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Chemistry Syllabus for Uttarakhand State Civil Services Preliminary Exam-2011

CHEMISTRY

1. Inorgaic Chemistry:

A **(i) Atomic Structure:** Elementary particles, Bhor's and Sommerfeld models of the atom, Wave-particles duality, De-broglie equation, Heisenberg uncertainity principle, elementary ideas of Schordinger wave equation, atomic number, electronic configuration of elements, Pauli's exclusion principle, Hund's rule of maximum spin multiplicity, Aufbau principle, Long form of periodic classification of elements.

(ii)Nuclear Chemistry: Natural and artificial radio-activity, half-life period, nuclear reactions, fisson and fusion reactions, uses of radioactive isotopes.

B. **Periodic Properties of the Elements :** Atomic, covalent, Vander Waal and ionic radii, ionization potential, electron affinity and electronegativity.

C. Salient features of s, p, d, and f-block elements.

D. **Chemical Bonding:** Ionic, covalent (polar and non-polar), coordinate bonds, α- and - ¶ bonds, Hydrogen bonding, concept of hybridization of atomic orbitals (sp, sp^2, sp^3, sp^3d, sp^3d^2 and sp^3d^3), prediction of shapes of simple inorganic molecules on the basis of VESPR theory, Elementary ideas of molecular orbital theory.

E. General principles of extraction and purification of metals.

F. **Structure and Bonding of:** Diborane, boric acid, anhydrous aluminium chloride, nickel carbonyl and Xenon fluorides.

G. **Redox Reaction:** Oxidation states, oxidation number, Equivalent weights of oxidizing and reducing agents, balancing of redox reactions.

H. **Coordination Chemistry:** Double salts and coordination compounds, Werner's theory, Effective atomic number (EAN), Electronic configuration of Complexes, IUPAC system of nomenclature.

I. **Environmental Pollution :** Pollutants and their influence on environment.

2. Organic Chemistry :

A. **Bonding in Carbon Compounds:** sp, sp^2 and sp^3 hybridization, α- and - ¶ - bonds, inductive and electromeric effects, hyperconjugation, resonance.

B. **Reaction Mechanism :** Homolytic and heterolytic cleavage of bonds (free radicals, carbonium ion and carbon ion), Addition and substitution reactions (E_1, E_2, SN_1 and SN_2 reactions).

C. **Hydrocarbons :** Studies of alkanes, alkenes and alkynes.

D. **Preparation and Properties of the following Aliphatic Compounds :** Halides, alcohols, ethers, aldehydes, ketones, acids, esters, amines, amides and hydroxyacids (lactic, tartaric, citric, maleic and fumeric acids).

E. **Carbohydrates :** Classification and general reactions. Structure of glucose, fructose and sucrose.

F. **Organometallic Compounds :** Grignard reagents and their synthetic applications.

G. **Stereochemistry :** Optical and geometrical isomerism, concept of conformation.

H. **Benzene and its Simple Derivations :** Benzene, toluene, xylene, phenols, halides, nitro and amino compounds. Benzoic, salicylic, cinnamic, mandelic and sulphonic acids. Aromatic aldehydes and ketones. Diazo and hydrazo compounds. Naphthalene, pyridine and quinoline.

I. Elementary idea of the chemistry of oils, fats, proteins, vitamins and their roles in nutrition and industry.

J. Basic principles involving spectral techniques (UV, visible, I.R.).

3. Physical Chemistry:-

A. **Gaseous State:** Kinetic theory of gases and gas law, Maxwell's law of distribution of velocities, Vander Waals equation, Critical behaviour of gases law of corresponding states, heat capacities of gases.

B. **Physical Properties and Molecular Constitution :** Molar volume, parachor, molar refraction,

molar polarisation and dipole moment.

C. **Liquid state :** Properties of liquids, viscosity, surface tension and vapour pressure.

D. **Solution :** Raoult's law, lowering of vapour pressure, depression of freezing point, elevation of boiling point, osmotic pressure. Determination of molecular weight of solutes. Association and dissociation of solutes.

E. **Thermodynamics :** The first law of thermodynamics, Isothermal and adiabatic expansions, Joule-Thomson effect, enthalpy, heat capacities. Enthalpies of reaction, formation, combustion and solution. Bond energies, Kirchoff's equation. Second law of thermodynamics, entropy, free energy. Criteria of spontaneity and chemical equalibrium.

F. **Chemical Equilibria:** Law of mass action and its application to homogeneous and heterogeneous equilibria, Le-chatelier principle and its application to chemical equilibria.

G. **Chemical Kinetics:** Molecularity and order of reaction. First order and second order reactions. Determination of order of a reaction. Effect of temperature on reaction rate, energy of activation. Collision theory of reaction rates, theory of activated complex.

H. **Electrochemistry:** Faraday's laws of electrolysis, conductivity of an electrolyte, equivalent conductivity and its variation with dilution. Transport number, solubility of sparingly soluble salts.

I. **Ionic Equilibria:** Electrolytic dissociation, Ionic product of water. Ostwald dilution law, theory of strong electrolytes. Solubility product. Acids & Bases (Bronsted concept and Lewis concept), strength of acids and bases, hydrolysis of salts, hydrogen ion concentration, pH, buffer solutions, theory of indicators.

J. **Reversible Cells:** Standard hydrogen and calomel electrodes. Electrodes and redox potentials. Concentration cells.

K. **Phase Rule:** Explanation of terms involved. Application to one and two component systems. Distribution law.

L. **Colloids:** General nature of colloidal solutions and their classification. General methods of preparation and properties of colloids. Coagulation, protective action and gold number. Absorption, physiosorption and chemisorption, Freundlisch and Langmuir isotherms.

M. **Catalysis:** Homogeneous and heterogeneous catalysis. Catalytic promoters and poisoning.

N. **Problems:** Simple numerical and conceptual problems based on the full syllabus.