



ગુજરાત ખહેર સેવા આયોગ

છ-૩ સર્કલ પાસે, છ રોડ, સેક્ટર-૧૦/એ, ગાંધીનગર-૩૮૨૦૧૦

ખ.ક.૧૪૦/૨૦૨૦-૨૧

જ્યાનું નામ: સીક્ર કેમીસ્ટ, વર્ગ-૧
(ઉદ્યોગ અને ખાણ વિભાગ)

ભાગ-૧ અને ભાગ-૨ ના ૧૮૦ મિનિટના સંયુક્ત પ્રશ્નપત્રની પ્રાથમિક કસોટીનો અભ્યાસક્રમ

પ્રાથમિક કસોટીનો અભ્યાસક્રમ ભાગ-૧	
માધ્યમ: ગુજરાતી	કુલ ગુણ : ૧૦૦
૧	ભારતની ભૂગોળ- ભૌગોલિક, આર્થિક, સામાજિક, કુદરતી સંસાધન અને વસ્તી અંગેની બાબતો- ગુજરાતના ખાસ સંદર્ભ સાથે
૨	ભારતનો સાંસ્કૃતિક વારસો- સાહિત્ય, કલા, ધર્મ અને સ્થાપત્યો- ગુજરાતના ખાસ સંદર્ભ સાથે
૩	ભારતનો ઇતિહાસ- ગુજરાતના ખાસ સંદર્ભ સાથે
૪	ભારતની અર્થવ્યવસ્થા અને આયોજન
૫	ભારતીય રાજનીતિ અને ભારતનું બંધારણ: (૧) આમુખ (૨) મૂળભૂત અધિકારો અને ફરજો (૩) રાજ્યનીતિના માર્ગદર્શક સિદ્ધાંતો (૪) સંસદની રચના (૫) રાષ્ટ્રપતિની સત્તા (૬) રાજ્યપાલની સત્તા (૭) ન્યાયતંત્ર (૮) અનુચિત જાતિ, અનુચિત જનજાતિ અને સમાજના પછાત વર્ગો માટેની ખેગવાઈઓ (૯) એટર્ની જનરલ (૧૦) નીતિ આયોગ (૧૧) પંચાયતી રાજ (૧૨) નાણા પંચ (૧૩) બંધારણીય તથા વૈધનિક સંસ્થાઓ- ભારતનું ચૂંટણી પંચ, સંઘ લોક સેવા આયોગ, રાજ્ય લોક સેવા આયોગ, કોમ્પ્રોલર એન્ડ ઓડિટર જનરલ, કેન્દ્રીયસતર્કતા આયોગ, લોકપાલ તથા લોકાયુક્ત અને કેન્દ્રીય માહિતી આયોગ
૬	સામાન્ય બૌદ્ધિક ક્ષમતા કસોટી
૭	સામાન્ય વિજ્ઞાન, પર્યાવરણ અને ઈન્ફર્મેશન એન્ડ કોમ્યુનિકેશન ટેકનોલોજી
૮	ખેલ જગત સહિત રોજબરોજના પ્રાદેશિક, રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય મહત્વના બનાવો

Syllabus of Preliminary Test

Part-1

Medium: Gujarati

Total Marks-100

1	Geography of India-Physical, Economic, Social, Natural Resources and population related topics- with special reference to Gujarat
2	Cultural heritage of India-Literature, Art, Religion and Architecture- with special reference to Gujarat
3	History of India with special reference to Gujarat
4	Indian Economy and Planning
5	<u>Indian Polity and the Constitution of India:</u> <ol style="list-style-type: none">1. Preamble2. Fundamental Rights and Fundamental Duties3. Directive Principles of State Policy4. Composition of Parliament5. Powers of the President of India6. Powers of Governor7. Judiciary8. Provisions for Scheduled Castes, Scheduled Tribes and backward classes of the society9. Attorney General10. NITIAayog11. Panchayati Raj Institutions12. Finance Commission13. Constitutional and Statutory Bodies: Election Commission of India, Union Public Service Commission, State Public Service Commission, Comptroller and Auditor General; Central Vigilance Commission, Lokpal and Lokayukta, Central Information Commission
6	General Mental Ability
7	General Science, Environment and Information & Communication Technology
8	Daily events of Regional, National and International Importance including Sports

Part-2
Syllabus for the preliminary test for the recruitment of
Chief Chemist (Industries and Mines Department), Class-I

Marks – 200

Questions - 200

Medium - English

1. Inorganic solids:

Defects, non-stoichiometric compounds and solid solutions, atom and ion diffusion, solid electrolytes. Synthesis of materials, monoxides of 3d-metals, higher oxides, complex oxides (corundum, ReO_3 , spinel, perovskites), framework structures (phosphates, aluminophosphates, silicates, zeolites), nitrides and fluorides, chalcogenides, intercalation chemistry, semiconductors, molecular materials.

2. Chemistry of coordination compounds:

Isomerism, reactivity and stability: Determination of configuration of cis- and trans-isomers by chemical methods. Labile and inert complexes, substitution reactions on square planar complexes, trans effect. Stability constants of coordination compounds and their importance in inorganic analysis.

Structure and bonding: Elementary Crystal Field Theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy, pairing energy. Jahn-Teller distortion. Metal-ligand bonding, sigma and pi bonding in octahedral complexes and their effects on the oxidation states of transition metals. Orbital and spin magnetic moments, spin only moments and their correlation with effective magnetic moments, d-d transitions; LS coupling, spectroscopic ground states, selection rules for electronic spectral transitions; spectrochemical series of ligands, charge transfer spectra.

3. Acid base titrations:

Titration curves for strong acid-strong base, weak acid-strong base and weak base-strong acid titrations, polyprotic acids, poly-equivalent bases, determining the equivalence point: theory of acidbase indicators, pH change range of indicator, selection of proper indicator. Principles used in estimation of mixtures of NaHCO_3 and Na_2CO_3 (by acidimetry).

4. Gravimetric Analysis:

General principles: Solubility, solubility product and common ion effect, effect of temperature on the solubility; Salt hydrolysis, hydrolysis constant, degree of hydrolysis. Stoichiometry, calculation of results from gravimetric data. Properties of precipitates. Nucleation and crystal growth, factors influencing completion of precipitation. Co-

precipitation and postprecipitation, purification and washing of precipitates. Precipitation from homogeneous solution. A few common gravimetric estimations: chloride as silver chloride, sulphate as barium sulphate, aluminium as oxinate and nickel as dimethyl glyoximate.

5. Redox Titrations:

Standard redox potentials, Nernst equation. Influence of complex formation, precipitation and change of pH on redox potentials, Normal Hydrogen Electrode (NHE). Feasibility of a redox titration, redox potential at the equivalence point, redox indicators. Redox potentials and their applications. Principles behind Iodometry, permanganometry, dichrometry, difference between iodometry and iodimetry. Principles of estimation of iron, copper, manganese, chromium by redox titration.

6. Complexometric titrations:

Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents. EDTA: acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves: indicators for EDTA titrations, titration methods employing EDTA: direct, back and displacement titrations, indirect determinations, titration of mixtures, selectivity, masking and demasking agents. Typical applications of EDTA titrations: hardness of water, magnesium and aluminium in antacids, magnesium, manganese and zinc in a mixture, titrations involving unidentate ligands: titration of chloride with Hg^{2+} and cyanide with Ag^+ .

7. Organometallic compounds:

18-electron rule and its applications to carbonyls and nature of bonding involved therein. Simple examples of metal-metal bonded compounds and metal clusters. Wilkinson's catalyst.

8. Nuclear chemistry:

Radioactive decay- General characteristics, decay kinetics, parent-daughter decay growth relationships, determination of half-lives. Nuclear stability. Decay theories. Unit of radioactivity. Preparation of artificial radionuclides by bombardment, radiochemical separation techniques. Experimental techniques in the assay of radioisotopes, Geiger-Muller counters. Solid state detectors.

9. Chemistry of d- and f-block elements:

d-block elements: General comparison of 3d, 4d and 5d elements in terms of electronic configuration, elemental forms, metallic nature, atomization energy, oxidation states, redox properties, coordination chemistry, spectral and magnetic properties.

f-block elements: Electronic configuration, ionization enthalpies, oxidation states, variation in atomic and ionic (3+) radii, magnetic and spectral properties of lanthanides, separation of lanthanides (by ion-exchange method).

10. Errors in quantitative analysis:

Accuracy and precision, sensitivity, specific standard deviation in analysis, classification of errors and their minimization, significant figures, criteria for rejection of data, Q-test, t-test, and F-test, control chart, sampling methods, sampling errors, standard reference materials, statistical data treatment.

11. Separation Methods:

Chromatographic analysis: Basic principles of chromatography (partition, adsorption and ion exchange), column chromatography, plate concept, plate height (HETP), normal phase and reversed phase concept, thin layer chromatography, frontal analysis, principles of High Performance Liquid Chromatography (HPLC) and Gas Liquid Chromatography (GLC), and Ion-exchange chromatography.

Solvent extraction: Classification, principle and efficiency of the technique, mechanism of extraction, extraction by solvation and chelation, qualitative and quantitative aspects of solvent extraction, extraction of metal ions from aqueous solutions.

12. Spectroscopic methods of analysis:

Lambert-Beer's Law and its limitations.

UV-Visible Spectroscopy: Basic principles of UV-Vis spectrophotometer, Instrumentation consisting of source, monochromator, grating and detector, spectrophotometric determinations (estimation of metal ions from aqueous solutions, determination of composition of metal complexes using Job's method of continuous variation and mole ratio method).

Infra-red Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instruments, sampling techniques.

Flame atomic absorption and emission spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and burner design), techniques of atomization and sample introduction, method of background correction, sources of chemical interferences and methods of removal, techniques for the quantitative estimation of trace level metal ions. Basic principles and theory of AAS. Three different modes of AAS - Flame-AAS, VG-AAS, and GF-AAS. Single beam and double beam AAS. Function of Hollow Cathode Lamp (HCL) and Electrode Discharge Lamp (EDL). Different types of detectors used in AAS. Qualitative and quantitative analysis.

13. Thermal methods of analysis:

Theory of thermogravimetry (TG), basic principle of instrumentation, techniques for quantitative analysis of Ca and Mg compounds.

14. X-ray methods of Analysis:

Introduction, theory of X-ray generation, X-ray spectroscopy, X-ray diffraction and X-ray fluorescence methods, instrumentation and applications. Qualitative and quantitative measurements. Powder diffraction method.

15. Inductively coupled plasma spectroscopy:

Theory and principles, plasma generation, utility of peristaltic pump, sampler-skimmer systems, ion lens, quadrupole mass analyzer, dynode / solid state detector, different types of interferences-spectroscopic and non-spectroscopic interferences, isobaric and molecular interferences, applications.

16. Analysis of geological materials:

Analysis of minerals and ores- estimation of (i) CaCO_3 , MgCO_3 in dolomite (ii) Fe_2O_3 , Al_2O_3 , and TiO_2 in bauxite (iii) MnO and MnO_2 in pyrolusite. Analysis of metals and alloys: (i) Cu and Zn in brass (ii) Cu, Zn, Fe, Mn, Al and Ni in bronze (iii) Cr, Mn, Ni, and P in steel (iv) Pb, Sb, Sn in 'type metal'. Introduction to petroleum: constituents and petroleum fractionation. Analysis of petroleum products: specific gravity, viscosity, Doctor test, aniline point, colour determination, cloud point, pour point. Determination of water, neutralization value (acid and base numbers), ash content, Determination of lead in petroleum.

Types of coal and coke, composition, preparation of sample for proximate and ultimate analysis, calorific value by bomb calorimetry.

17. The Granite Conservation and Development Rules, 1999

18. The Marble Development and Conservation Rules, 2002

19. Gujarat District Mineral Foundation Rules, 2016

20. Current Trends and Recent Advancements in the field of Chemical Analysis.