**IB HL Biology II – Seniors Semester I**

**MUSCLES p.290-299**

**Topic 11: B – Muscles and Movements**

* State the roles of bones, ligaments, muscles, tendons and nerves in human movement.
* Label a diagram of the human elbow joint, including cartilage, synovial fluid, joint capsule, named bones and antagonistic muscles (biceps and triceps).
* Outline the functions of the structures in the human elbow joint named in 11.2.2.
* Compare the movements of the hip joint and the knee joint.
* Describe the structure of striated muscle fibres, including the myofibrils with light and dark bands, mitochondria, the sarcoplasmic reticulum, nuclei and the sarcolemma.
* Draw and label a diagram to show the structure of a sarcomere, including Z lines, actin filaments, myosin filaments with heads, and the resultant light and dark bands.
* Explain how skeletal muscle contracts, including the release of calcium ions from the sarcoplasmic reticulum, the formation of cross-bridges, the sliding of actin and myosin filaments, and the use of ATP to break cross-bridges and re-set myosin heads.
* Analyse electron micrographs to find the state of contraction of muscle fibres.

**CIRCULATORY p. 157-162 & p. 618-627**

**Topic 6: B – The transport system**

* Draw and label a diagram of the heart showing the four chambers, associated blood vessels, valves and the route of blood through the heart.
* State that the coronary arteries supply heart muscle with oxygen and nutrients.
* Explain the action of the heart in terms of collecting blood, pumping blood, and opening and closing of valves.
* Outline the control of the heartbeat in terms of myogenic muscle contraction, the role of the pacemaker, nerves, the medulla of the brain and epinephrine (adrenaline).
* Explain the relationship between the structure and function of arteries, capillaries and veins.
* State that blood is composed of plasma, erythrocytes, leucocytes (phagocytes and lymphocytes) and platelets.
* State that the following are transported by the blood: nutrients, oxygen, carbon dioxide, hormones, antibodies, urea and heat.

**Option H: E – The transport system**

* Explain the events of the cardiac cycle, including atrial and ventricular systole and diastole, and heart sounds.
* Analyse data showing pressure and volume changes in the left atrium, left ventricle and the aorta, during the cardiac cycle.
* Outline the mechanisms that control the heartbeat, including the roles of the SA (sinoatrial) node, AV (atrioventricular) node and conducting fibres in the ventricular walls.
* Outline atherosclerosis and the causes of coronary thrombosis.
* Discuss factors that affect the incidence of coronary heart disease

**RESPRIATORY p.168-172 & p.627-634**

**Topic 6: D – Gas Exchange**

* Distinguish between ventilation, gas exchange and cell respiration.
* Explain the need for a ventilation system
* Describe the features of alveoli that adapt them to gas exchange.
* Draw and label a diagram of the ventilation system, including trachea, lungs, bronchi, bronchioles and alveoli.
* Explain the mechanism of ventilation of the lungs in terms of volume and pressure changes caused by the internal and external intercostal muscles, the diaphragm and abdominal muscles.

**Topic H: F – Gas Exchange**

* Define partial pressure.
* Explain the oxygen dissociation curves of adult hemoglobin, fetal hemoglobin and myoglobin.
* Describe how carbon dioxide is carried by the blood, including the action of carbonic anhydrase, the chloride shift and buffering by plasma proteins.
* Explain the role of the Bohr shift in the supply of oxygen to respiring tissues.
* Explain how and why ventilation rate varies with exercise.
* Outline the possible causes of asthma and its effects on the gas exchange system.
* Explain the problem of gas exchange at high altitudes and the way the body acclimatizes.

**DIGESTION**

**Topic 6: A – Digestion**

* Explain why digestion of large food molecules is essential.
* Explain the need for enzymes in digestion
* State the source, substrate, products and optimum pH conditions for one amylase, one protease and one lipase.
* Draw and label a diagram of the digestive system.
* Outline the function of the stomach, small intestine and large intestine.
* Distinguish between absorption and assimilation
* Explain how the structure of the villus is related to its role in absorption and transport of the products of digestion

**Option H: B – Digestion**

* State that digestive juices are secreted into the alimentary canal by glands, including salivary glands, gastric glands in the stomach wall, the pancreas and the wall of the small intestine
* Explain the structural features of exocrine gland cells.
* Compare the composition of saliva, gastric juice and pancreatic juice.
* Outline the control of digestive juice secretion by nerves and hormones, using the example of secretion of gastric juice.
* Outline the role of membrane-bound enzymes on the surface of epithelial cells in the small intestine in digestion.
* Outline the reasons for cellulose not being digested in the alimentary canal.
* Explain why pepsin and trypsin are initially synthesized as inactive precursors and how they are subsequently activated.
* Discuss the roles of gastric acid and Helicobacter pylori in the development of stomach ulcers and stomach cancers.
* Explain the problem of lipid digestion in a hydrophilic medium and the role of bile in overcoming this.

**Option H: C – Absorption of Digested foods**

* Draw and label a diagram showing a transverse section of the ileum as seen under a light microscope.
* Explain the structural features of an epithelial cell of a villus as seen in electron micrographs, including microvilli, mitochondria, pinocytotic vesicles and tight junctions.
* Explain the mechanisms used by the ileum to absorb and transport food, including facilitated diffusion, active transport and endocytosis.
* List the materials that are not absorbed and are egested.

**ENDOCRINE**

**Option H: A – Hormone control**

* State that hormones are chemical messengers secreted by endocrine glands into the blood and transported to specific target cells.
* State that hormones can be steroids, proteins and tyrosine derivatives, with one example of each.
* Distinguish between the mode of action of steroid hormones and protein hormones.
* Outline the relationship between the hypothalamus and the pituitary gland.
* Explain the control of ADH (vasopressin) secretion by negative feedback.

**Topic 6: E – Nerves, Hormones, and Homeostasis**

* State that the nervous system consists of the central nervous system (CNS) and peripheral nerves, and is composed of cells called neurons that can carry rapid electrical impulses.
* Draw and label a diagram of the structure of a motor neuron.
* State that nerve impulses are conducted from receptors to the CNS by sensory neurons, within the CNS by relay neurons, and from the CNS to effectors by motor neurons.
* State that the endocrine system consists of glands that release hormones that are transported in the blood.
* State that homeostasis involves maintaining the internal environment between limits, including blood pH, carbon dioxide concentration, blood glucose concentration, body temperature and water balance.
* Explain that homeostasis involves monitoring levels of variables and correcting changes in levels by negative feedback mechanisms
* Explain the control of body temperature, including the transfer of heat in blood, and the roles of the hypothalamus, sweat glands, skin arterioles and shivering.
* Explain the control of blood glucose concentration, including the roles of glucagon, insulin and α and β cells in the pancreatic islets.
* Distinguish between type I and type II diabetes

**EXCRETORY**

**Topic 11: C – The Kidneys**

* Define excretion.
* Draw and label a diagram of the kidney.
* Annotate a diagram of a glomerulus and associated nephron to show the function of each part.
* Explain the process of ultrafiltration, including blood pressure, fenestrated blood capillaries and basement membrane.
* Define osmoregulation.
* Explain the reabsorption of glucose, water and salts in the proximal convoluted tubule, including the roles of microvilli, osmosis and active transport.
* Explain the roles of the loop of Henle, medulla, collecting duct and ADH (vasopressin) in maintaining the water balance of the blood.
* Explain the differences in the concentration of proteins, glucose and urea between blood plasma, glomerular filtrate and urine.
* Explain the presence of glucose in the urine of untreated diabetic patients.

**NERVOUS**

**Topic 6: E – Nerves, Hormones, and Homeostasis**

* State that the nervous system consists of the central nervous system (CNS) and peripheral nerves, and is composed of cells called neurons that can carry rapid electrical impulses.
* Draw and label a diagram of the structure of a motor neuron.
* State that nerve impulses are conducted from receptors to the CNS by sensory neurons, within the CNS by relay neurons, and from the CNS to effectors by motor neurons.
* Define resting potential and action potential (depolarization and repolarization).
* Explain how a nerve impulse passes along a non-myelinated neuron.
* Explain the principles of synaptic transmission.
* State that the endocrine system consists of glands that release hormones that are transported in the blood.
* State that homeostasis involves maintaining the internal environment between limits, including blood pH, carbon dioxide concentration, blood glucose concentration, body temperature and water balance.
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* Explain the control of body temperature, including the transfer of heat in blood, and the roles of the hypothalamus, sweat glands, skin arterioles and shivering.
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**IMMUNE**

**Topic 6: C – Population and pathogens**

* Define pathogen.
* Explain why antibiotics are effective against bacteria but not against viruses.
* Outline the role of skin and mucous membranes in defense against pathogens.
* Outline how phagocytic leucocytes ingest pathogens in the blood and in body tissues
* Distinguish between antigens and antibodies.
* Outline the effects of HIV on the immune system
* Discuss the cause, transmission and social implications of AIDS.

**Topic 11: A – Defense against Infectious Diseases**

* Describe the process of blood clotting.
* Outline the principle of challenge and response, clonal selection and memory cells as the basis of immunity.
* Define active and passive immunity.
* Explain antibody production.
* Describe the production of monoclonal antibodies and their use in diagnosis and in treatment.
* Explain the principle of vaccination.
* Discuss the benefits and dangers of vaccination

**LIVER**

**Option H: D – Functions of the Liver**

* Outline the circulation of blood through liver tissue, including the hepatic artery, hepatic portal vein, sinusoids and hepatic vein.
* Explain the role of the liver in regulating levels of nutrients in the blood.
* Outline the role of the liver in the storage of nutrients, including carbohydrate, iron, vitamin A and vitamin D.
* State that the liver synthesizes plasma proteins and cholesterol.
* State that the liver has a role in detoxification.
* Describe the process of erythrocyte and hemoglobin breakdown in the liver, including phagocytosis, digestion of globin and bile pigment formation.
* Explain liver damage

**REPRODUCTION**

**Topic 6: F – Reproduction**

* Draw and label diagrams of the adult male and female reproductive systems.
* Outline the role of hormones in the menstrual cycle, including FSH (follicle stimulating hormone), LH (luteinizing hormone), estrogen and progesterone.
* Annotate a graph showing hormone levels in the menstrual cycle, illustrating the relationship between changes in hormone levels and ovulation, menstruation and thickening of the endometrium.
* List three roles of testosterone in males.
* Outline the process of in vitro fertilization (IVF).
* Discuss the ethical issues associated with IVF.

**Topic 11: D – Reproduction**

* Annotate a light micrograph of testis tissue to show the location and function of interstitial cells (Leydig cells), germinal epithelium cells, developing spermatozoa and Sertoli cells.
* Outline the processes involved in spermatogenesis within the testis, including mitosis, cell growth, the two divisions of meiosis and cell differentiation.
* State the role of LH, testosterone and FSH in spermatogenesis.
* Annotate a diagram of the ovary to show the location and function of germinal epithelium, primary follicles, mature follicle and secondary oocyte.
* Outline the processes involved in oogenesis within the ovary, including mitosis, cell growth, the two divisions of meiosis, the unequal division of cytoplasm and the degeneration of polar body.
* Draw and label a diagram of a mature sperm and egg.
* Outline the role of the epididymis, seminal vesicle and prostate gland in the production of semen.
* Compare the processes of spermatogenesis and oogenesis, including the number of gametes and the timing of the formation and release of gametes
* Describe the process of fertilization, including the acrosome reaction, penetration of the egg membrane by a sperm and the cortical reaction.
* Outline the role of HCG in early pregnancy.
* Outline early embryo development up to the implantation of the blastocyst.
* Explain how the structure and functions of the placenta, including its hormonal role in secretion of estrogen and progesterone, maintain pregnancy.
* State that the fetus is supported and protected by the amniotic sac and amniotic fluid.
* State that materials are exchanged between the maternal and fetal blood in the placenta
* Outline the process of birth and its hormonal control, including the changes in progesterone and oxytocin levels and positive feedback