LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

Topics Required for the Entrance Examination MCQ

Academic Year 2018/2019

BIOLOGY

1. General biology, cell biology and ecology

Levels of biological organization: a cellular level and pre-cellular level (atom, molecule, biomolecules complex); sub-cellular level (organelle), cellular level (cell), multi-cellular level (tissue); ecological level (organism, population, ecosystem, biome, biosphere).
Biologically important elements. Basic elements and they roles (Nitrogen (N), sulphur (S), oxygen (O), hydrogen (H), and carbon (C) form organic compounds, i.e. proteins, carbohydrates, fats, and vitamins. Micro and macroelements). Biopolymeres.
Microscope (optic, electron).
Heterotrophy, autotrophy. Prokaryotes and eukaryotes. Multicellularity.
Cell structure. Cell membrane. Cytoplasm. Endoplasmic reticulum. Golgi complex. Mitochondria. Ribosomes. Lysosomes. Vacuoles. Cytoskeleton. Cilia, flagella. Centrioles.
Basic life functions: ingestion, digestion, secretion, absorption, respiration, excretion, transport, regulation, synthesis, assimilation, reproduction, irritability, movement.
Modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, fragmentation; vegetative propagation in plants.
Nucleus. Nuclear envelope. Diffusion through a cell membrane. Active transport.
Endocytosis. Phagocytosis. Exocytosis. Energy production (Photosynthesis).
Cell division. Mitosis. Cell cycle. Simple organisms (ameba, paramecium, bacteria, viruses). Representatives (species) of the major groups of animals: arthropoda, fish, amphibians, reptiles, birds, mammals.
Habitat and niche, population and ecological adaptations; population interactions - mutualism, competition, predation, parasitism. Food chain, producers, consumers, decomposers.

2. Genetics

Meiosis and sexual reproduction. Fertilization. Diploidy. Haploidy. Polyploidy. Zygote. Comparison of meiosis and mitosis. Spermatogenesis and oogenesis. Mendel's laws. Mutations. Mutations and evolution.
Genes and gene interactions. Autosomes. Sex chromosomes. Gene linkage. Crossing over. Recombination. DNA. DNA replication. RNA.
Human karyotype. Human karyotype abnormalities.

3. Human Anatomy and Physiology

Tissues: epithelial, nerve, muscle, connective. Digestive tract: oral cavity, pharynx, esophagus, stomach, small intestine, large intestine. Liver, pancreas. Nutritional requirements.
Respiration. Lungs. Hemoglobin and its function. Inspired and expired air.
Blood circulation. Heart. Blood vessels. Lymphatic system.
Blood, plasma, red blood cells, white blood cells. Blood clotting, platelets.
Immune system, immune response. B lymphocytes, T lymphocytes.
Endocrine system. Hypophysis, adrenal, thyroid, parathyroid glands. Hormones.
Kidney, excretion. Glomerulus.
Nervous system. Evolution. Nerve impulses. Cerebral cortex. Response to sensory information. Muscle contraction.
Reproduction. Male and female reproductive system.

EXAMPLE OF MULTIPLE CHOICE QUESTIONS

1. Sex chromosomal pattern in mammals is:
   A) XY – female, XX – male
   B) YY – female, XX – male
   C) XX – female, YO – male
   D) XX – female, XY - male

CHEMISTRY

General and Inorganic Chemistry

Structure of the atom. Periodic properties of elements. Ions in combination. Formulas for chemical compounds. Naming chemical compounds.

2. Electronegativity. Oxidation numbers. Types of chemical bonds.

3. Periodic table of elements. General characteristic of the groups.

4. The utilization of the periodic table for predicting oxidation numbers. Properties, chemical formulas and types of bond within the compounds.

5. Nomenclature of inorganic and organic compounds.

6. Types of chemical reactions. Chemical equations and their balancing. Stoichiometry.

7. Definition of oxidation and reduction. Oxidizing and reducing agents. Balancing oxidation-reduction equations.

8. Chemical equilibrium and equilibrium constant. Equilibrium conditions in terms of pressures. Le Chatelier's principle. Equilibrium in solutions. Calculating the equilibrium constant. The response of equilibria to the conditions.

9. Reaction rate. Factors influencing the rate of a chemical reaction.

10. Gases and their properties. The gas laws.

11. Solutions and solubility. Concentration and related calculations. Hydrolysis of salts.

12. Electrolytes and nonelectrolytes. Ionization. Arrhenius and Bronsted-Lowry definitions of acid and base.

13. Ionization of water. pH. Calculations of pH of a strong acid or base.

14. Electrolysis. Electrolytic cells.

15. Chemical thermodynamics. The laws of thermodynamics. Free energy and equilibrium. Entropy, enthalpy and free energy.

16. Chemical kinetics. Conditions affecting reaction rates. Determining reaction orders and rate constants. Catalysts.

Organic Chemistry and biochemistry

1. Classification of organic compounds. Functional groups. Isomers. Chemical reactions of organic compounds.

2. Alkanes, alkenes and alkynes. Nomenclature and properties.

3. Saturated, unsaturated and aromatic hydrocarbons.

4. Functional groups with covalent single bonds. Halogen derivatives of hydrocarbons, alkohols, phenols, ethers, amines.

5. Functional groups with covalent double bonds. Aldehydes and ketones, carboxylic acids, esters, acyl halides and carboxylic anhidrides, amides.

6. Polymers.

7. Functional and substitutional derivatives of carboxylic acids.

8. Amines. Nitro compounds.

9. Monosaccharides, disaccharides, and polysaccharides.
10. Triglycerides. Fatty acids. Fats and oils.
11. Amino acids. Peptides. Proteins. Nucleic acids.

EXAMPLE OF MULTIPLE CHOICE QUESTIONS

1. Which of the following compounds is produced when fatty acid reacts with sodium hydroxide?
   A) soap
   B) ester
   C) aldehyde
   D) alcohol

The following books are recommended for preparation to the MCO Test:

1) Sylvia Mader, Michael Windelspecht. Biology. 12-th Edition. McGraw-Hill Education, 2015. ISBN-13: 978-0078024269 ISBN-10:0078024269. Previous Edition (10-th, 11-th) also suitable.
2) CK-12 Foundation Biology: https://upload.wikimedia.org/wikipedia/commons/c/ce/High_School_Biology_1-13.pdf

https://upload.wikimedia.org/wikipedia/commons/b/b1/High_School_Biology_14-26.pdfhttps://upload.wikimedia.org/wikipedia/commons/b/b1/High_School_Biology_14-26.pdf

3) Joseph A. Mascetta M.S, Mark Kernion. Barron's SAT Subject Test Chemistry, 12th Edition, Eds.
4) Morris Hein, Scott Pattison, Susan Arena, Leo R. Best. Introduction to General, Organic, and Biochemistry. Willey, 2012.
5) James E. Brady, Neil D. Jespersen, Alison Hyslop. Chemistry, Willey, 2015 (2012).
6) Leo J. Malone, Theodore O. Dolter. Basic Concepts of Chemistry, Willey, 2013.
7) J. Clayden, N. Greeves, S. Warren. Organic chemistry, Oxford University Press, 2012.

Some less recent editions of these books are likely to be quite satisfactory and other books, which cover the topics of the exam.