

Annexure XI

(Enclosure to Notification No. 1479/SS/T9/KGBV/URS/2022, Dt:16.06.2023 of DSE & EO-SPD, TSS, Hyd.)

Syllabus of Written Test for Recruitment of PGCRTs in KGBVs

PGCRT - Chemistry

Part I - General Studies

1. Current Affairs - Regional, National & International.
2. Indian Constitution; Indian Political System: Governance and Public Policy.
3. Social Exclusion; Rights issues such as Gender, Caste, Tribe, Disability etc., and inclusive policies.
4. Society Culture, Civilization Heritage. Arts and Literature of India and Telangana
5. General Science; India's Achievements in Science and Technology
6. Environmental Issues; Disaster Management- Prevention and Mitigation Strategies and Sustainable Development.
7. Economic and Social Development of India and Telangana.
8. Socio-economic, Political and Cultural History of Telangana with special emphasis on Telangana Statehood Movement and formation of Telangana state.

Part II – Basic Proficiency in English

1. School Level English Grammar:
Articles; Tenses; Noun & Pronouns; Adjectives; Adverbs; Verbs; Modals; Subject-verb Agreement; Non-finites; Reported Speech; Degrees of Comparison; Active and Passive Voice; Prepositions; Conjunctions; Conditionals.
2. Vocabulary:
Synonyms and Antonyms; Phrasal Verbs; Related Pair of Words; Idioms and Phrases; Proverbs.
3. Words and Sentences:
Use of Words; Choosing appropriate words and words often confused; Sentence Arrangement, Completion, Fillers and Improvement; Transformation of Sentences; Comprehension; Punctuation; Spelling Test; Spotting of Errors.

Part III - Perspectives in Education

1. **History of Education:** Pre-Vedic and Post-Vedic period, Medieval period Recommendations of various Committees during British period with special reference to Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944), Recommendations of various Committees in the post independent period with special reference to Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel Committee (1977), National Policy on Education, 1968, National Policy on Education, 1986, Programme of Action, 1992 and National Educational Policy, 2020.

Aims, Objectives, Functions, Unipolar, Bipolar and Tripolar Processes of Education, Types of Education - Formal, Informal and Non-formal Education, their significance and interrelations, Philosophical, Sociological and Psychological Perspectives of Education.

2. **Teacher Education:** Concept, Teacher Preparation, NCFTE-2009, Pre-service and In service Teacher Education Programs, Teacher Motivation, Continuous Professional Development.

Teacher Empowerment: Meaning, Interventions for Empowerment, Professional Code of Conduct for Teachers, Role of Teacher Organisations in Professional Development of Teachers, National and State Level Institutions for Teacher Education.

3. **Educational Concerns in Contemporary India:**

Environmental Education: Meaning, Scope of Environmental Education, Concept of Sustainable Development, Role of Teacher, School and NGOs in Development and Protection of Environment; **Democracy and Education:** Equality, Equity, Equality of Educational Opportunities, Role of Education in promoting Democracy; **Economics of Education:** Meaning and Scope, Education as Human Capital, Education and Human Resource Development; **Population Education:** Significance of Population Education. Population situation, Approaches to Population Education and Themes of Population Education, Family Life Education, Sustainable development, Adolescence Education, Health Education, Gender Equality, Equity and Empowerment of Women, the Role of School and Teacher, Urbanization and Migration, Life Skills; **Inclusive Education:** Concept, Prevalence, Areas of Disabilities, Disadvantaged Groups, Gender etc., Myths & Facts, Importance of Early Identification and Assessment, Planning Inclusive

Education, Initiatives in Education, Method & Strategies of Classroom Management, Psycho-Social Management, Creation of Awareness – Students, Parents and Society & Sensitization Strategies, Evaluation, Documentation and Maintenance of Records; **Liberalization, Privatization and Globalization; Value Education; Initiatives in Education:** Sarva Siksha Abhiyan (SSA), National Programme for Education of Girls at Elementary Level (NPEGEL), Mid-day-Meal Programme, Rashtriya Madhyamika Siksha Abhiyan (RMSA), Samagra Shiksha and its interventions, KGBVS and Model Schools etc.

4. Constitutional Provisions relevant to Education: Acts/Rights, Right of Children to Free and Compulsory Education Act, 2009, Right to Information Act 2005, Child Rights, Human Rights, PWD Act, 2016 and other Provisions pertaining to Education.
5. National Curriculum Framework, 2005 and NCFSE, 2023.

Part IV - Content

Inorganic chemistry:

1. **Atomic Structure:** Sub-atomic particles, Atomic models- Rutherford's nuclear model of atom, Developments to the Bohr's model of atom, Bohr's model for hydrogen atom. Towards quantum mechanical model of the atom. Quantum mechanical model of an atom. Important features of quantum mechanical model of atom-orbitals and quantum numbers-shapes of atomic orbitals-energies of orbitals-filling of orbitals in atoms. Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity-Electronic configurations of Atoms-Stability of half-filled and completely filled orbitals.
2. **Classification of Elements and Periodicity in Properties:** Need to classify elements, Genesis of periodic classification, Modern periodic law and present form of the periodic table, Electronic configuration of elements and the periodic table, Nomenclature of elements with atomic number greater than 100, Electronic configuration and types of elements s, p, d and f blocks. Trends in physical Properties- Periodic trends in chemical properties- Periodic trends and chemical reactivity
3. **Chemical Bonding and Molecular Structure:** Kossel - Lewis approach to chemical bonding, Ionic or electrovalent bond, Bond Parameters, The Valence Shell Electron Pair Repulsion (VSEPR) theory. Valence bond theory, Hybridisation, Coordinate bond, Molecular orbital theory -bonding in some homonuclear diatomic molecules, Hydrogen bonding
4. **Hydrogen and its Compounds**

Position of hydrogen in the periodic table, Dihydrogen-occurrence and isotopes,

Preparation of dihydrogen, Properties of dihydrogen, Hydrides: Ionic, covalent, and non-stoichiometric hydrides, Water: Physical properties; structure of water, ice chemical properties of water; hard and soft water, temporary and permanent hardness of water, Hydrogen peroxide: Preparation; physical properties; structure and chemical properties; storage and uses. Heavy water, Hydrogen as a fuel

5. **General Principles of Metallurgy**

Occurrence of Metals, Concentration of Ores, Extraction of Crude Metal from Concentrated Ore, Thermodynamic Principles of Metallurgy, Electrochemical Principles of Metallurgy, Oxidation – Reduction, Refining, Uses of Aluminium, Copper, Zinc and Iron

6. **s- Block elements (Alkali and Alkaline Earth Metals)**

Group 1 Elements:

Alkali metals; Electronic configurations; atomic and ionic radii; ionization enthalpy; hydration enthalpy: physical properties; chemical properties; uses, General characteristics of the compounds of the alkali metals: oxides; halides; salts of oxy acids, Anomalous properties of Lithium: Some important compounds of Sodium: Sodium carbonate; Sodium chloride; Sodium hydroxide; Sodium hydrogen carbonate. Biological importance of Sodium and Potassium.

Group 2 Elements:

Alkaline earth elements; Electronic configuration; ionization enthalpy; hydration enthalpy; physical properties; chemical properties; uses, General characteristics of compounds of the Alkaline earth metals. oxides, hydroxides, halides, salts of oxyacids (carbonates, sulphates and nitrates), Anomalous behaviour of beryllium; its diagonal relationship with aluminium, Some important compounds of calcium, Biological importance of calcium and magnesium

7. **p-Block Elements – Group 13 (Boron Family)**

General introduction - Electronic configuration, atomic radii, ionization enthalpy, electro negativity; physical & chemical properties, Important trends and anomalous properties of Boron, Some important compounds of Boron - borax, ortho boric acid, diborane, Uses of Boron, Aluminium and their compounds

8. **p-Block Elements - Group 14 (Carbon Family)**

General introduction - Electronic configuration, atomic radii, ionization enthalpy, electro negativity; physical & chemical properties, Important trends and anomalous properties of Carbon, Allotropes of Carbon, Uses of Carbon, Some important

compounds of Carbon and Silicon - Carbon monoxide, Carbon dioxide, Silica, Silicones, Silicates and Zeolites

9. **p-Block Elements**

Group -15 Elements

Introduction, Dinitrogen, Ammonia, Oxides of nitrogen, Nitric acid, Phosphine
Phosphorous-allotropic forms, Phosphorous Halides, Oxoacids of Phosphorus

Group -16 Elements

Introduction, Dioxygen, Simple Oxides, Ozone, Sulphur-Allotropic forms, Sulphur dioxide, Oxoacids of Sulphur, Sulphuric Acid

Group -17 Elements

Introduction, Chlorine, Hydrogen Chloride, Oxoacids of Halogens, Interhalogen Compounds

Group -18 Elements

Introduction- Occurrence, Electronic Configuration, Ionisation Enthalpy, Atomic radii, Electron Gain Enthalpy Physical and Chemical Properties

10. **d and f Block Elements and Coordination Compounds**

Position in the Periodic Table, Electronic Configuration, General Properties of The Transition Elements (d-Block), Some Important Compounds of Transition Elements Inner Transition Elements (f-Block), The Actinoids, Some Applications of d- and f-Block Elements, Werner's Theory of Coordination Compounds, Definitions of Some Terms used in Coordination Compounds, Nomenclature of Coordination Compounds, Isomerism in Coordination Compounds, Bonding in Coordination Compounds, Bonding in Metal Carbonyls, Stability of Coordination Compounds, Importance and Applications of Coordination Compounds

Physical chemistry:

11. Stoichiometry: Some basic concepts, Laws of chemical combinations, Gay Lussac's law of Gaseous volumes, Dalton's atomic theory, Avogadro law, Atomic and molecular masses- mole concept and molar mass concept of equivalent weight, Percentage composition of compounds and calculations of empirical and molecular formulae of compounds, Stoichiometry and stoichiometric calculations, Methods of expressing concentrations of solutions, Redox reactions, Oxidation number concept, Types of redox reactions, Balancing of redox reactions - oxidation number, method-half reaction (ion-electron) method, Redox reactions in titrimetry

12. States of Matter: Gases and Liquids:

Intermolecular forces, Thermal energy, Intermolecular forces Vs Thermal interactions. The gaseous state, The gas laws, Ideal gas equation, Graham's law of diffusion - Dalton's law of partial pressures, Kinetic molecular theory of gases, Kinetic gas equation of an ideal gas (no derivation)- Deduction of gas laws from kinetic gas equation, Distribution of molecular speeds - rms, average and most probable speeds-kinetic energy of gas molecules, Behaviour of real gases - deviation from ideal gas behaviour -compressibility factor Vs pressure diagrams of real gases, Liquefaction of gases, Liquid state - properties of liquids in terms of inter molecular interactions - vapour pressure, viscosity and surface tension (Qualitative idea only, no mathematical derivation)

13. Solid State

General Characteristics of Solid State, Amorphous and Crystalline Solids, Classification of Crystalline Solids, Probing the structure of solids: X-ray crystallography, Crystal Lattices and Unit Cells, Number of Atoms in a Unit Cell

Close Packed Structures, Packing Efficiency, Calculations Involving Unit Cell Dimensions, Imperfections in Solids, Electrical Properties, Magnetic Properties

14. Solutions

Types of Solutions, Expressing Concentration of Solutions, Solubility, Vapour Pressure of Liquid Solutions, Ideal and Non-Ideal Solutions Colligative Properties and Determination of Molar Mass, Abnormal Molar Masses

15. Electrochemistry and Chemical Kinetics

Electrochemistry

Electrochemical Cells, Galvanic Cells, Nernst Equation, Conductance of Electrolytic Solutions, Electrolytic Cells and Electrolysis, Batteries, Fuel Cells, Corrosion

Chemical Kinetics

Rate of a Chemical Reaction, Factors Influencing Rate of a Reaction, Integrated Rate Equations, Pseudo First Order Reaction, Temperature Dependence of the Rate of a Reaction, Collision Theory of Chemical Reaction Rates

16. Surface Chemistry

Adsorption, Catalysis, Colloids, Classification of Colloids, Emulsions, Colloids around Us

17. Chemical Equilibrium and Acids and bases: Equilibrium in physical process, Equilibrium in chemical process-dynamic equilibrium, Law of chemical equilibrium - Law of mass action and equilibrium constant, Homogeneous equilibria, equilibrium constant in gaseous systems, relationship between K_p and K_c , Heterogeneous

equilibria, Applications of equilibrium constant, Relationship between equilibrium constant 'K', reaction Quotient 'Q' and Gibbs energy 'G', Factors affecting equilibria, - Le-chatelier's principle, application to industrial synthesis of Ammonia and Sulphur trioxide, Ionic equilibrium in solutions. Acids, Bases and Salts- Arrhenius, Bronsted-Lowry and Lewis concepts of Acids and Bases, Ionisation of Acids and Bases, Buffer solutions, Solubility equilibria of sparingly soluble salts, Solubility product constant-common ion effect on solubility of Ionic salts

- 18. Thermodynamics:** Thermodynamic terms, Applications-work-enthalpy-extensive and intensive properties-heat capacity, Measurement of "U and H": Calorimetry, Enthalpy change, 'ΔH' of reactions, Enthalpies for different types of reactions, Spontaneity, Gibbs Energy change and equilibrium, Absolute entropy and the third law of thermodynamics.

Organic Chemistry:

19. Organic Chemistry – Some Basic Principles and Techniques

General introduction, Tetravalency of Carbon: shapes of organic compounds, Structural representations of organic compounds, Classification of organic compounds, Nomenclature of organic compounds, Isomerism, Fundamental concepts in organic reaction mechanisms, Methods of purification of organic compounds, Qualitative elemental analysis of organic compounds, Quantitative elemental analysis of organic compounds,

Hydrocarbons

Classification of hydrocarbons,

Alkanes - Nomenclature, isomerism (structural and conformations of Athane only), preparation of alkanes -properties of alkanes

Alkenes- Nomenclature, structure of ethene, isomerism (structural and geometrical)-methods of preparation of Alkenes-properties of Alkenes

Alkynes- Nomenclature and isomerism, structure of Acetylene, methods of preparation of Acetylene-physical properties and chemical reactions of Alkynes

Aromatic Hydrocarbons: Nomenclature and isomerism, structure of benzene, resonance and aromaticity-preparation of benzene physical and chemical properties of benzene-directive influence of functional groups in mono substituted benzene. Carcinogenicity and toxicity

20. Haloalkanes and Haloarenes

Classification, Nature of C-X bond, Methods of Preparation, Physical Properties, Chemical Reactions, Polyhalogen Compounds

21. Organic Compounds containing C, H and O

Alcohols, Phenols, Ethers

Classification, Nomenclature, Structures of Functional Groups, Alcohols and Phenols, Physical Properties, Chemical Reactions, Some Commercially Important Alcohols, Ethers

Aldehydes and Ketones

Nomenclature and Structure of Carbonyl Group, Preparation of Aldehydes and Ketones, Physical Properties, Chemical Reactions, Uses of Aldehydes and Ketones

Carboxylic Acids

Nomenclature and Structure of Carboxyl Group, Methods of Preparation of Carboxylic Acids, Physical Properties, Chemical Reactions, Uses of Carboxylic Acids

22. Organic Compounds containing Nitrogen

Amines

Structure of Amines, Classification, Nomenclature, Preparation of Amines, Physical Properties, Chemical Reactions

Diazonium Salts

Method of Preparation of Diazonium Salts, Physical Properties, Chemical Reactions, Importance of Diazonium Salts in Synthesis of Aromatic Compounds

Cyanides and Isocyanides

Structure of cyanides and isocyanides, Preparation

23. Polymers

Classification of Polymers, Types of Polymerization Reactions, Molecular Mass of Polymers, Biodegradable Polymers, Polymers of Commercial Importance

24. Biomolecules

Carbohydrates, Proteins, Enzymes, Vitamins, Nucleic acids, Hormones

25. Environmental Chemistry

Definition of terms: Air, Water and Soil Pollutions, Environmental pollution, Atmospheric pollution, Acid rain: Particulate pollutants, Stratospheric pollution, Water pollution, Soil Pollution: Pesticides, industrial wastes. Strategies to control environmental pollution, Green chemistry

26. Chemistry in everyday life

Drugs and their Classification, Drug-Target Interaction, Therapeutic Action of Different Classes of Drugs, Chemicals in Food, Cleansing Agents

Part V- Pedagogy

1. Nature of Physical Sciences

Science as a particular way of looking at nature, a rapidly expanding body of knowledge, an interdisciplinary area of learning, always tentative, an approach to investigation and as a Process of constructing knowledge.

- i. Scientific Method: Observation, inquiry, hypothesis, experimentation, data collection, generalization.
- ii. How Science Works, how children learn science?

2. Science and Society – Historical Development

- i. Physical science for environment, health, peace, equity (Gender & Science) and Inclusion.
- ii. Need and Significance of History of science in teaching science – Historical development perspective of Science.
- iii. Contributions of Scientists– Isaac Newton, John Dalton, J.C. Bose, Albert Einstein, Niels Bohr, C.V. Raman, Louis Victor de Broglie, Bimla Buti, Venkataraman Ramakrishnan, APJ Abdul Kalam, Marie Curie.

3. Aims of Learning Physical Science

- i. Aims of Learning Science
- ii. Knowledge and Understanding through Science
- iii. Nurturing Process Skills of Science, Curiosity, Creativity and Aesthetic Sense
- iv. Development of Scientific Attitude and Scientific Temper- Respect for evidence, Open-mindedness, Truthfulness in reporting observations, Critical thinking, Logical thinking, Skepticism, Objectivity, Perseverance – Notion of Popular Science – Its importance and involvement of science teacher.
- v. Relating Physical Science Education to Natural and Social Environment, Technology, Society and Environment.
- vi. Imbibing the Values Through Science Teaching – Feynman’s Perspective of Science values
- vii. Development of Problem Solving Skills

4. Learning objectives of physical science

- i. Meaning of Learning Objectives
- ii. Developing Learning Objectives, Features of well-developed learning objectives.
- iii. Bloom’s Taxonomy, Anderson and Krathwohl’s Taxonomy
- iv. Writing Learning Objectives, Remembering, Understanding, Applying, Analysing, Evaluating, Creating

- v. Learning Objectives for Upper Primary, Secondary and Higher Secondary Stages
- vi. Learning Objectives in the Constructivist Perspective
- vii. Academic Standards in Physical Science

5. Pedagogical Shift in Physical Science

- i. Pedagogical Shift:
 - a. Science as Fixed Body of Knowledge to the Process of Constructing Knowledge
 - b. Nature of Science
 - c. Learners learning and teacher
 - d. Physical Science curriculum, Diversity in class, Approaches
 - e. Planning Teaching-Learning Experiences
 - f. Assessment
 - g. Inclusion- Information and Communication Technology (ICT)
 - h. Professional development
- ii. Democratising Science Learning: Critical Pedagogy- Critical pedagogy and role of Teachers.
- iii. Content-cum-methodology: Meaning, Concept & Nature
- iv. Steps to Content-cum-methodology
 - v. Steps to Pedagogical Analysis
 - vi. Content and Teaching Skills

6. School Curriculum in Physical Science

- i. History of Development of Curriculum Framework
- ii. Curriculum Framework, Curriculum and Syllabus
- iii. Curriculum Development; From Subject-centred to Behaviourist to Constructivist Approach,
- iv. Recommendations of NCF-2005 and APSCF-2011 on Science Curriculum-National Focus Group position paper on Science and State position paper (2011) on Science
- v. Print Resources- Textbooks, Popular science books, Journals and magazines
- vi. Dale's Cone of Experience- Using the Cone of Experience
- vii. Teacher as Curriculum Developer – Localized curriculum, place for Artisans knowledge systems in curriculum, local Innovators and Innovative Practices of science.

7. Approaches and Strategies for Learning Physical Science

- i. Approaches and Strategies for Learning Physical Science, Difference between approach and strategy.
- ii. Different approaches and strategies of learning
 - a. Scenario from 1950–1980
 - b. Post 1980 Scenario
 - c. Selecting appropriate approach and strategy
- iii. Essential components of all approaches and strategies
- iv. Constructivist Approach – Science teaching strategies – State developed model.
 - v. 5E Learning Model
- vi. Collaborative Learning Approach (CLA)
 - a. Steps of collaborative approach
 - b. Ensuring meaningful learning through CLA
 - c. Ways of applying collaborative learning approach
 - d. Limitation of collaborative learning approach
- vii. Problem Solving Approach (PSA)
 - a. Steps in problem solving approach,
 - b. Teacher's role in problem solving approach,
 - c. Problem solving approach: an example
- viii. Concept Mapping- Phases of the concept mapping, Uses of concept maps
- ix. Experiential Learning- Abilities of an experiential learner

8. Learning Resources – Community, ICT and Laboratory

- i. Using Community Resources- Bringing community to the class, Taking class to the community: Field visit
- ii. Pooling of Learning Resources
 - a. Learning Resources from Immediate Environment (Natural pH indicators, Soaps and detergents, Baking soda, Washing soda, Common salt, Fruits, Fibre, Pulleys, Projectiles, Lenses and Mirrors, Inter-conversion of one form of energy to other, Propagation of waves in Solid, Liquid and Gas)
 - b. Improvisation of Apparatus
 - c. Inexpensive Sources of Chemicals
- iii. Science Kits
- iv. Laboratory as a Learning Resource- Approaches to laboratory work, Planning and organising laboratory work, Working in group in the laboratory
- v. Handling Hurdles in Utilization of Resources – Addressing underutilization of resources.
- vi. ICT resources – e-Text books, Journals, Websites, Magazines, Different forms of ICT and its applications in science education- Audio-aids, Video-aids, Audio-Video aids,

educational T.V., Use of computer for simulations, internet and Open Educational Resources

9. Planning for Teaching-Learning of Physical Sciences

- i. Planning - Annual Plan, Unit Plan and Period plan
- ii. Identification and Organisation of Concepts for teaching -learning of science / Physics and Chemistry (Motion, Work and Energy, Matter and their Measurements, Carbon and its Compounds, Periodic Properties of Elements, Atomic Structure, Dual Nature of Matter and Radiation).
- iii. Elements of a Physical Science Lesson- Learning objectives and key concepts, Pre-existing knowledge, Teaching-learning materials and involving learners in arranging them, Introduction, Presentation/ Development, Assessment: Acceptable evidences that show learners understand (i) Determining learning evidences (ii) Planning of the acceptable evidences of learning for assessment Extended learning/assignment.
- iv. Making Groups-Why group learning? Facilitating formation of groups
- v. Planning and Organising Activities in Physical Science
- vi. Planning Laboratory Work – State commitments in organizing experiments Text-book orientation.
- vii. Planning ICT Applications - Integrating ICT in teaching and learning process

10. Physical Science Teacher

- i. Characteristics and role Science Teacher
- ii. Professional Development
- iii. Reflective Practices
- iv. Science Teacher as a Researcher

11. Tools and Techniques of Assessment

- i. Test, Examination, Measurement, Assessment and Evaluation.
- ii. Continuous and Comprehensive Evaluation (CCE)- Educational assessment and educational evaluation, Performance-based assessment: A flexible way of school based assessment.
- iii. Assessment Framework,
 - (a) Purpose of assessment
 - (b) Learning Indicators (LI);
 - Types of indicators
 - Illustrations of Learning Indicators,
- Assessment of activity

- Assessment of presentation
 - Assessment of group work
 - Assessment of collaborative learning
 - (c) Tools and Techniques of Assessment;
 - Written test
 - Project Work
 - Field trips and field diary
 - Laboratory work
 - Interview/Oral test
 - Journal writing.
 - (d) Recording and Reporting
 - Measurement of students' achievements
 - grading system
 - Measurement of process skills
 - Measurement of attitudes
 - Portfolios
 - (e) Reflecting Process; Assessment as a reflecting process
- iv. Assessment of Learning of Students with Special Needs.