Exercise 3 (Module 3.3)

There are four main classes of macromolecules. Most are polymers, assembled from smaller monomers in a process called a dehydration reaction. Hydrolysis breaks polymers back down to monomers. State whether each of the following relates to dehydration (D) or hydrolysis (H).

1. Connects monomers to form a polymer.
2. Produces water as a by-product.
3. Breaks up polymers, forming monomers.
4. Water is used to break bonds between monomers.
5. Joins amino acids to form a protein.
6. Glycerol and fatty acids combine this way to form a fat.
7. Occurs when polysaccharides are digested to form monosaccharides.
8. —H and —OH groups form water.
9. Nucleic acid breaks up to form nucleotides.
10. Water breaks up, forming —H and —OH groups on separate monomers.

Exercise 4 (Modules 3.3-3.7)

Review carbohydrates by filling in the blanks in the following story.

Carbohydrates are a class of molecules ranging from the simplest sugars, called 1 _______________, to giant molecules called 2 _______________, built of many sugars. Carbohydrates are the main fuel molecules for cellular work.

Plants make their own carbohydrates, but humans, like all animals, must obtain them from plants or other animals. Imagine eating a piece of whole-wheat bread spread with strawberry jam. It contains a mixture of carbohydrates, along with other macromolecules such as 3 _______________ and 4 _______________. Much of the carbohydrate in the bread itself is in the form of a polysaccharide called 5 _______________, which is simply a chain of 6 _______________ monomers. The monomers were linked together in the wheat plant in a process called a 7 _______________ reaction. As the glucose units joined, 8 _______________ was produced as a by-product. When you swallow a bite of bread, digestive juices in the intestine separate the monomers in the opposite reaction, called 9 _______________. In the intestine, this is actually a two-step process. Secretions from the pancreas first break the starch down to maltose, a type of carbohydrate called a 10 _______________, which consists of two glucose monomers. Secretions from the walls of the intestine complete the process, breaking each maltose molecule down to two individual glucose molecules. Each glucose is a 11 _______________ -shaped molecule, containing 12 _______________ carbon atoms.

There are other carbohydrates in the bread and jam. Whole-wheat flour contains the tough coats of the wheat seeds. These contain a lot of 13 _______________, the fibrous polysaccharide that makes up plant cell walls. Like starch, it is made of glucose monomers, but these monomers are 14 _______________ in a different orientation. The human digestive tract is not capable of 15 _______________ cellulose, so it passes through the digestive tract unchanged, in the form of 16 _______________. Sucrose, a 17 _______________ refined from sugar cane or sugar beets, may be used to sweeten
the strawberry jam. Each sucrose molecule is hydrolyzed in the small intestine to form one molecule of \text{18} \underline{\text{..........}} \text{ and one molecule of } \text{19} \underline{\text{..........}}. \text{ This homemade jam naturally also contains a small amount of fructose, a } \text{20} \underline{\text{..........}} \text{ that is naturally produced by strawberries and is considerably sweeter than sucrose. (High-fructose corn syrup, or HFCS, used to sweeten many processed foods, is produced by hydrolyzing } \text{21} \underline{\text{..........}} \text{ and using enzymes to convert the resulting } \text{22} \underline{\text{..........}} \text{ to fructose. The increase in use of HFCS may be linked to the recent increase in } \text{23} \underline{\text{..........}}, \text{24} \underline{\text{..........}}, \text{ and other chronic diseases.)}

Once all the carbohydrates have been hydrolyzed to small monosaccharides, they can be absorbed by the body. Glucose and fructose pass through the wall of the intestine and into the bloodstream, which carries them to the liver. Like all carbohydrate molecules, these sugars are \text{25} \underline{\text{..........}}, so they easily dissolve in the water of blood plasma. In the liver, the fructose is converted to glucose. This process is relatively easy because glucose and fructose are \text{26} \underline{\text{..........}}, having the same molecular formula, written \text{27} \underline{\text{..........}}, but slightly different structures. Glucose circulates around the body as “blood sugar” and is taken up by the cells for fuel as needed. Extra glucose molecules are taken up by liver and muscle cells and linked together by \text{28} \underline{\text{..........}} \text{ synthesis to form a polysaccharide called } \text{29} \underline{\text{..........}}. \text{ This molecule is similar to plant } \text{30} \underline{\text{..........}}, \text{ except it is more branched. Later the glycogen can be hydrolyzed to release } \text{31} \underline{\text{..........}} \text{ into the blood.}