Biology OCR Year 12 - Personal Learning Checklist

OCR Y12 A Level Biology A

Remember to test yourself by doing an exam question!

OCR Y12 A Level Biology A - Module 1 – Development of practical skills in biology		R	A	G
B1.1.1 Planning	Recall how to use experimental design, including to solve problems set in a practical context (HSW3).			
	Describe how to identify different types of variables that must be controlled.			
	Evaluate an experimental method to ensure it is appropriate to meet the expected outcomes (HSW6).			
B1.1.2 Implementing	Describe how to use a wide range of practical apparatus and techniques correctly (HSW4).			
	Recall appropriate units for measurements during practical procedures: *(M0.1)* convert between units e.g. mm^3 to cm^3 as part of volumetric calculations.			
	Recall appropriate units for measurements during practical procedures: *(M0.1)* work out the unit for a rate e.g. breathing rate.			
	Describe how to present observations and data in an appropriate format (HSW8).			
B1.1.3 Analysis	Describe and explain how to process, analyse and interpret qualitative and quantitative experimental results and form valid conclusions (HSW5).			
	Describe how to use appropriate mathematical skills for analysis of quantitative data (HSW3).			
	Use significant figures appropriately *(M1.1)* report calculations to an appropriate number of significant figures given raw data and explain why calculated results can only be reported to the least accurate measurement.			
	Plot and interpret suitable graphs from experimental results *(M3.2)* including selection and labelling of axes with appropriate scales, quantities and units and (M3.3 & M3.5) measurement of gradients and intercept.			
B1.1.4 Evaluation	Describe how to evaluate results and draw conclusions (HSW6).			
	Explain the identification of anomalies in experimental measurements.			
	Explain the limitations in experimental procedures			
	Explain precision and accuracy of measurements and data, including margins of error, % errors and uncertainties in apparatus *(M1.11)*			
	Describe the refining of experimental design by suggestion of improvements to the procedures and apparatus (HSW3).			

OCR Y12 A Level Biology A - Module 2 – Foundations in biology		R	A	G
B2.1.1 Cell structure	Describe how to use microscopy to observe and investigate different types of cell and cell structure in a range of eukaryotic organisms.			
	Describe how to prepare and examine microscope slides for use in light microscopy.			
	Practical activity group (PAG1) - Microscopy: Use a light microscope at high power and low power, use a graticule and stage micrometer.			
	Practical activity group (PAG1) - Microscopy: Produce scientific drawings from observations with annotations.			
	Describe how to use differential staining to identify different cellular components and cell types.			
	Represent cell structure as seen under the light microscope using drawings and annotated diagrams of whole cells or cells in sections of tissue.			
	Describe how to the use and manipulation of the magnification formula			
	Recall the difference between magnification and resolution and compare for a light microscope, a transmission electron			
	microscope and a scanning electron microscope.			
	1. Describe the ultrastructure of eukaryotic cells and the functions of the different cellular components, nucleus, nucleolus, nuclear envelope, rough and smooth ER, Golgi apparatus, ribosomes.			
	2. Describe the ultrastructure of eukaryotic cells and the functions of the different cellular components, mitochondria, lysosomes, chloroplasts, plasma membrane, centrioles, cell wall, flagella and cilia.			
	Interpret photomicrographs of cellular components in a range of eukaryotic cells, including transmission and scanning electron microscope images.			
	Describe the interrelationship between the organelles involved in the production and secretion of proteins.			
	Explain the importance of the cytoskeleton.			
	Describe the similarities and differences in the structure and ultrastructure of prokaryotic and eukaryotic cells.			
B2.1.2 Biological molecules	Describe how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water for living organisms.			
	Explain the concept of monomers and polymers and the importance of condensation and hydrolysis reactions in a range of biological molecules.			
	Recall the chemical elements that make up biological molecules for carbohydrates, lipids, proteins and nucleic acids.			
	Describe the synthesis and breakdown of a disaccharide and polysaccharide by the formation and breakage of glycosidic bonds for sucrose, lactose and maltose.			
	Describe the structure of starch (amylose and amylopectin), glycogen and cellulose molecules.			
	Explain how the structures and properties of glucose, starch, glycogen and cellulose molecules relate to their functions in living organisms.			
	Describe the structure of a triglyceride and a phospholipid as examples of macromolecules, including an outline of saturated and unsaturated fatty acids.			
	Describe the synthesis and breakdown of triglycerides by the formation (esterification) and breakage of ester bonds between fatty acids and glycerol.			
	Explain how the properties of triglyceride, phospholipid and cholesterol molecules relate to their functions in living organism, including hydrophobic/hydrophilic regions and energy content.			
	Recall the general structure of an amino acid.			
	Describe the synthesis and breakdown of dipeptides and polypeptides, by the formation and breakage of peptide bonds.			
	Describe the levels of protein structure; primary, secondary, tertiary and quaternary, include hydrogen bonding, hydrophobic/hydrophilic interactions, disulfide bonds and ionic bonds.			
	Describe the structure and function of globular proteins including a conjugated protein (haemoglobin) a named enzyme and insulin.			
	Describe the properties and functions of fibrous proteins; collagen, keratin and elastin.			
	Recall the key inorganic ions that are involved in biological processes: cations: calcium ions (Ca^{2+}), sodium ions (Na^{+}), potassium ions (K+), hydrogen ions (H+) and ammonium ions (NH4+)			
	Recall the key inorganic ions that are involved in biological processes: anions: nitrate (NO3–), hydrogen carbonate (HCO3–), chloride (Cl –), phosphate (PO43–), hydroxide, (OH–).			
	Describe how to carry out the: biuret test for proteins, Benedict's test for reducing/non-reducing sugars, reagent test strips for reducing sugars, iodine test for starch and emulsion test for lipids.			
	Practical activity group (PAG9) - Qualitative testing - Use of qualitative reagents to identify biological molecules.			
	Describe the quantitative methods to determine the concentration of a chemical substance in a by colorimetry and the use of biosensors.			
	Practical activity group (PAG5) -Colorimetry - Use of appropriate instrumentation to record quantitative measurements and use of laboratory glassware apparatus to include serial dilutions.			
	Describe the principles and uses of paper and thin layer chromatography to separate biological molecules/compounds, include calculation of retention (Rf) values.			
	Practical activity group (PAG6) -Chromatography - Separation of biological compounds using thin layer/paper chromatography - amino acids.			

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B2.1.3 Nucleotides and nucleic acids	Recall the structure of a nucleotide as the monomer from which nucleic acids are made.			
	Describe differences between RNA and DNA nucleotides, recall the structure of purines and pyrimidines and identify the type of pentose sugar.			
	Practical activity group (PAG10) - Computer modelling - Investigating DNA structure using RasMol.			
	Describe the synthesis and breakdown of polynucleotides by the formation and breakage of phosphodiester bonds.			
	Describe the structure of ADP (adenosine diphosphate) and ATP (adenosine triphosphate) as phosphorylated nucleotides.			
	Describe the structure of DNA (deoxyribonucleic acid), include how H bonding between complementary base pairs (A to T, G to C) leads to its 'double-helix' shape.			
	Describe roles of the enzymes helicase and DNA polymerase in semi-conservative DNA replication and explain the importance of replication.			
	Describe the nature of the genetic code, include triplet code, non-overlapping, degenerate and universal nature of the code and how a gene determines the sequence of amino acids.			
	Describe and explain transcription and translation of genes resulting in the synthesis of polypeptides, include the roles of RNA polymerase, (m)RNA, (t)RNA and (r)RNA.			
B2.1.4 Enzymes	Explain the role of enzymes in catalysing reactions that affect metabolism at a cellular and whole organism level.			
	Explain the role of enzymes in catalysing both intracellular and extracellular reactions, to include catalase - intracellular reactions and amylase and trypsin extracellular reaction.			
	Describe and explain the mechanism of enzyme action, include lock and key hypothesis, induced-fit hypothesis and lowering of activation energy.			
	Describe and explain the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity, referring to the temperature coefficient (Q_{10}).			
	Describe practical investigations into the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity.			
	Practical activity group (PAG4) - Rates of enzyme controlled reactions - The effect of substrate concentration on the rate of an enzyme controlled reaction.			
	Explain the need for coenzymes, cofactors and prosthetic groups in some enzyme-controlled reactions, to include Cl^- - amylase, Zn^{2+} - prosthetic group carbonic anhydrase and vitamins- source of coenzymes.			
	Explain) the effects of inhibitors on the rate of enzyme controlled reactions, to include competitive and non-competitive and reversible and non-reversible inhibitors.			
B2.1.5 Biological membranes	Describe the roles of membranes within cells and at the surface of cells, to include partially permeable barriers, sites of chemical reactions and sites of cell communication (cell signalling).			
	Describe the fluid mosaic model of membrane structure and the roles of its components: phospholipids, cholesterol, glycolipids, proteins and glycoproteins.			
	Recall the effects of temperature and solvents on membrane structure and permeability.			
	Describe practical investigations into factors affecting membrane structure and permeability.			
	Practical activity group (PAG8) - Transport in and out of cells - An investigation into the water potential of potato.			
	Describe and explain the movement of molecules across membranes, to include diffusion and facilitated diffusion as passive methods.			
	Explain how the movement of water across membranes by osmosis and the effects that solutions of different water potential can have on plant and animal cells			
	Explain osmosis in terms of a water potential gradient across a partially-permeable membrane.			
	Describe practical investigations into the effects of solutions of different water potential on plant and animal cells.			
B2.1.6 Cell division, cell diversity and cellular organisation	Describe and explain the cell cycle, to include the processes taking place during interphase (G1, S and G2), mitosis and cytokinesis, leading to genetically identical cells.			
	Explain how the cell cycle is regulated.			
	Describe the main stages of mitosis, to include the changes in the nuclear envelope, chromosomes, chromatids, centromere, centrioles, spindle fibres and cell membrane.			
	Examine of stained sections and squashes of plant tissue and the produce labelled diagrams to show the stages observed.			
	Explain the significance of mitosis in life cycles, to include growth, tissue repair and asexual reproduction in plants, animals and fungi.			
	Explain the significance of meiosis in life cycles, to include the production of haploid cells and genetic variation by independent assortment and crossing over.			
	Describe the main stages of meiosis, to include interphase, prophase 1, metaphase 1, anaphase 1, telophase 1, prophase 2, metaphase 2, anaphase 2 and telophase 2.			
	Describe how the following cells are specialised for particular functions: erythrocytes, neutrophils, squamous and ciliated epithelial cells, sperm cells, palisade cells, root hair cells and guard cells.			
	Describe the organisation of cells into tissues, organs and organ systems, to include squamous and ciliated epithelia, cartilage, muscle, xylem and phloem as examples of tissues.			
	Explain the features and differentiation of stem cells, to include stem cells as a renewing source of undifferentiated cells.			
	Describe the production of erythrocytes and neutrophils derived from stem cells in bone marrow.			
	Describe the production of xylem vessels and phloem sieve tubes from meristems.			
	Describe and explain the potential uses of stem cells in research and medicine, to include the repair of damaged tissues, the treatment of Alzheimer's and Parkinson's, and research.			

Module 3 – Exchange and transport				
B3.1.1 Exchange surfaces	Explain the need for specialised exchange surfaces, to include surface area to volume ratio (SA:V), metabolic activity, single-celled and multicellular organisms.			
	Describe and explain the features of an efficient exchange surface, to include, increased surface area – root hair cells, thin layer – alveoli, good blood supply/ventilation to maintain gradient – gills/alveolus.			
	Describe the structures and functions of the components of the mammalian gaseous exchange system: to include cartilage, ciliated epithelium, goblet cells, smooth muscle and elastic fibres.			
	Describe the mechanism of ventilation in mammals, to include the function of the rib cage, intercostal muscles (internal and external) and diaphragm.			
	Describe and explain the relationship between vital capacity, tidal volume, breathing rate and oxygen uptake, and analyse and interpret primary and secondary data e.g. from a data logger or spirometer.			
	Describe the mechanisms of ventilation and gas exchange in bony fish and insects.			
	Carry out the dissection, examination and drawing of the gaseous exchange system of a bony fish and/or insect trachea			
	Practical activity group (PAG2) - Dissection - Safe use of instruments for dissection of an animal and production of scientific drawings from observations with annotations.			
	Carry out the examination of microscope slides to describe the histology of exchange surfaces.			
B3.1.2 Transport in animals	Explain the need for transport systems in multicellular plants in terms of size, metabolic rate and surface area to volume ratio (SA:V).			
	Describe the structure and function of the vascular system in the roots, stems, leaves of herbaceous dicotyledonous plants and xylem vessels, sieve tube elements and companion cells.			
	Carry out the examination and drawing of stained sections of plant tissue to show the distribution of xylem and phloem.			
	Carry out the dissection of stems, both longitudinally and transversely, and their examination to demonstrate the position and structure of xylem vessels.			
	Describe and explain the process of transpiration and the environmental factors that affect transpiration rate.			
	Carry out practical investigations to estimate transpiration rates.			
	Practical activity group (PAG5&11) - Potometer & Investigation into the measurement of plant responses -Use of a potometer to measure transpiration rates in different conditions.			
	Describe and explain the transport of water into the plant, through the plant and to the air surrounding the leaves, to include water potential, adhesion, cohesion and the transpiration stream.			
	Describe and explain adaptations of plants to the availability of water in their environment, to include xerophytes (cacti and marram grass) and hydrophytes (water lilies).			
	Describe and explain the mechanism of translocation, to details of sources (e.g. leaves) and sinks (e.g. roots, meristem).			

Module 4 – Biodiversity, evolution and disease		R	A	G
B4.1.1 Communicable diseases, disease prevention and the immune system	Recall the different types of pathogen that can cause communicable diseases in plants and animals.			
	Recall that bacteria cause tuberculosis (TB), bacterial meningitis, ring rot (potatoes, tomatoes).			
	Recall that viruses cause HIV/AIDS (human), influenza (animals), Tobacco Mosaic Virus (plants)			
	Recall that protoctista cause malaria, potato/tomato late blight.			
	Recall that fungi cause black sigatoka (bananas), ring worm (cattle), athlete's foot (humans).			
	Describe the means of transmission of animal and plant communicable pathogens, to include direct and indirect transmission, vectors, spores and living conditions – e.g. climate, social factors.			
	Describe plant defences against pathogens, to include production of chemicals, plant responses that limit the spread of the pathogen (e.g. callose deposition).			
	Describe the primary non-specific defences against pathogens in animals, to e skin, blood clotting, wound repair, inflammation, expulsive reflexes and mucous membranes.			
	Describe and explain the structure and mode of action of phagocytes, to include neutrophils and antigen-presenting cells, the roles of cytokines, opsonins, phagosomes and lysosomes.			
	Carry out practicals to examination and drawing of cells observed in blood smears.			
	Describe and explain the structure, different roles and modes of action of B and T lymphocytes in the specific immune response.			
	Explain the significance of cell signalling (reference to interleukins), clonal selection and clonal expansion, plasma cells, T helper cells, T killer cells and T regulator cells.			
	Describe the primary and secondary immune responses, to include T memory cells and B memory cells.			
	Describe the structure and general functions of antibodies, to include the general structure of an antibody molecule.			
	Describe an outline of the action of opsonins, agglutinins and anti-toxins.			
	Describe the differences between active and passive immunity, and between natural and artificial immunity, giving an example of each.			
	Describe what autoimmune diseases are and describe an example e.g. arthritis, lupus.			
	Explain the principles of vaccination and the role of vaccination programmes in the prevention of epidemics including changes to vaccination programmes.			
	Explain microbes and plants as possible sources of medicines, include examples, the need for biodiversity and the potential for personalised medicines and synthetic biology.			
	Describe and explain the benefits and risks of using antibiotics to manage bacterial infection, to include the wide use of antibiotics following the discovery of penicillin, resistance to antibiotics (e.g. Clostridium difficile and MRSA).			
B4.2.1 Biodiversity	Describe how biodiversity may be considered at different levels e.g. habitat, species and genetic.			
	Explain how sampling is used in measuring the biodiversity of a habitat and the importance of sampling, to include random sampling and non-random sampling.			
	Carry out practical investigations collecting random and non-random samples in the field.			
	Practical activity group (PAG3) - Sampling techniques - Use of sampling techniques in fieldwork to calculate species diversity			
	Describe how to measure species richness and species evenness in a habitat.			
	Describe the use and interpretation of Simpson's Index of Diversity (D) to calculate			
	the biodiversity of a habitat using the formula:			
	Describe and explain) how genetic biodiversity may be assessed, including calculations of genetic diversity within			
	isolated populations.			
	Describe and explain the factors affecting biodiversity, to include human population growth, agriculture (monoculture) and climate change.			
	Describe and explain the ecological, economic and aesthetic reasons for maintaining biodiversity.			
	Describe and explain international and local conservation agreements made to protect species and habitats, to include historic and/or current agreements.			
B4.2.2 Classification and evolution	Recall the biological classification of species, to include the taxonomic hierarchy of kingdom, phylum, class, order, family, genus and species and domain.			
	Describe the binomial system of naming species and explain the advantage of such a system.			
	Recall the features used to classify organisms into the five kingdoms: Prokaryotae, Protoctista, Fungi, Plantae, Animalia.			
	Describe the evidence that has led to new classification systems, such as the three domains of life, which clarifies relationships.			
	Explain the relationship between classification and phylogeny.			
	Evaluate the evidence for the theory of evolution by natural selection, to include the contribution of Darwin and Wallace and discuss and fossil, DNA and molecular evidence.			
	Describe the dfferent types of variation, intraspecific/interspecific, continuous/discontinuous variation, both genetic and environmental causes of variation.			
	Describe and explain the different types of anatomical, physiological and behavioural adaptations of organisms to their environment.			
	Discuss why organisms from different taxonomic groups may show similar anatomical features, including the marsupial mole and placental mole.			
	Explain the mechanism by which natural selection can affect the characteristics of a population over time.			
	Explain how evolution in some species has implications for human populations, to include the evolution of pesticide resistance in insects and drug resistance in microorganisms.			