Key

Basic Chemistry & Biochemistry Unit Review

NAME: _____ Period: ____ Date: _____

A. *Using the vocabulary terms in the following list, fill in the blacks in the statements below.*

Element	neutron	compound	atom	hydrolysis	nucleus	pH	nucleus
Atomic number	inorganic	ionic bonding	polymer	covalent bonding			
Isotopes	polysaccharide	dehydration synthesis	mass number	proton			
Acids	disaccharide	monosaccharide	reactants	electron			

1. A substance that cannot be broken down into other substances by ordinary chemical means is a(n) element.
2. A substance formed by the chemical combinations of two or more elements is a(n) compound.
3. The basic unit of structure of all elements is the atom.
4. Atoms are made up of three types of particles: protons, electrons, and neutrons.
5. The dense central portion of the atom is the nucleus.
6. The number of protons in the nucleus of an atom is the atomic # of the element.
7. The number of protons plus the number of neutrons in the nucleus of an atom is its mass #.
8. Different varieties of the same elements having different numbers of *neutrons* in their nuclei are called isotopes.
9. Chemical bonding in which there is a transfer of electrons from one atom to another is a(n) ionic bonding.
10. Chemical bonding in which there is a sharing of electrons between atoms is a(n) covalent bonding.
11. Measurement of the hydrogen ion concentration of a solution may be given in terms of pH.
12. Glucose is a monosaccharide, maltose is a disaccharide, and starch is a polysaccharide.
13. The type of reaction by which proteins are synthesized is dehydration synthesis
14. The type of reaction by which carbohydrates are broken down is hydrolysis.
15. Large molecules made up of chains of repeating units are polymers.
16. inorganic compounds do not contain carbon.
17. acids are substances that fall between 0-6.9 on the pH scale.
18. Substances to the *left* of the yields arrow in a chemical equation are called reactants.

B. *Place the letter of the definition in the space to the left of the term it defines.*

H 1. amino acid	**A.** Type of reaction by which complex molecules are synthesized from simple molecules
C 2. enzymes	**B.** A substance composed of similar repeating units.
F 3. nucleic acids	**C.** Proteins that act as organic catalysts.
I 4. unsaturated fat	**D.** Digestion is accomplished by this type of reaction.
J 5. amino group	**E.** COOH
D 6. hydrolysis	**F.** RNA and DNA
E 7. carboxyl group	**G.** Alcohol found in lipids.
A 8. dehydration synthesis	**H.** Monomer of proteins
G 9. glycerol	**I.** A lipid containing 1 double bond between the carbon atoms.
B 10. polymer	**J.** NH_2

C. *In the answer space for each question, write the letter of the choice that best completes the statement.*

d 1. An atom has 14 electrons. Its *third* energy level has _____ electrons. (a) 1 (b) 2 (c) 3 (d) 4

2. The part of an enzyme that attracts and holds the substrate is the C. (a) substrate site (b) Coenzyme (c) active site (d) competitive inhibitor

_____ 3. Unlike carbohydrates and fats, proteins contain d atoms. (a) carbon (b) oxygen (c) phosphorus (d) nitrogen

d 4. How many electrons can a carbon atom share? (a) 1 (b) 2 (c) 3 (d) 4

C 5. The nucleus of an atom contains (a) protons & electron (b) neutrons & electrons (c) protons & neutrons (d) only neutrons

C 6. A pH of 7 indicates a (a) strong acid (b) strong base (c) neutral solution (d) weak base d 7. Organic compounds always contain (a) oxygen (b) proteins (c) nitrogen (d) carbon

d.7

C 8. Carbohydrates are composed of (a) carbon, nitrogen, and oxygen (b) nitrogen, oxygen, and hydrogen (c) carbon, hydrogen, and oxygen (d) sulfur, nitrogen, and carbon

a 9. Glucose and fructose are both (a) monosaccharide (b) disaccharides (c) polysaccharides (d) starches

b 10. Maltose and sucrose are both (a) monosaccharide b) disaccharides (c) polysaccharides (d) starches

C 11. Monosaccharides join to form disaccharides by (a) hydrolysis (b) hydration (c) dehydration synthesis (d) dehydrolysis

a 12. Disaccharides are broken down into their component monosaccharides by (a) hydrolysis (b) hydration (c) dehydration synthesis (d) dehydrolysis

C 13. Cellulose and glycogen are (a) proteins (b) fatty acids (c) polysaccharides (d) disaccharides

a 14. Simple lipids consist of (a) three fatty acid molecules and one glycerol (b) fatty acids only (c) glycerol only (d) amino acids

a 15. The bonds between amino acids in proteins are (a) peptide bonds (b) unsaturated (c) hydrolytic (d) carboxylic

c 16. Enzymes are (a) carbohydrates (b) lipids (c) proteins (d) hormones

a b 17. Enzymes (a) decrease reaction rates (b) increase reaction rates (c) are involved only in synthetic reactions (d) are involved only in hydrolytic reactions

a 18. Nucleic acids are composed of (a) C, H, O, N, P (b) C, H, O, N (c) C, H, O, N, S (d) C, H, O

b 19. DNA (a) is the site of protein synthesis (b) contains the hereditary information (c) is found only in the cytoplasm (d) is found only in the animal cells

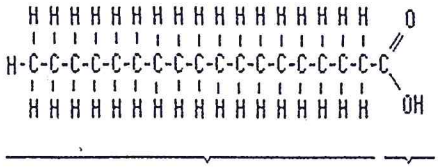
c 20. RNA is involved in (a) lipid synthesis (b) carbohydrate synthesis (c) protein synthesis (d) DNA synthesis

a b 21. How many <u>water molecules</u> are present, in the following chemical equation? $2H_2O \rightarrow 2H_2 + O_2$ (a) one (b) two (c) three (d) none

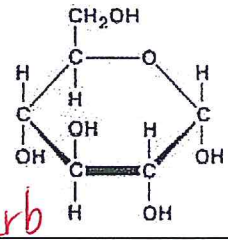
a d 22. How many <u>hydrogen atoms</u> are present, in the following chemical equation? $2H_2O \rightarrow 2H_2 + O_2$ (a) one (b) two (c) three (d) four

c 23. _____ consist of the majority of fat in an organism. (a) saturated fats b) carbohydrates (c) triglycerides (d) unsaturated fats

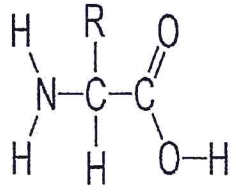
D. *Identification: Identify each of the following types of monomers or polymers.*



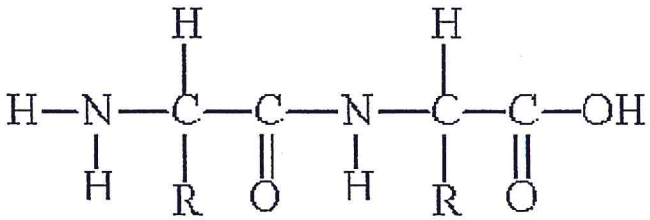
1. fatty acid



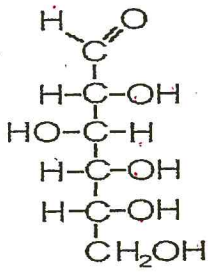
3. carb
monosaccharide



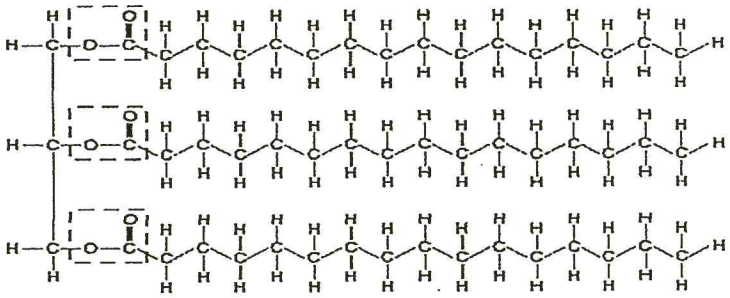
2. amino acid



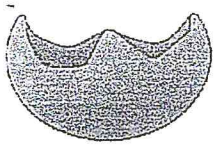
4. dipeptide
protein



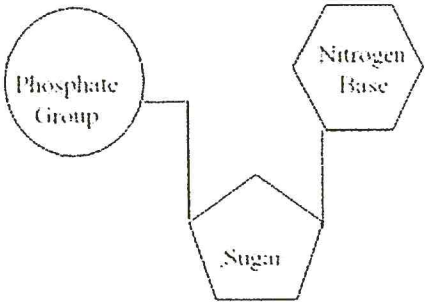
5. carb monosaccharide



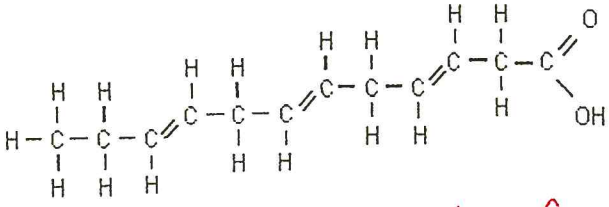
6. triglyceride (lipid)



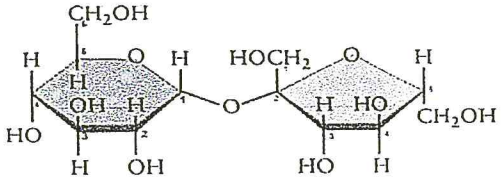
7. enzyme (protein)



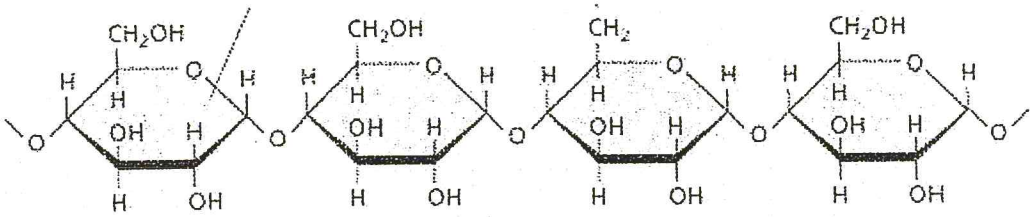
8. nucleic acid



9. ~~(bad)~~ polyunsaturated fat (lipid)



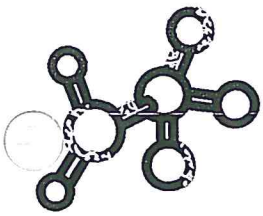
10. disaccharide (carb)

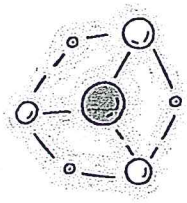


11. polysaccharide (carb)

Key

Biochemistry Review Worksheet





Directions: Answer the following questions completely and concisely.

1. List a kind of food that contains these polymers.
   a. Proteins: meat, dairy
   b. Carbohydrates: fruits, veg, pasta
   c. Fats: meat, oils, nuts,
2. What are the elements that make up all carbohydrates? CHO
   a. What is the specific ratio of hydrogen to oxygen? 2H : 1 O
3. Monosaccharides, disaccharides, and polysaccharides are a type of what macromolecule? carb
4. What are the monomers of carbs.? monosaccharides
5. What is the function of carbs.? Quick energy (short term ~24hr or less)
6. Write the formula for monosaccharides $C_6H_{12}O_6$
7. Write the formula for disaccharides $C_{12}H_{22}O_{11}$
8. What are the monomers of proteins? amino acids
9. What are the elements that make up all proteins? CHON
10. What is the name of the bond that joins together amino acids? peptide bond
11. What are 2 functions of proteins?
    a. control chem rxn (enzymes)
    b. build/repair cells
12. What are the monomers of a lipid? 1 glycerol + 3 fatty acids
13. What is the common name(s) given to lipids? triglycerides, fats,
14. What are 2 functions of lipids?
    a. long term energy storage
    b. build cell membranes
    make hormones
15. What is the difference between a saturated fatty acid and an unsaturated fatty acid?
    saturate - all single bonds, straigh C chain, solid
    unsaturated - 2 or more double bonds, curved C chain, liquid
16. Identify the following functional groups:
    a. – OH hydroxyl
    b. – NH_2 amino
    c. – COOH carboxyl

17. Define isomer. Bleeh molecules with same chem formula but different structural formula

18. What is the difference between a hydrolysis reaction and dehydration synthesis?
hydrolysis - breaks down polymers; H_2O added
D.S - builds polymers; removes H_2O

19. Provide an example of a dehydration synthesis reaction below. Hint: you should have 2 reactants and 2 products and you do not have to draw the structural formulas.

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

glucose + fructose $\longrightarrow$ maltose + water

20. List the 5 elements that make up most nucleic acids CHONP

21. What is an essential amino acid?
one needed daily; must consumer; cannot make

22. What type of polymer are enzymes? amino acid

23. What are the monomers of nucleic acids? nucleotides

24. What is the function of DNA? control hereditary traits

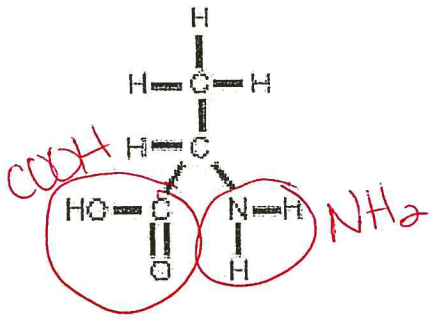
25. What is the function of RNA? make protein

26. A compound that consists of only hydrogen and carbon would be called a(n) hydrocarbon.

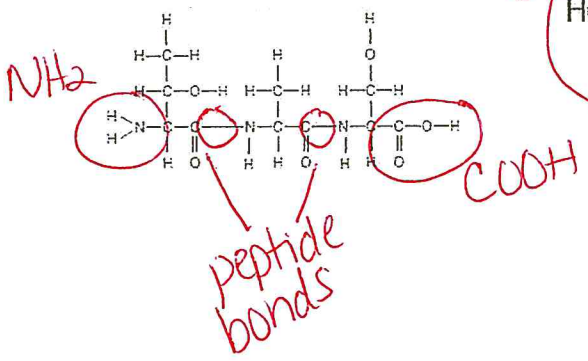
27. Which macromolecule stores more energy, fats or carbohydrates? fats.

28. What macromolecule would most likely be represented by the following formula, $C_{57}H_{110}O_6$? How do you know?
Fat (lipid)
- contains only C, H, O
H:O ratio is > 2:1

29. Below is the structural formula for an amino acid. Circle and label the 2 functional groups. Also write the chemical formula.

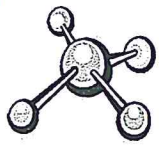


30. Circle the peptide bonds.



Key

ORGANIC MOLECULES WORKSHEET



Name:_____Period:_____Date:_____

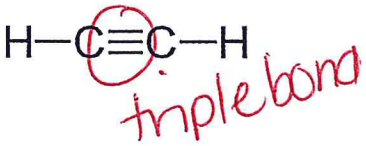
Part 1: CARBON: Answer the following questions.

1) All organic compounds contain C + H

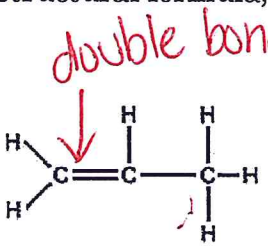
2) In order for a carbon atom to be considered stable it needs to form 4 covalent bonds.

3) Compounds that contain only hydrogen and carbon atoms are called hydrocarbons.

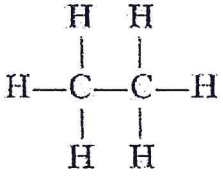
4) The following structural formulas show four different compounds of carbon and hydrogen (hydrocarbons). Below each structural formula, write the chemical formula and label any double and triple bonds.



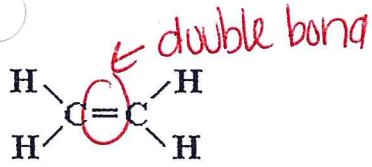
1. C_2H_2



2. C_3H_6



3. C_2H_6



4. C_2H_4

Part 2: CARBOHYDRATES: Answer the following questions.

1) What atoms make up carbohydrates? C H O

2) What is the ratio of hydrogen to oxygen atoms present in all carbohydrates? 2:1

3) What are the three types of carbohydrates?

a. monosaccharides

b. disaccharides

c. polysaccharides

Part 3: MONOSACCHARIDES & DISACCHARIDES: Answer the following questions.

1) What are the monomers of carbohydrates? monosaccharides

2) What is the difference between monosaccharides and disaccharides?

di = 2 monosacchandes joined mono = 1

3) What are the three examples of monosaccharides?

a. glucose

b. fructose

c. galactose

4) What are the three examples of disaccharides?

a. sucrose

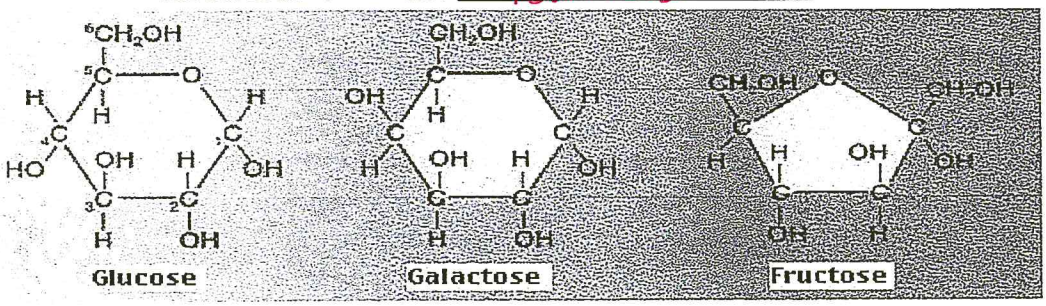
b. maltose

c. lactose

5) Look at the structural formulas below. These three sugars all have the same chemical formula ($C_6H_{12}O_6$).

a. Are the structural formulas the same? no

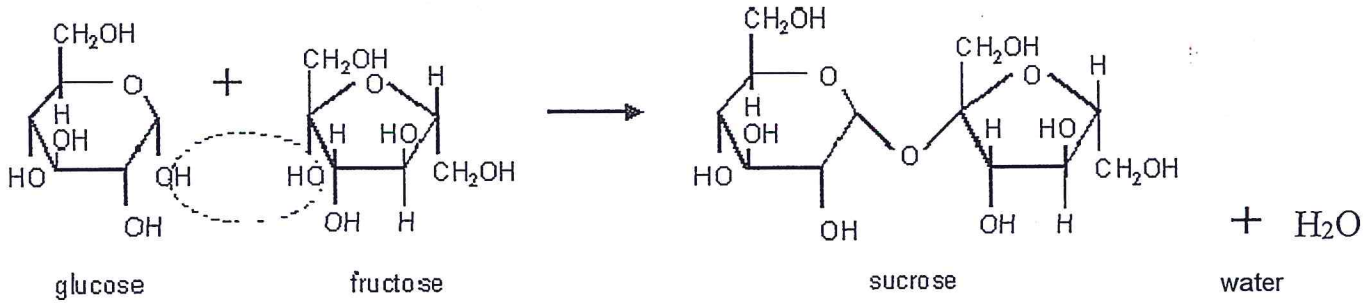
b. What do we call compounds that have the same chemical formula, but differ in their structural formulas? isomers



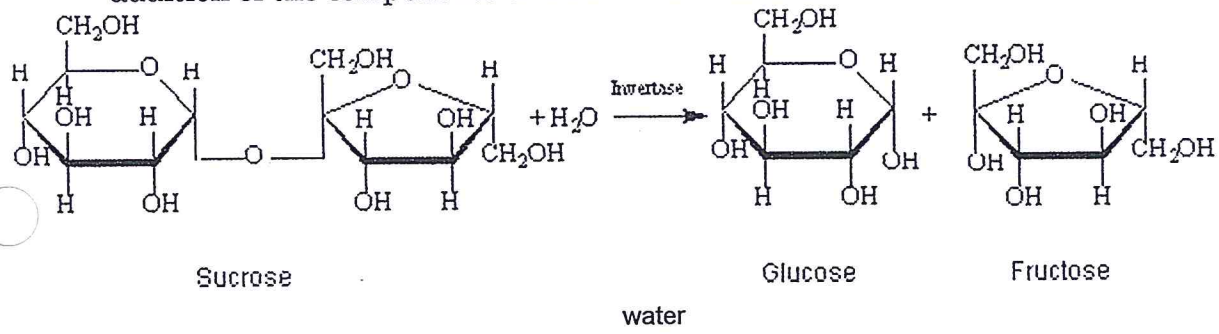
6) Monosaccharides all have the same formula: $C_6H_{12}O_6$. How can you write this formula in the simplest form (reduced) that illustrates the proportion of elements in monosaccharides?

CH_2O

7) Below is an example of **dehydration synthesis**. In dehydration synthesis, a hydrogen atom from one molecule joins with a hydroxyl group (-OH) from another molecule to form water, leaving two molecules bonded to the same oxygen atom. For example, when glucose and fructose combine by dehydration synthesis, they form sucrose and water.



8) Below is an example of **hydrolysis**. Complex organic molecules are broken down by the addition of the components of water – H^+ and OH^-.



9) What are the products of the hydrolysis reaction? glucose + fructose

10) What are the reactants of the dehydration synthesis reaction? glucose + fructose

11) How are the reactions in #7 and #8 related? opposite - one breaks down sucrose (#8); other makes sucrose (#7)

12) What is the chemical formula for disaccharides? $C_{12}H_{22}O_{11}$

13) Why is the chemical formula of disaccharides not double that of the monosaccharides? bc H_2O is removed by joining the 2 monosaccharides together

14) In what life process does hydrolysis occur? digestion

15) Look at the three reactions below. Which reaction(s) is hydrolysis taking place?

C

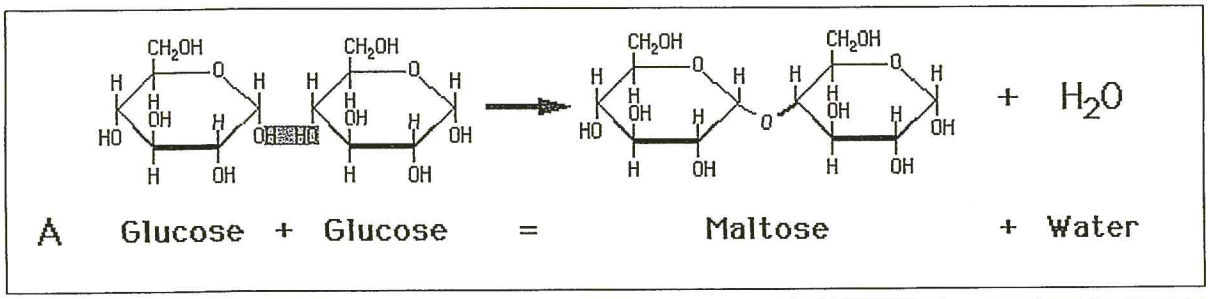
a. How do you know?

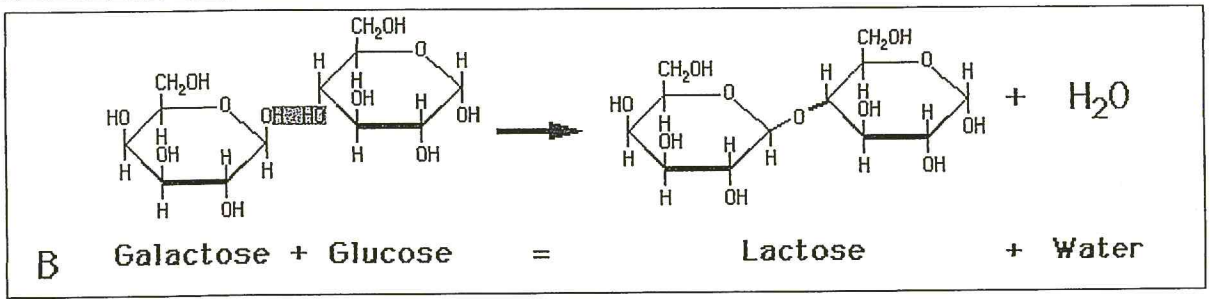
H_2O is being added as a reactant

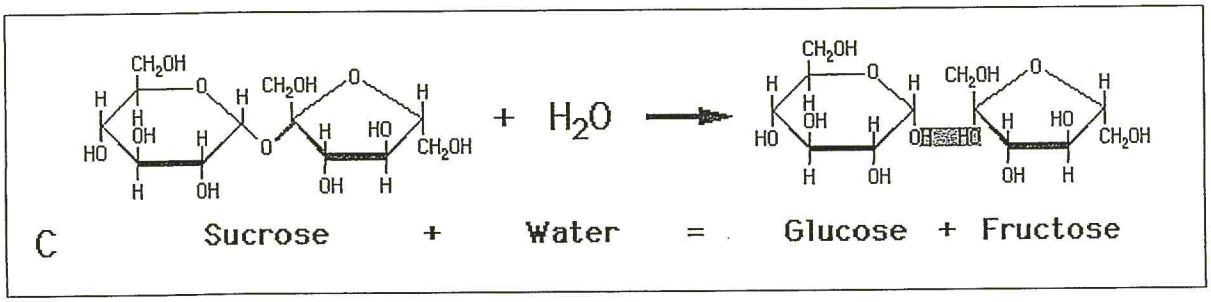
16) Look at the three reactions below. Which reaction(s) is dehydration synthesis taking place?

A+B

a. How do you know? H_2O is being removed; it's a product







17) What are the common names for sucrose and lactose? sugar / milk sugar

18) What are polysaccharides? many monosaccharides joined together

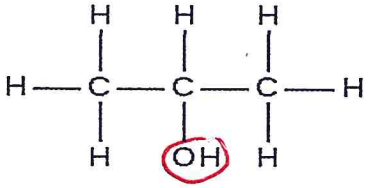
19) What substance would be the repeating unit that makes up starch, cellulose, and glycogen?

monosaccharides

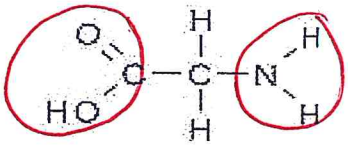
Key

Biomolecules Worksheet

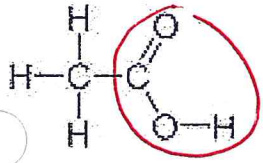
PART 1: IDENTIFYING FUNCTIONAL GROUPS: A functional group in a molecule gives the molecule its distinctive properties. Find the functional groups in the following structural formulas. Circle the functional group(s) and write the functional group name(s) on the first line. Then write the chemical formula on the second line.



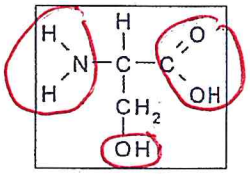
1. alcohol
   C_3H_7OH



2. carboxly / amino
   $C_2H_5O_2N$



3. Carboxly
   $C_2H_4O_2$

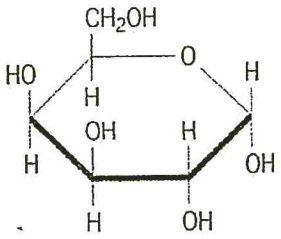


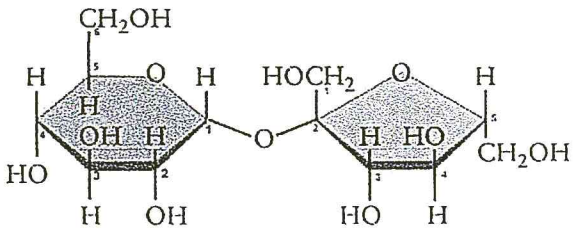
4. amino / carboxly / alcohol
   $C_3H_7O_3N$

PART 2: MONOMERS & POLYMERS: Monomers are the repeating units that make up a polymer.

POLYMERS	MONOMERS (building blocks)	Atom present
Carbohydrate	monosaccharide	CHO
Protein	amino acid	CHON (S)
Lipid	glycerol + 3 fatty acids	CHO
Nucleic Acid	nucleotides	CHONP

PART 3: BUILDING A MACROMOLECULE: All living things make large molecules, called macromolecules, from smaller molecules. Macromolecules 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.



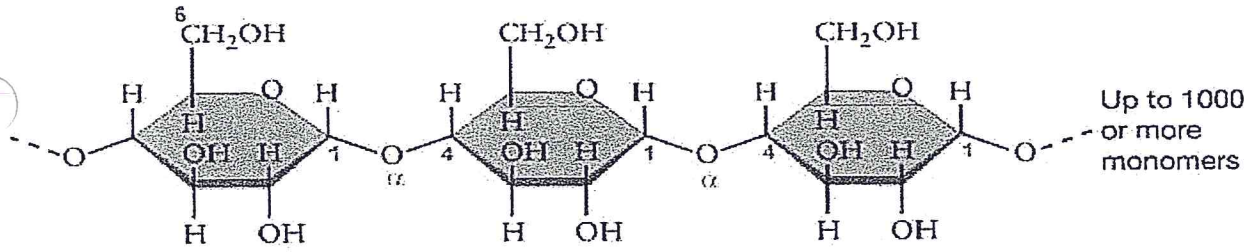


Glucose subunit

Fructose subunit

1. monosaccharide

2. disaccharide



3. polysaccharide

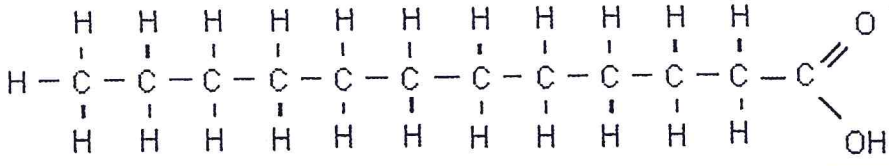
4. What is the function of #3 in our bodies?
stored energy (short term)

5. After you eat carbs. and the immediate energy requirements of all your body's tissues have been met, the excess glucose in your blood will be converted into glycogen

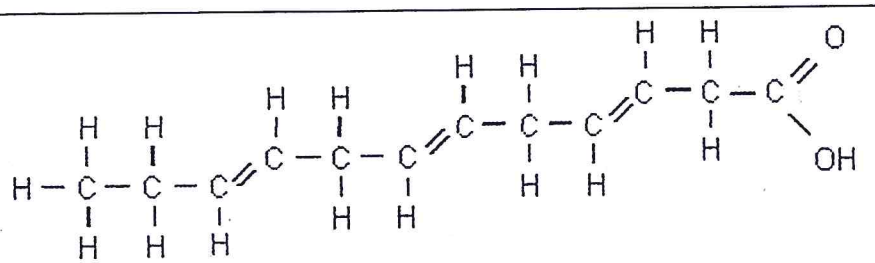
a) If all of your glycogen stores are full and you still have excess glucose in your bloodstream, the remaining glucose will be converted to fat.

6. What is the name of the chemical process that joined the disaccharide and the polysaccharide? dehydration synthesis

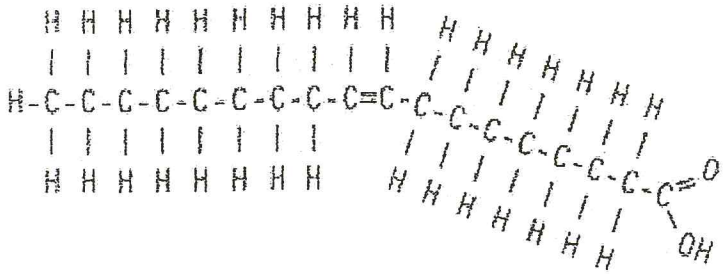
PART 4: DEGREE OF SATURATION: Each of the following structural formulas shows a fatty acid molecule. On the line, identify the fatty acid as saturated, unsaturated, or polyunsaturated.



1. saturated



2. polyunsaturated



3. unsaturated

4. Define a saturated fatty acid. Provide one example of a saturated fatty acid.

-single bonds between carbon -straight chain- solid @ room temp

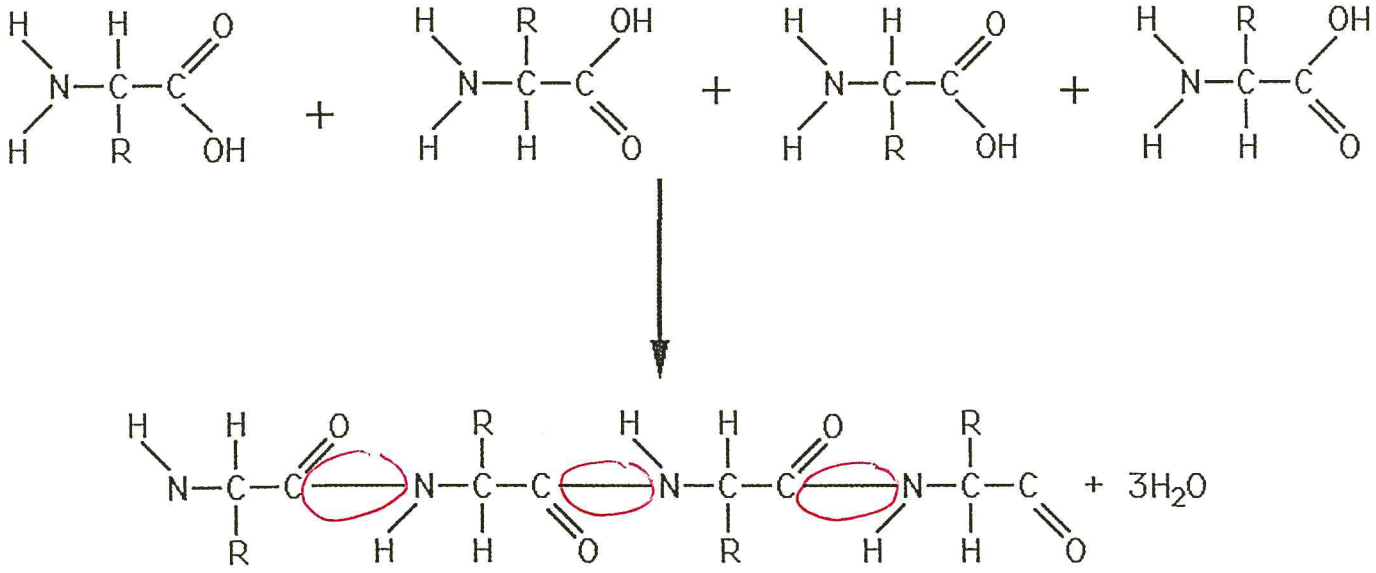
ex- triglycerides such as butter (dairy + meat)

5. Define an unsaturated fatty acid. Provide one example of an unsaturated fatty acid.

- one double bond between carbons - curve chain liquid @ room temp ex- oil

6. Define a polyunsaturated fatty acid. Multiple double bonds

PART 5: SYNTHESIS-ANAYLZING MACROMOLECULES: Study the diagram below and then answer the following questions.



1. What are the reactants? 4 amino acids

2. What are the products? polypeptide = protein + 3H2O

3. What chemical process occurred in order to create this protein? dehydration synthesis

a. How do you know? bc H_2O is a product = removed from the a.a.

4. Circle the peptide bonds. How many peptide bonds are present? 3

5. How many molecules of water are produced in order to form the peptide bonds?
3

6. If a protein contained 200 peptide bonds, how many molecules of water do you suppose would be required to break it down into its components? 200

7. What is the ratio of molecules of water to the number of peptide bonds?
1:1

(# of peptide bonds = # of amino acids − 1)

Proteins, Lipids & Carbs Comparison