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

**STATS**

**Topic 1: Statistical analysis**

* State that error bars are a graphical representation of the variability of data.
* Calculate the mean and standard deviation of a set of values
* State that the term standard deviation is used to summarize the spread of values around the mean, and that 68% of values fall within one standard derivation of the mean.
* Explain how the standard deviation is useful for comparing the means and spread of data between two or more samples.
* Deduce the significance of the difference between two sets of data using calculated values for t and the appropriate tables.
* Explain that the existence of a correlation does not establish that there is a causal relationship between two variables.

**CELLS**

**Topic 2: A – Cell theory**

* Outline the cell theory
* Discuss the evidence for the cell theory
* State that uni-cellular organisms carry out all the functions of life.
* Compare the relative sizes of molecules, cell membrane thickness, viruses, bacteria, organelles and cells, using the appropriate SI unit.
* Calculate the linear magnification of drawings and the actual size of specimens in images of known magnification
* Explain the importance of the surface area to volume ratio as a factor limiting cell size.
* State that multicellular organisms show emergent properties
* Explain that cells in multicellular organisms differentiate to carry out specialized functions by expressing some of their genes but not others
* State that stem cells retain the capacity to divide and have the ability to differentiate along different pathways.
* Outline one therapeutic use of stem cells

**Topic 2: B – Prokaryotic Cells**

* Draw and label a diagram of the ultrastructure of Escherichia coli (E. coli) as an example of a prokaryote
* Annotate the diagram from 2.2.1 with the functions of each named structure.
* Identify structures from 2.2.1 in electron micrographs of E. coli.
* State that prokaryotic cells divide by binary fission.

**Topic 2: C – Eukaryotic Cells**

* Draw and label a diagram of the ultrastructure of a liver cell as an example of an animal cell.
* Annotate the diagram from 2.3.1 with the functions of each named structure.
* Identify structures from 2.3.1 in electron micrographs of liver cells.
* Compare prokaryotic and eukaryotic cells
* State three differences between plant and animal cells.
* Outline two roles of extracellular components

**Topic 2: D - Membranes**

* Draw and label a diagram to show the structure of membranes.
* Explain how the hydrophobic and hydrophilic properties of phospholipids help to maintain the structure of cell membranes.
* List the functions of membrane proteins.
* Define diffusion and osmosis.
* Explain passive transport across membranes by simple diffusion and facilitated diffusion.
* Explain the role of protein pumps and ATP in active transport across membranes.
* Explain how vesicles are used to transport materials within a cell between the rough endoplasmic reticulum, Golgi apparatus and plasma membrane
* Describe how the fluidity of the membrane allows it to change shape, break and re-form during endocytosis and exocytosis.

**BIOCHEMISTRY p.12-38, p.46-57, p.66-69, & p.206-214**

**Topic 3: A –Chemical Elements and Water**

* State that the most frequently occurring chemical elements in living things are carbon, hydrogen, oxygen and nitrogen.
* State that a variety of other elements are needed by living organisms, including sulfur, calcium, phosphorus, iron and sodium.
* Draw and label a diagram showing the structure of water molecules to show their polarity and hydrogen bond formation.
* Outline the thermal, cohesive and solvent properties of water.

**Topic 3: B – Carbohydrates, Lipids, and Proteins**

* Distinguish between organic and inorganic compounds.
* Identify amino acids, glucose, ribose and fatty acids from diagrams showing their structure
* List three examples each of monosaccharides, disaccharides and polysaccharides.
* State one function of glucose, lactose and glycogen in animals, and of fructose, sucrose and cellulose in plants.
* Outline the role of condensation and hydrolysis in the relationships between monosaccharides, disaccharides and polysaccharides; between fatty acids, glycerol and triglycerides; and between amino acids and polypeptides.
* State three functions of lipids.
* Compare the use of carbohydrates and lipids in energy storage.

**Topic 7: E – Nerves, Hormones, and Homeostasis**

* Explain the four levels of protein structure, indicating the significance of each level.
* Outline the difference between fibrous and globular proteins, with reference to two examples of each protein type.
* Explain the significance of polar and non-polar amino acids.
* State four functions of proteins, giving a named example of each.

**Topic 7: F – Enzymes**

* State that metabolic pathways consist of chains and cycles of enzyme-catalysed reactions
* Describe the induced-fit model.
* Explain that enzymes lower the activation energy of the chemical reactions that they catalyse.
* Explain the difference between competitive and non-competitive inhibition, with reference to one example of each.
* Explain the control of metabolic pathways by end-product inhibition, including the role of allosteric sites.

**BOTANY p.238-263**

**Topic 9: A – Plant structure and growth**

* Draw and label plan diagrams to show the distribution of tissues in the stem and leaf of a dicotyledonous plant.
* Outline three differences between the structures of dicotyledonous and monocotyledonous plants.
* Explain the relationship between the distribution of tissues in the leaf and the functions of these tissues.
* Identify modifications of roots, stems and leaves for different functions: bulbs, stem tubers, storage roots and tendrils.
* State that dicotyledonous plants have apical and lateral meristems.
* Compare growth due to apical and lateral meristems in dicotyledonous plants.
* Explain the role of auxin in phototropism as an example of the control of plant growth.

**Topic 9: B – Transport in Angiospermophytes**

* Outline how the root system provides a large surface area for mineral ion and water uptake by means of branching and root hairs.
* List ways in which mineral ions in the soil move to the root.
* State that terrestrial plants support themselves by means of thickened cellulose, cell turgor and lignified xylem.
* Define transpiration.
* Explain how water is carried by the transpiration stream, including the structure of xylem vessels, transpiration pull, cohesion, adhesion and evaporation.
* State that guard cells can regulate, by means of hormones, transpiration by opening and closing stomata.
* State that the plant hormone abscisic acid causes the closing of stomata.
* Explain how the abiotic factors light, temperature, wind and humidity, affect the rate of transpiration in a typical terrestrial plant.
* Outline four adaptations of xerophytes that help to reduce transpiration.
* Outline the role of phloem in active translocation of sugars (sucrose) from source (photosynthetic tissue and storage organs) to sink (fruits, seeds, roots).

**Topic 9: C – Reproduction in Angiospermophytes**

* Draw and label a diagram showing the structure of a dicotyledonous animal-pollinated flower
* Distinguish between pollination, fertilization and seed dispersal.
* Draw and label a diagram showing the external and internal structure of a named dicotyledonous seed.
* Explain the conditions needed for the germination of a typical seed.
* Outline the metabolic processes during germination of a starchy seed.
* Explain how flowering is controlled in long-day and short-day plants, including the role of phytochrome.

**ENERGY p.70-78, p. 217-236**

**Topic 3: G – Cell Respiration**

* Define cell respiration.
* State that, in cell respiration, glucose in the cytoplasm is broken down by glycolysis into pyruvate, with a small yield of ATP.
* Explain that, during anaerobic cell respiration, pyruvate can be converted in the cytoplasm into lactate, or ethanol and carbon dioxide, with no further yield of ATP.
* Explain that, during aerobic cell respiration, pyruvate can be broken down in the mitochondrion into carbon dioxide and water with a large yield of ATP.

**Topic 3: H – Photosynthesis**

* State that photosynthesis involves the conversion of light energy into chemical energy.
* State that light from the Sun is composed of a range of wavelengths (colors).
* State that chlorophyll is the main photosynthetic pigment
* Outline the differences in absorption of red, blue and green light by chlorophyll.
* State that light energy is used to produce ATP, and to split water molecules (photolysis) to form oxygen and hydrogen.
* State that ATP and hydrogen (derived from the photolysis of water) are used to fix carbon dioxide to make organic molecules.
* Explain that the rate of photosynthesis can be measured directly by the production of oxygen or the uptake of carbon dioxide, or indirectly by an increase in biomass
* Outline the effects of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis

**Topic 8: A – Cell Respiration**

* State that oxidation involves the loss of electrons from an element, whereas reduction involves a gain of electrons; and that oxidation frequently involves gaining oxygen or losing hydrogen, whereas reduction frequently involves losing oxygen or gaining hydrogen.
* Outline the process of glycolysis, including phosphorylation, lysis, oxidation and ATP formation
* Draw and label a diagram showing the structure of a mitochondrion as seen in electron micrographs.
* Explain aerobic respiration, including the link reaction, the Krebs cycle, the role of NADH + H+, the electron transport chain and the role of oxygen.
* Explain oxidative phosphorylation in terms of chemiosmosis
* Explain the relationship between the structure of the mitochondrion and its function.

**Topic 8: B - Photosynthesis**

* Draw and label a diagram showing the structure of a chloroplast as seen in electron micrographs.
* State that photosynthesis consists of light-dependent and light-independent reactions.
* Explain the light-dependent reactions.
* Explain photophosphorylation in terms of chemiosmosis.
* Explain the light-independent reactions
* Explain the relationship between the structure of the chloroplast and its function.
* Explain the relationship between the action spectrum and the absorption spectrum of photosynthetic pigments in green plants.
* Explain the concept of limiting factors in photosynthesis, with reference to light intensity, temperature and concentration of carbon dioxide