Topic 19 – Amino Acids, Polymers, Organic Synthesis and Biochemistry

* I can describe and explain that amino acids have both acidic and basic properties, including the formation of zwitterions, and I can draw the structures of amino acids as zwitterions and the ions formed from amino acids in acid solution and in alkaline solution
* I can describe the formation of condensation polymers by reactions between dicarboxylic acids and diols, dicarboxylic acids and diamines, and amino acids, I can draw the repeating unit from a section of the polymer chain, draw the structure(s) of the monomer(s) from a section of the polymer, describe the repeating units in polyesters (eg Terylene) and polyamides (eg nylon 6,6 and Kevlar), describe the linkages between these repeating units and state the typical uses of these polymers
* I can explain the nature of the intermolecular forces between molecules of condensation polymers
* I can explain that proteins are sequences of amino acids joined by peptide links, draw the structure of a peptide formed from up to three amino acids, describe and identify in diagrams the primary, secondary (α-helix and β–pleated sheets) and tertiary structure of proteins and explain how these structures are maintained by hydrogen bonding and sulfur–sulfur bonds
* I can describe polyalkenes as chemically inert and non-biodegradable, understand that polyesters and polyamides can be broken down by hydrolysis and are biodegradable, state the advantages and disadvantages of different methods of disposal of polymers, including recycling, and explain why polyesters and polyamides can be hydrolysed but polyalkenes cannot
* I can explain that hydrolysis of the peptide link in proteins produces the constituent amino acids
* I can describe enzymes as proteins, describe the action of enzymes as catalysts, including the concept of a stereospecific active site that binds to a substrate molecule, explain why a stereospecific active site can only bond to one enantiomeric form of a substrate or drug, describe the principle of a drug acting as an enzyme inhibitor by blocking the active site, and understand that computers can be used to help design such drugs
* I can describe a nucleotide as made up from a phosphate ion bonded to 2-deoxyribose which is in turn bonded to one of the four bases adenine, cytosine, guanine and thymine (structures given in the Chemistry data booklet), that a single strand of DNA (deoxyribonucleic acid) is a polymer of nucleotides linked by covalent bonds between the phosphate group of one nucleotide and the 2-deoxyribose of another nucleotide which results in a sugar-phosphate-sugar-phosphate polymer chain with bases attached to the sugars in the chain, and that DNA exists as two complementary strands arranged in the form of a double helix, and I can explain how hydrogen bonding between base pairs leads to the two complementary strands of DNA
* I can state that the Pt(II) complex cisplatin is used as an anticancer drug, explain that cisplatin prevents DNA replication in cancer cells by a ligand replacement reaction with DNA in which a bond is formed between platinum and a nitrogen atom on guanine, explain why cisplatin prevents DNA replication and explain why such drugs can have adverse effects
* I can appreciate that society needs to assess the balance between the benefits and the adverse effects of drugs, such as the anticancer drug cisplatin
* I understand that the synthesis of an organic compound can involve several steps, explain why chemists aim to design processes that do not require a solvent and that use non-hazardous starting materials, explain why chemists aim to design production methods with fewer steps that have a high percentage atom economy, and use reactions in this specification to devise a synthesis, with up to four steps, for an organic compound