AP Biology

CH 3

Concept Review w/answers

**3.1**

**In what ways does a methyl group differ chemically from the other six important chemical groups?**

*The methyl group is nonpolar and not reactive. The other six groups are called functional groups and can participate in chemical reactions. Except for the sulfhydryl group, these functional groups are hydrophilic; they increase the solubility of organic compounds in water. Because they are not reactive, they can act as “tags” on certain molecules.*

**3.2**

**What is the fundamental basis for the differences between carbohydrates, proteins, and nucleic acids?**

*The polymers of carbohydrates, proteins, and nucleic acids are built from three different types of monomers: monosaccharides, amino acids, and nucleotides respectively.*

**3.3**

**Compare the composition, structure, and function of starch and cellulose. What roles do starch and cellulose play in the human body?**

*Both starch and cellulose are polymers of glucose, but the glucose monomers are in the α configuration in starch and the β configuration in cellulose. The glycosidic linkages thus have different geometries, giving the polymers different shapes and thus different properties. Starch is an energy storage compound in plants; cellulose is a structural component of plant cell walls. Humans can hydrolyze starch to provide energy but cannot hydrolyze cellulose. Cellulose aids in the passage of food through the digestive tract.The difference between the alpha and beta forms is just a flipping of a –H and an –OH and thus when bonded either all –OH ‘s on one side of the molecule(starch) or alternating(cellulose)*

**3.4**

**Why are lipids not considered to be macromolecules or polymers?**

*Lipids are not polymers because they do not exist as a chain of linked monomers. They are not considered macromolecules because they do not reach the giant size of many polysaccharides, proteins, and nucleic acids.*

**3.5**

**Explain the basis for the great diversity of proteins.**

*A polypeptide, which may consist of hundreds of amino acids in a specific sequence(PRIMARY STRUCTURE), has regions of coils and pleats(SECONDARY STRUCTURE), which are then folded into irregular contortions(TERTIARY STRUCTURE), and may be non-covalently associated with other polypeptides(QUARTERNARY STRUCTURE). The linear order of amino acids, with the varying properties of their SIDE CHAINS(-R GROUPS), determines what secondary and tertiary structures will form to produce a protein. The resulting unique three-dimensional shapes(CONFORMATIONS) of proteins are key to their SPECIFIC and diverse FUNCTIONS.*

**3.6**

**What role does complementary base pairing play in the functions of nucleic acids?**

*The complementary base pairing of the two strands of DNA makes possible the precise replication of DNA every time a cell divides, ensuring that genetic information is faithfully transmitted. In some types of RNA, complementary base pairing enables RNA molecules to assume specific three-dimensional shapes that facilitate diverse functions. For example, rRNA as a component of ribosomes and tRNA as a key player in the process of translation. NOTE: ATP is a nucleic acid which has more than one phosphate group; polynucleotides like RNA and DNA have only one phosphate group per nucleotide, when considering a nucleotide without any phosphate group we refer to it as a nucleoside.*

*NOTE: The 5’ carbon atom is the one with the phosphate group attached to it. The sugar phosphate backbones have directionality and run antiparallel to each other: 5’ to 3’ and the other strand 3’ to 5’. PHOSPHODIESTER LINKAGES link the phosphate groups and five carbon sugars. PYRIMIDINES(one ring) pair with PURINES(two rings).*

**BONUS**

**Describe and give an example of both a dehydration(condensation) reaction and hydrolysis.**

*A dehydration reaction occurs when monomers are covalently bonded to each other and one water molecule is LOST. One monomer provides an –OH and the adjacent one provides the –H. So two hydrogens and one oxygen have to be subtracted from the formula for every bond that forms this way. Remember – as an example—ten glucose molecules would have only NINE of these GLYCOSIDIC LINKAGES.*

*A hydrolysis reaction occurs when polymers are DISASSEMBLED back to monomers in essentially the reverse of a dehydration reaction. A water molecule is ADDED . A –H from the water attaches to one monomer, and an –OH to the adjacent monomer. Polymers are broken apart this way in the process of digestion(aided by ENZYMES).*