

Grade 8

Substances and their properties

Topics:

- We are organising our workspace. Safety in the lab
- Basic equipment and glassware
- States of matter. Changes of state
- Units of measurement. Density
- Mixtures. Types of substances
- Methods of separating
- Elements
- Metals and nonmetals properties. Alloys. Percentage composition

Student:

- Knows how to behave in the lab and safety rules
- Knows basic lab equipment and glassware
- Knows basic lab techniques
- Knows properties of metals and non-metals
- Can convert different measurement units
- Distinguishes different mixtures, and know methods of separating
- Knows definition of atoms, molecules, compounds
- Knows definition of alloy, examples and their application
- Knows most common ores and alloys
- Knows how to extract metals from ore
- Understands electrolytic extraction
- Knows states of matter, and changes between them
- Can describe physical properties of substances
- Distinguishes chemical reactions from physical process
- Knows symbols and names of important elements
- Can calculate density, mass and volume of substances

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: " We are looking for mixtures in everyday life"
- Essay: "Alloys"
- Lab experiments

Atoms and molecules

Topics:

- Everything is made of particles. Atomic theories
- Across the periodic table
- Physical process and chemical reaction. Introduction to chemical equation
- Types of chemical reactions - synthesis, analysis, displacement
- Molecular and structural formulas.
- Molecular formula – valence. Exercises in writing formulas
- Nomenclature of acids, hydroxides and salts - writing their molecular formulas
- Ions - anion and cation. Formulas in ionic form

Student:

- Knows definition of diffusion and contraction
- Reads the periodic table of the elements
- Knows the development of the atomic structure theories
- Can write molecular formulas and draw structural formulas
- Can describe trends in periodic table
- Knows periodicity law
- Knows portraits of Mendeleev
- Knows the most common valencies of some elements
- Knows types of chemical reactions - synthesis, analysis and displacement
- Knows definitions of reactants and products
- Knows basic nomenclature of oxides, hydroxides, acids and salts

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: “ Making structural formulas from everyday items”
- Essay: “Famous Chemists”
- Lab experiments

Chemical reactions

Topics:

- Relative formula mass
- Equations for chemical reactions - balance exercises
- Law of conservation of mass. Law of constant composition
- The mole and Avogadro's constant
- Percentage composition of element in compound
- Empirical and molecular formulas - with exercises
- Stoichiometric calculations
- Efficiency of reaction. Percentage yield
- Endothermic and exothermic reactions

Student:

- Can acquire information from chemical equations
- Understands law of conservation of the mass
- Understands law of constant composition
- Understands what is an Avogadro number and know its application
- Knows how to calculate percentage constitution of the elements in a chemical compound and mass proportion
- Knows how to calculate the amount of a substance according to the chemical reaction
- Can calculate relative formula mass
- Knows how to determine empirical and molecular formula
- Can describe exothermic and endothermic reactions with examples
- Can calculate yield of the reactions
- Can do complexed stoichiometric calculations

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Essay: "Perpetuum mobile"
- Lab experiments

Air and other gases

Topics:

- Air composition (*properties of gases*)
- Another look at air. Noble gases
- Oxygen and its cycle in nature. Ozone hole
- Properties of carbon oxides and hydrogen. *Obtaining*.
- What do we know about oxides? *Structure, obtaining and nomenclature*.
- Properties of oxides
- Uses of oxides (CaO, FeO_x, Al₂O₃)
- Corrosion and rusting
- Nitrogen and its cycle in nature.
- Pollution alert!

Student:

- Knows air components
- Understands why ozone layer is so important
- Can describe ozone hole phenomenon
- Knows properties of common gases - carbon oxides, hydrogen, noble gases
- Knows carbon, oxygen and nitrogen cycles in nature
- Knows threats caused by air pollution
- Can identify CO₂, hydrogen and oxygen
- Can obtain simple gases
- Can write molecular and structural formulas of oxides
- Knows properties and methods of obtaining of oxides
- Knows application of the most common oxides
- Can describe corrosion and rusting
- Can divide oxides into acidic, alkaline, neutral and amphoteric

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Rust it!"
- Essay: "Oxides are everywhere"
- Lab experiments

Water and water solutions

Topics:

- Water and water cycle
- Water as a solvent. Solutions division. Colloids
- Solubility. Solubility curves
- The concentration of a solution
- Solution changes
- Mixing different concentration solutions
- Making use of water. Water hardness.
- Water pollution. Waste water and sewage works

Student:

- Understands water cycle in nature
- Knows unusual water properties
- Knows meaning of water for living organisms
- Can convert different concentrations (e.g. from molar to percentage by mass)
- Knows formulas for concentrations
- Understands the importance of density in the case of solutions
- Knows how to prepare a solution with the exact concentration
- Can prepare solutions with different concentrations
- Understands meaning of water pollution
- Knows how to clean water (Wastewater Treatment Plant)
- Knows definition and types of water hardness and knows how to remove, prevent it
- Can obtain crystals
- Knows definitions of suspension, colloid and solution
- Knows which compounds are good or bad solute
- Knows definition of saturated and unsaturated solution
- Can possess information from solubility curves
- Can calculate different solution and solution changes

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "My water filter"
- Essay: "Meaning of water"
- Lab experiments

Grade 9

Atomic Structure

Topics:

- Atomic structure
- More about the atom. Atomic number, mass number
- Isotopes
- Radioactivity
- Nuclear power
- Information about atomic structure
- Electron arrangement (shells, subshells, Noble gas, ions)
- Atoms combining. Electronegativity
- Bonds - Lewis structures. The ionic bonding
- The coordination bonding. Exercises in drawing formulas
- Properties of ionic and covalent compounds

Student:

- Knows definitions of: valency, atomic number and mass number
- Knows the structure of the atom
- Recognises the number of the three basic particles in an atom: protons, neutrons, electrons
- Knows the term isotope and its application
- Understands radioactivity process
- Can discuss about advantages and disadvantages of nuclear power plant
- Can calculate half value period
- Can show on periodic table and short describe transuranic elements
- Can write electronic configuration of atoms
- Recognises the difference between atomic weight and molecular weight
- Knows the idea of a bond formation
- Understands the application of the electronegativity table
- Recognises type of bond present in a particular molecule
- Knows the ways of bond presentation
- Understands the idea of a bond energy
- Understands how the atoms are combined

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Essay: "Radioactivity - salvation or doom? "
- Lab experiments

Acid and Base

Topics:

- pH scale of solution. Indicators. Arrhenius theory.
- Bases - sodium and potassium hydroxides
- Hydroxides of other metals
- A closer look at acids. *Nomenclature, structure and obtaining*
- Binary acids
- Properties of oxyacids. The reactivity series of metals
- Sulfuric (VI) acid and Nitric (V) acid
- Other inorganic acids
- Ionic dissociation. Electrolytes and non-electrolytes. Conductors and insulators.
- Acid rain

Student:

- Knows common indicators and can use them to determine pH
- Knows definitions of: ion, cation, anion
- Knows how to calculate pH of solution
- Knows Arrhenius definition of acid and base
- Knows formulas, properties and uses of carbonic, sulphuric, nitric acids
- Knows formulas, properties and uses of hydrochloric, hydrofluoric and hydrosulphuric acids
- Knows formulas, properties and uses of NaOH, KOH
- Recognises formulas of inorganic compounds
- Can define and describe oxyacids and binary acids
- Can obtain acid solutions
- Knows which acids are strong and stable
- Knows other common (also organic) acids in our world
- Can obtain alkalic solutions (eg. solution of NaOH)
- Can draw structural formulas of acids and hydroxides
- Can obtain simple acids, oxides and hydroxides
- Knows major properties of inorganic compounds
- Knows which hydroxides are bases
- Knows how to work with corrosive substances
- Knows reactivity series of metals and can use it
- Can design experiments with acids and hydroxides
- Understands process of ionic dissociation
- Can write ionic dissociation equations of acids and hydroxides
- Understands threat of acid rain
- Knows acid-base titration
- Knows the definitions of electrolyte, non-electrolyte
- Recognises the difference between conductors and insulators

Assessment:

- Quick Tests
- Major Test at the end of the chapter

- Project: "My enemy - acid rain"
- Essay: "Acids around me"
- Lab experiments

Salts

Topics:

- A closer look at salts. Methods of obtaining
- Neutralization and precipitation reactions
- Properties of salts. Exercises in writing inorganic equations
- Ionic dissociation of salts.
- Degree of dissociation
- Writing equations in the ionic form
- Salt hydrolysis. The electrolysis of the solutions*
- Uses of salts (*carbonates, nitrates, sulphates, phosphates, chlorides*)
- Acid-base titrations

Student:

- Knows properties of salts
- Can design neutralisation and precipitation reactions
- Recognises formulas of salts
- Knows degree of dissociation
- Can draw structural formulas of salts
- Can obtain salts using many methods
- Can write ionic dissociation equations of salts
- Knows salt hydrolysis process and can write equations of it
- Knows application of many salts

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "How much acid in the vinegar?"
- Essay: "Salts not only on the table"
- Lab experiments

Carbon and its compounds

Topics:

- Carbon as an element
- Petrochemical industry. The fossil fuels management
- Organic compounds. Hydrocarbons.
- Methane- simplest hydrocarbon
- The alkanes. Chemical properties of alkanes.
- Isomerism and nomenclature
- Alkenes homologous series
- Properties of alkenes
- Acetylene – properties and obtaining of alkynes
- Polymerisation
- Uses of polymers
- Utilisation of plastics. Recycling
- Natural and synthetic polymers

Student:

- Can describe carbon and its properties using periodic table
- Knows allotropy of carbon
- Knows what organic chemistry is about
- Can do chemical decomposition of carbon and knows products of it
- Know definition of homologues series
- Recognises the structure among alkanes, alkenes, alkynes
- Can obtain simple organic gases like methane, ethane, acetylene
- Gives the appropriate name of each group of hydrocarbons based on IUPAC system
- Understands the reactivity of single, double and triple bond
- Knows how to obtain each group of hydrocarbon
- Can describe petrochemical processes
- Knows fossil fuels management
- Predicts the physical properties of hydrocarbons based on their structure
- Draws the particular isomers according to total formula of the hydrocarbons
- Can carry out experiments which show properties of hydrocarbons
- Identifies polymers, and know their properties
- Knows why plastic is danger for environment and how to utilised it
- Understands polymerisation reactions

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Polymers segregation"
- Essay: "Plastic is (not) fantastic!"
- Lab experiments

Grade 10

Hydrocarbons with functional group

Topics:

- The alcohols - introduction
- The properties of alcohols. Harmfulness of ethanol.
- Polyhydric alcohols
- Ketones and aldehydes*
- Homologues series of carboxylic acids
- Properties of organic acids. (*acetic acid*)
- Esterification reaction. Uses of esters
- Other organic acids: saturated: palmitic, stearic, unsaturated: oleic

Student:

- Understands the function of the group influence on the physical and chemical properties
- Recognises the structure of particular hydrocarbon based on functional group present
- Gives the appropriate name of each compound based on the IUPAC system
- Draws the semi-structural formula according to the name given
- Knows how to recognise the compound based on the characteristic reactions for each group of compounds
- Knows how to obtain each group of compounds
- Application and occurrence the compounds in everyday life
- Understands harmfulness of ethanol
- Knows alcohols properties and method of obtaining
- Can carry out experiments showing alcohol properties
- Knows formulas of polyhydric alcohols
- Distinguishes polyhydric and monohydric alcohols
- Understands meaning of fatty acids and amino acids
- Knows homologues series of organic acids
- Knows properties of organic acids
- Knows occurrence of formic, acetic acids
- Carries out experiments showing properties of organic acids
- Knows the differences and similarities of organic and non-organic acids
- Knows formulas and properties of palmitic, stearic and oleic acids
- Knows what soap is
- Can divide soaps
- Knows meaning of detergents
- Recognises some fragrant chemical compounds
- Can obtain esters and knows their properties
- Knows esters nomenclature
- Can carry out distillation process
- Recognises the structure of amino acids

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Soap"
- Essay: "Let it smell!"
- Lab experiments

Elements of biochemistry

Topics:

- Fatty acids and synthetic detergents.
- Fats are the esters too. Properties and meaning of fat
- Urea. Amines (*glycine, methylamine*)
- Amino acids
- The proteins
- Proteins properties
- Structure and composition of monosaccharides
- Glucose – the simplest sugar
- Saccharose as an example of disaccharides
- The starch
- Cellulose is also a sugar
- Food chemistry

Student:

- Knows major food components
- Can draw a simple protein structures
- Knows how to combine amino acids to form a protein
- Knows influence of temperature on proteins
- Knows the structure of glycerine and fatty acids
- Can carry out experiments showing reactions of fats with KMnO_4 and bromine water
- Knows rules of fats keeping
- Occurrences and the state of fats
- Knows natural and synthetic polymers
- Can detect proteins in food
- Knows definition of colloid
- Knows the structure and properties of basic monosaccharides, disaccharides and polysaccharides
- Identifies the structure of monosaccharides from the Haworth's structure of the sugar
- Knows properties of starch
- Knows meaning of starch in animals and plants world
- Knows properties and structure of cellulose
- Knows where cellulose is and was used
- Can find the relationship between biology and chemistry
- Understands chemical analysis processes
- Knows application of chromatography

- Understands medicaments, poisons and drugs influence on our bodies

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "We are what we eat"
- Lab experiments

*Elements of physical chemistry***Topics:**

- Rates of a reaction
- Factors affecting rate of the reaction
- Catalyst. Activation energy and collision theory.
- Equilibrium state. Reversible reactions
- Energy changes in reactions. Internal energy. Enthalpy
- Le Chatelier principle
- Calculations in the electrolysis*
- Bond energy
- Experimental thermochemistry

Student:

- Can do rates of reaction calculations
- Can describe factors influencing on reaction rate
- Understands processes undergoing during chemical reactions
- Knows definition of equilibrium state and can explain this process
- Can describe Le Chatelier principle
- Understands meaning of catalyst in chemical reactions
- Can explain meaning of catalyst in car

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Catalyst here, catalyst there"
- Lab experiments

*Reactions in aqueous solution**

Topics:

- Oxidation number
- Redox reactions
- Balancing the reactions based on redox rules
- Behavior of potassium manganate (VII) and chromium compounds according to the applied environment
- Electrochemical cells

Student:

- Knows how to determine the oxidation number of the elements in a chemical compound
- Knows how to calculate the efficiency of a reaction
- Can balance the reactions based on redox rules
- Understand the importance of oxidising and reducing agents in the reactions
- Know how to balance the reactions in ionic forms
- Know the behaviour of potassium manganate(VII) according to the applied environment
- Knows how to balance ionic equations
- Understand electrolysis process
- Can carry out electrolysis process
- Recognise electrochemical cells

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Batteries"
- Essay: "Cells of the past, present and future"
- Lab experiments

*Earth and its resources**

Topics:

- From the Big Bang to Earth's crust
- Rocks and the rock cycle
- Silicon and silicon dioxide
- Soil and its properties
- Calcareous rocks
- Making use of limestone
- Gypsum rock
- Metals and their ores

Student:

- Knows Earth's resources
- Can describe components of Earth's crust
- Knows properties of silicon and its oxide
- Can describe properties of major minerals
- Knows uses of limestone
- Can describe and name most common minerals
- Knows processes going in calcareous rocks
- Knows soil composition

Assessment:

- Quick Tests
- Major Test at the end of the chapter
- Project: "Let's Rock!"
- Essay: "Planet not based on carbon and silicon"
- Lab experiments

*Aromatic hydrocarbons**

Topics:

- Characteristic of aromatic compounds
- Benzene - substitution reactions

Student:

- Identify the structure of an aromatic hydrocarbon
- Know the structure of mono-substituted benzene
- Understand the influence of the present group on further substitution
- Give the IUPAC name of aromatic hydrocarbons
- Separation the mixture of benzene and toluene using distillation process

Assessment:

- Quick Tests
- Major Test at the end of the chapter

- Project: "Where is this aroma? p"
- Lab experiments

* - *optional Topics / Chapters*