

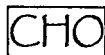
BIOCHEMISTRY

Biochemistry is the chemistry of _____! This field of study uses chemistry to help us understand biological functions of living organisms. We will study the molecules that make up living things and the changes they go through, specifically _____ and _____ or _____.

ORGANIC VS. INORGANIC MOLECULES

In the context of chemistry, what does it mean to be *organic*?

It means the chemical composition consists of BOTH _____ and _____
And maybe _____



This is **DIFFERENT** from how we use the word **ORGANIC** in the grocery store, right?

4 TYPES of **ORGANIC** molecules we will study in biochemistry include

1) _____

2) _____

3) _____

4) _____

Inorganic compounds are those **WITHOUT both Carbon & Hydrogen**

Label these molecules as **organic** or **inorganic**!

1. CH₄ _____

2. H₂O _____

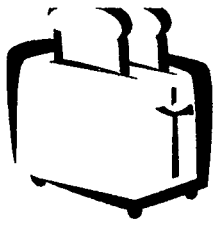
3. CO₂ _____

4. C₄H₁₁O₂₄N₈ _____

5. NaCl _____

6. C₁₂O₅₆H₁₈ _____

CARBOHYDRATES



Contain _____ & _____

Ratio of carbon to hydrogen to oxygen: _____:_____:

Carbohydrates are **SUGARS**. Their names end with the suffix _____.

Carbohydrates contain _____ calories per gram.

FOODS that normally contain carbohydrates include:

FUNCTION of carbohydrates:

Carbohydrate Type	Example	Structure	Found in...

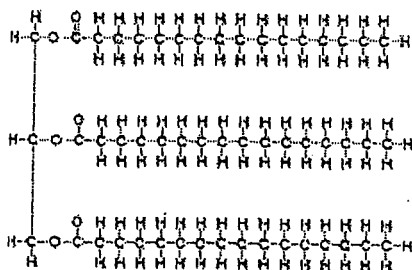
DIRECTIONS

1. UNDERLINE all the ORGANIC substances.
2. CIRCLE the names of all the CARBYHYDRATES.
3. Leave the inorganic substances alone.

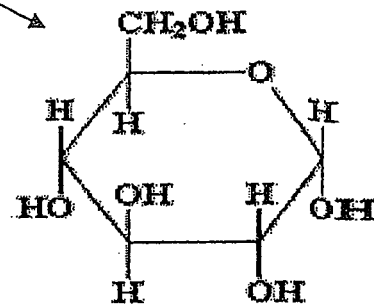
Can some of these substances have a circle (carbohydrate) AND an underline(organic)? _____

- | | | |
|--|--|--|
| 1. water | 17. meat | 33. an compound with a 2:1 ratio of hydrogen atoms to oxygen atoms |
| 2. carbon dioxide (CO ₂) | 18. potato | |
| 3. rust (iron oxide) | 19. rice | 34. you |
| 4. protein | 20. butter | |
| 5. methane (natural gas, CH ₄) | 21. cheese | |
| 6. sucrose | 22. cheerios | |
| 7. fructose | 23. minerals in your bones | |
| 8. lipids (fats & oils) | 24. vitamins | |
| 9. glycogen | 25. polysaccharides | |
| 10. starch | 26. monosaccharides | |
| 11. cellulose | 27. disaccharides | |
| 12. a glucose polymer | 28. maltose | |
| 13. nucleic acids (DNA & RNA) | 29. maltase (a protein enzyme) | |
| 14. C ₆ H ₁₂ O ₆ | 30. C ₁₂ H ₂₂ O ₁₁ | |
| 15. C ₄ H ₈ O ₂ N | 31. bicarbonate ion (HCO ₃ ⁻) | |

16. →

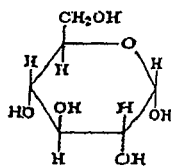


32. →

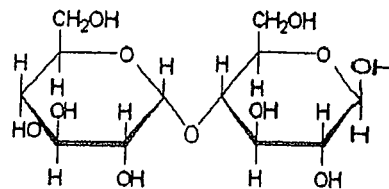


can be made from a few repeating units, or can be composed of hundreds or thousands of smaller molecules. Each macromolecule has properties quite different from the units of which it is composed. Study the diagrams below, which show carbohydrate molecules. Beside each molecule, write whether it is a *monosaccharide*, a *disaccharide* or a *polysaccharide*. Then answer the questions.

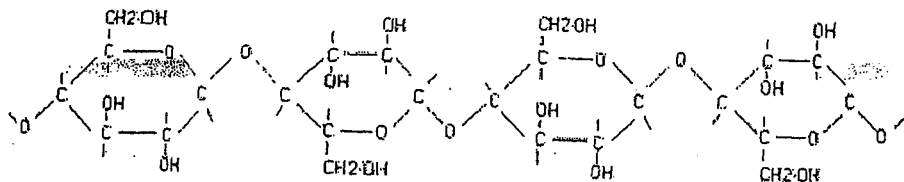
A.



B.



C.



1. Molecule A is _____. Its function is _____.
2. Molecule B is formed from 2 _____ molecules. It is _____.
The name of this sugar is _____.
(malt sugar)
3. Molecule C is a _____, made from many single sugar molecules. It is a polymer formed from repeating units called _____. Molecule C's job is _____.
4. Molecules B and C are made from the chemical process where water is taken out to link molecules together. This process is known as _____.

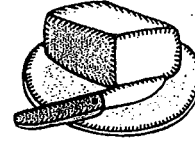
LIPIDS (ex. FATS)

Contain _____, _____, & _____

Then, how can you tell the difference between lipids and carbohydrates?

Ratio of carbon to hydrogen to oxygen is NOT _____:_____:

Lipids contain _____ calories/gram.



3 TYPES of lipids include:

- a) fats
- b) oils
- c) waxes

ALL LIPIDS are made from

1 GLYCEROL molecule and 3 FATTY ACIDS = 1 LIPID

You can draw them like this:

FUNCTION of LIPIDS

- 1.
- 2.
- 3.



Saturated vs. Unsaturated LIPIDS



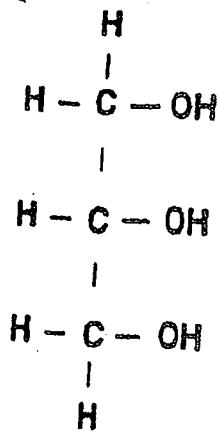
Lipid Type	Carbon to Carbon bonds	Phase at Room Temperature	Sources	Healthy or Unhealthy?
Saturated				
Unsaturated				

For each of the following, tell if the statement refers to saturated or unsaturated fats:

1. Liquid at room temperature _____.
2. Raises cholesterol _____.
3. Decreases cholesterol _____.
4. Causes heart disease _____.
5. Found in animal products _____.
6. Olive oil is an example _____.

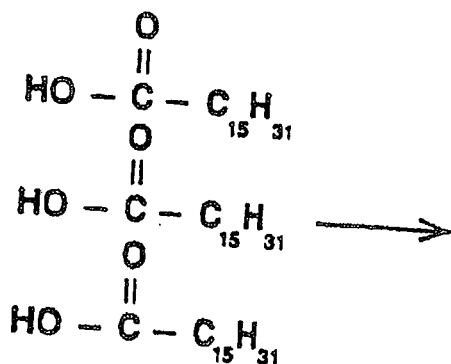
Identify the following fat structures as saturated or unsaturated:

Synthesis of a Fat



1 glycerol molecule

+



3 fatty acid molecules

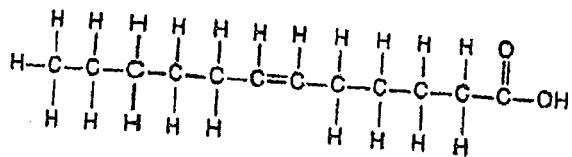


1 fat molecule

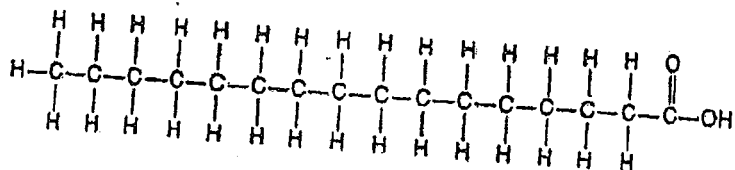
+

3 water molecules

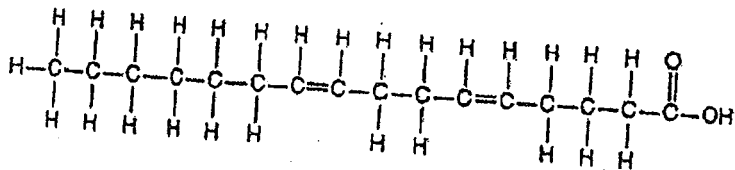
Each of the following structural formulas shows a fatty acid molecule. On the line after each formula, identify the fatty acid as saturated, unsaturated, or polyunsaturated.



1. _____

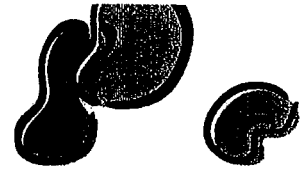
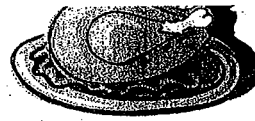


2. _____



3. _____

PROTEINS



Contain _____, _____, _____ & _____

Proteins contain _____ calories/gram.

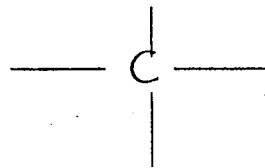
Foods that typically contain proteins include:

FUNCTION of PROTEINS

- 1.
- 2.
- 3.
- 4.

PROTEINS are long chains (_____) of _____.

AMINO ACID STRUCTURE



In nature there are only _____ amino acids.

Is there a common shape to all proteins?

The _____ of a protein affects its _____.

_____ = to CHANGE a protein's shape

- a)
- b)
- c)
- d)

Once a protein is denatured, can it go back to its previous form?

YES/NO

If we change a protein's shape, can it do its job?

YES/NO

How will you tell proteins apart from carbohydrates and lipids?

PROTEIN STRUCTURE

a) primary

b) secondary

c) tertiary

d) quaternary

PROTEINS, continued... ENZYMES (a SPECIAL kind of protein)

Enzymes are _____.

Enzymes names' end with the suffix _____.

Enzymes _____ the rate of chemical reactions.

Enzymes are not _____ during a reaction, so can be used over and over again.

ALL LIVING THINGS use enzymes to control the rate of reactions.

Can we live without enzymes? YES/NO

Protein Review

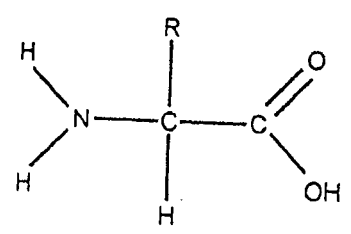
Name: _____

1. Please list foods that are high in protein.
2. Circle the names of the above foods that are also high in lipids.
3. List body parts that are composed mostly of protein.

4. How do our bodies use proteins?
 - a) _____
 - b) _____
 - c) _____
 - d) _____

5. Four elements always found in proteins are _____, _____, _____, and _____.

6. This is a subunit of a protein polymer. It is a(n) _____.



Amino Group = **CIRCLE** it
Carboxyl Group = **SQUARE** around it

- What does the "R" represent? (circle one)
- a) an element from the periodic table
 - b) "R" is for Randell ☹
 - c) This group varies from amino acid to amino acid. It could be an H, an OH or other combinations of elements.

7. If many of the molecules in #6 are bonded together, the result would be called a _____.
8. Bonds between amino acids are called _____ bond.
9. What process would create the bonds mentioned in #8? _____.
10. What other organic molecules are created by this process?
9. What is left when we cut up a protein into its building blocks? _____.
10. What is the process by which we cut up proteins into their building blocks? _____.

Enzymes

Proteins so special they get their own section!!

Enzymes are _____.

Enzymes usually end with the suffix _____.

Enzymes _____, or change the speed of, chemical reactions.

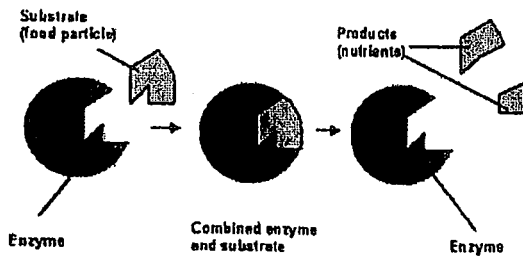
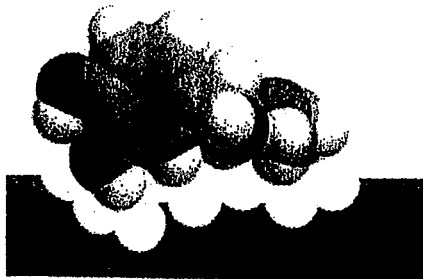
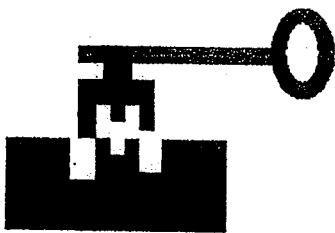
Enzymes are not _____ during the reaction, so they are used over & over again by our bodies.

Can we live without enzymes? YES / NO

A. Active Site:

B. Substrate:

C. Lock and Key hypothesis



How enzymes break down food into nutrients

Each enzyme has _____ reaction that it catalyzes. The _____ of an enzyme is CRITICAL to its function. That is why we don't like going around changing the enzyme's shape (_____)!!

D. Factors that effect enzyme function

a) pH

Optimal pH =

b) Temperature

Optimal Temperature =

c) Substrate Concentration

d) Enzyme Concentration

e) Co-enzymes (_____)

Sometimes enzymes will not work without _____.

They connect to the _____, allowing the enzyme to do its job.

E. Enzyme examples (these are just a few)

Read the passage below, which is reproduced from page 41 of your textbook. Answer the questions that follow.

During a chemical reaction, a substance on which an enzyme acts is called a substrate. Enzymes act only on specific substrates. For example, the enzyme amylase assists in the breakdown of starch to glucose. In this reaction, starch is amylase's substrate.

An enzyme's shape determines its activity. Typically, an enzyme is a large protein with one or more deep folds on its surface. These folds form pockets called active sites. An enzyme's substrate fits into an active site.

Step 1: When an enzyme first attaches to a substrate during a chemical reaction, the enzyme's shape changes slightly so that the substrate fits more tightly in the enzyme's active site.

Step 2: At an active site, an enzyme and a substrate interact in a way that reduces the activation energy of the reaction, making the substrate more likely to react.

Step 3: The reaction is complete when products have formed. The enzyme is now free to catalyze further reactions.

Read each question and write your answer in the space provided.

SKILL: Reading Effectively

1. Define the two Key Terms contained in this passage.

2. What substance is a substrate of amylase?

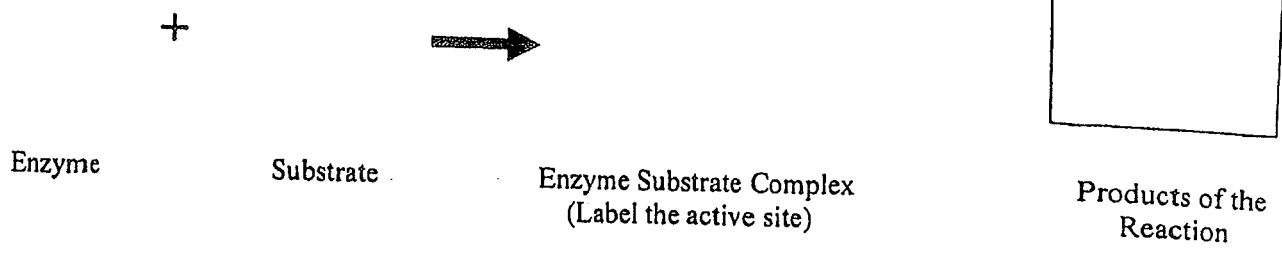
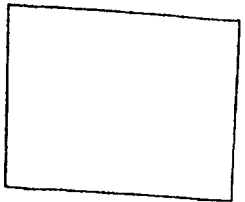
3. What determines an enzyme's activity?

5. What occurs when an enzyme and a substrate interact at an active site?

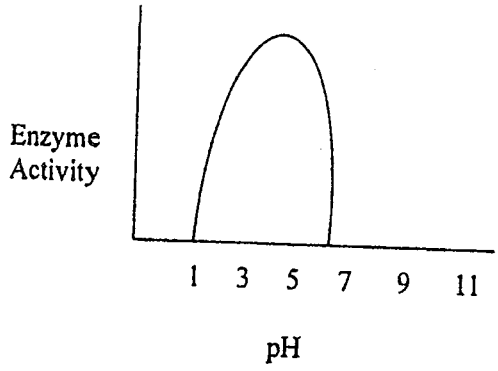
- a. activation energy is reduced
- b. the substrate changes shape
- c. the enzyme is changed by the reaction
- d. activation energy is increased

Name: _____

1. What are enzymes made of? _____
2. Where in the cell are enzymes made? _____
3. The names of most enzymes end in _____.
4. Maltase is an enzyme that speeds up _____.
Maltose is a _____.
5. The place on the enzyme where a chemical reaction takes place is the _____.
6. Sometimes enzymes need a _____, or _____, to work.
7. In the space, sketch ...



8.



What is the optimum pH of this enzyme? _____

Is this an acid pH? YES / NO

Could this enzyme work efficiently in your stomach? _____

What happens to the enzyme at pH's above 7?

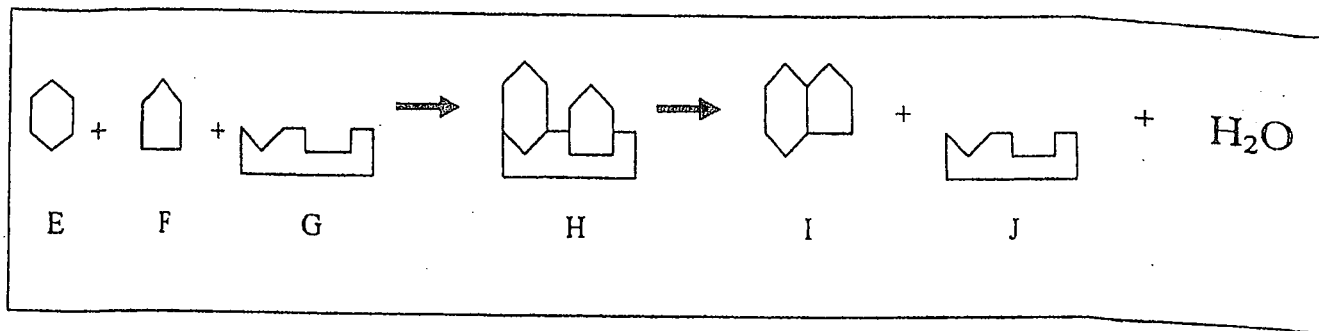
What other factors affect enzyme reaction rate?

10. Match the test with the substance identified by the test

- ___ a) Protein
- ___ b) Glucose & other sugars
- ___ c) Starch, glycogen & cellulose
- ___ d) lipids

1. Benedict's test
2. Biuret test
3. Translucent Spot Test (brown paper)
4. Iodine Test

In the space at the left, write the letter of the term or phrase that correctly answers the question or best completes the statement. Use the following diagram of a cellular enzyme reaction to answer questions 1-10.



- _____ 1. The enzyme is represented by

a) E and F b) G and J c) H d) I
- _____ 2. The product (s) of the reaction is (are)

a) E and F b) H c) I d) I and H₂O
- _____ 3. During the reaction, bonds form between

a) E and F b) F and G c) E and G d) H and I
- _____ 4. During the reaction, the number of substrate molecules

a) increases b) decreases c) stays the same d) cannot be determined
- _____ 5. Activation energy is lowered at stage

a) G b) H c) I d) J
- _____ 6. The molecule of H₂O is actually removed at stage

a) G b) H c) I d) J
- _____ 7. If energy were needed for this reaction to occur, it would be provided directly by

a) a coenzyme b) heat c) glucose d) ATP
- _____ 8. If energy were needed for this reaction to occur (energy needed to enter), the reaction would be

a) exothermic b) anaerobic c) endothermic d) aerobic
- _____ 9. The drawing is a good example of the

a) raising of activation energy c) aerobic respiration

b) lock and key hypothesis d) ATP cycle
- _____ 10. The reaction above could be considered an example of

a) the ATP-ADP cycle c) fermentation

b) hydrolysis d) dehydration synthesis

Nucleic Acids

Contains _____, _____, _____, _____ & _____

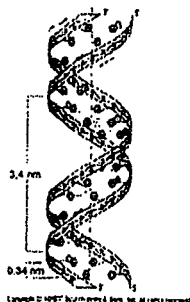
Nucleic acids contain _____ calories per gram.

Nucleic Acids are long chains (_____) of _____.

A. Composition

_____ are made up of...

- 1)
- 2)
- 3)



If the _____ in the nucleotide is deoxyribose, then the nucleic acid is called _____

If the _____ in the nucleotide is ribose, then the nucleic acid is called _____

<u>Nucleotides are Linked Together by...</u> (chemical process)	<u>Nucleic Acids are Digested by...</u> (chemical process)

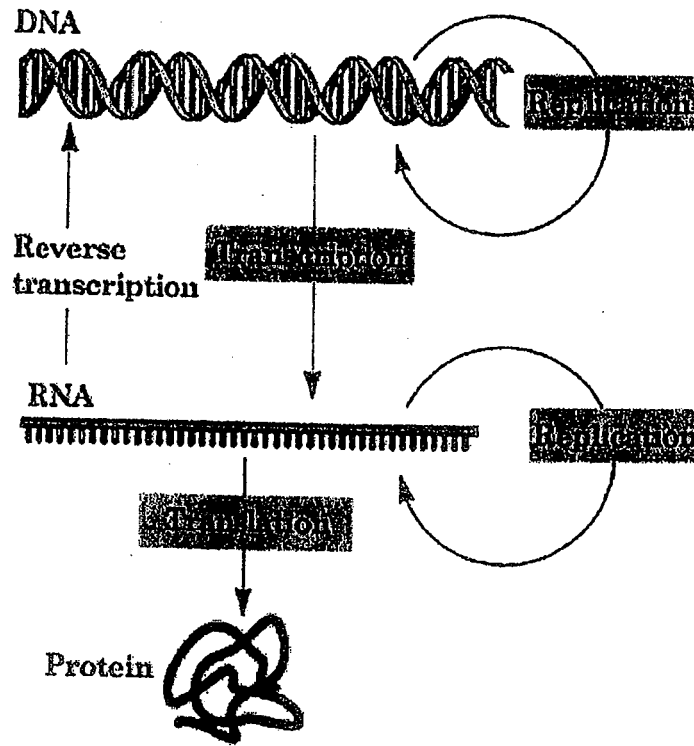
B. How do use nucleic acids?

1. DNA
2. RNA
 - a)
 - b)
 - c)

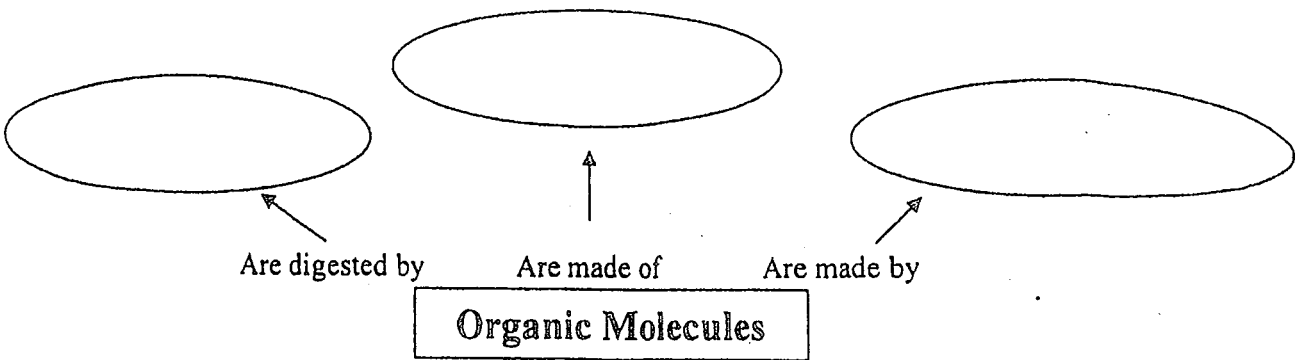
Now, for what you have all been waiting for...

Central Dogma in Molecular Biology

_____ codes information (genes) that the cells in an organism use to make _____



Stay Tuned for more on Nucleic Acids in January/February... 😊



Include 4 types of Macromolecules

	<u>Carbohydrates</u>	<u>Lipids</u>	<u>Proteins</u>	<u>Nucleic Acids</u>
Elements				
Calories				
Types	1	1	1	1
	2	2	2	2
	3	3	3	2
Foods				
Uses	1	1	1	1
	2	2	2	2
	3	3	3	2
Made By				
Digested by				
MISC				
Building Blocks				
Structure				

Biochemistry Review
Living Environment

Name:

Date:

1. Define Organic:
2. Put the following terms into the correct column:
H₂O, Protein, Sugar, Salt, Carbohydrate, CO₂, Fat, Glucose

Organic	Inorganic

3. When you eat food your body must break these macromolecules down into smaller particles.
 - a. Give two different words to describe this process.
 - b. Give three examples of big molecules that we break down.
 - i. .
 - ii. .
 - iii. .
 - c. Where in your body do these processes occur?
 - d. Once these big molecules are broken down, *draw a picture* of where they go!
4. Once the molecules have been broken down and been absorbed into your bloodstream, the small molecules travel and diffuse into your cells (is that how you answered part d above?). In your cells, these small molecules can be combined and assembled into larger molecules.
 - a. What do we call this process?
 - b. Give three examples of small molecules that can be assembled into bigger ones.
 - i. .
 - ii. .
 - iii. .
5. Reactions in our bodies would be too slow to sustain life if we didn't have help. What molecules help speed up our chemical reactions? _____.
Draw a picture showing how these biological catalysts might speed up a chemical reaction:

6. Fill out this table:

Building Blocks	Macromolecule
	Protein
Simple sugars	

7. Using your notes, draw an example of each of the following: (you won't be asked to draw on the test)

Amino acid

glucose

fatty acid

glycerol

Which is the building block of proteins? _____

Which is the building block of carbohydrates? _____

Which 2 are the building blocks of lipids? _____ and _____

8. List three types of Carbohydrates and 1 example of each

Type

Example

9. List 4 ways proteins are used in our body.

10. In your own words, explain how the building blocks of food are like a Lego set to our body.