AP Biology **Name** _____

Chapter 5 Guided Reading: The Structure and Function of Large Biological Molecules
10ed

1. **Name the four** main classes that large molecules of all living things fall into.

2. **Circle the three** classes that are called *macromolecules*. **Define** *macromolecule*.

3. **What** is a *polymer*? **What** is a *monomer*?

4. Monomers are connected in **what** type if reaction? **What** occurs in this reaction?

5. Polymers are converted to monomers in **what** type of reaction?

6. **What** does each root word mean?

   hydro-

   -lysis

7. Consider the following reaction:

   $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11}$

   a. The equation is not balanced; it is missing a molecule of water. **Write** it in on the correct side of the equation.

   b. Polymers are assembled and broken down in two types of reactions: *dehydration synthesis* and *hydrolysis*. **Which** kind of reaction is this?

   c. Is $C_6H_{12}O_6$ (glucose) **a monomer or a polymer**? _____

   d. To summarize, when two monomers are joined, a molecule of _____ is always removed.

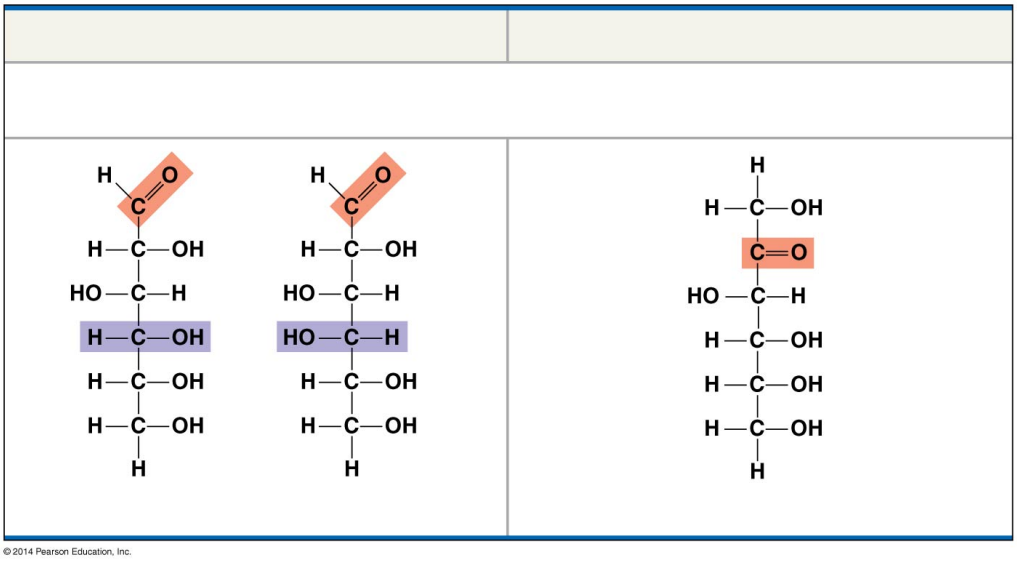
8. **What** are the monomers of all carbohydrates?

9. Most monosaccharides are some multiple of CH_2O. For example, ribose is a five-carbon sugar with the formula $C_5H_{10}O_5$. **What** is the formula of a hexose sugar?

10. **Label** each of the hexose sugars provided. Notice that all sugars have the same two functional groups, listed below. **Name each one.**

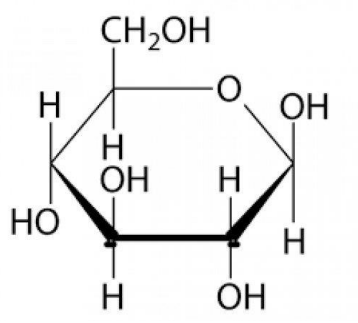
    --C = O _____

    --OH _____



11. All of the sugars in the previous figure have the same chemical formula. However, remember this: change the structure change the function. **What** term did you learn in Chapter 4 for compounds that have the same molecular formulas but different structural formulas? _____

12. Here is the abbreviated ring structure of glucose. **Put an "X"** through all the carbons? Pay attention to the numbering system. **Circle** the number 3 carbon. Put a **square** around the number 5 carbon.



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13. Let's look at our reaction in question 7 again:

$C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$

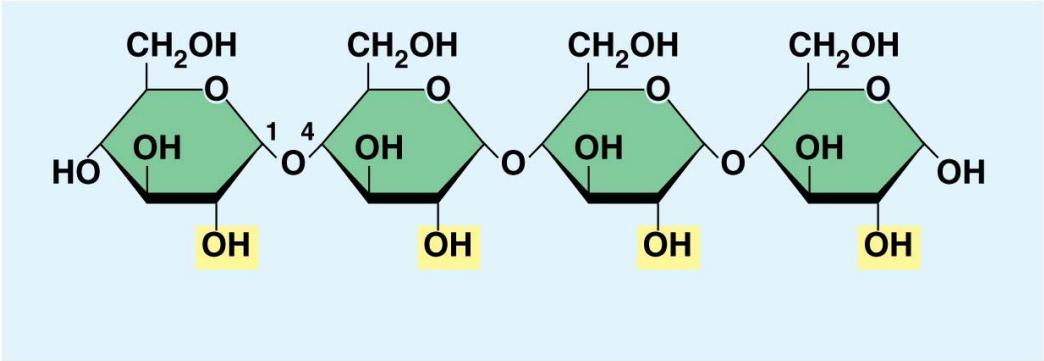
Notice that two monomers are joined to make a polymer. Since the monomers are monosaccharides, the polymer is a *disaccharide*. Three disaccharides have the formula $C_{12}H_{22}O_{11}$. **Fill out the following chart.**

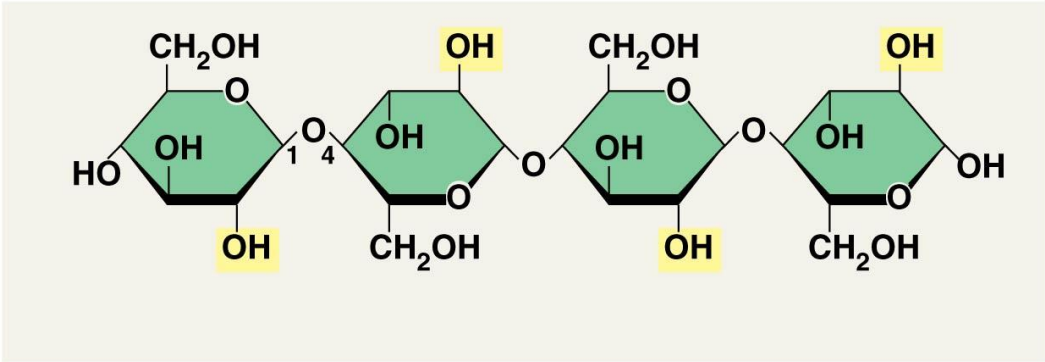
Disaccharide	Formed from which Two Monosaccharides?	Found Where?

14. Have you noticed that all sugars end in *–ose*? This root word means _____.

15. **What** is *glycosidic linkage*?

16. Here are molecules of glucose, the first one shows starch with its 1-4 glycosidic linkages of α glucose monomers. **Number the carbons** in the first two sugars of this figure. Use this to **explain** what is meant by a 1-4 glycosidic linkage.





17. There are two categories of *polysaccharides*. **Name them and give examples.**

Type of Polysaccharide	Examples

18. Look at the Cellulose: β glucose monomer in #16 (It is the second one) **why** can you not digest cellulose? **What** organisms can?

19. Let's review some key points about the carbohydrates. Each of the following prompts describes a unique carbohydrate. **Name** the correct carbohydrate for each.

    a._____ Has 1-4 β glucose linkages

    b._____ Is a storage polysaccharide produced by vertebrates that is stored in your liver

    c._____ Two monomers of this form maltose

    d._____ Glucose + _____ form sucrose

    e._____ Monosaccharide commonly called "fruit sugar"

    f._____ "Milk Sugar"

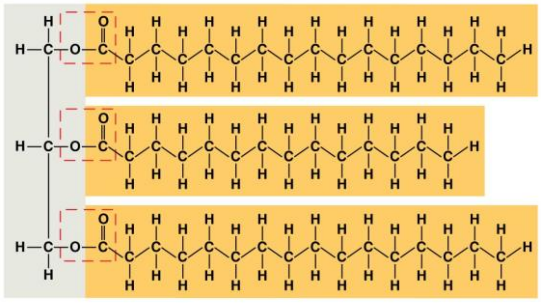
    g._____ Structural polysaccharide that gives cockroaches their crunch

    h._____ Malt sugar; used to brew beer

    i._____ Structural polysaccharide that comprises plant cell walls

20. Lipids include fats, waxes, oils, phospholipids, and steroids. **What** characteristic do all lipids share?

21. **What** are the building blocks of *fats*? **Label** them on this figure, as well as the ester linkages.



22. If a fat is composed of three fatty acids and one glycerol molecule, **how many** water molecules will be removed to form it? **What** is this process called?

23. **Draw** a fatty acid chain that is eight carbons long and is *unsaturated*. **Circle** the element in your chain that makes it unsaturated, and **explain** what this means.

24. **Name two** saturated fats.
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    -

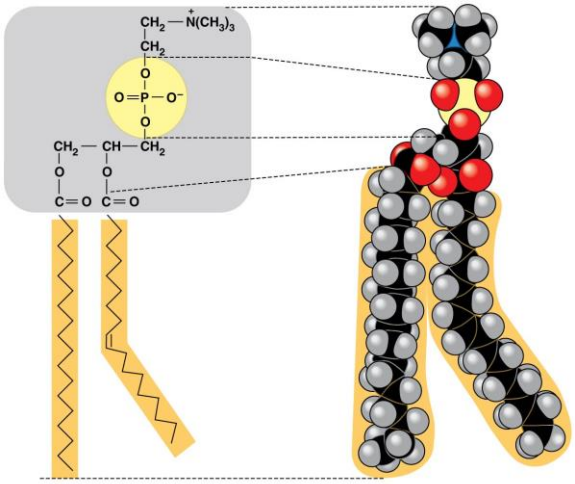
25. **Name two** unsaturated fats.
    -
    -

26. **Why** are many unsaturated fats liquid at room temp?

27. **What** is *trans fat*? **Why** should you limit them in your diet?
    -
    -

28. **List four** important functions of fats.
    -
    -
    -
    -

29. Here is a figure that shows the structure of a phospholipid. **Label** the sketch to show the *phosphate group*, the *glycerol*, and the *fatty acid chains*. **Also indicate** the region that is hydrophobic and the region that is *hydrophilic*.



30. **Why** are the “tails” hydrophobic?

31. **Which** of the two fatty acid chains in the figure with question 29 is unsaturated? **Label it**. **How** do you know it is unsaturated?

32. **Sketch** the phospholipid bilayer structure of a plasma membrane. **Label** the *hydrophilic heads, hydrophobic tails,* and *location of water.*

33. **Why** are all the tails in your sketch located in the interior?

34. Some people refer to the structure shown in a cholesterol molecule as three hexagons and a doghouse. Cholesterol and other steroids all have this general shape. **Name two other steroids.**
    -
    -

35. Figure 5.15 in your text is an important one! It shows many different functions of proteins. **Select any five types of proteins and summarize each type here:**

Type of Protein	**Function**	**Example**

36. The monomers of proteins are *amino acids*. **Sketch** an amino acid here. **Label** the α or *central carbon, amino group, carboxyl group* and *R group.*

37. **What** is represented by R? **How many** different R groups are there?

38. **Define** these terms:

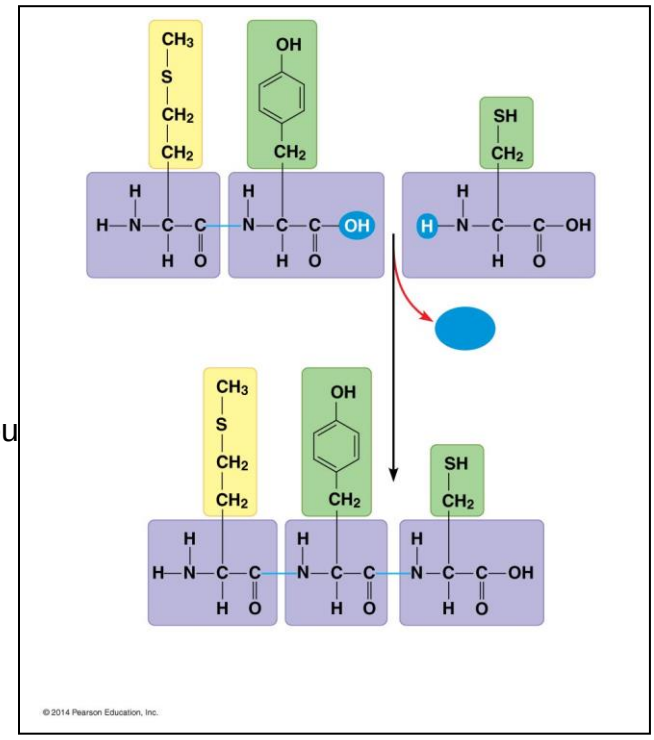
peptide bond

dipeptide

polypeptide

dehydration synthesis

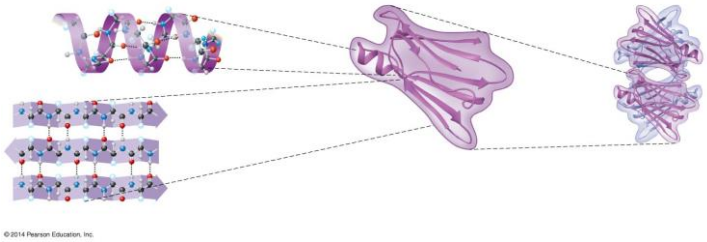
Label each of these terms on the accompanying diagram. **Also label** an R grou a central carbon and an amino group.

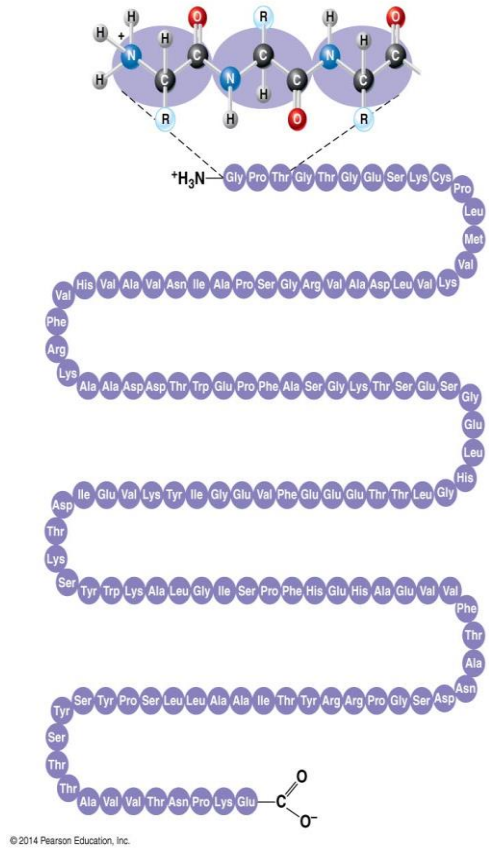


39. There are four levels of protein structure. Refer to Figure 5.18 in your text, and **summarize each level in the following table.**

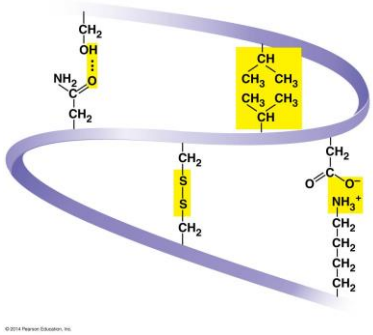
Level of Protein Structure	**Explanation**	**Example**
Primary		
Secondary α *helix* β *pleated sheet*		
Tertiary		
Quaternary		

40. **Label** each of the levels of protein structure on this figure.

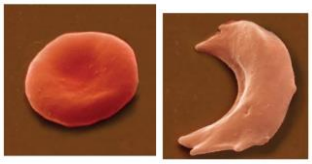




41. Enzymes are globular proteins that exhibit at least tertiary structure. As you study Figure 5.20 in your text, use this figure to **identify and explain** each interaction that folds this protein fragment.



42. Do you remember when, in Chapter 4, we said, “To change the structure will change the function?” **Explain** how this principle applies to sickle-cell disease. **Why** is the structure changed?



43. **Define** *denaturation* and **give at least three** ways a protein may become denatured.
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-
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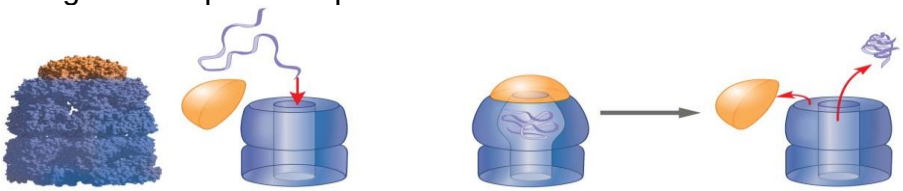
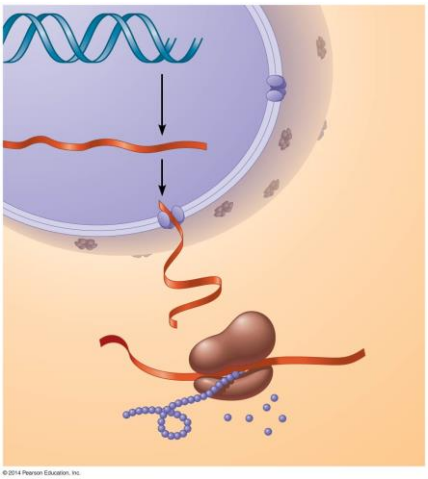
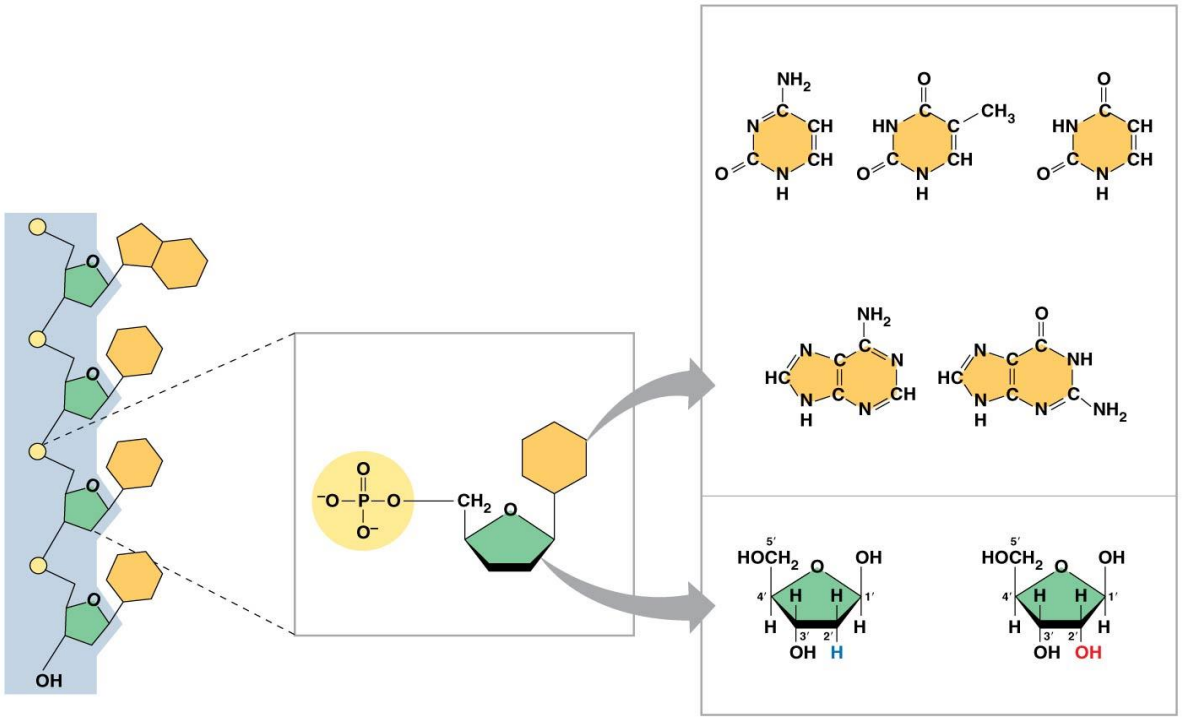
44. *Chaperone proteins* or *chaperonins* assist in the proper folding of proteins. **Annotate** this figure to explain the process.



45. The flow of genetic information is from the DNA → RNA → protein. **Label** the *nucleus, DNA, mRNA, ribosome,* and *amino acids.*



46. **Label** each nitrogenous base, a *sugar*, *a phosphate group*, **indicate** which are *purines*, and which are *pyrimidines*, label *deoxyribose,* and *ribose.*



47. **Label** the end of the strand on the figure above that has the number sugar **5'** and the other end of the chain **3'**, and **label** one nucleotide.

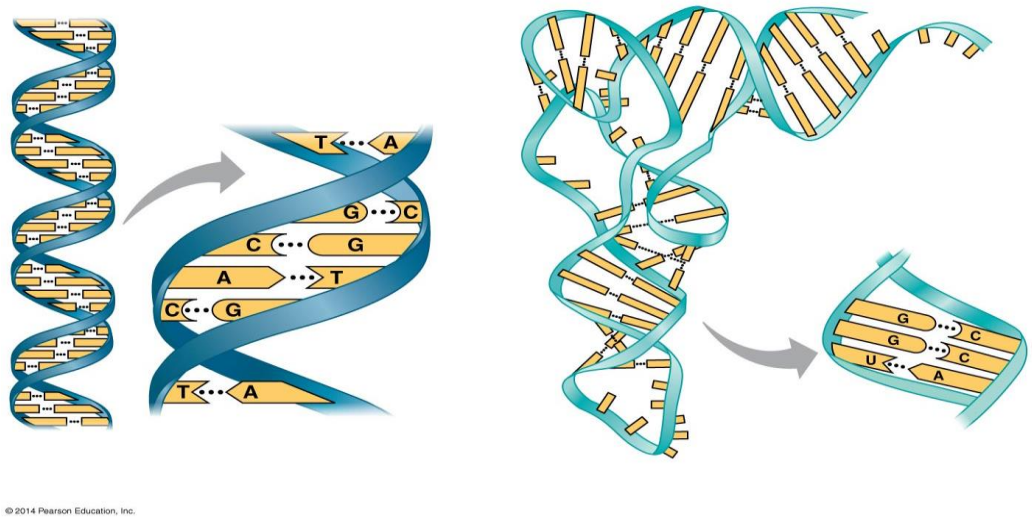
48. Of the five nitrogen bases, **which** four are found in DNA?

49. **Which** four are found in RNA?

50. **How** do ribose and deoxyribose sugars differ?

51. **What** are the **three** components of a nucleotide?

52. Here is a model of DNA which was proposed by James Watson and Francis Crick, with help from Rosalind Franklin, and Maurice Wilkins. **What** is this shape called?



53. **Why** are the strands said to be *antiparallel*?

54. **What** two molecules make up the “uprights”?

55. **What** molecules make up the “rungs”?

56. In a DNA double helix, a region along one DNA strand has the sequence of nitrogenous bases shown below. **Write** the complementary strand and **indicate** the 5’ and 3’ ends of the new strand.

5’-T A G G C C T- 3’

57. **Explain** *genomics* and *proteomics* and give an example of their application.

58. **Why** can DNA and protein sequences serve as tape measures of evolution?