

Name: _____ Date: _____

CONCEPT 5.1: Macromolecules are polymers, built from monomers

CONCEPT 5.2: Carbohydrates serve as fuel and building material

CONCEPT 5.3: Lipids are a diverse group of hydrophobic molecules

CONCEPT 5.4: Proteins have many structures, resulting in a wide range of functions

CONCEPT 5.5: Nucleic acids store and transmit hereditary information

1. Describe the purpose of the following two reactions **and what happens with water** in each.

a. Condensation or dehydration synthesis reaction ... _____

b. Hydrolysis ... _____

2. Complete the summary table of organic molecules below:

Organic Molecule	Structure	Examples	Function
Carbohydrate	Monomer –		
	Polymer -		
Lipid	“Monomers” –		
	Polymer -		
Protein	Monomer –		
	Polymer -		
Nucleic Acid	Monomer –		
	Polymer -		

3. Which of the organic molecules listed in the table above are often composed of C, H, and O alone?

4. What other elements are commonly associated with each of these four types of macromolecules?

	Carbohydrates	Lipids	Proteins	Nucleic Acids
Always contain P				
Generally contain <u>no</u> P				
Always contain N				
Generally contain <u>no</u> N				
Frequently contains S				
Generally contain <u>no</u> S				

5. Functional groups can modify the properties of organic molecules. In the following table, indicate whether each functional group is polar or nonpolar and hydrophobic or hydrophilic. Which of these functional groups are found in proteins and lipids? (Hint: you may need to refer back to Chapter 4 for help.)

Functional Group	Polar or Nonpolar	Hydrophobic or Hydrophilic	Found in ALL Proteins	Found in Many Proteins	Found in Many Lipids
- OH					
- CH ₂					
- COOH					
- NH ₂					
-SH					
- PO ₄					

6. You want to use a radioactive tracer that will label only the protein in an RNA virus. Assume the virus is composed of only a protein coat and an RNA core. Which of the following would you use? Be sure to explain your answer.

- a. Radioactive P b. Radioactive N c. Radioactive S d. Radioactive C

7. Closely related macromolecules often have many characteristics in common. For example, they share many of the same chemical elements and functional groups. Therefore, to separate or distinguish closely related macromolecules, you need to determine how they differ and then target or label that difference.

a. What makes RNA different from DNA? _____

- b. If you wanted to use a radioactive or fluorescent tag to label only the RNA in a cell and not the DNA, what compound(s) could you label that is/are specific for RNA?

- c. If you wanted to label only the DNA, what compound(s) could you label? _____

8. Based on your answers to questions 3-7, what simple rule(s) can you use to identify the following macromolecules?

Carbohydrates	
Lipids	
Proteins	
Nucleic Acids	
DNA versus RNA	

9. A student, Mary, is given four samples and told they are lysine (an amino acid), lactose (a disaccharide), insulin (a protein hormone), and RNA. The samples are in test tubes marked 1, 2, 3, and 4, but Mary doesn't know which compound is in which tube. She is instructed to identify the contents of each tube.
- In her first test, she tries to hydrolyze a portion of the contents of each tube. Hydrolysis occurs in all tubes except tube 3.
 - In Mary's next test, she finds the tubes 1, 2, and 3 are positive for nitrogen by only tube 2 gives a positive result for the presence of sulfur.
 - The last test Mary performs shows that the compound in tube 1 contain a high percentage of phosphate.

Based on these data, fill in the following table and explain your answers.

Tube Number	Contents	Explanation
1		
2		
3		
4		

10. Polypeptides and proteins are made up of linear sequences of amino acids. In its functional form, each protein has a specific three-dimensional structure or shape. Interactions among the individual amino acids and their side chains play a major role in determining this shape.

a. Describe how amino acids are linked together to form polypeptides or proteins. What is this type of bond called?

b. Define the four structures of a protein	c. What kinds of bonds hold each of these structures together?
Primary:	
Secondary:	
Tertiary:	
Quaternary:	

11. Lipids as a group are defined as being hydrophobic, or insoluble in water. As a result, this group includes a fairly wide range of compounds – for example, fats, oils, waxes, and steroids like cholesterol.

a. How are fatty acids and glycerol linked together to form fats (triglycerides)? _____

b. Fats can be classified as saturated and unsaturated. Distinguish between saturated and unsaturated fats. _____

c. What functions do fats serve in living organisms? _____

d. How do phospholipids differ from triglycerides? _____

e. What characteristics do phospholipids have that triglycerides do not have? _____
