

Government of Andhra Pradesh
Department of School Education
State Council of Educational Research & Training
Category of Post: PGT
Paper II – Chemistry Syllabus

Part – I

General Knowledge and Current Affairs (Marks: 10)

Part – II

Perspectives in Education (Marks: 10)

1. History of Education :

- The Education in Ancient India - Pre-Vedic and Post-Vedic period, Medieval Education.
- Education in Pre Independent era - Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944).
- Education in Post Independent era - Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel committee (1977), NPE-1986, POA-1992

2. Teacher Empowerment:

- Need, interventions for empowerment, Professional code of conduct for teachers, Teacher motivation, Professional development of Teachers and Teacher organizations, National / State Level Organizations for Teacher Education, Maintenance of Records and Registers in Schools.

3. Educational Concerns in Contemporary India:

- Democracy and Education, Equality, Equity, Quality in Education, Equality of Educational opportunities.
- Economics of Education, Education as Human Capital, Education and Human Resource Development, Literacy - Saakshar Bharat Mission.
- Population Education, Gender - Equality, Equity and Empowerment of Women, Urbanization and migration, Life skills.
- Adolescence Education
- Value Education – More Value and Professional Ethics in Education.
- Health and Physical Education
- Inclusive Education - Classroom Management in Inclusive Education
- Role of Education in view of Liberalization, Privatization and Globalization
- Programmes and Projects – APPEP, DPEP, Sarva Siksha Abhiyan, National Programme for Education of Girls at Elementary Level (NPEGEL), Rashtriya Madhyamika Siksha Abhiyan(RMSA), Rashtriya Aveshekar Abhiyan (RAA), KGBVs, Model Schools.
- Incentives and special provisions – Mid Day Meals, Free Books, Scholarship, Awards, Welfare Hostels, Transportation.
- Current Trends in Education – Badi pelusthondi, Badi ki Vasta, Mavuru – Mana Badi, Vidyanjali, Swacha Patasala, Inspire, Kalavutsav.

4. Acts / Rights:

- Right of Children to Free and Compulsory Education Act - 2009
- Right to Information Act - 2005
- Child Rights

- Human Rights.
5. **National Curriculum** - Framework, 2005: Perspective, Guiding Principles, Learning and Knowledge, Teaching Learning Process, Assessment, Systemic Reforms.

Part - III

Educational Psychology (Marks: 10)

1. Development Of Child

- Development, Growth & Maturation — Concept & Nature
- Principles of development and their education implication
- Factors influencing Development — Biological, Psychological, Sociological, emotional.
- Dimensions of Development and their interrelationships — Physical & Motor, Cognitive, Emotional, Social, Moral, Language relating to Infancy, early Childhood, late Childhood, adolescence.
- Understanding Development — Piaget, Kohlberg, Chomsky, Carl Rogers, Erikson
- Individual differences — Intra & Inter Individual differences in the areas of Attitudes, Aptitude, Interest, Habits, Intelligence and their Assessment.
- Development of Personality — Concept, Factors effecting development of personality, self concept.
- Adjustment, Behavioural problems, Mental Health, Defense mechanism.
- Methods and Approaches of Child Development — Introspection, Observation, Interview, Case study, Experimental, Cross sectional and Longitudinal
- Developmental tasks and Hazards

2. Understanding Learning

- Concept, Nature of Learning — input — process — outcome
- Factors of Learning — Personal and Environmental
- Approaches to Learning and their applicability—Behaviorism (Skinner, Pavlov, Thorndike) Constructivism (Piaget, Vygotsky), Gestalt(Kohler, Koffka) and Observational (Bandura)
- Dimensions of Learning — Cognitive, Affective and Performance.
- Motivation and Sustenance —its role in learning.
- Memory & Forgetting
- Transfer of Learning

3. Pedagogical Concerns

- Teaching and its relationship with learning and learner.
- Learners in Contexts: Situating learner in the socio-political and cultural context
- Children from diverse contexts—Children With Special Needs (CWSN), Inclusive Education.
- Understanding of pedagogic methods — Enquiry based learning, Project based learning, Survey, Observation and Activity based learning, Cooperative and collaborative learning.
- Individual and Group learning: Issues and concerns with respect to organizing learning in class room like Study habits, Self learning and Learning to learn skills.
- Organizing learning in heterogeneous class room groups — Socio-economic background, Abilities and Interest.
- Paradigms of organizing Learning-Teacher centric, Subject centric and Learner centric.
- Theory of instruction – Bruner
- Teaching as Planned activity — Elements of Planning
- Phases of Teaching — Pre active, Interactive and Post active

- General and Subject related skills, competencies required in teaching and attributes of good facilitator.
- Learning resources — Self, Home, School, Community, Technology.
- Class room Management: Role of student, teacher, Leadership style of teacher, Creation of non threatening learning environment, Managing behaviour problems, Guidance & Counselling, Punishment and its legal implications, Rights of a child, Time Management.
- Distinction between Assessment for Learning & Assessment of Learning, School based Assessment, Continuous & Comprehensive Evaluation : Perspective & Practice.
- Understanding teaching & learning in the context of NCF, 2005 & Right to Education Act, 2009.

Part - IV

Content (Marks: 50)

I. General Chemistry:

Atomic Structure and elementary quantum mechanics: Blackbody radiation, Planck's radiation law, photoelectric effect, Compton Effect, de Broglie's hypothesis, Heisenberg's uncertainty principle. Postulates of quantum mechanics, Schrodinger wave equation and a particle in a box, energy levels, wave functions and probability densities, Schrodinger wave equation for H-atom, Separation of variables, Radial and angular functions, hydrogen like wave functions, quantum numbers and their importance Chemical Bonding: Valence bond theory, Hybridization, VB theory as applied to ClF_3 , BrF_5 , $\text{Ni}(\text{CO})_4$, XeF_2 , Dipole moment, Molecular orbital theory. Stereochemistry of carbon compounds: Stereo isomerism, Stereo isomers: enantiomers, diastereomers - Conformational and Configurational isomerism-Conformational, Enantiomers, Optical activity asymmetric and dissymmetric molecules, General Principles of Inorganic qualitative analysis: Molecular symmetry: Concept, types, The symmetry operations of a molecule form a group, Theory of quantitative analysis Principles of volumetric, gravimetric analysis, introductory treatment to Pericyclic Reactions.

II. Inorganic chemistry:

Periodicity and Periodic Properties, s,p,d, and f block elements Theories of bonding in metals: Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators. Metal carbonyls and related compounds – EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni, Metal nitrosyls and metallocenes Coordination Chemistry: IUPAC nomenclature, bonding theories, Isomerism in coordination compounds – structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers. Spectral and magnetic properties of metal complexes, Reactivity of metal complexes, Stability of metal complexes: Hard and soft acids bases (HSAB): Classification, application of HSAB principles – Stability of compounds / complexes. Bioinorganic chemistry: Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride, Metalloporphyrins – haemoglobin, structure and function, Chlorophyll, structure and role in photosynthesis.

III. Organic Chemistry:

Structural theory in Organic Chemistry, Bond polarization, Alicyclic hydrocarbons Cycloalkanes Benzene and its reactivity, Concept of resonance, resonance energy, Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene, Concept of aromaticity, Huckel's rule. Application to Benzenoid (Benzene, Napthalene) and Non Benzenoid compounds (cyclopropenyl

cation, cyclopentadienyl anion and tropylium cation) Reactions. General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation, Orientation of aromatic substitution. Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic).

Orientation effect of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and Sulfonic acid groups. (iii). Halogens (Explanation by taking minimum of one example from each type). Halogen compounds, Hydroxy compounds - Polyhydroxy compounds: Carbonyl compounds, Physical and chemical properties Base catalysed reactions with mechanism: Aldol, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes: BaeyerVilliger oxidation of ketones with mechanism. Reduction: Wolf Kishner reduction, MPV reduction, reduction with LiAlH₄ and NaBH₄ Analysis of aldehydes and ketones. Carboxylic acids and derivatives physical and chemical properties, Active methylene compounds Acetoacetic esters: Malonic ester: Synthetic applications, inter conversion: Nitrogen compounds: Carbohydrates: Amino acids and proteins

IV. Physical Chemistry:

Liquid state: Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases, Liquid crystals, the mesomorphic state, Classification of liquid crystals into Smectic and Nematic, Differences between liquid crystal and solid/liquid, Application of liquid crystals as LCD devices. Solid state: Classification of solids, crystalline state, seven crystal systems, close packed structure of solids, nearest neighbours, ionic radii, simple ionic compounds, point defects. Solutions: Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions, Vapour pressure, composition and vapour pressure-temperature curves. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation, partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature, immiscible liquids and steam distillation, Nernst distribution law, Calculation of the partition coefficient, Applications of distribution law; Catalysis: Types of catalysis, Electrochemistry: Electro chemical cells and cell reactions. Electrode potentials, Nernst equation and its relation to DG, Electrochemical series, emf of galvanic cells, Faraday's laws of electrolysis: Electrolytic conductance, specific, equivalent and molar conductance, Kohlrausch's law: concentration cells. Chemical kinetics: Rates of chemical reactions, order of reactions- first, second, third and zero order reactions with examples, effect of temperature on rate of reaction, Thermodynamics.

V. Chemistry And Industry:

Physico Chemical methods of analysis, Separation techniques Spectrophotometry, spectroscopy, Spectral interpretation, Drugs, formulations, pesticides and green chemistry, Macromolecules, Material Science and catalysis

Teaching Methodology (Marks: 20)

1. The Nature of Science: Nature and scope of science, Science, ideology and Society, Structure of Science (a) Substantive structure – Empirical knowledge, Theoretical Knowledge – (Facts, Concepts, hypothesis, theory, Principle Law), (b) Syntactic Structure of Science – Scientific inquiry, Processes of Science, Attitudes of inquiry.

2. The History and Development of Science: A brief introduction to oriental and western science, Contribution of the following Scientists in the Development of Science: Aryabhata, BhaskaraCharya, Aristotle, Copernicus, Newton, Einstein, C.V.Raman, Various organizations working for the development of science in India.
3. Aims and Values of teaching Physical Sciences: Aims of teaching Physical Sciences, Values of teaching Physical Science, Correlation of Physics and with other subjects.
4. Objectives of teaching Physical Sciences: Meaning and importance of objectives, Bloom's Taxonomy of Educational objectives, Specific /Behavioral objectives / (Instructional objectives), Critique on Bloom's Taxonomy.
5. Approaches and Methods of teaching Physical Sciences: Inductive and Deductive Approaches, Micro Teaching, Team Teaching, Lecture Method, Lecture cum Demonstration Method, Historical Method, Heuristic Method, Project Method, Laboratory method, Problem Solving Method, Scientific Method, Multimedia Approach in Teaching Learning process, Programmed Learning, CAI and CAL.
6. Planning for effective instruction in Science: Year Plan, Unit Plan, Lesson Plan, Learning experience, characteristics, classification, source and relevance.
7. Teaching Learning Material (TLM): Characteristics and Importance of TLM, Classification and Types of TLM, Hardware and Software in TLM, TLM Principles to be followed, Edgar Dale's cone of learning experience.
8. Science laboratories: Importance of Practical work in science, Planning of Science laboratories, Procurement, care and maintenance of laboratory equipment, Registers, Management of safety and science kits, Development of improvised Apparatus.
9. Physical Science Curriculum: Principles of Curriculum Construction, Defects in the existing school science curriculum, Qualities of a good Science Text Book.
10. Non-formal Science Education: Science Clubs, Science Fairs – purposes, levels, organization, advantages, Science Library, Role of NGOs and State in popularizing Science.
11. Evaluation: Concept and Process of Evaluation, Tools of Evaluation, Preparation of Scholastic Achievement Test (SAT), Analysis and interpretation of Scores.