GRE Subject Test Chemistry

GRE will comprise of around 130 multiple choice questions.

In the test booklet, a periodic table is drafted and a table of information mentioning different physical constants and a few conversion factors among SI units. Whenever required, additional values of physical constants are printed with the text of question.

Test questions are constructed to simplify mathematical manipulations. Ultimately, calculators as well as tables of logarithms are not required. If the solution to a problem requires the use of logarithms, the essential values are covered with the question. The test content focuses on the four fields into which chemistry has been categorised and some inter-relationships among such fields.

The focus of the above mentioned four fields in the given outline of material covered by the test should not be taken definitive.

1. Analytical Chemistry-15%
    a. Data Acquisition and Use of Statistics-Errors, statistical considerations
    b. Solutions and Standardization-Concentration terms, and primary standards
    c. Homogeneous Equilibria-Acid-base, oxidation-reduction, complexometry
    d. Heterogeneous Equilibria-Gravimetric analysis, solubility, precipitation titrations, chemical separations
    e. Instrumental Methods-Electrochemical methods, spectroscopic methods, chromatographic methods, thermal methods, calibration of instruments
    f. Environmental Applications
    g. Radiochemical Methods-Detectors, applications

2. Inorganic Chemistry-25%
    a. General Chemistry-Periodic trends, oxidation states, nuclear chemistry
    b. Ionic Substances-Lattice geometries, lattice energies, ionic radii and radius/ratio effects
    c. Covalent Molecular Substances-Lewis diagrams, molecular point groups, VSEPR concept, valence bond description and hybridization, molecular orbital description,

bond energies, covalent and van der Waals radii of the elements, intermolecular forces

d. Metals and Semiconductors-Structure, band theory, physical and chemical consequences of band theory

e. Concepts of Acids and Bases-Bronsted-Lowry approaches, Lewis theory, solvent system approaches

f. Chemistry of the Main Group Elements-Electronic structures, occurrences and recovery, physical and chemical properties of the elements and their compounds

g. Chemistry of the Transition Elements-Electronic structures, occurrences and recovery, physical and chemical properties of the elements and their compounds, coordination chemistry

h. Special Topics-Organometallic chemistry, catalysis, bioinorganic chemistry, applied solid-state chemistry, environmental chemistry

3. Organic Chemistry-30%

a. Structure, Bonding, and Nomenclature-Lewis structures, orbital hybridization, configuration and stereochemical notation, conformational analysis, systematic IUPAC nomenclature, spectroscopy (IR and 1H and 13C NMR)

b. Functional Groups-Preparation, reactions, and interconversions of alkanes, alkenes, alkynes, dienes, alkyl halides, alcohols, ethers, epoxides, sulfides, thiols, aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives, amines

c. Reaction Mechanisms-Nucleophilic displacements and addition, nucleophilic aromatic substitution, electrophilic additions, electrophilic aromatic substitutions, eliminations, Diels-Alder and other cycloadditions

d. Reactive Intermediates-Chemistry and nature of carbocations, carbanions, free radicals, carbenes, benzynes, enols

e. Organometallics-Preparation and reactions of Grignard and organolithium reagents, lithium organocuprates, and other modern main group and transition metal reagents and catalysts

f. Special Topics-Resonance, molecular orbital theory, catalysis, acid-base theory, carbon acidity, aromaticity, antiaromaticity, macromolecules, lipids, amino acids, peptides, carbohydrates, nucleic acids, terpenes, asymmetric synthesis, orbital symmetry, polymers

4. Physical Chemistry-30%

a. Thermodynamics-First, second, and third laws, thermochemistry, ideal and real gases and solutions, Gibbs and Helmholtz energy, chemical potential, chemical equilibria, phase equilibria, colligative properties, statistical thermodynamics

b. Quantum Chemistry and Applications to Spectroscopy-Classical experiments, principles of quantum mechanics, atomic and molecular structure, molecular spectroscopy

c. Dynamics-Experimental and theoretical chemical kinetics, solution and liquid dynamics, photochemistry