

Review Questions: Carbohydrates

8. What is an example of a monosaccharide?

- a. cellulose
- b. fructose
- c. lactose
- d. sucrose

The solution is (B). Fructose is a simple ketose monosaccharide found in many plants. (A) Cellulose is a polysaccharide (C) Lactose is a disaccharide [Glucose + Galactose] (D) Sucrose is a disaccharide [Glucose + Fructose] and is the common 'table' sugar that we consume

9. Cellulose and starch are examples of _____.

- a. disaccharides
- b. lipids
- c. monosaccharides
- d. polysaccharides

The solution is (D). A long chain of monosaccharides linked by glycosidic bonds is known as a polysaccharide, which can contain the same or different monosaccharides. Starch is the stored form of sugars in plants and is made up of a mixture of amylose and amylopectin, while cellulose is made up of glucose monomers that are linked by β -1-4 glycosidic bonds. This is something you might just have to memorize

42. Why is it impossible for humans to digest food that contains cellulose?

- a. There is no energy available in fiber.
- b. An inactive form of cellulase in human digestive tract renders it undigested and removes it as waste.
- c. The acidic environment in the human stomach makes it impossible to break the bonds in cellulose.
- d. Human digestive enzymes cannot break down the β -1,4 glycosidic linkage in cellulose, which requires a special enzyme that is absent in humans.

The solution is (D). Human digestive enzymes cannot break down the β -1-4 linkage. It requires a special enzyme, cellulase, which is secreted by bacteria and protists in the digestive tract of herbivores. Don't worry about knowing the specific bond that is broke, but more generally that we lack the enzyme needed to break the polymer into monomers. (A) Fiber has energy because it has chemical bonds and energy is stored in chemical bonds. (B) Cellulase is not 'inactive' in the human digestive tract, we lack it completely (C) An enzyme is required to break down cellulose, an acidic environment is insufficient for this.

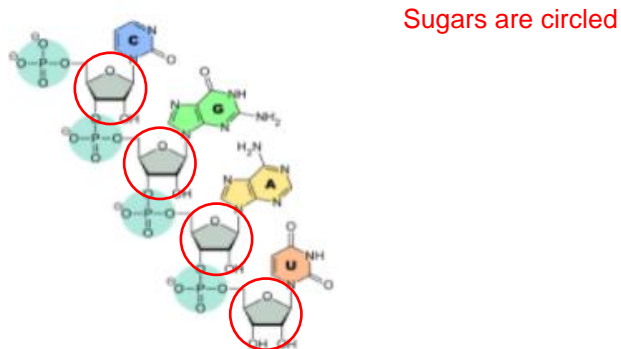
44. Which of these best describes the production of sucrose, maltose, and lactose?

- a. Glucose and fructose combine to form sucrose. Glucose and galactose combine to form lactose. Two glucose monomers combine to form maltose.
- b. Glucose and fructose combine to form sucrose. Glucose and galactose combine to form **maltose**. Two glucose combine to form **lactose**.
- c. Two glucose combine to form **lactose**. Glucose and galactose combine to form **sucrose**. Glucose and fructose combine to form **maltose**.

- d. Two **galactose** combine to form sucrose. Fructose and glucose combine to form **lactose**. Two glucose combine to form maltose.

The solution is (A). Glucose and fructose are combined to form sucrose. Glucose and galactose are combined to form lactose. Two glucose monomers are combined to form maltose. Incorrect statements are highlighted in red. For the exam you should be able to list the 5 monosaccharides, the 3 disaccharides and the monomers the make up each of them

Identify the Sugar in the RNA molecule below:



Review Questions: Lipids

14. Which fat serves as an animal's major form of energy storage?
- cholesterol
 - glycerol
 - phospholipid
 - triglycerides

The solution is (D). Triglycerides, stored in adipose tissue, are a major form of energy storage in animals. Fat cells are designed for continuous synthesis and breakdown of triglycerides in animals. (A) Cholesterol is a steroid hormone and a component of the plasma membrane of animal cells and is found within the phospholipid bilayer. (B) Glycerol forms the backbone of a triglyceride and isn't the best answer (C) Phospholipid are the major components of cell membranes

16. Which of the following characteristics is not true for saturated fats?
- They are solid at room temperature.
 - They have single bonds within the carbon chain.
 - They contain mostly hydrogen and carbon atoms.
 - They tend to dissolve in water easily.

The solution is (D). Saturated fats are solid at room temperature, and have single bonds between carbon and hydrogen atoms. However, they are nonpolar molecules. Water is a polar solvent, so it is not true that saturated fats do not dissolve in water.

20. What is the basic structure of a steroid?

- a. four fused hydrocarbon rings
- b. glycerol with three fatty acid chains
- c. two fatty acid chains and a phosphate group
- d. two six carbon rings

The solution is (A). All steroids have four linked carbon rings and some of them have a short tail. Cholesterol and many hormones such as estrogen and cortisol are steroids. Review diagrams if necessary

46. What are three functions that lipids serve in plants and/or animals?

- a. Lipids serve in the storage of energy, as a structural component of hormones, and also as signaling molecules.
- b. Lipids serve in the storage of energy, as carriers for the transport of proteins across the membrane, and as signaling molecules.
- c. Lipids serve in the breakdown of stored energy molecules, as signaling molecules, and as structural components of hormones.
- d. Lipids serve in the breakdown of stored energy molecules, as signaling molecules, and as channels for protein transport.

The solution is (A). Lipids serve as a source of long-term energy storage, and as a structural component of some hormones in animals. Hormones are signaling molecules. A class of lipids, the phospholipids, is a major constituent of cell membranes in both plants and animals. (B) Proteins are typically the carriers for membrane transport. (C) Lipids don't really serve in the breakdown of stored energy molecules, they are the stored energy molecule that is broken. They don't really break themselves down. (D) Proteins are the channels

48. How do phospholipids contribute to cell membrane structure?

- a. Phospholipids orient their heads towards the polar molecules and tails in the interior of the membrane, thus forming a bilayer.
- b. Phospholipids orient their tails towards the polar molecules of water solutions, and heads in the interior of the membrane, thus forming a bilayer.
- c. Phospholipids orient their heads towards the non-polar molecules and tails in the interior of the membrane, forming a bilayer.
- d. Phospholipids orient their tails towards the polar molecules and heads in the non-polar side of the membrane, forming a bilayer.

The solution is (A). The hydrophilic head orients toward polar molecules such as water or the cytoplasm of the cell, whereas the hydrophobic tails of the molecules orient toward other nonpolar molecules. This forms the middle of the membrane, with heads on the outermost and innermost surfaces of the cell membrane.

50. What part of cell membranes gives flexibility to the structure?

- a. carbohydrates
- b. cytoskeleton filaments
- c. lipids
- d. proteins

The solution is (C). Lipids add flexibility to the membrane, allowing it to bend and twist as necessary. Something you have to remember from class and the reading. Remember cis and trans play a part in this.

Review Questions: Proteins

24. Which of the following is a function of proteins in cells?

- a. energy storage
- b. gene storage and access
- c. membrane fluidity
- d. structure

The solution is (D). Proteins provide structure and support for cells. They also fulfill many other functions. For example, they allow the body to move (e.g., actin), catalyze reactions as enzymes, act as cellular messengers and receptors, and provide defense against pathogens as antibodies. (A) Lipids are energy storage (B) Nucleic acids are gene storage and Cholesterol is membrane fluidity

25. What type of protein facilitates or accelerates chemical reactions?

- a. an enzyme
- b. a hormone
- c. a membrane transport protein
- d. a tRNA molecule

The solution is (A). Enzymes accelerate, or catalyze, chemical reactions. Almost all metabolic processes in the cell need enzymes to occur at rates fast enough to sustain life. Enzymes increase the rate of a reaction by lowering its activation energy. General bio knowledge question.

27. What are the monomers that make up proteins called?

- a. amino acids
- b. chaperones
- c. disaccharides
- d. nucleotides

The solution is (A). Amino acids are organic compounds (monomers) that combine to form proteins. There are 20 amino acids, 10 of which are referred to as essential amino acids in humans because the body cannot synthesize them and they must be supplied by the diet. General bio knowledge question.

29. The α -helix and the β -pleated sheet are part of which protein structure?

- a. the primary structure
- b. the secondary structure
- c. the tertiary structure
- d. the quaternary structure

The solution is (B). The local folding of the polypeptide in some regions gives rise to the secondary structure of the protein. The α -helix and β -pleated sheets are the secondary structure of proteins that forms because of hydrogen bonding between carbonyl and amino groups in the peptide backbone. General bio knowledge question.

31. Which of the following may cause a protein to denature?

- a. changes in pH
- b. high temperatures
- c. the addition of some chemicals
- d. all of the above

The solution is (D). If the protein is subject to changes in temperature, pH, or exposure to chemicals, the protein structure may change, losing its shape without losing its primary sequence, in a process known as denaturation. General bio knowledge question.

68. What categories of amino acids would you expect to find on the surface of a soluble protein and which would you expect to find in the interior? Which of these are some examples for each part of the answer?

- a. Non-polar and charged amino acids will be present on the surface and polar in the interior of the membrane whereas non-polar will be found in the membrane embedded proteins.
- b. Non-polar and uncharged proteins will be found on the surface with non-polar in the interior, while only non-polar will be found in the embedded proteins.
- c. Polar and charged amino acids will be found on the surface whereas non-polar in the interior.
- d. Polar and charged amino acids will be found on the surface of a membrane protein whereas non-polar in the interior. The membrane protein will be polar and hydrophobic.

The solution is (C). Polar amino acids—such as proline, asparagine, and glutamine—would be found at the surface of a soluble protein, while nonpolar amino acids—such as leucine, methionine, and glycine—would be oriented toward the interior.

69. You have been identifying the sequence of a segment of a protein. The sequence to date is: leucine-methionine-tyrosine-alanine-glutamine-lysine-glutamate. You insert arginine between the leucine and methionine. What effect would this have on the segment?

- a. Arginine is a negatively charged amino acid and could attach to the glutamate at the end of the segment
- b. Inserting arginine places a positively charged amino acid in a portion that is non-polar, creating the possibility of a hydrogen bond in this area.
- c. There would be no effect other than an additional amino acid.
- d. The arginine could attach to the lysine and bend the protein chain at this point.

The solution is (B). Inserting arginine places a positively charged amino acid in a portion that is nonpolar, creating the possibility of a hydrogen bond in this area.

