**Review questions for Biological Macromolecules lecture**

**Multiple choice review questions:**

1) Organic molecules always contain \_\_\_\_\_\_ atoms

 A) oxygen

 B) carbon

 C) cation

 D) anion

2) A monosaccharide consists of carbon atoms and a \_\_\_\_ ratio of hydrogen to oxygen.

 A) one-to-two (1:2)

 B) one-to-one (1:1)

 C) two-to-one (2:1)

 D) three-to-two (3:2)

3) Which of the following is a polysaccharide?

 A) starch

 B) sucrose

 C) glucose

 D) galactose

4) Which of the following characteristics do all lipid molecules have in common?

 A) They are composed of three six-sided rings and one five-sided ring.

 B) They consist of three fatty acids linked to a glycerol molecule.

 C) They are all hydrophobic.

 D) They are made entirely of carbon, hydrogen, nitrogen, and oxygen.

5) A steroid may be best described as a

 A) highly branched polysaccharide molecule.

 B) lipid that consists of four carbon rings

 C) diglyceride attached to a phosphate group and choline.

 D) polypeptide covalently bonded to a carbohydrate.

6) Although we hear much about the evils of cholesterol, it is actually very important to the human body. Among other things it serves as

 A) a component of cell membranes

 B) the precursor for the formation of blood

 C) a surfactant which aids in digestion of water molecules.

 D) a blood vessel lubricant which aids in blood flow.

8) In animals, the primary form of carbohydrate storage is

 A) starch.

 B) glycogen.

 C) cellulose.

 D) keratin.

9) Which of the following are functions of proteins in the cell membrane?

 A) transport of substances

 B) making DNA molecules

 C) forming a hydrophobic barrier

 D) detecting molecules outside the cell

**Answers to multiple-choice questions:**

1 = B

 2 = C

 3 = A

 4 = C

 5 = B

 6 = A

 8 = B

 9 = A and D

**Fill-in-the-blank review questions:**

1) Organic molecules all contain \_\_\_\_\_.

2) Six molecules are shown below (a - f). Which ones are organic molecules? \_\_\_\_\_\_\_\_\_\_\_\_\_

 H H O

 | | ||

 a) H–C–C–C–OH b) H2O

 | |

 H OH

 c) Na+ d) C8H18

 e) H–N–H f)

 |

 H

3) The biological macromolecules are all\_\_\_\_\_\_\_\_\_\_\_\_\_, which means that they are chains of smaller molecules known as \_\_\_\_\_\_\_\_\_\_.

4) Write the names of the four macromolecule types. Following the name of each one, also write the name of its monomer(s) in parenthesis.

5) List all the atoms that carbohydrates are made out of: \_\_\_\_\_\_\_\_

6) The main function of carbohydrates in the body is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

7) A \_\_\_\_\_ is a simple, single-ring sugar; a \_\_\_\_\_ is formed when two of these link together,

 and a \_\_\_\_\_ is formed when many of them link together.

8) Monosaccharides, disaccharides, and polysaccharides all belong to a class of organic molecules known as \_\_\_\_\_\_\_\_\_

9) Sugar molecule names are characterized by the suffix (ending letters) \_\_\_\_\_\_\_\_\_ (3 letters).

10) Which carbohydrate is our blood sugar? Be as specific as possible and write its molecular formula.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11) A certain monosaccharide molecule has 7 carbons. Write its entire molecular formula: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12) Sugars are (carbohydrates/fats/lipids/proteins) (Which word is correct?)

13) What monosaccharide is starch made out of?

14) Plants store glucose as a polysaccharide called \_\_\_\_\_\_\_\_\_. A very similar polysaccharide, called \_\_\_\_\_\_\_\_\_\_\_\_, is the form that glucose is stored as in animal livers and muscles.

15) Name 3 foods that are rich in starch:

16) Starch is to plants, as \_\_\_\_\_\_\_\_\_ is to animals.

17) All lipids are characterized as being \_\_\_\_\_\_\_\_\_ molecules, in terms of their attraction to water.

19) Fats and oils are this type of lipid: \_\_\_\_\_\_\_\_

20) List two examples of triglycerides in your body.

21) What are the two major functions of triglycerides?

22) A triglyceride is a lipid that is made from one \_\_\_\_\_\_\_\_\_ molecule joined to three \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules.

23) The major type of lipid in cell membranes is \_\_\_\_\_\_\_\_\_

24) A \_\_\_\_\_ is formed by replacing one fatty acid in a triglyceride with a phosphorous-

 containing molecule.

25) Phospholipids are made of 3 kinds of smaller “building block” molecules. List all three:

26) Cholesterol is a member of the class of lipids known as \_\_\_\_\_\_\_\_\_

27) Write T for true and F for False after each statement about steroids below:

 Steroids are lipids \_\_\_\_\_\_

 Steroids are hydrophobic \_\_\_\_\_\_

 Steroids contain glycerol \_\_\_\_\_\_

 Steroids contain fatty acids \_\_\_\_\_\_

 Fats are steroids \_\_\_\_\_\_

 Cholesterol is a steroid \_\_\_\_\_\_

28) How many fused carbon rings do steroids have? \_\_\_\_\_\_

29) After each statement below, write C if it applies to carbohydrates, write L if it applies to lipids, and write B if it applies to both.

 Triglycerides are an example. \_\_\_\_\_\_\_\_

 They are used for energy storage. \_\_\_\_\_\_\_\_\_

 Most of their monomer names end in “ose” (For example, fructose)\_\_\_\_\_\_\_\_

 Cholesterol is an example \_\_\_\_\_\_\_\_\_\_

 The molecule C4H8O4 is an example. \_\_\_\_\_\_\_\_\_\_\_

30) Of the four macromolecule types, which is the most abundant in the body?

31) Proteins are made of smaller molecules called \_\_\_\_\_, joined together in a chain.

33) There are \_\_\_\_\_ (a number) different amino acids.

35) If a protein’s name ends in -ase, it probably is a(n) \_\_\_\_\_ type of protein.

36) If a reaction is performed by an enzyme, the reactants are called the \_\_\_\_\_ of the enzyme.

37) Receptors are large molecules found in the membranes of all our cells. Answer the questions below about receptors.

 a) Receptors are proteins/carbohydrates/lipids/nucleotides (circle one)

 b) What monomers are receptors made out of?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

38) \_\_\_\_\_ is a tough, extremely strong fibrous protein.

39) \_\_\_\_\_ is a type of fibrous protein that, when stretched, snaps back to its original length.

40) After each description below, write the type(s) of protein that match it. Some descriptions may match more than one protein type. Write the names of all matching proteins.

 a) It performs the chemical reactions in our body. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b) It is in the cell membrane.

 c) It is most abundant in the tissues that connect bone to bone and muscle to bone.

 d) It is abundant in hair. \_\_\_\_\_\_\_\_\_\_\_\_

 e) It binds to other molecules very specifically.

 f) It allows the cell to detect molecules outside the membrane. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 g) It moves molecules through the cell membrane. \_\_\_\_\_\_\_\_\_\_\_\_\_

41) In the blank space after each protein type on the left, write the letters of all descriptions (a-e) on the right that match it. Some descriptions may match more than one protein type. Write the letters of **all** matching descriptions.

 Collegen\_\_\_\_\_\_\_\_ a) A fibrous protein

 Enzyme \_\_\_\_\_\_\_\_ b) Has a crevice to specifically bind molecules

 Receptor \_\_\_\_\_\_\_ c) The material of hair and fingernails

 Elastin \_\_\_\_\_\_\_ d) Carries out chemical reactions

 Keratin \_\_\_\_\_\_\_ e) Detects the presence of molecules outside the cell

 Membrane transport protein \_\_\_\_\_\_\_ f) A channel through the cell membrane

42) The monomers of nucleic acids are \_\_\_\_\_.

43) The two major types of nucleic acids are \_\_\_\_\_ and \_\_\_\_\_.

44) The genetic molecule (the "blueprint") for humans (and other species) is made of \_\_\_\_\_.

45) \_\_\_\_\_\_\_\_\_ are structures that can be seen with a microscope in the nucleus of cells. They are mostly made out are made out of DNA.

46) The primary molecule used inside the cell to supply energy when needed is \_\_\_\_\_. It is in the molecular family known as \_\_\_\_\_\_\_ (one of the monomers you studied). The energy in this molecule is released when one of its \_\_\_\_\_ is removed.

47) Fill in the blanks about nucleic acids:

 a) The genetic molecule is the nucleic acid \_\_\_\_\_\_\_\_\_\_\_\_\_.

 b) The other type of nucleic acid (different than the genetic molecule in the previous answer) is

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) The molecule in cells that directly supplies energy for all cellular processes is \_\_\_\_\_\_\_\_\_\_\_

 d) When the above molecule has been drained of energy, it becomes another type of molecule

 known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Answers to fill-in-the-blank review questions:**

1) Carbon atoms

2) A, D, and F

3) Polymers

 Monomers

4) Carbohydrates (monosaccharides)

 Lipids (glycerol and fatty acids)

 Proteins (amino acids)

 Nucleic acids (nucleotides)

5) Carbon

 Hydrogen

 Oxygen

6) Energy storage

7) Monosaccharide

 Disaccharide

 Polysaccharide

8) Carbohydrates

9) ose

10) Glucose (C6H12O6)

11) C7H14O7

12) Carbohydrates

13) Glucose

14) Starch

 Glycogen

15) Potatoes

 Bread

 Pasta

 Rice

 Corn

16) Glycogen

17) Hydrophobic

19) Triglyceride

20) Body fat

 Skin oils

21) Energy storage

 Insulation

22) Glycerol

 Fatty acid

23) Phospholipid

24) Phospholipid

25) Glycerol, fatty acids, and a phosphate-containing molecule.

26) Steroids

27) T

 T

 F

 F

 F

 T

28) Four

29) L

 B

 C

 L

 C

30) Proteins

31) Amino acids

33) 20

35) Enzyme

36) Substrates

37) Proteins

 Amino acids

38) Collagen

39) Elastin

40) (a) Enzymes

 (b) Receptors and membrane transport proteins

 (c) Collagen (a fibrous proteins)

 (d) Keratin (a fibrous protein)

 (e) Enzymes, Receptors and membrane

 transport proteins

 (f) Receptors

 (g) Membrane transport proteins

41) A

 BD

 BE

 A

 AC

 BF

42) Nucleotides

43) DNA

 RNA

44) DNA

45) Chromosomes

46) ATP

 Nucleotides

 Phosphates

47) DNA

 RNA

 ATP

 ADP

**Short answer review questions:**

1) Describe (or draw) a fatty acid in the space below:

2) The symbol below is often used to represent a type of lipid called a \_\_\_\_\_\_\_\_.

 a) Draw a box around the part that contains phosphate ion

 b) Make a box around the hydrophobic parts

3) Draw the backbone of a steroid in the space below:

4) What is the function of an enzyme? What is the “active site” of an enzyme?

5) Explain briefly the function of a receptor:

6) Explain briefly what makes each receptor specific for only the molecule it is supposed to work with:

7) Compare and contrast the characteristics of collagen, elastin, and keratin.

8) DNA is often called the “genetic molecule” because it controls many of our traits. How exactly does DNA control our traits? In other words, what is its function at the cellular level?

9) The drawing below shows a molecule of ATP, the energy-delivering molecule inside cells. The three black circles are the three phosphate ions that form the “tail” of the ATP molecule. The ATP’s structure is changed when it delivers its energy. To the right of the arrow, redraw the molecule *after* it has delivered its energy.

 ATP

**Answers to short answer review questions:**

1) A molecule containing a long “tail” of only carbon and hydrogen atoms

2)

3)

4) Enzymes are proteins that carry out all the chemical reactions in the body. The active site of an enzyme is a crevice in the side of the protein where it binds the molecules that it carries out a chemical reaction on.

5) A receptor is a protein found in the cell membrane that can bind to molecules outside the cell. It alerts the cell to the presence of molecules outside the cell binds to molecules outside the cell.

6) Each receptor has a binding site that that is exactly shaped to fit only the molecule it is supposed to detect. Only the one specific molecule can fit into the receptor’s binding site.

7) All three molecules are fibrous proteins. Collagen is extremely strong and tough. Elastin is rubber band-like (it can stretch to a long size and then recoil back to its original length). Keratin is a tough plastic-like waterproof protein.

8) DNA contains the instructions for making all the proteins in our body. The proteins made by DNA give us our traits.

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