ADMISSION FOR STUDIES IN ENGLISH – MEDICINE, DENTISTY & NURSING

RANGE OF KNOWLEDGE REQUIRED – TOPICS TO PREPARE FOR THE ENTRANCE EXAM

BIOLOGY

Macromolecules: carbohydrates and lipids (structure, synthesis, metabolism, functions, examples of the use in living organisms), proteins and nucleic acids (structure, synthesis, metabolism, functions, examples of the living organisms)

Energy of life: metabolism, energy flow through organisms, forms of energy, lows governing energy flow, free energy, equilibrium, ATP (powering cells, synthesis, hydrolysis, function, regeneration)

Enzymes: activation energy, speeding up reactions, substrates, active site

Prokaryotic cell – characterization

Eukaryotic cell – characterization

Cell membranes - structure and functions (built, transport)

Cellular organelles - structure and function of mitochondria and chloroplast

Cellular organelles - structure and function of nucleus, nucleolus and rough endoplasmic reticulum

Cellular organelles - structure and function of ribosomes, Golgi apparatus and the cytoskeleton

Cell communication: cell junctions, receptors and chemical messengers, pathways of intracellular signal transduction

Cell cycle, mitosis and meiosis process.

Catabolic and anabolic processes in human organism – from macromolecules to simplest inorganic compounds (general pathways)

Glycolysis (and its connection to other metabolic pathways)

Krebs cycle (and its connection to other metabolic pathways)

Cellular respiration (electron transport, proton motive force, oxidative phosphorylation)

Protein and fats metabolism (and its connection to other metabolic pathways)

Mendelian genetics (concepts, experiments, laws, connection to modern genetics)

Linkage and chromosomes (organization of genetic material in cell, sex linked genes, linked genes, genetic disorders, inheritance patterns)

Nucleic acids as genetic material (DNA - structure, function, organization, role in cell and organism)

Nucleic acids as genetic material (RNA - structure, function, organization, role in cell and organism)

Expression of genes - transcription and translation (role, function, all the details)

Regulation of gene expression in prokaryotes and eukaryotes

Mutations in organism (gene level, chromosome level, role in pathogenesis and role in evolution)

DNA technology and genome evolution (sequencing, cloning, GMO, DNA-based biotechnology)

Skeletal System: the structure and functions of bones, types of bones, structural classes of joints (fibrous, cartilaginous and synovial joints)

Muscle structure and physiology: structure of a muscle cell, structures of muscle filaments, basic types of vertebrate muscle (skeletal muscle, cardiac muscle, smooth muscle) processes of muscle contraction.

Structure and function of the skin, accessory structures of the skin: nails, hairs (which extend from hair follicles), glands located within the layers of the skin (sebaceous glands, sudoriferous glands, ceruminous glands.

Structure and function of the nervous system, main parts (sub-divisions) of the nervous system, parts of the central nervous system , neurons and glial cells, blood-brain barrier, structure and function of electrical and chemical synapses

Sense organs: the visual system, hearing and equilibrium, taste and olfaction, types of sensory receptors.

Respiratory system: structure of upper and lower respiratory tract, external and internal respiration, function of hemoglobin
Circulation system: pulmonary and systemic circulation, the structure and function of the heart, structure and functions of blood vessels, comparison between arteries and veins.

The structure and functions of blood: the functions of blood (generally - as opposed to the functions of particular components of blood), the composition of blood (incl. the different types of blood cells and their properties and functions), process of oxygenation of tissues due to circulation of blood, types of leucocytes (white blood cells), the blood clotting mechanism,

Immune system: the organs of the immune system, the cells of the immune system, the immune response, antigen-antibody, allergies, vaccination.

Endocrine system: definition of the hormone, water-soluble hormones and fat-soluble hormones, hormone regulation feedback mechanisms, major glands of the endocrine system and other (non-endocrine glands) organs and tissues that secrete hormones.

Structure of the digestive tract, digestive enzymes and their functions ,absorption in the digestive tract, function of the liver and gallbladder, pancreas and its functions.

2

Urinary system: parts and functions of the urinary system, anatomy of the kidney, kidney nephron and bladder, processes of blood filtration by the kidneys, female bladder and urethra, male bladder and urethra, characteristics and composition of urine.

Reproductive system: parts and functions of the female and male reproductive system, gametogenesis, the menstrual cycle

Viruses: definition, structure and replication, bacteriophage, viroids and prions, human virus infections, transmission of viruses, virus tissue tropism, emerging viruses.

Bacteria: characteristics of bacteria, five basic shapes of bacteria, cell surface structures, the gram stain, motility, bacterial growth, plasmids, diverse nutritional and metabolic adaptation, harmless, beneficial, and harmful bacteria

Fungi: types and characteristics, body structure, fungal reproduction, fungi as pathogens, role in ecosystems

Protists: definition, characteristics and examples, role in environment.

Ecology: biosphere, ecosystem, community, population, habitat, niches, biotic potential, limiting factors, tolerance, carrying capacity, adaptation, succession, consumers, producers, food chain, symbiosis, mutualism, commensalism, parasitism

Evolution: evolution in population, evolution of human being, Hardy-Weinberg equilibrium, natural selection, genetic drift, and gene flow, phylogeny and the tree of life.

CHEMISTRY

I. **Chemistry and mesurements**
1. Chemistry
2. Units of mesurements
3. Density

II. **Matter and energy**
1. Classification of matter
2. States nad properties of matter
3. Temperature
4. Energy
5. Specific heat
6. Changes of state

III. **Atoms and elements**
1. Elements and symbol
2. The periodic table
3. The atom
4. Atomic number and mass number
5. Isotopes and atomic mass
6. Elektron energy levels

IV. Nuclear chemistry

1. Nuclear radioactivity
2. Nuclear reactions
3. Radiation measurement
4. Half-life of a radioisotope
5. Nuclear fission and fusion

V. Ionic and molecular compounds

1. Ions
2. Naming ionic compounds
3. Whiting formulas for ionic compounds
4. Polyatomic ions
5. Molecular compounds
6. Electronegativity and bond polarity
7. Shapes and polarity of molecules
8. Attractive forces of compounds

VI. Chemical quantities and reactions

1. The mole
2. Molar mass and calculations
3. Equations for chemical reactions
4. Types of reactions
5. Oxidation-reduction reactions
6. Mole reletionships in chemical equations
7. Mass calculation for reactions
8. Energy in chemical reactions

VII. Gases

1. Properties of gases
2. Boyle's law
3. Charles's law
4. Gay-Lussac's law
5. Avogadro's law
6. Dalton's law

VIII. Solutions

1. Solutions
2. Electrolytes and nonelectrolytes
3. Solubility
4. Concentrations of solutions
5. Dilution of solutions
6. Properties of solutions

IX. Acids and bases and equilibrium

1. Acids and bases
2. Strengths of acids and bases
3. Ionization of water
4. The pH scale

5. Reactions of acids and bases
6. Buffers

X. Organic chemistry, hydrocarbons
1. Organic compounds
2. Alkanes
3. Alkanes and substituents
4. Properties of alkanes
5. Alkenes and alkynes
6. Cis-trans isomers
7. Aromatic compounds

XI. Alcohols, thiols, ethers, aldehydes and ketones
1. Alcohols, phenols, thiols and ethers
2. Properties of alcohols
3. Aldehydes and ketones
4. Reactions of alcohols, thiols, aldehydes and ketons

XII. Carbohydrates
1. Carbohydrates
2. Chiral molecules
3. Fischer projections of monosaccharides
4. Haworth structures of monosaccharides
5. Chemical properties of monosaccharides
6. Disaccharides
7. Polysaccharides

XIII. Carboxylic acids, esters, amines and amides
1. Carboxylic acids
2. Properties of carboxylic acids
3. Esters
4. Hydrolysis of esters
5. Amines
6. Amides

XIV. Lipids
1. Lipids
2. Fatty acids
3. Waxes and triacylglycerols
4. Phospholipids
5. Steroids: cholesterol, bile salts, steroid
6. Cell membranes

XV. Amino acids, proteins and enzymes
1. Proteins and amino acids
2. Amino acids as acids and bases
3. Protein: primary structure
4. Protein: secondary, tertiary and quaternary structures
5. Enzymes

5

6. Factor affecting enzyme activity

XVI. **Nucleic acids and protein synthesis**
1. **Components of nucleic acids**
2. **Primary structure of nucleic acids**
3. **DNA double helix**
4. **RNA and the genetic code**
5. **Protein synthesis**
6. **Genetic mutations**
7. **Viruses**

XVII. **Metabolic pathways and energy production**
1. **Metabolism and ATP energy**
2. **Digestion of food**
3. **Coenzymes in metabolic pathways**
4. **Glycolysis: oxidation of glucose**
5. **The citric acid cycle**
6. **Electron transport and oxidative phosphorylation**
7. **Oxidation of fatty acids**
8. **Degradation of amino acids**

Physics

Units, Conversions, and Estimation

Describing Motion: Kinematics in One Dimension

Kinematics in Two Dimentions; Vectors

Dynamics: Newton's Laws of Motion

Circular Motion; Gravitation

Work and Energy

Linear Momentum

Rotational Motion

Static Equilibrium; Elasticity and Fracture

Fluids

Oscillation and Waves

Sound

Temperature and Kinetic Theory

Heat

The Laws of Thermodynamics

Electric Charge and Electric Field

Electric Potential

Electric Currents

DC Circuits

Magnetism

Electromagnetic Induction and Farady's Law

Electromagnetic Waves

Light: Geometric Optics

The Wave Nature of Light

Optical Instruments, lenses

MATHEMATICS

ARITHMETIC eg:

Systems of numeracy, Numeration systems in the decimal base, Positional system

Transformation of a number from a given base to another base, Properties of Additions

Properties of subtraction, The properties of multiplication , The number of the digits of a product, The properties of division, Division with remainder, Partial remainders, Algorithm, Measuring quantities, Means, The figurative method , The method of reduction to the same comparative term

The method of the false hypothesis, Divisibility of the natural numbers

The rules of divisibility and criteria

Diophantine equations of first degree with two unknowns

Prime Numbers

Properties of the divisors of a composed number

Ordinary fractions, Comparison of fractions, Amplification of fractions, Simplification of a fraction

Decimal fractions, The division of decimal numbers

Transformation of ordinary fractions in decimal fractions

Simple periodical fractions, Mixed periodical functions

The transformation of the periodical decimal fractions in ordinary fractions

Fractional units or principal fractions

Approximate calculations

Absolute error, Approximate values resulted from computations

Operations with approximated numbers

The quotient's error, Relative errors

The relative error of a product , The relative error of a ratio

Ratio and proportions, Derived proportions, Average proportions

Multiple equal proportions

Direct proportional measures, Invers proportional measures

The fundamental rule of proportions

The compound proportions' fundamental rule

Ratio to percentage , Successive percentages, Periodical simple fractions

PLANE GEOMETRY eg:

Lines, Angles, Triangles , The properties of an equilateral triangle, The properties of the isosceles triangle, equality of triangles, Relations between the sides and the angles of a triangle

Inequalities between the sides of a triangle

Quadrilaterals, Parallelogram, Rhombus, Rectangle, Square , Trapezoid , Circle

The position of point with respect to a circle , The position of line with respect to a circle, The position of two circles

Arc subtended by a given angle , Inscribable quadrilaterals

First Theorem of Ptolemy , Second Theorem of Ptolemy

The power of a point in relation to circle

Regular polygons

Quadrilateral complete, Gauss' Theorem

Geometric transformations

Vectors , Translation , Symmetry

Homothetic transformation, Inversion transformation , Rotation transformation , Conformal transformation, Proportional segments

The harmonic conjugate points

Thales' Theorem, Bisector Theorem

Similarity of polygons

The cases of similarity of two triangles

The fundamental theorem of similarity

Polar triangle

Metric relations in a right triangle

Pythagoras Theorem, Metric relations in arbitrary triangles, Adjacent polygons

Menelaus' Theorem and generalization of Menelaus's theorem

Ceva's theorem, Van Aubel's theorem

Simson's line , Euler's circle (the circle of the 9 points), Euler's Theorem

Isogonal lines

Symmedian

The point of Lemoine

Orthic triangle

Orthogonal circles

d'Alembert theorem , Gergonne's theorem, Torricelli's theorem, The relation of Van Aubel

Apollonius circle, Newton's theorem, Pascal's theorem, Miquel's point, The Lemoine line, Brocard theorem

Quadrilateral harmonic, Pappus' theorem, Steiner's theorem , Pompeiu's theorem

Homological triangles