

Biochemistry

I. Review of Basic Chemistry

A. Simple Units

1. Element =

2. Atom =

3. Chemical Symbols

C = _____ O = _____

H = _____ N = _____

B. Chemically Combined Atoms

1. Compare the following substances.

Criteria	NaCl	C ₆ H ₁₂ O ₆
Elements Present		
# of Each Element		
Source		
Inorganic or Organic		
Compound or Molecule		

2. Define the following terms:

a. Inorganic Substance -

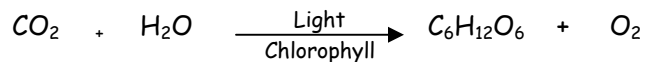
b. Organic Substance -

c. Compound -

d. Molecule -

C. Chemical Reactions

1. Study the equation below:



a. List the reactants:

b. List the Products:

c. In the formula H_2O :

- List the kinds of atoms
- List the number of each kind of atoms

d. Is the formula H_2O_2 the formula for water? Explain.

e. Compare the following formulas:

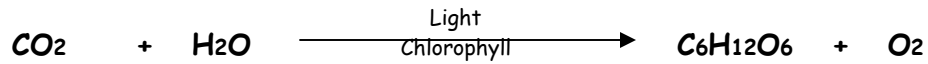
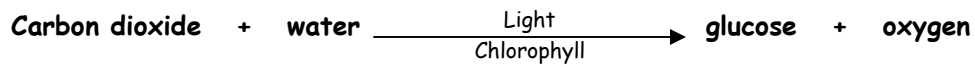
Criteria	CH_4	$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \end{array}$
Kind of Atoms		
# of Each Atom		
Location of H Atoms		
Visualization of bond		

D. Define: Biochemistry -

Chemical Reactions in the Biological World

I. Chemical Reactions

a. Study the equation below and answer the questions that follow.



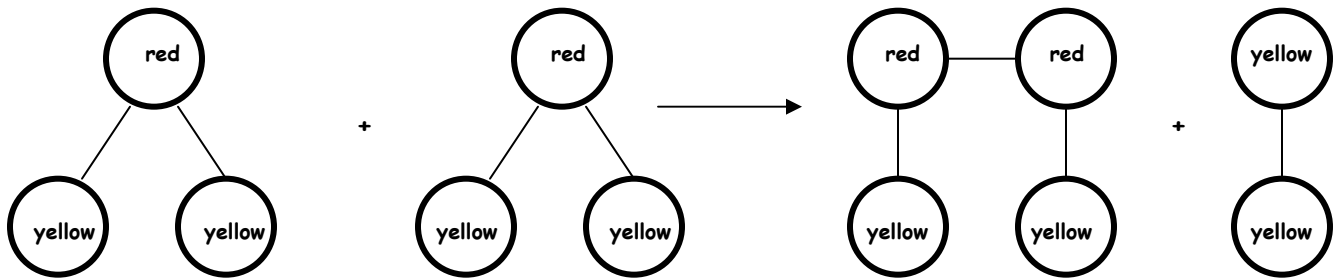
1. List the reactants.

2. List the Products.

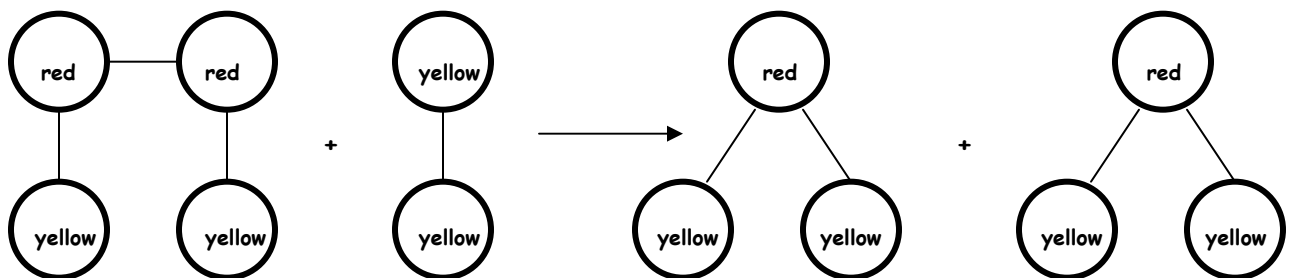
II. Buildup and Breakdown of Molecules in the Biological World

a. With your partner, manipulate the molecular models as represented in the diagrams below. Answer the questions that follow.

1.



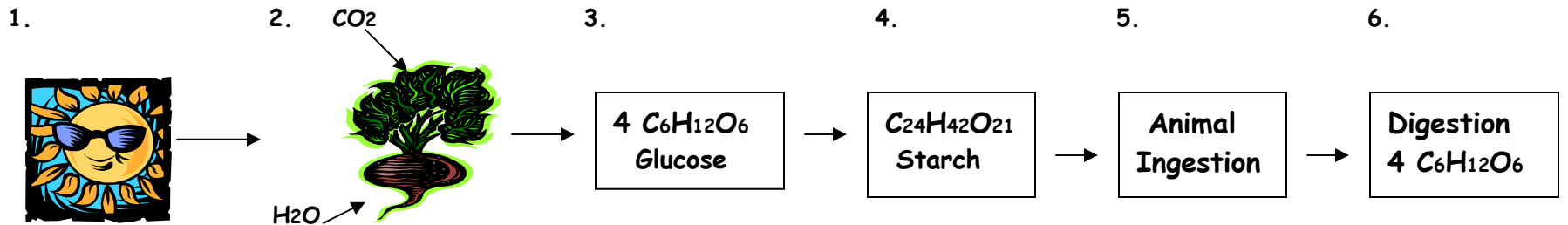
2.



Describe what you had to do to the "Reactants" to form the "Products" for numbers 1 and 2.

Sequence and Consequence: Buildup and Breakdown of Molecules in the Biological World

Directions: Observe the diagram below. Based on the diagram, complete the table. List the sequence of events that are taking place. Explain the consequence at each stage in the sequence.



<u>Sequence</u>	<u>Consequence</u>
1.	
2.	
3.	
4.	
5.	
6.	

Define: Dehydration Synthesis:

Hydrolysis:

Carbohydrates

I. Molecular Characteristics

A. Study the chemical formula $C_6H_{12}O_6$ and write the names of the elements present in a carbohydrate.

B. Study the formulas below and indicate the ratio of hydrogen to oxygen.

1. $C_{12}H_{22}O_{11}$ _____

2. $C_{18}H_{32}O_{16}$ _____

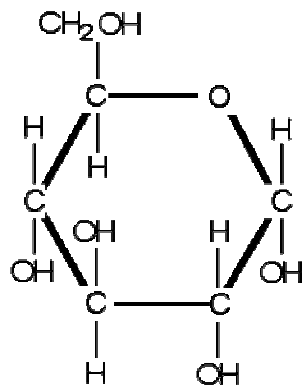
3. $C_{24}H_{42}O_{21}$ _____

4. The ratio is _____ to _____

C. Study the outline of the structural formula of the simple sugar glucose and with your pencil trace the inner area of the formula. Draw the structure on the right side.

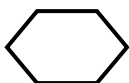
Glucose (trace the inner area)

Draw Symbol



II. Classification of Carbohydrates

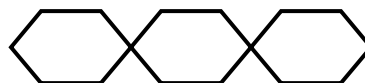
A. Directions: Study the symbolic formulas for each of the different carbohydrates below.



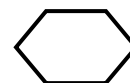
Glucose



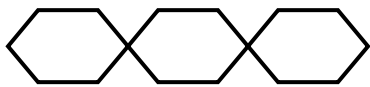
Sucrose



Starch



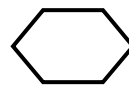
Fructose



Cellulose



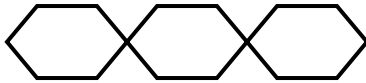
Maltose



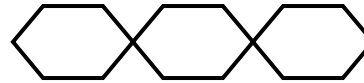
Galactose



Lactose



Chitin



Glycogen

B. Classify the carbohydrates above into groups. Write the name of the carbohydrate in the proper column and write the common characteristics above each group.

C. Based on the classification above define the following terms:

1. Monosaccharide -
2. Disaccharide -
3. Polysaccharide -

III. Role of Water

A. Synthesis Demonstration

Directions: Observe the molecular models. Each ball represents an atom and each stick represents a covalent bond.



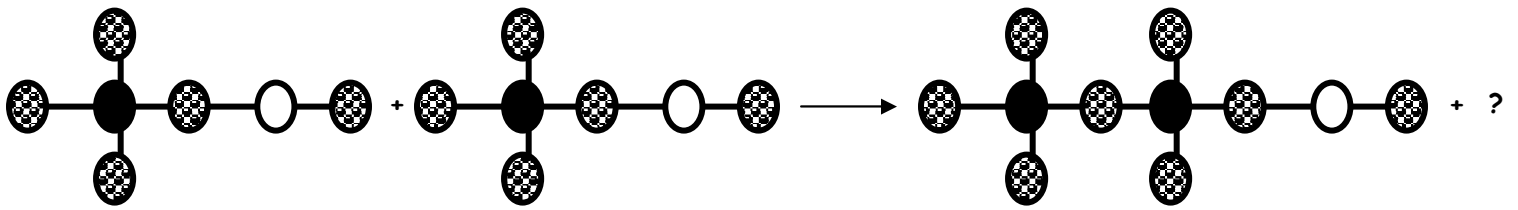
= hydrogen



= oxygen



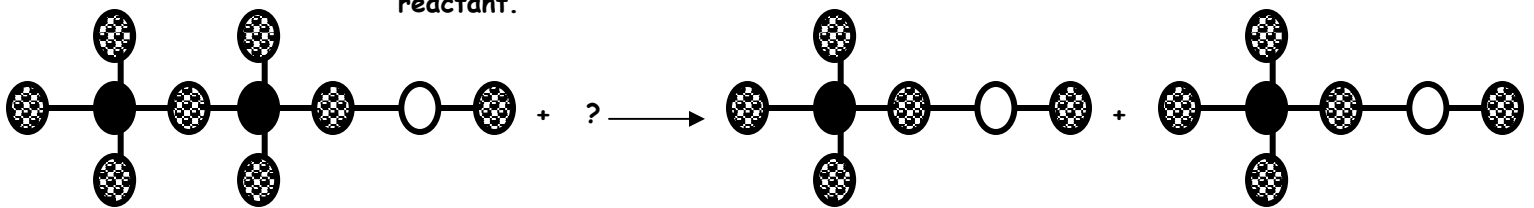
= carbon



What should take the place of the question mark? Explain.

B. Hydrolysis Demonstration

Directions: Observe the molecular models and explain why water must be added as a reactant.

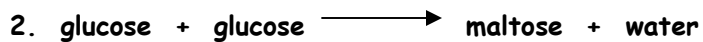


What should take the place of the question mark? Explain.

IV. The Synthesis of a Carbohydrate

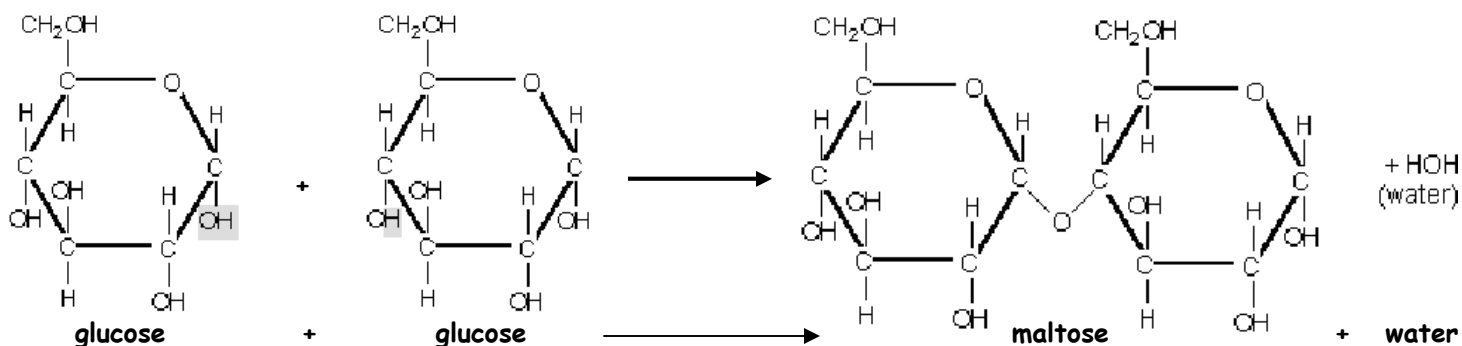
A. Symbolic Equation

Directions: Draw the symbolic formula equation in space 3 below the word equation.



3.

B. Study the structural equation below



1. Explain why this reaction is a synthesis reaction.
2. Explain why water must be removed (dehydration) in order to have the synthesis reaction.
3. Is water a product or a reactant in the above equation? Explain.

V. The Hydrolysis of a Carbohydrate

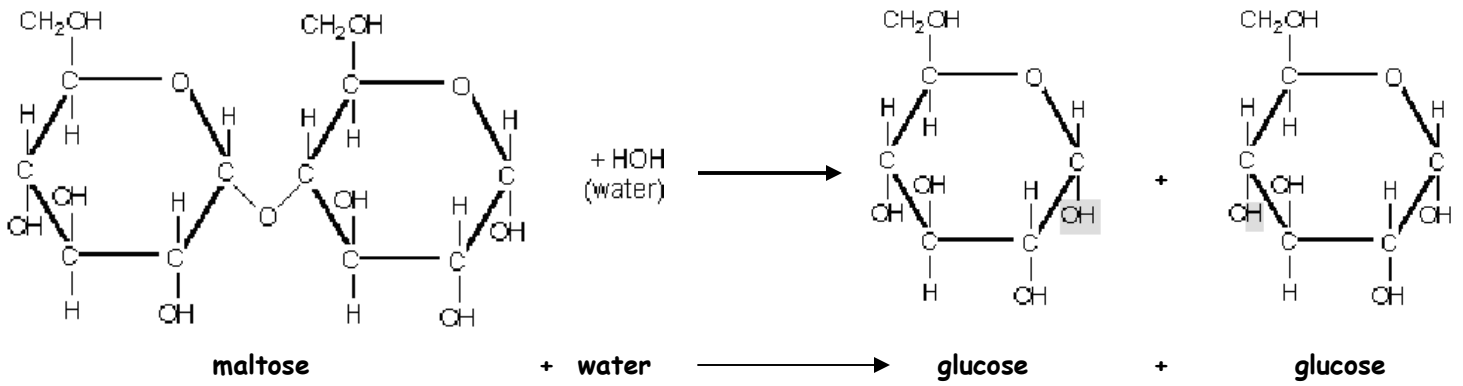
A. Directions: Draw the symbolic (ring) formula equation in space 3 below the word equation.

1. disaccharide + water → monosaccharide + monosaccharide

2. maltose + water → glucose + glucose

3.

B. Study the structural formula equation below.



1. Explain why this is a hydrolysis reaction.

2. Explain why water must be a reactant in this reaction.

C. Tests for carbohydrates:

Directions: Record your observations.

1. Starch + Lugol's Iodine \longrightarrow _____

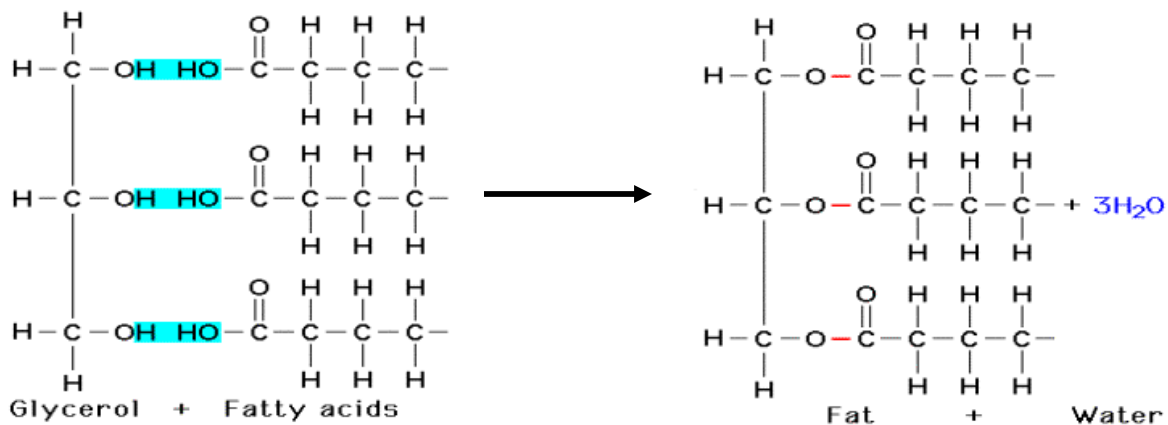
2. Simple sugar + Benedict's Solution + Heat \longrightarrow _____

Lipids and Proteins

I. Lipids

A. Dehydration Synthesis - Study the word equation and diagram below and answer the questions.

glycerol + fatty acid + fatty acid + fatty acid \longrightarrow lipid (fat) + water

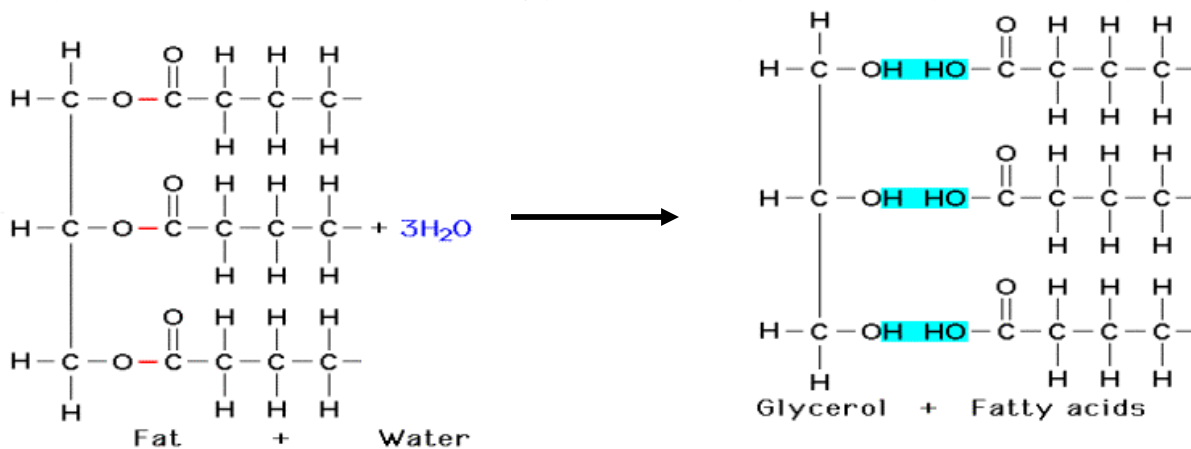


1. Explain why this is a synthesis reaction.

2. Explain why water must be a product.

B. Hydrolysis - Complete the equation below and answer the questions.

Lipid (fat) + water \longrightarrow glycerol + fatty acid + fatty acid + fatty acid

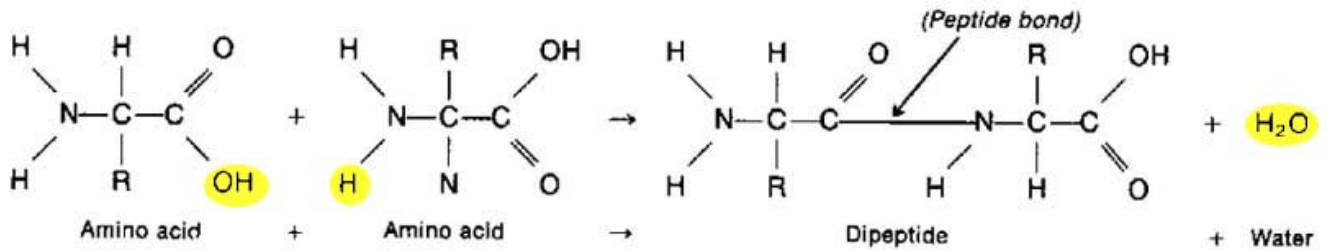


1. Explain why this is hydrolysis.

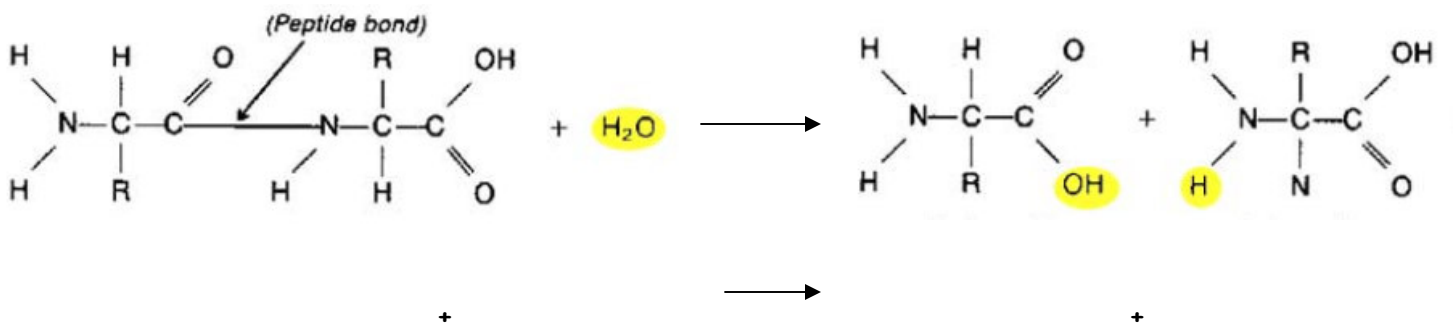
2. Explain why water must be a reactant.

II. Proteins

A. Dehydration Synthesis - study the word equation and diagram below and explain why this is a dehydration synthesis reaction.



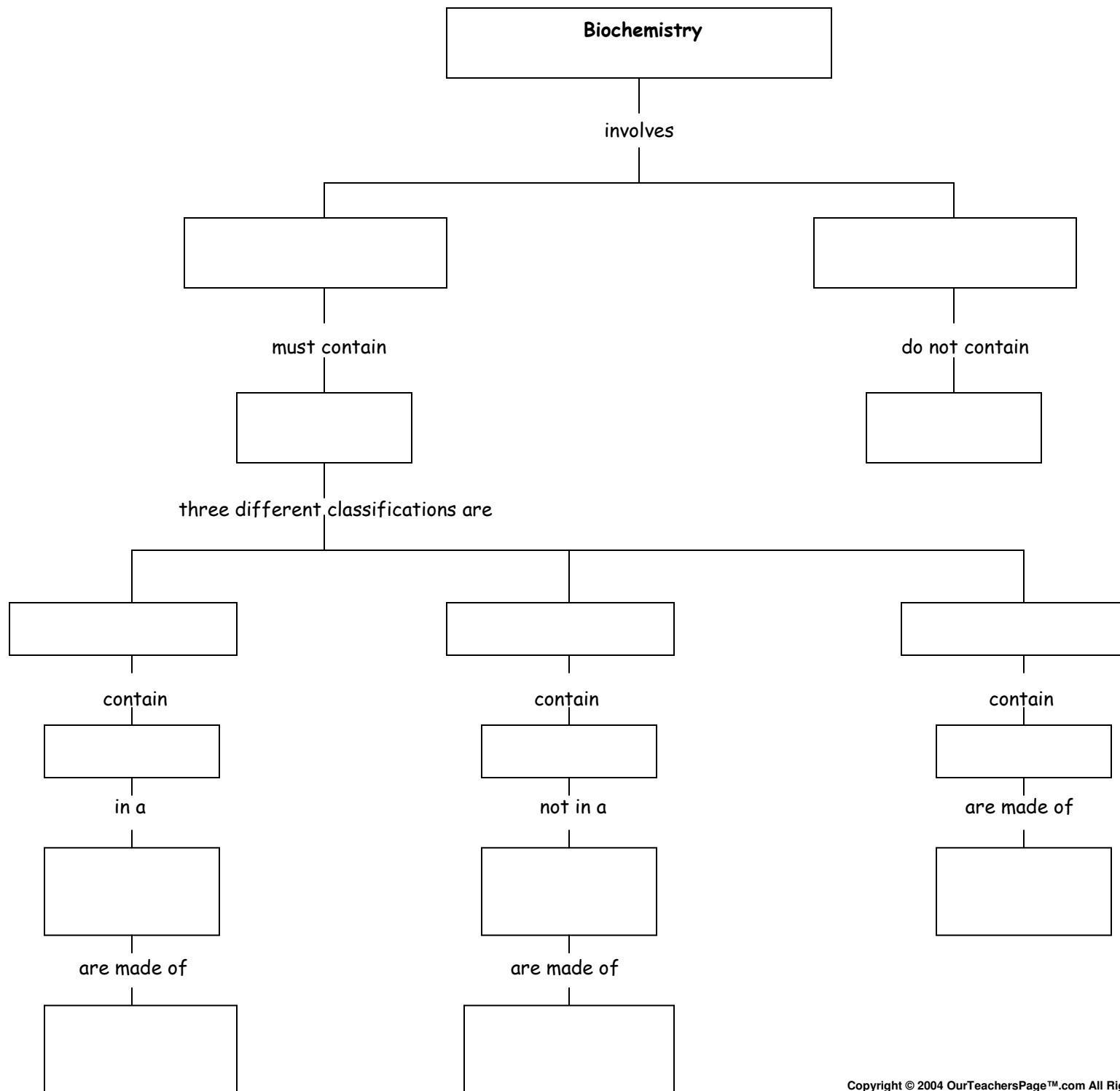
B. Hydrolysis - write a word equation that illustrates the hydrolysis reaction below.



Comparison - Hydrolysis vs. Synthesis

Criteria	Hydrolysis	Synthesis	Sim/Diff
Type of Reaction			
Role of Water			
Nature of Reactants			
Nature of Products			
Occurrence in body			

Conclusion: write a conclusion using the information in the table above.



The Living Environment - Homework: Biochemistry

Directions: Complete all questions on a separate sheet of loose-leaf in complete sentences.

1. a. Define: Molecule
- b. Indicate and explain which formula is an organic molecule and an inorganic molecule. (1) $C_2H_6NO_2$ (2) HCl
- c. With the aid of a chemical formula, indicate 6 molecules of water.
2. In a chemical equation indicate the differences between the reactants and the products.
3. For molecules of glucose:
 - a. Write the molecular formula.
 - b. Draw the structural formula
4. Explain why:
 - a. Glucose is a monosaccharide.
 - b. Sucrose is a disaccharide.
 - c. Starch is a polysaccharide.
5. a. Draw the symbol for glucose.
- b. Using the glucose symbol, draw the equation for dehydration synthesis for the synthesis of a maltose molecule.
- c. Draw the equation for the hydrolysis of a maltose molecule.
6. Describe how you can tell the differences between the equations for dehydration synthesis and hydrolysis.
7. In the human body, describe specific examples of the synthesis of a carbohydrate, lipid, and protein.
8. Explain the relationship of hydrolysis, to the process of diffusion.
9. Explain why your cells and body are considered a bag of organic and inorganic molecules.