The AS specification content that is developed or required for the A2 units in 2022.

AS Unit 1 – Basic biochemistry and cell organisation

1. Chemical elements are joined together to form biological compounds

(a) the key elements present as inorganic ions in living organisms: Mg^{2+}, Fe^{2+} Ca^{2+} PO_4^{3-}

(b) the importance of water in terms of its polarity, ability to form hydrogen bonds, surface tension, as a solvent, thermal properties, as a metabolite

(c) the structure, properties and functions of carbohydrates: monosaccharides (triose, pentose, hexose sugars); disaccharides (sucrose, lactose, maltose); polysaccharides (starch, glycogen, cellulose, chitin)

(d) alpha and beta structural isomerism in glucose and its polymerisation into storage and structural carbohydrates, illustrated by starch, cellulose and chitin

(f) the structure, properties and functions of lipids as illustrated by triglycerides and phospholipids

(h) the structure and role of amino acids and proteins

(i) the primary, secondary, tertiary and quaternary structure of proteins

(j) the relationship of the fibrous and globular structure of proteins to their function

2. Cell structure and organisation

(a) the structure and function of the following: mitochondria; endoplasmic reticulum (rough and smooth); ribosomes; Golgi body; lysosomes; centrioles; chloroplasts; vacuoles; nucleus; chromatin; nuclear envelope; nucleolus; plasmodesmata

(b) the structure of prokaryotic cells and viruses

(d) the levels of organisation including aggregation of cells into tissues, tissues into organs and organs into organ systems and also the examination of a range of prepared slides showing examples of epithelia, muscle and connective tissue

3. Cell membranes and transport

(a) the principal components of the plasma membrane and understand the fluidmosaic model

(b) the factors affecting permeability of the plasma membrane

(c) the following transport mechanisms: diffusion and factors affecting the rate of diffusion; osmosis and water potential; pinocytosis; facilitated diffusion; phagocytosis; secretion (exocytosis); active transport and the influence of cyanide

4. Biological reactions are regulated by enzymes

(a) metabolism as a series of enzyme controlled reactions

(d) active sites, interpreted in terms of three dimensional structure

(f) the meaning of catalysis; the lowering of the activation energy

(g) the influence of temperature, pH, substrate and enzyme concentration on rate of activity and inactivation and denaturation of enzymes and the importance of buffers for maintaining a constant pH

(h) the principles of competitive and non-competitive inhibition

5. Nucleic acids and their functions

(a) the structure of nucleotides (pentose sugar, phosphate, organic base)
(b) the importance of chemical energy in biological processes
(c) the central role of ATP as an energy carrier and its use in the liberation of energy for cellular activity
(d) the structure of ATP
(f) the similarities and differences in the structure of RNA and DNA
(g) the two major functions of DNA; replication and protein synthesis
(h) the semi-conservative replication of DNA including the roles of DNA polymerase and helicase and be able to use evidence from the Meselson and Stahl experiments
(i) the term genetic code
(j) the triplet code for amino acids
(k) exons as regions of DNA that contain the code for proteins and that between the exons are regions of non-coding DNA called introns
(l) the transcription of DNA to produce messenger RNA
(m) the translation of mRNA using ribosomes and the structure and function of transfer RNA, to synthesise proteins
(n) the 'one gene - one polypeptide' hypothesis
(o) the further modification and combination of some polypeptides

6. Genetic information is copied and passed on to daughter cells

(a) interphase and the main stages of mitosis
(b) the significance of mitosis as a process in which daughter cells are provided with identical copies of genes and the process of cytokinesis
(c) the significance of mitosis in terms of damage and disease: repeated cell renewal, damage repair and healing and unrestricted division leading to cancerous growth
(d) the main stages of meiosis (names of subdivisions of prophase 1 not required) and cytokinesis
(e) the differences between mitosis and meiosis, including that mitosis produces genetically identical daughter cells whereas meiosis produces non-identical daughter cells

AS Unit 2 – Biodiversity and physiology of body systems

1. All organisms are related through their evolutionary history

(f) the concept of species
(h) biodiversity as the number and variety of organisms found within a specified geographic region
(i) biodiversity varying spatially and over time and affected by many factors
(k) biodiversity can be assessed within a species at a genetic level by looking at the variety of alleles in the gene pool of a population, i.e. the proportion of polymorphic loci across the genome
(l) biodiversity can be assessed at a molecular level using DNA fingerprinting and sequencing
(m) biodiversity has been generated through natural selection
(n) the different types of adaptations of organisms to their environment including anatomical, physiological and behavioural adaptations

3. Adaptations for transport

(b) the mammalian circulatory system including the structure and function of heart and blood vessels and the names of the main blood vessels associated with the human heart
(f) the Bohr effect and chloride shift
(m) the detailed structure of xylem as seen by the light and electron microscope, including examination of microscope slides of T.S. dicotyledon primary stem
(q) the detailed structure of phloem as seen by the light and electron microscope

4. Adaptations for nutrition

(a) the terms autotrophic and heterotrophic and that autotrophic organisms can be photoautotrophic or chemoautotrophic
(b) the terms saprotrophic/saprobiotic, holozoic, parasitic in relation to heterotrophic organisms