1a, 03 marks)

Other Important Questions:

1. **Calculate mole fraction of methanol / ethylene glycol in water**
   - Appeared in: W22 (Q4a, 03 marks), S25 (Q4a, 03 marks)
2. **Define: Parachor, Dipole Moment, Molar Refraction**
   - Appeared in: S23 (Q2b, 04 marks)
3. **Explain the importance of Nanocomposites**
   - Appeared in: W25 (Q5a, 03 marks), W22 (Q1b, 04 marks)
4. **Define: Lowering of Vapor Pressure**
   - Not directly asked, but part of colligative properties theory.

Unit 2 – General Principles of Organic Reactions

Repeated Questions:

1. **Explain: Resonance Effect, Inductive Effect, Electron Displacement Effect**
   - Appeared in: W25 (Q2b, 04 marks), S25 (Q2a, 03 marks), S24 (Q2a, 03 marks)
2. **Define: Fission of Covalent Bond, Heterolytic/Homolytic Fission**
   - Appeared in: W25 (Q2a, 03 marks), W23 (Q2a, 03 marks)
3. **Explain: Reactive Intermediates – Carbocations, Carbanions, Carbenes**
   - Appeared in: W25 (Q2c, 07 marks), S23 (Q2b, 04 marks)
4. **Differentiate between SN1 and SN2 reactions**
   - Appeared in: W24 (Q2c, 07 marks), W22 (Q1c, 07 marks), S25 (Q1c, 07 marks)
5. **Explain Markovnikov's Rule, Ortho/Para directing groups**
   - Appeared in: W24 (Q2b, 04 marks), W22 (Q2a, 03 marks)

Other Important Questions:

1. **Explain Acylation, Nitration, Sulphonation, Alkylation of Toluene**
   - Appeared in: W25 (Q2c OR, 07 marks)
2. **Explain Electrophilic Substitution / Addition reactions**
   - Appeared in: W23 (Q2c, 07 marks), S23 (Q2c, 07 marks)
3. **Define: Molecularity, Order of Reaction, Rate Law**
   - Appeared in: W24 (Q4b, 04 marks), S23 (Q4b, 04 marks)
4. **Explain Nucleophilic Aromatic Substitution (SN1)**
   - Appeared in: S24 (Q2c OR, 07 marks)

Unit 3 – Stereochemistry

Repeated Questions:

1. **Explain Optical Isomerism in Tartaric Acid / Lactic Acid**
   - Appeared in: W24 (Q1b, 04 marks), W23 (Q3c, 07 marks), S25 (Q3c, 07 marks), S23 (Q2a, 03 marks)
2. **Define: Enantiomers, Diastereomers, R-S Configuration, E-Z Isomers**
   - Appeared in: W24 (Q4a, 03 marks), S24 (Q2c, 07 marks), W23 (Q5a, 03 marks)
3. **Explain Resolution of Racemic Mixture**
   - Appeared in: W23 (Q3b, 04 marks), S25 (Q3b, 04 marks)
4. **Explain Conformational Isomerism in n-Butane**
   - Appeared in: W25 (Q3b, 04 marks)

Other Important Questions:

1. **Explain Chirality**
   - Appeared in: S25 (Q3c, 07 marks)
2. **Draw R and S isomers of Lactic Acid**
   - Appeared in: S25 (Q5a, 03 marks)
3. **Differentiate between Nematic and Smectic Phases (Liquid Crystals)**
   - Appeared in: W22 (Q3a, 03 marks), S25 (Q3a, 03 marks)

Unit 4 – Quantum Theory & Chemical Bonding

Repeated Questions:

1. **Explain Heisenberg Uncertainty Principle**
   - Appeared in: W25 (Q3a OR, 03 marks), W24 (Q3a, 03 marks), S24 (Q3a, 03 marks), S23 (Q3b, 04 marks)
2. **Derive/Explain Schrodinger Wave Equation**
   - Appeared in: W24 (Q4a OR, 03 marks), W22 (Q5c, 07 marks), S25 (Q5c, 07 marks)
3. **Explain Molecular Orbital Theory**
   - Appeared in: W24 (Q3b, 04 marks), W23 (Q3c, 07 marks), S24 (Q3c, 07 marks)
4. **Explain Hybridization (sp^3, sp^2, sp) with examples**
   - Appeared in: W25 (Q3c, 07 marks), S24 (Q3b, 04 marks), S23 (Q3a, 03 marks)
5. **Predict shapes using VSEPR Theory (H_2O, NH_3, SF_4, XeF_4, etc.)**
   - Appeared in: W22 (Q3c, 07 marks), S25 (Q3c, 07 marks)

Other Important Questions:

1. **Define Wave Function and its significance**
   - Appeared in: W25 (Q3a, 03 marks)
2. **Draw Molecular Orbital Diagram of N_2 / O_2**
   - Appeared in: S25 (Q3b, 04 marks), W22 (Q3b, 04 marks)
3. **Explain Paramagnetic Behavior of O_2**
   - Appeared in: W22 (Q3b, 04 marks)

Unit 5 – Phase Rule

Repeated Questions:

1. **Define: Phase, Component, Degree of Freedom**
   - Appeared in: W24 (Q2a, 03 marks), S24 (Q3a, 03 marks)
2. **Derive Gibbs Phase Rule**
   - Appeared in: S24 (Q3b, 04 marks)
3. **Explain One-Component System (Water / Sulphur)**
   - Appeared in: W24 (Q3c, 07 marks), S25 (Q2c, 07 marks), S24 (Q3c, 07 marks)
4. **Explain Two-Component Systems (Ag-Pb, Zn-Cd, $FeCl_3$-Water)**
   - Appeared in: W24 (Q3c OR, 07 marks), W22 (Q2c, 07 marks), W23 (Q3c, 07 marks)

Other Important Questions:

1. **Define Eutectic Point**
   - Appeared in: W23 (Q4b, 04 marks), S23 (Q4b, 04 marks)
2. **Explain Phase Diagram of Ferric Chloride-Water System**
   - Appeared in: W25 (Q3c, 07 marks), S23 (Q3c, 07 marks)

Unit 6 – Chemical Kinetics

Repeated Questions:

1. **Define: Reaction Rate, Order, Molecularity, Pseudo Order**
   - Appeared in: W23 (Q1b, 04 marks), S23 (Q1b, 04 marks), W24 (Q4b, 04 marks)
2. **Derive Rate Equation for First Order Reaction**
   - Appeared in: W24 (Q4c, 07 marks), S24 (Q4c, 07 marks), W22 (Q3c, 07 marks)
3. **Explain Half-Life Period of First Order Reaction**
   - Appeared in: W25 (Q4c, 07 marks), S24 (Q4c, 07 marks), S25 (Q2c OR, 07 marks)
4. **Explain Second Order Reaction Rate Constant Expression**
   - Appeared in: W25 (Q4c OR, 07 marks), S24 (Q4c, 07 marks), S23 (Q4c, 07 marks)

Other Important Questions:

1. **Numerical: First order reaction % completion time calculation**
   - Appeared in: W24 (Q4b, 04 marks), S24 (Q4b, 04 marks)
2. **Prove Decomposition of H_2O_2 is First Order (Data given)**
   - Appeared in: W23 (Q4b, 04 marks)
3. **Prove Hydrolysis of Ethyl Acetate is Second Order (Data given)**
   - Appeared in: S23 (Q4b, 04 marks)
4. **Explain Zero Order Reaction**
   - Appeared in: W23 (Q4a, 03 marks), S23 (Q1b, 04 marks)

Unit 7 – Thermochemistry

Repeated Questions:

1. **Define: Enthalpy, Internal Energy, Endothermic, Exothermic Reactions**
   - Appeared in: S24 (Q4a, 03 marks), W24 (Q1c, 07 marks), S23 (Q4b, 04 marks)
2. **State and Explain Hess's Law**
   - Appeared in: W22 (Q4b, 04 marks), S25 (Q4b, 04 marks), S24 (Q5b, 04 marks)
3. **Calculate Enthalpy of Formation / Combustion using given data**
   - Appeared in: W25 (Q4b, 04 marks), W23 (Q4b, 04 marks), S25 (Q4b, 04 marks)
4. **Define: Heat of Neutralization, Heat of Transition, Heat of Combustion**
   - Appeared in: W25 (Q4a OR, 03 marks), W24 (Q5b, 04 marks), S23 (Q4b, 04 marks)

Other Important Questions:

1. **Numerical: Calculate ΔH using thermo-chemical equations**
   - Appeared in: W24 (Q5c, 07 marks), W23 (Q3b, 04 marks)
2. **Explain Experimental Measurement of Heat of Reaction**
   - Not directly asked but part of syllabus.

Unit 8 – Materials Science & Analytical Techniques

Repeated Questions:

1. **Explain: Ceramics, Refractories, Insulators, Zeolites, Nanocomposites**
   - Appeared in: W24 (Q5a, 03 marks), S25 (Q5a, 03 marks), S24 (Q5a, 03 marks), S23 (Q5a, 03 marks)
2. **Define: Glass Transition Temperature, Liquid Crystals, Viscoelasticity**
   - Appeared in: W25 (Q4a, 03 marks), S23 (Q5a, 03 marks), W22 (Q5a, 03 marks)
3. **Explain SEM / TEM – Principle, Instrumentation, Applications**
   - Appeared in: W25 (Q5c, 07 marks), S25 (Q4c, 07 marks), S24 (Q5c, 07 marks), W22 (Q4c, 07 marks)
4. **Explain NMR / Mass Spectroscopy – Principle, Instrumentation**
   - Appeared in: S24 (Q5c, 07 marks), W23 (Q5c, 07 marks), W22 (Q1c, 07 marks)

Other Important Questions:

1. **Explain XRD, PSA, Fluorescence Spectroscopy**
   - Appeared in: W25 (Q5c OR, 07 marks), S25 (Q4c, 07 marks), S24 (Q5b, 04 marks)
2. **Define: Copolymers, Biomaterials, Amphiphiles**
   - Appeared in: S23 (Q5a, 03 marks)
3. **Explain Surface Characterization Techniques**
   - Appeared in: W24 (Q5a OR, 03 marks)

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