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

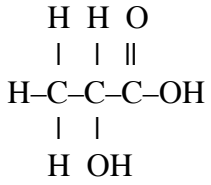
Answers to multiple-choice questions:

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 _____.

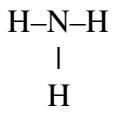
2) Six molecules are shown below (a - f). Which ones are organic molecules? _____

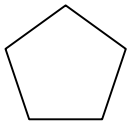
a)


b) H_2O

c) Na^+

d) C_8H_{18}

e)


f)


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 $C_4H_8O_4$ 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 ($C_6H_{12}O_6$)

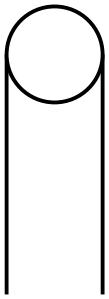
11) $C_7H_{14}O_7$
12) Carbohydrates
13) Glucose
14) Starch
    Glycogen
15) Potatoes
    Bread
    Pasta
    Rice
    Corn
16) Glycogen
17) Hydrophobic
19) Triglyceride
20) Body fat
    Skin oils
21) Energy storage
    Insulation
22) Glycerol
    Fatty acid
23) Phospholipid
24) Phospholipid
25) Glycerol, 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?

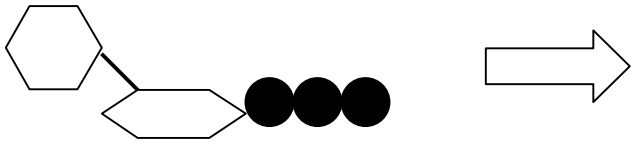
5) Explain briefly the function of a receptor:

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.

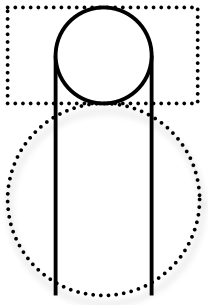


ATP

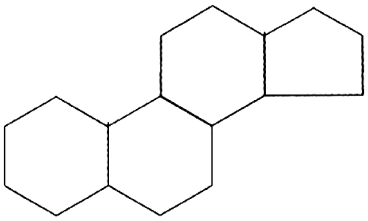
Answers to short answer review questions:

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.

9)