

**FURTHER DETAILS REGARDING MAIN TOPICS OF
PROGRAMME No. 05/2019 (Item No.4)**

CHEMICAL ASSISTANT

GROUND WATER DEPARTMENT

(Category No.440/2016)

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PART - I

General Knowledge, Current Affairs & Renaissance in Kerala

Salient Features of Indian Constitution

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

Social Welfare Legislations and Programmes

Social Service Legislations like Right to Information Act, Prevention of atrocities against Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

RENAISSANCE IN KERALA

Towards A New Society

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories, printing press etc.

Efforts To Reform The Society

(A) Socio-Religious reform Movements

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

(B) Struggles and Social Revolts

Upper cloth revolts.Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha. Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act .Malyalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

Role Of Press In Renaissance

Malayalee, Swadeshabhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, AI-Ameen, Prabhatham, Yukthivadi, etc

Awakening Through Literature

Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam, Nataka Prashtanam*, Library movement etc

Women And Social Change

Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu.Akkamma Cheriyar, Anna Chandi, Lalithambika Antharjanam and others

Leaders Of Renaissance

Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali.Chattampi Swamikal, Brahmananda Sivayogi, Vagbhadananda, Poikayil Yohannan(Kumara Guru) Dr Palpu, Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chaavra, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr.Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad, Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan. Swami Ananda Theerthan , M C Joseph, Kuttippuzha Krishnapillai and others

Literary Figures

Kodungallur Kunhikkuttan Thampuran, KeralaVarma Valiyakoyi Thampuran, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

PART – II

Inorganic Chemistry

Atomic spectrum of Hydrogen, Rydberg equation, Bohr Theory, Schrodinger wave equation

Chemical bonding, Lattice energy – Born Haber Cycle, Fajan’s rules, electro negativity scales, dipole moment, Hydrogen bond, Hybridisation, VSEPR theory, LCAO method

Chemical periodicity

Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.

Main group elements and their compounds: Allotropy, structure and bonding, industrial importance of the compounds

Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties

Inner transition elements: spectral and magnetic properties

Organometallic compounds: synthesis, bonding and structure, and reactivity.

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine.

Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis, carbon dating and rock dating.

Physical Chemistry

Basic principles of quantum mechanics: Postulates; exactly-solvable systems
States of matter-Gaseous state, Ideal gas equation, Deviation from ideal behaviour- Solid state, Space lattice, Laws of Crystallography, X-ray diffraction-
Liquid state

Chemical thermodynamics: Laws, state and path functions and their applications; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities

Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance - Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations, reference electrodes.

Chemical kinetics: Empirical rate laws and temperature dependence; collision and transition state theories of rate constants; Order and molecularity; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

Colloids and surfaces: Stability and properties of colloids

Ionic Equilibrium: Concepts of Acids and Bases, ionization of weak electrolytes. pH, Buffer solutions, Henderson equation. Hydrolysis of salt

Organic Chemistry

Stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds

Examples-Optical and Geometrical isomerism.

Aromaticity: Benzenoid and non-benzenoid compounds

Organic reactive intermediates Reaction Intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes.

Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species.

Common named reactions and rearrangements

Chemistry of natural products: Carbohydrates, proteins and peptides, Oils and fats, nucleic acids, terpenes, steroids and alkaloids, Vitamins.

Analytical Principles and Instrumental Methods

Principles of volumetric analysis - primary standard - standard solutions normality and molarity, molality, theory of acid-base titrations, permanganometric and dichrometric titrations, iodometry and complexometric titrations, gravimetric analysis, Theory of acid-base indicator, redox indicators, adsorption and metallochromic indicators. Principles of colorimetric titration. Principle of chromatography.

Evaluation of analytical data - accuracy and precision, classification of errors. Detection and correction of determinate errors, standard deviation, variance and coefficient of variation.

Principles of UV-Visible, Infrared and NMR Spectroscopy, Application of HPLC, GC and Mass spectrometry.

Chemistry in Everyday life

Polymers-classification, commercially important polymers, bio degradable polymers

Dyes-Classification and applications

Drugs-Antipyretic, analgesic, antiseptic, antibiotic, tranquilisers

Pesticides and chemical fertilisers, soaps and detergents, food preservatives, artificial sweeteners.

BIOCHEMISTRY AND BIOLOGY

Scope and importance of bio chemistry in agriculture – Plant cell organelles-structure and function – photosynthesis ,C3,C4 and CAM pathways, photo respiration – bio chemistry of nitrogen fixation – nitrate assimilation – sulphate reduction and amino acid formation – bio chemistry of seed germination and development – fruit ripening- phytohormones – vitamins and enzymes- bioenergetics-

Biochemistry of soil humus formation - nutrients transformation – N,P,S; trace metal interaction with humic substances- significance of chelation reactions in soil – reactive functional groups of humic substances – clay – organic matter complexes – humus – pesticides interactions in soil

Soil microbial biomass – root - soil interface – microbiology and biochemistry of root soil interface – soil enzymes – microbial transformation of nutrients in soil – biofertilizers – biowaste management

INTRODUCTIN TO SOILS - SOIL FERTILITY AND FERTILISER USE

Rocks and minerals – weathering and soil formation – soil physical properties- soil texture- soil structure- bulk density – particle density –porosity- soil colour- soil consistency- soil water- retention and movement of soil water- soil temperature and soil air- soil colloids- CEC and AEC – soil organic matter- carbon cycle- soil fertility and nutrient management- soil quality indicators- assessment of soil health- soil health card- soil bio remediation

Problem soils- acidic-,saline, sodic and physically degraded soil- management of problem soil- types of soil erosion and measures to conserve.

Soil fertility and soil productivity, nutrient sources – fertilizers and manures; essential plant nutrients – functions and deficiency symptoms

Fertilizer nitrogen, Fertilizer phosphorus, Fertiliser Sulphur, Micronutrient fertilizers – Sources, Forms, Use and Management

Fertiliser use efficiency

Soil fertility evaluation – various methods

Instrumental Analysis in agriculture- Potentiometry, Conductometry, Spectrophotometry, Chromatographic techniques, Atomic Absorption, flame photometry, Mass spectrometry and X- ray diffractometry.

SOIL PHYSICS

Soil texture- soil consistence- soil structure – densities of soil

Soil water: content and potential, soil water retention, soil- water constants, measurement of soil water content, energy state of water, soil water potential, soil- moisture characteristics curve ; hysteresis , measurement of soil- moisture potential.

Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.

Infiltration - Soil air- oxidation reduction potential – mode of energy transfer in soil – energy balance- thermal properties of soil

SOIL CHEMISTRY

Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics

Soil colloids:- Goldschmidt's law of crystal chemistry -, inorganic and organic colloids – principles of silicate clay structure, origin of charge, concept of point of zero charge(PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids; electrometric properties of soil colloids;

Sorption properties of soil colloids; - relative stability of clay minerals, soil organic matter – fraction of soil organic matter and different fractions, clay-organic interactions & Metal Organic Complexes

Ion exchange processes in soil; cation exchange – theories based on law of mass action (Kerr - Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermo dynamics, statistical mechanics; anion and ligand exchange – innersphere and outer-sphere surface complex formation, fixation of oxyanions hysteresis in sorption – desorption of oxy-anion and anions, shift of PZC on ligand exchange. AEC, CEC; Ion exchange system in humid tropical soils

Potassium , phosphate and ammonium fixation in soil

Chemistry of acid soil – liming materials and action- chemistry of salt affected soils and amendments

SOIL, WATER AND AIR POLLUTION

Soil, water and air pollution problems associated with agriculture, nature and extent.

Nature and sources of pollutant- agricultural, industrial, urban wastes, fertilizers and pesticides, acid rain , oils spills etc; air, water and soil pollutant-their CPC standards and effect on plants, animals and human beings.

Sewage and industrial effluents – their composition and effects on soil properties/health, and plant growth and human beings; soil as sink for waste disposal.

Remediation/amelioration of contaminated soil and water ; remote sensing application in monitoring and management of soil and water pollution.

Pesticides & Toxic elements – effect on plant and human health and on soil micro organisms – salt sensitive crops

Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), nitrate and ammoniacal nitrogen and phosphorus and heavy metal content in effluents.

Water Quality - Parameters used to assess water quality – Physical parameters (temperature, colour, odour, turbidity, foam and froth, suspended solids etc.), chemical parameters (BOD, COD, pH, hardness, carbonate and bicarbonate, nitrate, chloride, total salt, cations (Na, Ca, Mg , toxic elements and heavy metals and biological parameters (bacteria coliform, algae, virus, etc.)

Water quality indices and suitability of irrigation water – agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters

The Environment Protection Act, The Air Act, The Water Act, The Wildlife Protection Act and Forest Conservation Act, Woman and child welfare and Role of information technology on environment and human health.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper