11th Grade
Chemistry
Structure of atoms
- Particle nature of matter
- Atomic theory, cathode rays, gold-foil experiment, atomic orbitals, nuclear forces, isotopes, electron configurations
- Radioactive isotopes, atomic radii, ion formation
- Ion formation
- Covalent molecules, bond length, molecular orbitals
- Structure of carbon
- Hydronium ions; electrolytes and nonelectrolytes
- Proton donors and acceptors
- Electric charge

Structure and properties of matter
- Defining characteristics of elements and compounds, physical properties as a consequence of structure, models for solids, liquids, and gases, density
- Structural models
- Conservation of mass, laws of definite and multiple proportions, atomic mass and moles
- Periodicity of properties; physical properties as a consequence of structure; metals, nonmetals, and semiconductors; plasmas; crystal packing
- Ionic bonding, physical properties as a consequence of structure, models for solids, liquids, and gases
- Covalent bonding, physical properties as a consequence of structure, catenation of carbon, functional groups, electronegativity
- More relationships for single substances
- Kinetic molecular theory, vapor pressure
- Solutions and suspensions; separating mixtures
- Complex ions
- Properties of acids and bases, pH
- Collision theory, catalysts, inhibitors, antioxidants
- Oxidizing and reducing agents
- Nuclear stability, half-life

Chemical reactions
- Characteristics of reactions and activation energy
- Periodicity and reactivity, nuclear transmutations
- Oxidation numbers, polyatomic ions
- Formation of molecules
- Organic reactions
- Conservation of mass and reactions, types of reactions
- Mass relationships in reactions, limiting reactants, reaction efficiency
- Thermodynamic properties of reactions, photosynthesis, metabolism
- Free radial reactions
- Reversible reactions, equilibrium systems, precipitation reactions, common ion effect
- Acid-base reactions, buffers
- Reaction rates
- Oxidation/reduction reactions
- Nuclear reactions, decay of radioactive isotopes

Motions and forces
- Chemical bonds
- Coulombic force
- Metallic bonds
- Bond character, hydrogen bonding, and London forces
- Network solids
- Elastic collisions
- Pressure, ideal gas concept, diffusion, effusion, condensation
- Solubility, emulsions, surfactants
- Elastic collisions energy transfers
- Nuclear forces

Entropy and conservation of energy
- Conservation of energy, chemical energy
- Energy transfers
- Heat versus temperature; entropy, enthalpy, Gibbs energy
- Average kinetic energy
- Reaction mechanisms
- Electrosynthesis processes
- Mass defect, binding energy

Interactions of matter and energy

- Endothermic vs. exothermic processes
- States of matter, specific heat capacity, potential and kinetic energy, heat and temperature
- Wave characteristics, electromagnetic spectrum, quanta, spectral analysis
- Conductors, insulators, semiconductors
- Lattice energy
- Bond energy, VSEPR theory
- Bond strength
- Enthalpy
- Changes of state
- Pressure, volume, temperature relationships; phase diagrams
- Colligative properties
- Le Chatelier's principle
- Activation energy, catalysis
- Electrochemical cells, galvanic cells
- Nuclear fission and fusion

Nature of scientific knowledge

- Scientific research, chemical industry, history of aluminum
- Scientific methods, peer review, chance discoveries, history of helium
- Evolution of scientific thought: atomic structure; history of beryllium
- Periodic table; history of oxygen
- History of sodium, nomenclature
- Lewis dot models, nomenclature
- Polymer discoveries, history of silicon, nomenclature
- History of hydrogen, nitrogen, lead, and magnesium
- Bosch and Haber processes
- History of chlorine, Faraday's experiments
- Discovery of radioactivity

Abilities to do scientific inquiry

- Mathematical tools: 81measurement, significant figures, composition stoichiometry, proportional reasoning, reaction stoichiometry, thermodynamics, gas laws, concentration, equilibrium constants, solution stoichiometry, reaction rates, electrochemical processes
- Labs: use of technology and mathematics in investigations, formulate hypotheses, formulate and revise explanations

Personal and community health

- Aspirin warnings
- Essential elements
- Mercury poisoning
- Saturated fats
- Fire extinguishers
- Automobile air bags
- Energy and nutrition
- Greenhouse effect, ozone hole, caffeine
- Sports drinks, vitamins
- Lead poisoning
- Antacids and health
- Enzyme supplements
- Radiation exposure

Natural resources

- Aluminum, chemical industry
- Helium, beryllium, oxygen, sodium
- Nonrenewable resources
- Silicon, recycling codes
- Hydrogen, nitrogen, magnesium, chlorine

Environmental quality; and natural and human-induced hazards

- Explosives
- Biodegradable substances
- Automobile pollution control
- Greenhouse effect, ozone hole, pollution, chlorofluorocarbons, non-CFC air conditioning
- Fertilizers
- Acid precipitation
- Red tides
- Corrosion
- Fission reactors

Science and technology challenges

- Fireworks
- Superconductors

- Mars exploration
- Landfills and waste
- Protease inhibitors
- Air-bag design
- Supercritical fluids
- Ammonia and World War I
- Enzyme technologies
- Fuel cells, batteries
- Radioactivity, nuclear energy

Abilities of technological design

- Scientific methods, discoveries of Teflon and cisplatin
- Superconducting devices
- Engine efficiency
- Removing caffeine
- Electrosynthesis, fuel-cell technologies
- Dating techniques, radiological technologies
- Labs: identify problems, design solutions, implement designs, evaluate designs, and communicate processes