RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF LECTURER (SCHOOL EDUCATION)

CHEMISTRY

PAPER - II

Part – I Senior Secondary Level

1. **Atomic Structure:**
   Fundamental particles, Modern concept of atomic structure, Quantum numbers, Aufbau principle, Pauli's exclusion principle, Hund's rule. Electronic configuration of elements, Classification of elements and periodicity in properties, s, p, d and f -Block elements.

2. **p- Block Elements:**
   General introduction, Electronic configuration, Occurrence, Oxidation states, compounds of p-block elements, trends in physical and chemical properties.

3. **Transition Elements:**
   Transition elements, Electronic configuration, Oxidation states, Absorption spectra including charge transfer spectra and magnetic properties, compounds of transition elements, Co-ordination compounds (Werner's theory). Nomenclature (IUPAC), Isomerism, colour and stability of coordination compounds.
   Lanthanides and Actinides: Electronic configuration, Ionic sizes, Oxidation states, Chemical reactivity and general characteristics.

   Applications of d and f-block elements.

4. **Solid State and Surface Chemistry:**
   Classification of solids, Calculation of density of unit cell, Packing in solids, Point defects, electrical and magnetic properties of solids, Physical and Chemical adsorption, catalysis, Colloids and Emulsions.

5. **Solutions:**
   Types of solutions, Solubility and concentrations, vapour pressure of liquid solutions, Ideal and non-ideal solutions, Colligative properties and calculations of molar mass, Abnormal molecular mass, Vant Hoff factor.

6. **Thermodynamics:**
   Thermodynamic terms, Laws of thermodynamics, Zeroth, first and second law and their applications, Concept of work and heat, Spontaneity, Gibb's energy change and equilibrium.

7. **Alkanes, Alkenes, Alkynes and Halo-alkanes:**
   Methods of preparations and chemical reactions of alkanes, alkenes, alkynes and haloalkanes.

8. **Alcohols, Aldehydes, Ketones, Carboxylic Acids and their derivatives:**
   Classification, nomenclature, methods of preparation, physical properties, Chemical reactions of alcohols, aldehydes, ketones, carboxylic acids and their derivatives.

9. **Halo, Nitro, Amino-Arenes and Diazonium Salts:**
   Preparations, Chemical properties of Halo, Nitro, Amino-Arenes and diazonium salts, synthetic applications of diazonium salts.

10. **Bio-molecules:**
    Carbohydrates, proteins, enzymes, vitamins and nucleic acids.

Part – II Graduation Level

1. **Chemical Bonding:**
   Theories of chemical bonding, VB and MO theories of Diatomic molecules, VSEPR theory, Hydrogen bonding, Quantum mechanics, Schrodinger's wave equation for one electron system.

2. **Co-ordination Complexes:**
   Details of Crystal field theory for weak and strong field complexes. Comparison of VB and CFT theories. Factors affecting 10 Dq. Thermodynamic aspects of Crystal fields, Jahn-Teller effect, importance and applications of coordination compounds.

3. **Chemistry of Lanthanides and Actinides:**
   Lanthanide and Actinide contraction and its consequences, Co-ordination behavior of Lanthanides and Actinide complexes. Magnetic and spectroscopic properties, separation of lanthanides.

4. **Chemical Dynamics:**
   Rate of reaction, factors affecting rate of reactions. Zero, first, pseudo first and second order reactions. Half life period, methods for determination of the order of reactions, Collision and Transition state theories and their comparison, Arrhenius equation and concept of activation energy.

5. **Electrochemistry:**
   Conductance, equivalent and molar conductivity, their variation with dilution for weak and strong electrolytes, types of electrodes, SHE, Electrochemical and Galvanic cells, Theory of strong electrolytes. Debye-Huckel theory of activity coefficient, Nernst equation, Ionic equilibria. Fuel cells, concentration cells, Corrosion.

6. **Enthalpy and Entropy:**
   Enthalpy and its changes at constant pressure and temperature. Enthalpy change for different types of reactions, Entropy as a function of temperature and volume. Hess's Law of constant heat summation, Gibbs and Helmoltz functions.

7. **Stereo chemistry of organic compounds :**
   Concept of chirality, optical activity, configuration : Geometrical and Optical isomerism, enantiomerism, distereoisomers, meso compounds, R/S and E/Z

nomenclature, resolution of enantiomers, inversion, retention and racemisation. Conformations of alkanes (ethane, butane), cyclo-hexane and its derivatives,

8. **Reactions Intermediates:**
   Free radicals, carbocations, carbanions, cabenes, benzyne, nitrene.
   Name Reactions: Mechanism of Aldol, Cannizzaro, Perkin, Stobbe, Benzoin, Reformatsky, Knovengel, Baeyer–Villiger, Wittig and Mannich reactions.

9. **Aromaticity and Arenes:**
   Aromaticity, nomenclature and isomerism of aromatic hydrocarbons, Benzene, Alkyl-arenes, Structure of benzene, physical and chemical properties of benzene, Electrophilic substitution reactions, orientation of functional groups,
   Aromatic heterocyclic compounds (pyridine, pyrrole, furan, thiophene)

10. **Polymers and Drugs:**
    Polymers, types and mechanism of polymerization, Natural and synthetic polymers. Drugs (antacids, anti-histamines, analgesics, antipyretics, antibiotics and antifertility).

Part – III Post Graduation Level

1. **Molecular Orbital Theory:**
   Symmetry elements, operations and point groups, mulliken symbols, GMT and character tables, M.O. Theory of hetronuclear di-atomic and polyatomic molecules (AX_2, AX_3 and AX_4).

2. **Organometallic Compounds:**
   Organometallic compounds of Li, Mg, Sn, Fe, Cu and Zn. Structure, bonding and applications; Metal carbonyls: structure and bonding, cage and cluster compounds, organometallic reagents in catalysis and in organic synthesis.
3. **Kinetics and Catalysis:**
   Kinetics of photo-chemical and polymerization reactions, Acid-Base and Enzyme catalysis, ionic reactions, kinetic salt effect, complex reactions.

4. **Electrochemistry:**
   Measurement of EMF, Kohlrausch's Law and its applications, Membrane equilibria, calculation of Δ H, Δ G, Δ S and equilibrium constant from EMF data.

5. **Thermodynamics:**
   Third Law of Thermodynamics and Joule-Thompson's experiment, Maxwell's relation and their applications, Gibbs-Duhem equitation, Fugacity and Activity concept.

6. **Substitutions and Elimination Reactions:**
   SN^1, SN^2, SN^i, E1 and E2 reactions of haloalkanes, Preparation and Chemical reactions of phenols, ethers and epoxides.

7. **Pericyclic Reactions:**
   Electrocyclic, Cyclo-addition and Sigmatropic rearrangement, Photo-organic chemistry of alkenes and carbonyl compounds.

8. **Environmental Pollution:**
   Air, Water, Soil and heavy metal pollution, photochemical smog, acid rain, Ozone depletion, Green house effect, Global warming and Green chemistry principles.

9. **Spectroscopy:**
Elementary idea of IR, UV, NMR, Raman, ESR and mass spectrometry techniques and structure elucidation of organic compounds.

Part – IV (Pedagogy, Teaching Learning Material, Use of Computers and Information Technology in Teaching Learning)

I. Pedagogy and Teaching Learning Material (Instructional Strategies for Adolescent Learner)

- Communication skills and use of various verbal and non verbal classroom communication strategies.
- Teaching models- advance organizer and inquiry training (information processing) Group Investigation (Social Interaction) Non-Directive model (Personal development).
- Preparation and use of teaching-learning material during teaching.
- Cooperative learning.

II. Use of Computers and Information Technology in Teaching Learning

- Concept of ICT and Digital learning
- E-learning and Virtual Classroom.
- Technology integration in teaching-learning and assessment.

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For the competitive examination for the post of **School Lecturer:** -
The question paper will carry maximum **300 marks**.

1. Duration of question paper will be **Three Hours**.
2. The question paper will carry **150 questions** of multiple choices.
3. Negative marking shall be applicable in the evaluation of answers. For every wrong answer one third of the marks prescribed for that particular question shall be deducted.
4. Paper shall include following subjects: -
   (i) Knowledge of Subject Concerned: Senior Secondary Level
   (ii) Knowledge of Subject Concerned: Graduation Level.
   (iii) Knowledge of Subject Concerned: Post Graduation Level.
   (iv) Pedagogy, Teaching Learning Material, Use of Computers and Information Technology in Teaching Learning.

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