BIOLOGY EXAM TOPICS

1. Chemical composition of the cell.
Elements and compounds in living organisms. Properties of water. Mineral salts. Lipids. Carbohydrates. Proteins. Nucleic acids. Enzymes. Factors affecting enzyme activity.

2. Supramolecular complexes.
Viruses – structure, reproduction, origin. Viral diseases in humans: chickenpox, smallpox, measles, mumps, poliomyelitis, AIDS. Vaccination.

3. Cell – the basic unit of life.
The cell theory – unicellular and multicellular organisms. Prokaryotic cells – ultrastructure and functions. Significance of bacteria in nature and for humans. Bacterial diseases. Methods for cell observation – light microscopy and electron microscopy.

4. Eukaryotic cells –structure and functions.
Membrane-bound organelles: single-membranous (endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes, secretory vesicles, vacuoles); double-membranous (nucleus, mitochondria, plastids). Non-membranous organelles – ribosomes, cytoskeleton, cytocentre.

5. Cell membrane.
Membrane structure and functions. Passive transport across membranes – diffusion, facilitated diffusion, osmosis. Active transport across membranes. Exocytosis and endocytosis. The endomembrane system.

6. Cell reproduction.
Cell division in prokaryotes and eukaryotes. Stages of mitosis; biological significance of mitosis; mitotic regulation. Meiosis – stages; biological significance. The cell cycle; cell differentiation; cell aging and cell death.

7. Metabolism.
Anabolic processes – photosynthesis. Light-dependent stage of photosynthesis (photosystem I and photosystem II; photolysis of water). Light-independent stage (Calvin cycle). Catabolism – cell respiration. Glycolysis. Fermentation. Krebs cycle. Electron-transport chains. Oxidative phosphorylation. ATP – structure and synthesis.

8. Genetic processes within the cells.
DNA replication. Transcription. Translation.

9. Mendelian genetics.
Monohybrid and dihybrid crosses. Test cross. Mendel's laws. Gene interactions between the alleles of the same gene – complete and incomplete dominance. Codominance. Lethal genes. Complementary and polygenic inheritance; epistasis.

10. Genes and chromosomes.
Chromosomal sex differentiation. Sex-linked inheritance. Linked genes and crossing-over. Mutations – gene and chromosomal mutations. Polyploidy and aneuploidy. Prenatal testing – amniocentesis; chorionic villi sampling. Karyotyping. Genetic disorders in humans.

11. Reproduction and development.
Male and female reproductive systems. Gametogenesis – oogenesis and spermatogenesis. Embryonic development (fertilization, cleavage, gastrulation, germ layers, organogenesis). Postembryonic development – metamorphosis. Aging and death.

12. Levels of organization in the human body.
Tissues, organs, organ systems. Epithelial, connective, muscle and nervous tissues. The organism as an integral unit - endocrine glands and hormonal regulation. The integumentary system.

13. Locomotor system.
The skeleton. Structure of bones and joints. Bones of the skull. Trunk and limb bones. Skeletal muscles - structure; muscle groups; muscle functions; the physiological properties of muscles. Diseases of the locomotor system and their prevention.

14. Digestive system.
Food and diet. Digestive organs. Digestion. Disorders and diseases of the digestive system. Hygiene of the digestive system.

15. Cardiovascular and lymphatic systems.
The internal body fluids. Blood – plasma and formed elements. Blood groups. Innate and adaptive immunity. Heart and blood vessels. Blood circulation – pulmonary and systemic circulation. Blood pressure. Lymph circulation. Disorders and diseases of the cardiovascular system.

16. Respiratory system.
The respiratory pathways. Respiratory movements. Ventilation and gas exchange. Regulation of breathing. Hygiene and diseases of the respiratory system.

17. Excretory system.
Structure and functions of excretory organs. Urine production. Regulation of excretion. Hygiene and diseases of the excretory system.

18. Nervous system and sensory system.
General structure and principles of activity of the nervous system. Central nervous system – the brain and the spinal cord. Sensory systems – visual, auditory, vestibular, olfactory, gustatory and somatosensory. Autonomic nervous system.

19. Evolution.
Evidence for evolution. Classification and biodiversity. Human evolution.

20. Ecology.
Species, communities and ecosystems. Human impact on the ecosystems.

References:

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2. Belk C., V. Borden. 2000. Biology – Science for Life.
3. Kent, M. Advanced Biology. 2000. Oxford University Press.
4. Mader S., M. Windelspeht. 2015. Biology. Mc Graw Hill, 12th ed.
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