

# Chemistry

## 1. *Atomic structure*

- nucleus and electron cloud
- subatomic particles, atomic mass, isotopes
- the mole concept; simple problems to demonstrate understanding of the relationship between moles, number of particles and mass
- electron structure of atoms: shells; valence electrons and their role in chemical reactions
- relationship between electron structure and periodic properties (position and periodic trends)

## 2. *Chemical bonding*

- types of intramolecular forces and their relationship to the valence structure of the bonding elements; demonstration of bonding types on specific examples; periodic trends in bonding, demonstrations of concepts for groups on the periodic table of elements
- concept of polarity; bond polarity and molecular polarity; understanding how polarity influences solubility and physical properties
- intermolecular forces among molecules
- lattice structures: comparison of the properties of ionic, metallic and covalent solids

## 3. *Chemical changes*

- types of reactions, with examples
- simple stoichiometry: balancing reactions; simple mole-to-mole and mass-to-mass conversion problems
- enthalpy change of reactions: exothermic and endothermic reactions; heat of a reaction
- reaction kinetics: reaction rate and factors that determine reaction rates; explaining graphs
- chemical equilibrium; factors affecting equilibrium. demonstration of shifting of the equilibrium on examples
- acid base reactions: concepts of acids and bases; conjugate pairs
- pH scale
- hydrolysis and the pH of salt solutions
- redox reactions: understanding of reduction and oxidation in lieu of electron transfer and changes in oxidation states; examples.
- basic electrochemistry: components of a galvanic cell and an electrolytical cell; electromotive force, standard potential

## 4. *Inorganic chemistry*

- understanding the relationship between the periodic trends and the reactivity of elements and their compounds, with specific attention to electronegativity, standard potential (redox properties) and metallic character
- key trends and reactions for the individual groups and blocks of elements (s-,p-,d-block); demonstrate understanding of how behavior/reactivity changes as we move across the blocks and groups
- specific examples, reactions to demonstrate key trends in groups

## 5. *Organic chemistry*

- carbon: a unique atom - properties that make it able to form millions of compounds
- classification of organic compounds based on functional groups
- hydrocarbons: alkanes, alkenes, alkynes, aromatic compounds and their typical reactions
- compounds containing oxygen - the role of the oxygen atom in the polarity and physical properties of compounds; ethers, alcohols, phenols, ketones, aldehydes, carboxylic acids, esters
- key reactions of organic compounds based on functional groups
- key representatives of groups
- understanding of molecular formula, structural formula, basic concepts of naming rules
- isomerism