Annexure - 5

Syllabus for written examination for PGT(CHEMISTRY)

1. **Some Basic concepts of Chemistry:** Scope of chemistry-

Historical approach to nature of matter - states of matter, properties of matter and its measurement, S. I system of units, Uncertainty in measurements, dimensional analysis, Laws of chemical combination, atomic and molecular masses, Mole concept and molar masses, percentage composition, empirical and molecular masses, equivalent weight, concept of limiting reagent

2 **States of Matter:** Gases, liquids and solids, three states of matter, types of intermolecular forces. The laws governing ideal gas behaviour, Dalton's law of partial pressure, Kinetic molecular theory of ideal gases, Maxwell Boltzmann distribution law on molecular motion, real gases – deviation from ideal behaviour, vander Waals equation. *Liquid* and their properties. *Solids*: Classification of solids, fundamental types of lattices, two and three dimensional lattice types, Simple crystal structures, Transformation of crystal structure on varying temperature, Bragg's law, density in solids, energy band, band gaps, semiconductors, magnetic and dielectric properties, stoichiometric and non- stoichiometric defects in solids.

3 **Structure of Atom:***Structure of Atom (Classical Theory),* Dalton's atomic theory, Bohr's model of atom, *Structure of atom (modern theory),* de Broglie's relationship, Heisenberg's uncertainty principal, Classical wave equation, Schrödinger's wave equation, Probability distribution curve, Quantum numbers, Pauli's exclusion principle, Aufbau principle, Hund's rule of maximum multiplicity.

4 **Equilibrium:** Reversible reactions, criteria of equilibrium, Law of mass action, equilibrium constant, Kc and Kp , Le Chatelier principle, Ionic equilibrium, Ostwald's dilution Law, solution of acids, bases, ionic equilibria in solution, Common ion effect – its application to qualitative analysis, acids and bases, Bronsted- Lowry theory of acids and bases, Lewis concept of acid and bases, relative strengths of acids and bases, their quantitative estimation, buffer solution and its use, determination of pH, theories of indicators, conductometric titration, Solubility product, hydrolysis.

5. **Surface Chemistry:**Adsorption, absorption, sorption, Physical adsorption, Chemisorption adsorption, isotherms (Freundlich, Langmuir), application of adsorption, types of Catalysis theories of catalysis, classification of colloids, preparation of Colloidal Solution (lyophobic and lyophilic), Special characteristics of colloidal solutions , electrophoresis, Precipitation of colloids – Hardy Schulze law, multimolecular and macromolecular colloids, Emulsion and Gels.

6 **Chemical Kinetics:** Theories of reaction rates, rate of reaction , molecularity and order of reaction, Fast reactions- Luminescence and energy transfer process, reaction mechanisms(Simple and complex reactions).

7 **Redox Reaction** and **Electrochemistry:** Oxidation and reduction, redox reaction and its application, oxidation number, Strong and weak electrolytes, activity coefficient, conductance and conductivity, Kohlrausch law, resistance and resistivity molar conductivity,

equivalent conductivity, Qualitative and quantitative aspect of electrolysis, electrochemical cell and electrolytic cell, Electrode and electrode potential and standard electrode potential, Electrochemical series and its applications, Nernst equation and its application, Equilibrium constant and EMF of the cell.

8 **Solutions:**Solution and its types, expression of concentration of solution, solubility and factors affecting the solubility of a solid in a liquid (temperature and pressure), Vapour pressure of a liquid, Raoult's law for both volatile and non volatile solute,Ideal and non ideal solution, Colligative properties, abnormal molecular masses and Van't Hoff factor.

9 **Chemical bonding and Molecular Structure:** Valence electrons and Lewis structures, Ionic bond, Covalent bond, Bond parameters ,Co-ordinate bond, polarity and dipole moment, Quantitative idea of – valence bond theory, molecular orbital theory (LCAO), Concept of hybridization involving s, p, d orbitals, Hydrogen bond, Resonance.

10. **Thermodynamics:**Macroscopic properties of the system, modes of transfer of energy between system and surrounding, Phase transition, phase rule and phase diagram, First Law, second law and third law, of thermodynamics. Internal energy and enthalpy of the reaction, their measurement and application, spontaneity of process, Entropy and spontaneity, Helmholtz and Gibb's free energy, Thermodynamics of electrochemical cells.

11. **Classification of elements and periodicity in properties:** Significance of classification, brief history of the development of periodic table, periodic laws, name of the elements with

Z>100 according to IUPAC system, classification of elements into s, p, d, f –block elements and their characteristics,
Periodic trends in the properties of elements – Ionization enthalpy, Electron gain enthalpy, electronegativity, atomic radii, ionic radii, periodicity of valency or oxidation state.

1Z. **Hydrogen:**Position of Hydrogen in periodic table, occurrence, isotopes, Preparation of hydrogen, on small and commercial scale, hydrides, water, hard and soft water, heavy water, hydrogen peroxide, hydrogen economy, hydrogen as a fuel.

13. **General principles and processes of isolation of elements and s – block elements:** Principles and methods of extraction, oxidation and reduction as applied to the extraction procedures of Al, Cu, Zn and Fe. s – block elements, general introduction – Electronic configuration, occurrence, Anomalous properties of the first element of each group, diagonal relationship, Trends in variation of the properties, reaction of alkali and alkaline earth metals. Preparation and properties and uses of some important compounds: - sodium carbonate, sodium bicarbonate, sodium chloride, sodium hydroxide, calcium hydroxide and calcium carbonate, industrial uses of lime and lime stone, biological importance of sodium, potassium, magnesium and calcium.

14. **p – Block Elements:** Electronic configuration, variation in physical and chemical properties of groups 13 to 18, physical and chemical properties of borax, boric acid, boron hydride, silicones, preparation and uses, preparation, properties and uses of nitrogen, ammonia, nitric acid and oxides of nitrogen, phosphorus – allotropic forms, preparation and properties of phosphine,phosphorus pentachloride and phosphorus trichloride, preparation, properties and uses of oxygen and ozone, hydrides and halides of 16 group elements, their structure and nature,allotropic forms of sulphur- their preparation, preparation, properties and uses of sulphur dioxide, industrial preparation of oxo-acids of sulphur, preparation and properties of

halogen and halogen acids, inter halogen compounds, pseudohalide ions. Oxo-acids of halogens, their structure and nature, preparation, properties and uses of xenon fluorides, oxides of xenon and xenon oxo fluorides.

15. **The d – and f- Block Elements:** General introduction, electronic configuration and general trend in the properties of first row transition metals like metallic character, ionization enthalpy, oxidation states, ionic radii, coloured ion formation, catalytic properties, magnetic properties, oxides, halides and sulphides of first row transition metals, complex compound formation etc. Preparation, properties and structures of KMnO4 and K2Cr2 O7, lanthanoids and actinoids.

16. **Co-ordination Compounds and organometallics:** Meaning of co-ordination compounds, Werner's theory, ligands – their types, IUPAC nomenclature of co- ordination compounds, isomerism, bonding in co-ordination compounds, colour, magnetic properties and, stabilities of co-ordination compounds. Chemical and biological importance of coordination compounds, metal carbonyls: preparation, properties and bonding, organometallic compounds and their classification.

17. **Organic Chemistry : Some Basic Principles and Techniques:** General Classification of organic compounds, Shapes of organic compounds-Hybridisation(sp, sp2,sp3), Structural representation of organic molecules, Functional groups, Homologous, series. Common or trivial names, nomenclature of aliphatic, aromatic and substituted aromatic compounds.
Isomerism : Structural and Stereo isomerism **Fundamental Concepts in Reaction Mechanism:** Cleavage of covalent bond, Types of attacking species, electron movement in organic reactions, electronic displacement in a covalent bond and types of organic reactions.
Methods of purification of organic compounds: Qualitative analysis, Quantitative analysis., estimation of the elements and determination of empirical and molecular formula.

18. **Hydrocarbons:** Classification of hydrocarbons.
Alkanes: Conformations (Newmann and Sawhorse formulae), Physical properties, Chemical reactions
Cycloalkanes: Preparation, physical and chemical properties, stability of cycloalkanes(Bayer strain theory), chair and boat forms of cyclohexane.
Alkenes:, structure of double bond, geometrical isomerism, physical properties, methods of preparation, chemical reactions.
Alkadienes: Classification of dienes, Preparation of conjugated dienes, Chemical properties(1,2 and 1,4- addition to conjugated dienes).
Alkynes:, structure of triple bond, physical properties, methods of preparation Chemical properties, Acidic nature of alkynes
Aromatic Hydrocarbons:, Structure of benzene, resonance, aromaticity (Huckel's rule) Chemical properties, mechanism of electrophilic substitution direct influence of substituents in monosubustituted benzene.

19. **Environmental Chemistry:** Environmental pollution, Atmospheric pollution, Tropospheric pollution(Air pollution), Major air pollutants. Control of air pollution, Smog(Chemical and Photochemical smog), Stratospheric pollution: Ozone layer and its depletion, Acid rain, Green House Effect and Global warming, Water pollution, Soil pollution and Industrial waste.

20. **Haloalkanes and Haloarenes:** Classification, methods of preparation of haloalkanes and haloarenes, their physical properties, tests to distinguish between alkyl and aryl halides, **mechanism of SN1 and SN2 reactions**, elimination reactions (**Saytzeff Rule, E1 & E2 mechanism**).**Poly halogen compounds:** Preparation and properties.

21. **Alcohols, Phenols and Ethers:** Classification, preparation, properties and uses, tests to distinguish between primary, secondary and tertiary alcohols. Distinctions between alcohols and phenols. Preparation of ethers , physical and chemical properties.

22. **Aldehydes, Ketones and Carboxylic Acids:** Structure of carbonyl group, preparation of aldehydes and ketones, physical , Chemical properties and uses, tests to distinguish between aldehydes and ketones .Preparations of carboxylic acids preparation properties and uses.

23. **Amines (Organic compounds containing nitrogen):** Classification, Structure of amino group, preparation, Physical, Chemical properties, tests to distinguish between primary, secondary and tertiary amines

24. **Polymers:** Polymerization, Classification of polymers based on : origin, structure, molecular forces, mode of polymerization. **Addition polymerization Condensation polymerization(Step-growth polymerization)** Preparation of condensation polymers Synthetic and natural rubber and vulcanization, Determination of molecular mass of polymers:. Poly dispersity index(PDI) **Bio-degradable polymers like PHBV.**

25. **Biomolecules(Biochemistry):Carbohydrates:** Classification of carbohydrates , Structural determination of glucose and fructose on the basis of their chemical properties, Open chain (Fischer) structure, cyclic structure(**Haworth form**), □ and □ **forms of glucose, Mutarotation, anomers and epimers**, Chemical reactions of glucose, Reducing and non-reducing sugars, Configuration of glucose and fructose. Disaccharides Sucrose, **Haworth representation of disaccharides**, Polysaccharides, Starch, Cellulose, and amylopectin structures, Functions of Carbohydrates in living organisms. Carbohydrate metabolism, glycolysis, electron-transport chain,
Proteins: Amino acids, Zwitter ion, Iso-electric point, peptides and peptide bond, Fibrous proteins, Globular proteins and their functions, Primary, Secondary(Helix and pleated sheet structures) and tertiary structure of proteins, denaturation and renaturation, Enzymes, specificity and mechanism of enzyme activity , coenzymes, applications of enzymes.
Nucleic acids : Nucleosides, Nucleotides, Structure of ATP, Photosynthesis(Light and dark reactions) Primary and Secondary structure of DNA(Double Helix structure) , biological functions of nucleic acids, Replication, Protein synthesis (Transcription, Translation, mutation), genetic code, genetic errors, Vitamins, classification, diseases caused by the deficiency of vitamins, Hormones (steroid hormones and non-steroid hormones) and their functions

26. **Chemistry in Everyday life: Drugs and medicines -** designing a drug, drug metabolism, classification of drugs, enzymes as drug targets, action of drug through drug receptor interaction, types of drugs: Antipyretics, Analgesics, antiseptics, disinfectants, tranquilizers, antimicrobials, antibiotics(Narrow spectrum and broad spectrum antibiotics), antifertility drugs, antihistmmines, antacids. Chemicals in food, Food preservatives, artificial sweetening agents, Soaps and detergents, Preparation soaps(Saponification) and detergents, cleansing action of soaps, advantages of detergents over soaps, DeodorantsEdible colours, antioxidants. [==========]

Teaching Methodology :

1.Physical Science in School Curriculum

- Nature of Physical Science: Nature and Scope of Science and Physical Science in particular, Importance of Physical Science in daily life,
- Objectives of teaching-learning Physical Science at the secondary school level
- Curriculum Reforms in Science Education: Rationale, objectives, principles, designs and materials in Science, recent curricular reforms at the National and State levels (NCF 2005).

2. Methods of Teaching-learning Science

- Discovery - Nature and purpose; guided discovery strategies in teaching and learning of concepts in science.
- Experimentation- Experimentation under controlled conditions within laboratory and beyond laboratory situation; Process and limitations.
- Problem Solving- Problem identification, formulation of hypotheses, collection of data, testing hypotheses and arriving at solution.
- Demonstration-cum-Discussion
- Project – Situation analysis, selection of the project, preparation of the project proposal, implementation of the project, evaluation and reporting.
- Constructivist Approaches: Self-learning and peer learning strategies, Collaborative strategies; 5E and ICON Models

3. Curricular Activities

- Preparation of Unit Plan; Preparation of Lesson Plans (Traditional, Activity Approach and constructivist approach)
- Teaching- Learning Materials – Preparation, collection, procurement and use of teaching-learning materials in Science like, Charts, Graph, Bulletin Board, Models; ICT materials like , Filmstrips, Slides, Transparencies, TV, Audio and Video, Computer, and Internet;
- Learning Activities – Science Laboratory Activities; Field Trip, Science Club, Science Seminar, Science Exhibition
- Key Learning Resources in Science: Assessing progress and performances, Monitoring and giving feedback, Local and community resources, Using pair work, Using group work, Using questioning (both by teacher and learners) to promote thinking, Talk for learning and Involving all

4.Assessment in Science learning

- Construction of Classroom tests and Unit tests, designing blueprint, preparation of test items.
- Assessment devices; Assignments, projects work, portfolios, Observation of activities.
- Diagnosis of learning difficulties in Physical Science, Remediation of difficulties, Enrichment Programmes.
- Planning for continuous assessment of classroom learning.