
Chemistry

Finalità

to give the fundamental knowledge about the atomic and molecular structure of matter, in order to interpret the chemical-physical properties and the transformations which can be useful in technical areas.

Programma

The atomic structure of matter

Historical development of atomic theory. Subatomic particles. Principles of stoichiometry

Electronic structure of atoms

Early atomic models: the Bohr atom; wave mechanical models. Multielectronic atoms and the Aufbau principle. Electron configurations of the elements in the periodic table. Periodic properties of the elements.

Chemical bonds

Ionic bond, covalent bond, electronic delocalization and resonance. Polar covalent bond. Electronegativity. Molecular geometry and polarity. Metal bond (band theory from MO model). Conductors, insulators and semiconductors. Van der Waals forces and hydrogen bond.

Nomenclature

Oxidation numbers, classification and nomenclature of inorganic compounds. Types of chemical equations.

Thermochemistry and thermodynamics

The First Law. Enthalpy. Heat of formation, thermochemical equations, Hess's law and enthalpy diagrams.

The gaseous state

Introduction. Equation of state of an ideal gas. Partial pressure and partial volume. Graham's law. Gas liquefaction, critical temperature.

The liquid state

Introduction. Evaporation. Vapour tension and its dependence from the temperature. Relative humidity. Boiling. Sublimation. Fusion and solidification. H₂O and CO₂ phase diagrams.

The solid state

Crystalline and amorphous solids. Crystal lattice and lattice planes. Primitive and non-primitive cells. X-ray diffraction. Covalent, ionic, molecular and metallic crystals. Polymorphism. Liquid crystals basics.

Solutions

Nature of solutions. Concentration of solutions. Raoult's law. Colligative properties of solutions.

The van't Hoff coefficient.

Chemical equilibrium

Chemical equilibrium: the law of mass action. The equilibrium constants K_p and K_c . Homogeneous and heterogeneous equilibrium. The Le Chatelier-Braun principle.

Equilibria in solution

Acids and bases: Arrhenius' theory, the Brønsted-Lowry theory. Water autoionization. The ionic product of water. The pH scale

Electrochemistry

Electrolytic cells. Electrolysis and its applications. Stoichiometry of electrolysis. Galvanic cells. Daniell's battery. Stoichiometry of galvanic processes. Electrode potentials and electromotive force (emf) in standard conditions. Applications.

Kinetics of reaction

Reaction rates. Rate laws and reaction order. Factors affecting reaction rates: radiations, concentration of reactants, temperature, catalysts. Temperature-dependence of reaction rates, Arrhenius equation, activated complex theory, activation energy. Catalysis. Catalytic converters.

Attività d'esercitazione

problems and numerical applications relating to the course theory.

Testi consigliati

A. M. Manotti Lanfredi, A. Tiripicchio, "Fondamenti di Chimica", Ed. Ambrosiana, Milano
Oxtoby/Nachtrieb, Chimica moderna, EdiSES, Napoli
Clerici/Morrocchi, Esercitazioni di chimica, Ed. Spiegel