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| **Module 1: Biological Molecules**  **2.1.1 Biological Molecules** |
| (a) describe how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water in living organisms |
| (b) describe, with the aid of diagrams, the structure of an amino acid; |
| (c) describe, with the aid of diagrams, the formation and breakage of peptide bonds in the synthesis and hydrolysis of dipeptides and polypeptides; |
| (d) explain, with the aid of diagrams, the term *primary structure;* |
| (e) explain, with the aid of diagrams, the term *secondary structure* with reference to hydrogen bonding |
| (f) explain, with the aid of diagrams, the term *tertiary structure*, with reference to hydrophobic and hydrophilic interactions,  disulfide bonds and ionic interactions; |
| (g) explain, with the aid of diagrams, the term *quaternary structure*, with reference to the structure of haemoglobin; |
| (h) describe, with the aid of diagrams, the structure of a collagen molecule; |
| (i) compare the structure and function of haemoglobin (as an example of a globular protein) and collagen (as an example of a fibrous protein); |
| (j) describe, with the aid of diagrams, the molecular structure of alpha-glucose as an example of a monosaccharide carbohydrate; |
| (k) state the structural difference between alpha- and beta-glucose; |
| (l) describe, with the aid of diagrams, the formation and breakage of glycosidic bonds in the synthesis and hydrolysis of a disaccharide (maltose) and a polysaccharide (amylose); |
| (m) compare and contrast the structure and functions of starch (amylose) and cellulose; |
| (n) describe, with the aid of diagrams, the structure of glycogen; |
| (o) explain how the structures of glucose, starch (amylose), glycogen and cellulose molecules relate to their functions in living organisms; |
| (p) compare, with the aid of diagrams, the structure of a triglyceride and a phospholipid; |
| (q) explain how the structures of triglyceride, phospholipid and cholesterol molecules relate to their functions in living organisms; |
| (r) describe how to carry out chemical tests to identify the presence of the following molecules: protein (biuret test), reducing  and non-reducing sugars (Benedict’s test), starch (iodine solution) and lipids (emulsion test); |
| (s) describe how the concentration of glucose in a solution may be determined using colorimetry |
| 2.1.2 Nucleic Acids |
| (a) state that deoxyribonucleic acid (DNA) is a polynucleotide, usually double stranded, made up of nucleotides containing the bases adenine (A), thymine (T), cytosine (C) and guanine (G); |
| (b) state that ribonucleic acid (RNA) is a polynucleotide, usually single stranded, made up of nucleotides containing the  bases adenine (A), uracil (U), cytosine (C) and guanine (G); |
| (c) describe, with the aid of diagrams, how hydrogen bonding between complementary base pairs (A to T, G to C) on two  antiparallel DNA polynucleotides leads to the formation of a DNA molecule, and how the twisting of DNA produces its ‘doublehelix’ shape |
| (d) outline, with the aid of diagrams, how DNA replicates semi-conservatively, with reference to the role of DNA polymerase; |
| (e) state that a gene is a sequence of DNA nucleotides that codes for a polypeptide |
| (f) outline the roles of DNA and RNA in living organisms (the concept of protein synthesis must be considered in outline only). |
| 2.1.3 Enzymes |
| (a) state that enzymes are globular proteins, with a specific tertiary structure, which catalyse metabolic reactions in living  organisms; |
| (b) state that enzyme action may be intracellular or extracellular; |
| (c) describe, with the aid of diagrams, the mechanism of action of enzyme molecules, with reference to specificity, active site, lock and key hypothesis, induced-fit hypothesis, enzyme-substrate complex, enzyme-product  complex and lowering of activation energy; |
| (d) describe and explain the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity; |
| (e) describe how the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity  can be investigated experimentally; |
| (f) explain the effects of competitive and noncompetitive inhibitors on the rate of enzyme-controlled reactions, with reference  to both reversible and non-reversible inhibitors; |
| (g) explain the importance of cofactors and coenzymes in enzyme-controlled reactions; |
| (h) state that metabolic poisons may be enzyme inhibitors, and describe the action of one named poison; |
| (i) state that some medicinal drugs work by inhibiting the activity of enzymes |