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|  | The variety of life, both present and present, is extensive but the biochemical basis of life is similar for all living things. |  |  |  |  |  |
|  | Monomers are the smaller units form which larger molecules are made. |  |  |  |  |  |
|  | Polymers are molecules made from a large number of monomers joined together. |  |  |  |  |  |
|  | Monosaccharaides, amino acids and nucleotides are examples of monomers. |  |  |  |  |  |
|  | A condensation reaction joins two molecules together with the formation of a chemical bond and involves the elimination of a molecules of water. |  |  |  |  |  |
|  | A hydrolysis reaction breaks a chemical bond between two molecules and involves the use of a water molecule. |  |  |  |  |  |
|  | Monosaccharides are the monomers from which larger carbohydrates are made. Glucose, galactose and fructose are common monosaccharides. |  |  |  |  |  |
|  | A condensation reaction between two monosaccharides forms a glycosidic bond. |  |  |  |  |  |
|  | Disaccharides are formed by the condensation of two monosaccharides.* Maltose is a disaccharide formed by condensation of two glucose molecules.
* Sucrose is a disaccharide formed by condensation of a glucose and a fructose molecule.
* Lactose is a disaccharide formed by condensation of a glucose and a galactose molecule.
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|  | Glucose has two isomers, alpha-glucose and beta-glucose and their structures. |  |  |  |  |  |
|  | Polysaccharides are formed by the condensation of many glucose units:* Glycogen and starch are formed by the condensation of alpha-glucose.
* Cellulose is formed by the condensation of beta-glucose.
 |  |  |  |  |  |
|  | The basic structure and functions of glycogen, starch and cellulose. The relationship of structure to function of these substances in animal cells and plant cells. |  |  |  |  |  |
|  | Biochemical tests using Benedict’s solution for reducing sugars and non-reducing sugars and iodine/potassium iodide for starch. |  |  |  |  |  |
|  | Triglycerides and phospholipids are two groups of lipid. |  |  |  |  |  |
|  | Triglycerides are formed by the condensation of one molecule of glycerol and three molecules of fatty acids. |  |  |  |  |  |
|  | A condensation reaction between glycerol and a fatty acid (RCOOH) forms an ester bond. |  |  |  |  |  |
|  | The R-group of a fatty acid may be saturated or unsaturated. |  |  |  |  |  |
|  | In phospholipids, one of the fatty acids of a triglyceride is substituted by a phosphate-containing group. |  |  |  |  |  |
|  | The different properties of a triglycerides and phospholipids related to their different structures. |  |  |  |  |  |
|  | The emulsion test for lipids. |  |  |  |  |  |
|  | Amino acids are the monomers from which proteins are made.  |  |  |  |  |  |
|  | The general structure of an amino acid. In this structure NH2 represents an amine group, COOH represents a carboxyl group and R represents a carbon-containing side chain. The twenty amino acids that are common in all organisms differ only in their side group. |  |  |  |  |  |
|  | A condensation reaction between two amino acids forms a peptide bond.* Dipeptides are formed by the condensation of two amino acids.
* Polypeptides are formed by the condensation of many amino acids.
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|  | A functional protein may contain one or more polypeptides. |  |  |  |  |  |
|  | The role of hydrogen bonds, ionic bonds and disulphide bridges in the structure of proteins. |  |  |  |  |  |
|  | Proteins have a variety of functions within all living organisms. The relationship between primary, secondary, tertiary and quaternary structure and protein function. |  |  |  |  |  |
|  | The biuret test for proteins. |  |  |  |  |  |
|  | Each enzyme lowers the activation energy of the reaction it catalyses. |  |  |  |  |  |
|  | The induced-fit model of enzyme action. |  |  |  |  |  |
|  | The properties of an enzyme relate to the tertiary structure of its active site and its ability to combine with complementary substrate(s) to form an enzyme-substrate complex.* The specificity of enzymes.
* The effects of the following factors on the rate of enzyme-controlled reactions – enzyme concentration, substrate concentration, concentration of competitive and of non-competitive inhibitors, pH and temperature.
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|  | Relate the structure of proteins to properties of proteins named throughout the specification. |  |  |  |  |  |
|  | Appreciate how models of enzyme action have changed over time. |  |  |  |  |  |
|  | Appreciate that enzyme catalyse a wide range of intracellular and extracellular reactions that determine structures and functions from cellular to whole-organism level. |  |  |  |  |  |
|  | Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) are important information-carrying molecules. In all living cells, DNA holds genetic information and RNA transfers genetic information from DNA to the ribosomes. |  |  |  |  |  |
|  | Ribosomes are formed from RNA and proteins. |  |  |  |  |  |
|  | Both DNA and RNA are polymers of nucleotides. Each nucleotide is formed from a pentose, a nitrogen-containing organic base and a phosphate group.* The components of a DNA nucleotide are deoxyribose, a phosphate group and one of the organic bases adenine, cytosine, guanine or thymine.
* The components of an RNA nucleotide are ribose, a phosphate group and one of the organic bases adenine, cytosine, guanine or uracil.
* A condensation reaction between two nucleotides forms a phosphodiester bond.
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|  | A DNA molecule is a double helix with two polynucleotide chains held together by hydrogen bonds between specific complementary base bases. |  |  |  |  |  |
|  | An RNA molecule is a relatively short polynucleotide chain. |  |  |  |  |  |
|  | Appreciate that the relative simplicity of DNA lad many scientists to doubt that it carried the genetic code. |  |  |  |  |  |
|  | The semi-conservative replication of DNA ensures genetic continuity between generations of cells. |  |  |  |  |  |
|  | The process of semi-conservative replication of DNA in terms of:* Unwinding of the double helix.
* Breakage of the hydrogen bonds between complementary bases in the polynucleotide strands.
* The role of DNA helicase in unwinding DNA and breaking its hydrogen bonds.
* Attraction of new DNA nucleotides to exposed bases on template strands and base pairing.
* The role of DNA polymerase in the condensation reactions that joins adjacent nucleotides.
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|  | Evaluate the work of scientist in validating the Watson-Crick model of DNA replication. |  |  |  |  |  |
|  | A single molecule of adenosine triphosphate (ATP) is a nucleotide derivative and is formed form a molecule of ribose, a molecule of adenine and three phosphate groups. |  |  |  |  |  |
|  | Hydrolysis of ATP to adenosine diphosphate (ADP) and an inorganic phosphate group (pi) is catalysed by the enzyme ATP hydrolase.* The hydrolysis of ATP can be couple to energy-requiring reactions within cells.
* The inorganic phosphate released during the hydrolysis of ATP can be used to phosphorylate other compounds, often making them more reactive.
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|  | ATP is resynthesized by the condensation of ADP and Pi. This reaction is catalysed by the enzyme ATP synthase during photosynthesis, or during respiration. |  |  |  |  |  |
|  | Water is a major component of cells. |  |  |  |  |  |
|  | Water is a metabolite in many metabolic reactions, including condensation and hydrolysis reactions. |  |  |  |  |  |
|  | Is an important solvent in which metabolic reactions occur. |  |  |  |  |  |
|  | Has a relatively high heat capacity, buffering changes in temperature. |  |  |  |  |  |
|  | Has a relatively large latent heat of vaporisation, providing a cooling effect with little loss of water through evaporation. |  |  |  |  |  |
|  | Has strong cohesion between water molecules; this supports columns of water in the tube-like transport cells of plants and produces surface tension where water meets air. |  |  |  |  |  |
|  | Inorganic ions occur in solution in the cytoplasm and body fluid of organisms, some in high concentrations and other in very low concentrations. |  |  |  |  |  |
|  | Each type of ion has a specific role, depending on its properties. |  |  |  |  |  |
|  | Recognise the role of ions in the following topics: hydrogen ions and pH; iron ions as a component of haemoglobin; sodium ions in the co-transport of glucose and amino acides; and phosphate ions as components of DNA and of ATP. |  |  |  |  |  |