Dipartimento di Scienze della Vita e dell'Ambiente

KNOWLEDGE REQUIRED FOR ACCESS

SYLLABUS

Mathematics

Numbers and their representation. Cartesian plane. Functions and their graphs. Straight lines and parabolas and their representation in the Cartesian plane.

First and second degree equations and inequalities. Fractional equations and equations with radicals. Systems of equations and inequalities.

Graphs and elementary properties of modular, power, exponential, and logarithmic functions. Angular functions.

Areas and perimeters of notable flat figures.

Physics

Quantities: definition and operations. - International System of Units. Fundamental and derived quantities. Scientific notation (powers of 10). Prefixes for multiples and submultiples. Equivalences. Units of measurement for the main quantities and conversion equations. Dimensional analysis.

Measurements. Direct and indirect measurements. Absolute error and instrument sensitivity. Relative error and percentage. Significant figures and rounding. Random and systematic errors. Representation and analysis of measurements: histograms, Cartesian representation, mean value, and error.

Area of regular polygons and volume of cubes, parallelepipeds, cylinders, cones, and spheres. Ratios. Proportions. Percentages. Tables, formulas, and Cartesian graphs. Direct proportionality, linear dependence, and straight lines. Inverse proportionality. Trigonometric definition of tangent, sine, and cosine of an angle. Properties of logarithmic and trigonometric functions.

Scalar and vector quantities. Operations between vectors. Graphical composition of two vectors. Decomposition of vectors. Analytical composition of vectors by summing their components.

Chemistry

Elementary substances, compounds, and mixtures. The electrical nature of matter. Electrons, protons, and neutrons. Quantum numbers and atomic orbitals. Electronic configuration. Pauli exclusion principle, Aufbau principle, and maximum multiplicity principle. Atomic and molecular mass. Mass number and atomic number. Isotopes. Atomic mass units. Mole, molar mass, and Avogadro's number. Periodic table of elements. Metals, transition metals, and non-metals. Atomic and ionic radius, ionization energy, electron affinity. Nomenclature of the main classes of inorganic

compounds. Oxidation number. Classification and balancing of chemical reactions. Oxidation-reduction reactions. Ionic bond. Homopolar and heteropolar covalent bond. Electronegativity. Metallic bonding. States of matter: solid, liquid, and gaseous. Intermolecular forces: hydrogen bonding. Structure and properties of liquid water. Thermodynamics: internal energy, enthalpy, free energy, and entropy. Concentration of solutions and colligative properties. Acids and bases. pH and pOH.

Biology

1. Biological molecules

The importance of water in biology. Understanding the chemical composition of living organisms: carbohydrates, lipids, proteins, and nucleic acids. Polymers and monomers. Structure and function of macromolecules. Water and its characteristics. Hydrophilic and hydrophobic substances. Chemical composition, structure, and function of the main biological molecules: carbohydrates, lipids, amino acids and proteins, nucleotides, and nucleic acids.

2. Cell organization

The fundamental differences between prokaryotic and eukaryotic cells; the structure and basic functions of the plasma membrane and the main organelles of the eukaryotic cell. The fundamental differences between animal and plant cells. Organization of the prokaryotic cell. Organization of the eukaryotic cell. Differences between animal and plant cells. Structure and function of: plasma membrane, cell wall, nucleus, cytoplasm, mitochondria, chloroplasts, ribosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles, cytoskeleton.

3. Fundamentals of genetics

The modes of transmission and expression of hereditary traits at the prokaryotic and eukaryotic cell levels. The structure of genetic material and its levels of organization in microbial, plant, and animal systems, including humans. Chromosomes. Mendelian genetics. Conservation of genetic information and its expression. Genetic code. DNA and genes. Transcription and translation.

4. Cellular bases of reproduction and heredity

Significance of cell division in unicellular and multicellular eukaryotic organisms. Mitosis and cell duplication. Meiosis and sexual reproduction. Gametes and zygote formation. Cell division. Mitosis and meiosis. Cytokinesis. Gametes and fertilization.

5. Elements of animal and human anatomy and physiology

Hierarchical organization of multicellular organisms: cells, tissues, organs, and systems. Structure and functions of the main tissues. Structure of body systems and their fundamental functions in animals and humans. Structure and main functions of animal tissues (epithelial, connective, muscular, and nervous). General organization of the digestive, respiratory, circulatory, musculoskeletal, excretory, reproductive, immune, nervous, and endocrine systems in humans. Vital functions in animals and humans. Nutrition and digestion. Respiration. Circulation. Excretion. Nervous and chemical communication. Protection, support, and movement. Immunity. Reproduction.

6. Elements of plant anatomy and physiology

Basic knowledge of the structure and function of the main plant tissues and organs. Basic knowledge of chlorophyll photosynthesis, linked to the ability to convert light energy into chemical energy for

the production of organic molecules. Importance of plant organisms in ecosystems, both for the nutrition of other organisms and for the production of oxygen and consumption of carbon dioxide that occur in the photosynthetic process. Importance of roots in terrestrial plants, for their functions of anchoring plants to the ground and absorbing water and mineral nutrients. Structure and function of plant tissues and organs: leaf, root, stem, flower. Fruits and seeds. Growth. Photosynthesis. Mineral nutrition. Water absorption and transpiration.

7. Biodiversity, classification, evolution

General lines of the evolution of living organisms and their classification into Domains and Kingdoms. Recognizing biodiversity: general characteristics of Bacteria, Protists, Fungi, Plants, Animals. Viruses. Classifying biodiversity: general concepts of classification and phylogeny, homology and analogy. Bacteria. Viruses. Protists. Fungi. General characteristics of the main plant phyla (bryophytes, ferns, gymnosperms, angiosperms). General characteristics of the main animal phyla (porifera, cnidaria, platyhelminthes, nematodes, mollusks, annelids, arthropods, echinoderms, chordates). Classification and phylogeny, homology and analogy.