Pearson Edexcel GCE Biology B

Scheme of work – A level Biology B

This is an example and may be adapted.

Week	Topic	Content of lessons	Teaching suggestions	Spec. reference	Student Book
1	Carbohydrates	• Know the difference between monosaccharides, disaccharides and polysaccharides. • Know the structure of the hexose glucose (alpha and beta) and the pentose ribose. • Understand how monosaccharides (glucose, fructose, galactose) join to form disaccharides (sucrose, lactose and maltose) and polysaccharides (starch formed from amylose and amylopectin; glycogen) through condensation reactions forming glycosidic bonds, and how these can be split through hydrolysis reactions. • Understand how the structure of glucose, starch, glycogen and cellulose relates to their function.	Use of model beads to construct carbohydrate molecules. Use of paper shapes to construct carbohydrate molecules. Use of immobilised lactase to show hydrolysis of the disaccharide lactose into the monosaccharides glucose and galactose.	1.1 i, ii, iii, iv	
2	Lipids	• Understand how a triglyceride is synthesised including the formation of ester bonds during condensation reactions between glycerol and three fatty acids. • Know the differences between saturated and unsaturated lipids. • Understand how the structure of lipids relates to their role in energy storage, waterproofing and insulation. • Understand how the structure and properties of phospholipids relate to their function in cell membranes.	Use of model beads to construct lipids. Use of paper shapes to construct lipids.	1.2 i, ii, iii, iv	

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3	Inorganic ions and water	• Understand the role in plants of:
		  • nitrate ions – to make DNA and amino acids
		  • calcium ions – to form calcium pectate for the middle lamellae
		  • magnesium ions – to produce chlorophyll
		  • phosphate ions – to make ADP and ATP.
		• Understand the importance of the dipole nature of water leading to hydrogen bonding and the significance of the following to organisms:
		  • high specific heat capacity
		  • polar solvent
		  • surface tension
		  • incompressibility
		  • maximum density at 4°C.
			Experiments involving mineral deficiency and plant growth.	1.6 i
				1.7 i	

4	Proteins	• Know the structure of an amino acid (structures of specific amino acids are not required). • Understand the formation of polypeptides and proteins (as amino acid monomers linked by peptide bonds in condensation reactions). • Understand the role of ionic, hydrogen and disulphide bonding in the structure of proteins. • Understand the significance of the primary, secondary, tertiary and quaternary structure of a protein in determining the properties of fibrous and globular proteins, including collagen and haemoglobin. • Understand how the structure of collagen and haemoglobin are related to their function.	Use of model beads to construct proteins. Use of paper shapes to construct proteins.	1.3 i, ii, iii, iv, v	

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5	DNA and protein synthesis	• Know the structure of DNA, including the structure of the nucleotides (purines and pyrimidines), base pairing, the two sugar-phosphate backbones, phosphodiester bonds and hydrogen bonds. • Understand how DNA is replicated semi-conservatively, including the role of DNA helicase, polymerase and ligase. • Know that a gene is a sequence of bases on a DNA molecule coding for a sequence of amino acids in a polypeptide chain. • Know the structure of mRNA including nucleotides, the sugar phosphate backbone and the role of hydrogen bonds. • Know the structure of tRNA, including nucleotides, the role of hydrogen bonds and the anticodon. • Understand the processes of transcription in the nucleus and translation at the ribosome, including the role of sense and anti-sense DNA, mRNA, tRNA and the ribosomes. • Understand the nature of the genetic code, including triplets coding for amino acids, start and stop codons, degenerate and non-overlapping nature, and that not all the genome codes for proteins. • Understand the term gene mutation as illustrated by base deletions, insertions and substitutions. • Understand the effect of point mutations on amino acid sequences, as illustrated by sickle cell anaemia in humans.	Use of paper shapes to construct nucleic acids. Extract DNA from onion tissue. Interpret diagrams showing the results obtained by Meselson and Stahl. Demonstrate the relevance of experiments that used *Acetabularia*.	1.4 i, ii, iii, iv, v, vi, vii, viii, ix	

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6	Enzymes	• Know the structure of enzymes as globular proteins. • Understand the concepts of specificity and the induced fit hypothesis. • Understand that enzymes are catalysts that reduce activation energy. • Understand how temperature, pH, substrate and enzyme concentration affect the rate of enzyme activity. • **Core practical 1**: Investigate a factor affecting the initial rate of an enzyme-controlled reaction. • Understand how the initial rate of enzyme activity can be measured and why this is important. • Understand how enzymes can be affected by competitive, non-competitive and end-product inhibition. • Know that enzymes catalyse a wide range of intracellular reactions as well as extracellular ones.	All students should carry out the core practical. Use liver tissue as catalase source and hydrogen peroxide as substrate to measure the effect of different variables on rate of oxygen production. Use starch suspension and iodine to measure starch digestion by use of a colorimeter – opportunity to create calibration curve.	1.5 i, ii, iii, iv, v, vi, vii	
7		Consolidate and recap on Topic 1.			

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16	Cell transport mechanisms	• Know the structure of the cell surface membrane with reference to the fluid mosaic model.
		• Understand how passive transport is brought about by:
		  • diffusion
		  • facilitated diffusion (through carrier proteins and protein channels)
		  • osmosis.
		• Understand how the properties of molecules affects how they are transported, including solubility, size and charge.
		• Know that large molecules can be transported into and out of cells through the formation of vesicles, in the processes of endocytosis and exocytosis.
		• **Core practical 5**: Investigate the effect of temperature on beetroot membrane permeability.
		• **Core practical 6**: Determine the water potential of a plant tissue.
		Water potential = turgor pressure + osmotic potential
		$\Psi = P + \pi$
		• Understand the process of active transport, including the role of ATP.
		• Know that phosphorylation of ADP requires energy and that hydrolysis of ATP provides an accessible supply of energy for biological processes.
			All students should carry out the core practicals.
			Demonstrate diffusion using several pieces of litmus paper placed at different distances in a sealed glass tube, with a ball of cotton wool soaked in ammonium hydroxide solution placed at one end, all done in a fume cupboard.
			Demonstrate mass flow using same apparatus but do not seal glass tube and blow air through using a syringe.
			Use different concentrations of ethanol to investigate membrane permeability in beetroot.
			Observe mammal red blood cells placed in hypertonic, isotonic and hypotonic salt solution.
				4.2
				i, ii, iii, iv, v, vi	

17	Surface area to volume ratio	• Understand how surface area to volume ratio affects transport of molecules in living organisms. • Understand why organisms need a mass transport system and specialised gas exchange surfaces as they increase in size.	Use different cube sizes of potato to find out how SA:VOL ratio affects percentage water uptake. Use different-sized agar cubes and potassium manganate(VII) solution.	4.1 i, ii	

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18	Gas exchange	• Understand how insects, fish and mammals are adapted for gas exchange. • **Core practical 7**: Dissect an insect to show the structure of the gas exchange system, taking into account the safe and ethical use of organisms. • Understand gas exchange in flowering plants, including the role of stomata, gas exchange surfaces in the leaf and lenticels.	All students should carry out the core practical. Look at prepared slides of mammal lung tissue. Use leaf peels or varnish impressions to calculate stomatal density in different species.	4.3 i, ii	

19 - 20	Circulation	• Know the structure of the heart, arteries, veins and capillaries.
		• Understand the advantages of a double circulatory system in mammals over the single circulatory systems in bony fish, including the facility for blood to be pumped to the body at higher pressure and the splitting of oxygenated and deoxygenated blood.
		• Know the sequence of events of the cardiac cycle.
		• Understand myogenic stimulation of the heart, including the roles of the sinoatrial node (SAN), atrioventricular node (AVN) and bundle of His.
		• Be able to interpret data showing ECG traces and pressure changes during the cardiac cycle.
		• Know the structure of blood as plasma and blood cells, to include erythrocytes and leucocytes
		• Know the function of blood as transport, defence, and formation of lymph and tissue fluid.
		• Understand the role of platelets and plasma proteins in the sequence of events leading to blood clotting, including:
		  • platelets form a plug and release clotting factors, including thromboplastin
		  • prothrombin changes to its active form, thrombin
		  • soluble fibrinogen forms insoluble fibrin to cover the wound.
			Dissect a sheep heart.
			Look at prepared slides showing an artery and a vein.
			Demonstrate elastic recoil by suspending a ring of artery and vein from a hook on a clamp stand. Record the length of the ring once the mass carrier has been attached to the free end of the ring. Attach a 10g mass and record the length of the ring after the mass is added. Remove the mass and record the length of the ring. Calculate percentage change.
			Use ECG traces to calculate heart rate.
			Look at prepared microscope slides showing blood cells.
				4.4
				i, ii, iii, iv, v, vi, vii, viii, ix	

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		• Understand the stages that lead to atherosclerosis, its effect on health and the factors that increase the risk of its development.			
21	Transport of gases in the blood	• Understand the structure of haemoglobin in relation to its role in the transport of respiratory gases, including the Bohr effect. • Understand the oxygen dissociation curve of haemoglobin. • Understand the similarities and differences between the structures and functions of haemoglobin and myoglobin. • Understand the significance of the oxygen affinity of fetal haemoglobin as compared to adult haemoglobin.	Interpret graphs that compare dissociation curves for different blood samples, such as warm and cold blood, llama and horse blood, and mouse and elephant blood.	4.5 i, ii, iii, iv	
22	Transfer of materials between the circulatory system and cells	• Understand how the interchange of substances occurs through the formation and reabsorption of tissue fluid, including the effects of hydrostatic pressure and oncotic pressure. • Know that tissue fluid that is not reabsorbed is returned to the blood via the lymph system.	Measure blood pressure. Opportunity to also measure BMI and plot a graph showing correlation between systolic blood pressure and BMI.	4.6 i, ii	
23	Transport in plants	• Understand the structure of xylem and phloem tissues in relation to their role in transport. • Understand how water can be moved through plant cells by the apoplastic and symplastic pathways. • Understand how the cohesion-tension model explains the transport of water from plant roots to shoots. • Understand how temperature, light, humidity and movement of air affect the rate of transpiration. • Understand the strengths and weaknesses of the mass-flow hypothesis in explaining the movement of sugars through phloem tissue. • **Core practical 8**: Investigate factors affecting water uptake by plant shoots using a potometer.	All students should carry out the core practical. Tease apart tinned rhubarb stained with methylene blue to look at xylem. Prepare or look at stained sections of plant stems. Place plant shoots in dye and cut sections to observe the location of the dye. Determine the tensile strength of plant fibres.	4.7 i, ii, iii, iv, v	

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24		Recap and consolidation of Topic 4.			