

**Part I. Basic Chemistry.**

Use the following word bank to fill out the following paragraph. Make sure you read the paragraph when you're done to see if it makes sense! Put all answers on your scantron (this is why there are multiples of the same letter).

- |               |                         |          |                  |
|---------------|-------------------------|----------|------------------|
| a. element    | b. compound or molecule | c. polar | d. protons       |
| e. electrons  | a. neutrons             | b. atom  | c. covalent bond |
| d. ionic bond | e. isotope              | a. ion   |                  |

An 1. b. atom is the basic unit of matter. Each type of atom (determined by the number of subatomic particles it is made up of), represents a certain 2. a. element, or a pure chemical substance. An atom is made up of 3 types of subatomic particles. The 3. positively charged d. proton and 4. neutral a. neutron are located in the nucleus of the atom, while the 5. e. electrons move around the outside of the atom. When two or more atoms are chemically bonded, they make up a 6. b. compound or molecule

The atoms in a 7. c. covalent bond share electrons, while in an 8. d. ionic bond atoms with opposite charges are bonded together, and electrons are transferred. Sometimes, in a covalently bonded molecule, the electrons are not shared equally. This results in an uneven distribution of charge (the molecule has a positive and a negative end), and we say the molecule is 9.

c. polar.

An 10. e. isotope of an element has the same number of protons and electrons, but different numbers of *neutrons*. An 11. a. ion has the same number of protons and neutrons in the nucleus, but a different number of *electrons*.

Label the following with a A for chemical change, or a B for physical change.

12. physical Ice melting

13. chemical Nail rusting

14. physical Sugar dissolving in water

15. chemical The formation of NaCl from a sodium ion and a chlorine atom.

16. physical Cutting a piece of magnesium ribbon to a different size.

17. chemical A candle burning

18. chemical Photosynthesis or Respiration

19-23. Label the following diagram with the structures below. Each is used once.

A. Nucleus

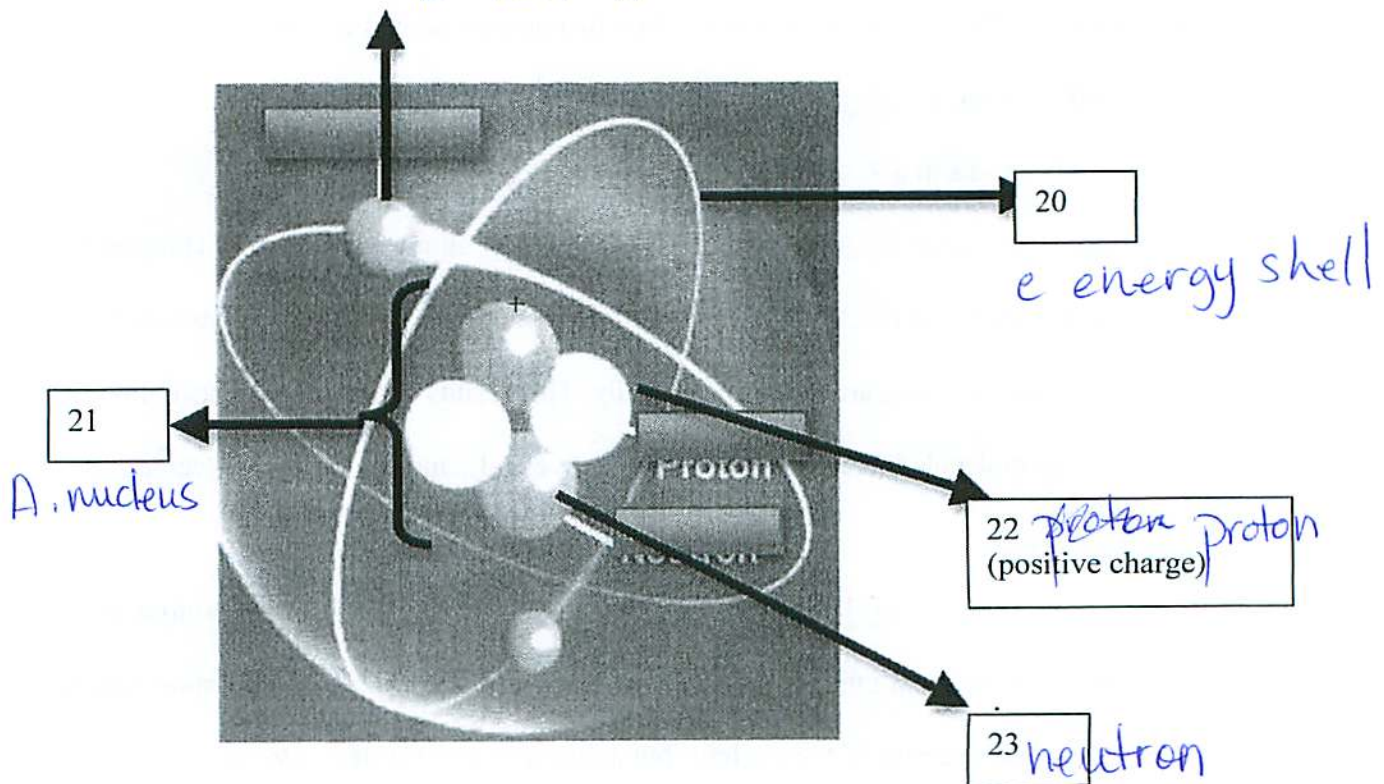
B. Neutron

C. Proton

D. electron

E. Electron Energy Shell

19. D electron



24. What atom is this (in the previous diagram)?
- a. Beryllium
  - b. hydrogen
  - c. oxygen
  - d. carbon
  - e. helium
25. Which two particles make up the mass of the atom?
- a. protons and electrons
  - b. neutrons and protons
  - c. isotopes and protons
  - d. neutrons and electrons
26. The atomic numbers tells us
- a. the mass of the protons and neutrons
  - b. the number of isotopes
  - c. the number of valence electrons
  - d. the number of protons

Label the following structures with the correct charge:

- A. positive (+),
- B. negative (-) or
- C. neutral.

27. + proton
28. - electron
29. neutral "normal" atom
30. neutral neutron
31. + atom nucleus
32. neutral isotope
33. + cation
34. - anion

35. A chemical formula must be balanced because matter cannot:
- a. be created or destroyed
  - b. become more or less dense
  - c. lose or gain electrons
  - d. take up more or less space
36. A mixture is different from a chemical compound because
- a. it does not have uniform ratios of elements
  - b. it can be separated physically
  - c. it can be combined physically
  - d. all of the above
37. A buffer regulates
- a. elements
  - b. compounds
  - c. ions
  - d. pH
  - e. carbohydrates
38. In a salt water solution salt is the
- a. solute
  - b. solvent

- c. element  
39. In covalent bonds electrons are \_\_\_\_\_, whereas in ionic bonds electrons are \_\_\_\_\_.  
d. atom
- a. shared; transferred  
b. shared; lost  
c. transferred; shared  
d. shared; gained

## Part II. pH scale

40-42. Choose A for acid, B for base, or C for neutral

40. Inside of your stomach **A**

41. In your mouth **A**

42. Most cleaners, such as soap, bleach or drain cleaner **B**

43. What is the hydrogen ion concentration for a substance with a pH of 5 (refer to the pH scale on the next page)?

- a. 1,000  
b. 1/10  
c. 100  
d. 1

44. A pH of 8?

- a. 1,000  
b. 1/10  
c. 100  
d. 1

45. Acids have an \_\_\_\_\_ relative to distilled water:

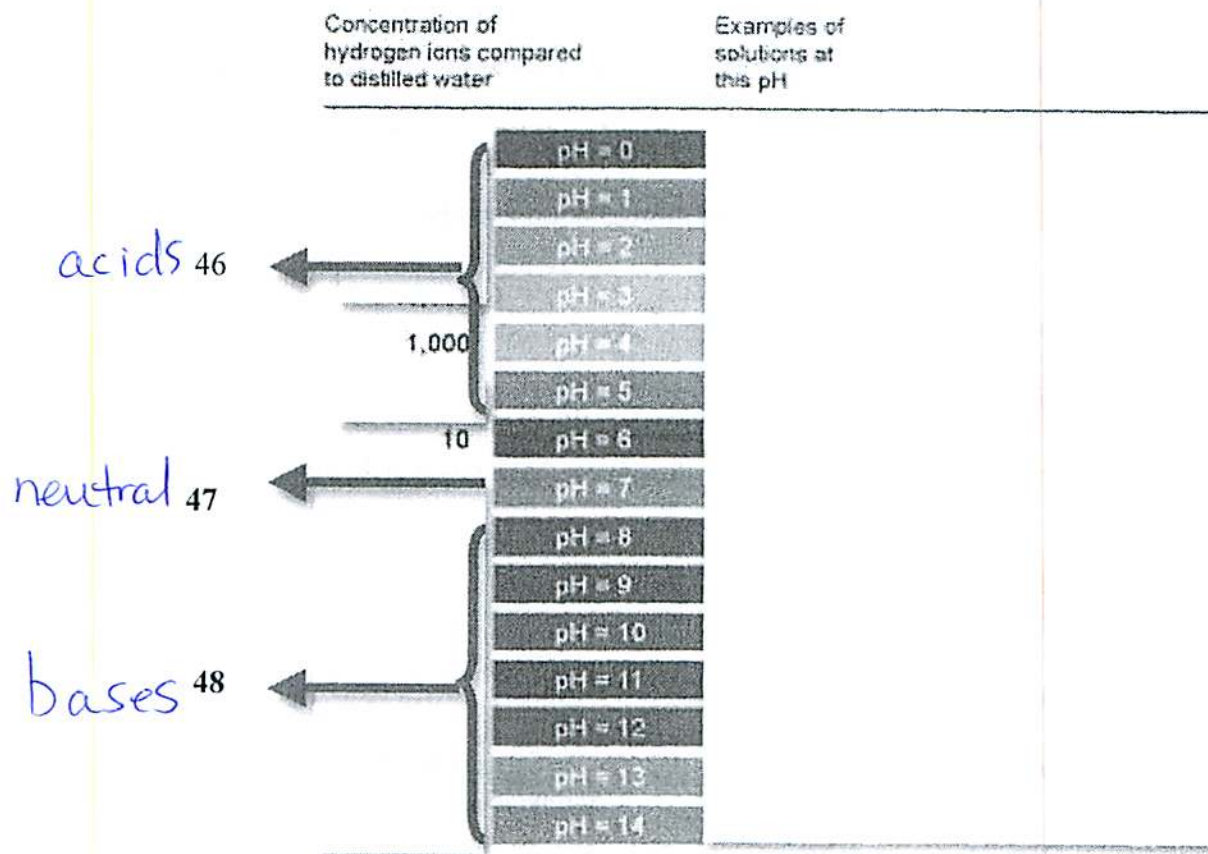
- a. Abundance of hydroxide ions (OH<sup>-</sup>)  
b. Abundance of hydrogen ions (H<sup>+</sup>)

46-48. Label the blanks on the pH scale using the words and phrases below. Make sure to fill in the correct letters on your scantron.

a. acids

b. bases

c. neutrals



The scale is courtesy of The Pacific Institute for the Mathematical Sciences

### Part III. Characteristics of Water

49. When water is placed in a glass tube, the water molecules are attracted to the glass because both are polar. The attraction of the water to the glass is an example of

- a. cohesion
- b. water as a universal solvent
- c. adhesion
- d. water resists temperature change

50. Coastal climates are more mild because:

- a. water expands when it freezes
- b. water is a universal solvent
- c. water resists temperature change
- d. water is polar

51. Which characteristic of water allows it to act as an insulator in the cells of organisms?  
a. water expands when it freezes                      c. water resists temperature change  
b. water is a universal solvent                      d. water is polar
52. One reason that it is important that water expands when it freezes is that:  
a. it leads to soil formation                      c. it kills off fish in the winter  
b. it makes climates more mild                      d. it allows water to move up a tree
53. We were able to float paper clips on the surface of the water because water has a high  
a. surface tension                      c. heat capacity  
b. ability to dissolve substances                      d. pH
54. Our blood is able to carry important nutrients throughout our bodies due to water's ability to  
a. retain heat  
b. expand when it freezes  
c. stick to other water molecules  
d. dissolve many substances
55. Water is the universal solvent, but CANNOT dissolve substances which are  
a. polar  
b. non-polar  
c. ionically charged  
d. covalently charged
56. Water's polar nature allows it to form \_\_\_\_\_ with other polar molecules.  
a. covalent bonds                      c. hydrogen bonds  
b. ionic bonds                      d. physical bonds

#### Part IV. Macromolecules & Organic Chemistry

57. Carbon is fundamental to life because it  
a. expands when it freezes                      c. has a neutral pH  
b. it forms chemical bonds readily                      d. is used in dating methods
58. Many monomers bonded together will form a \_\_\_\_\_.  
a. molecule                      c. compound  
b. polymer                      d. polar molecule
59. An enzyme is considered a catalyst for biological reactions because it...  
a. stops chemical reactions at the right time  
b. breaks down molecules to provide energy for reactions to take place  
c. reads the genetic code, and builds cellular structures  
d. speeds up biological reactions.

60. When we refer to the "lock and key" model of how an enzyme works, we are referring to an enzyme having a very specific \_\_\_\_\_, which only allows it to be involved in certain chemical reactions.

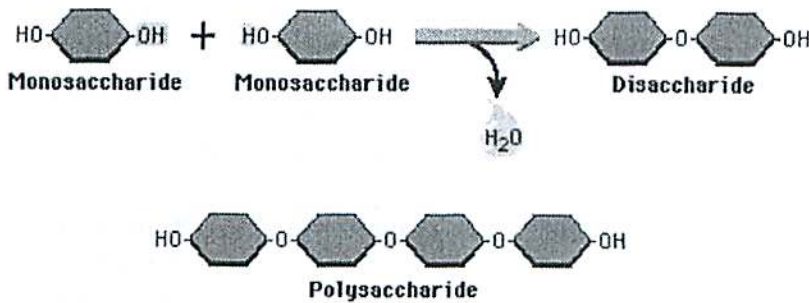
- a. pH      b. size      c. number of triple bonds      d. shape

61. In a dehydration synthesis reaction, polymers are \_\_\_\_\_, and water \_\_\_\_\_ the reaction.

- a. broken down; is put into      c. built; is put into  
b. broken down; comes out of      d. built; comes out of

62. Does the following diagram represent a dehydration synthesis reaction or a hydrolysis reaction?

- a. dehydration synthesis      b. Hydrolysis



63. Organic compounds make-up

- a. chemical reactions  
b. elements  
c. living or once living tissue  
d. polymers

64. Organic compounds contain

- a. at least one carbon atom and a C-H bond  
b. at least one carbon atom and a C-O bond  
c. at least 4 carbon atoms  
d. Carbon, Hydrogen, and Oxygen

Choose the correct option to fill in the box. There is ONE choice for each box, so make sure to use process of elimination! Don't forget to fill out your scantron for this section.

**Building block choices**

- a. nucleotides
- b. monosaccharides
- c. amino acids
- d. 1 glycerol and three fatty acids

**Elements Present choices**

- a. Carbon, hydrogen, oxygen
- b. Carbon, hydrogen, oxygen
- c. Carbon, hydrogen, oxygen, and nitrogen
- d. carbon, hydrogen, oxygen, nitrogen, and phosphorus

**Function**

- a. energy storage & release
- b. stores genetic information
- c. provides insulation, stores energy, and provides a waterproof layer
- d. provides the structural components of organisms (skin, nails, horns, etc.), and acts as a catalyst for biological reactions

**Common names & examples**

- a. starches, sugars and fiber
- b. fats, oils, & waxes, & steroids
- c. DNA & RNA
- d. muscle tissue, enzymes

Macromolecule	Building Block	Elements Present	Function	Common Names or examples
Carbohydrates	65. B	66. A or B	67. A	68. A
Proteins	69. C	70. C	71. D	72. D
Lipids	73. D	74. A or B	75. C	76. B
Nucleic Acids	77. A	78. D	79. B	80. C



81-82. Given the below information, identify the substances.

Benedict test—monosaccharides

Iodine test—starches (polysaccharides)

Biuret test—Proteins

Brown paper bag test—Lipids

	Benedict Test	Iodine Test	Biuret Test	Brown Paper Bag Test
Substance A	--	--	+	+
Substance B	--	+	--	--
Substance C	+	--	--	--

81. Substance B

~~a. table sugar~~

b. pasta

c. olive oil

82. Substance C

a. chicken

b. rice

c. mango

83. Which of the following is the best example of a saturated fat?

a. olive oil

c. avocado

b. fat on steak

d. fat in most fish

84. A disaccharide has is made up of \_\_\_\_\_ building blocks.

a. 1

c. 3

b. 2

d. 4

85. Which of the following is an example of a complex carbohydrate?

a. cellulose

c. fructose

b. glucose

d. maltose

86. Which of the following is a monosaccharide?

a. cellulose

c. fructose

b. glucose

d. maltose

87. Which of the following is a disaccharide?

a. cellulose

c. fructose

b. glucose

d. maltose

88-93. Identify the following building blocks.

a) carbohydrate

b) saturated lipid

c) amino acid

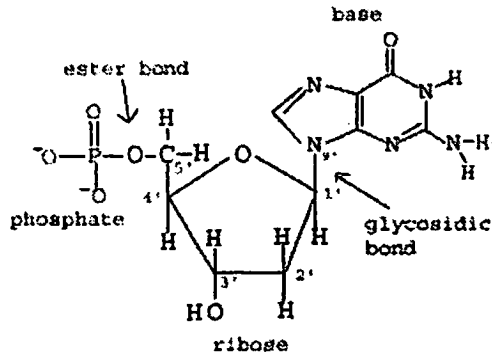
d) nucleic acid

e) unsaturated lipid

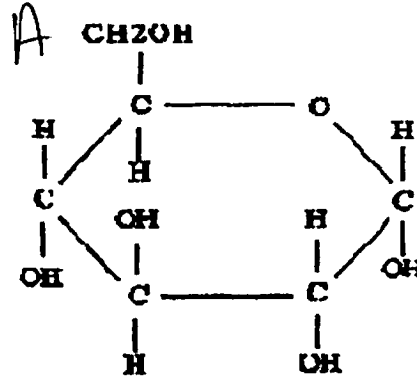
a) hydrocarbon

e.

88. D

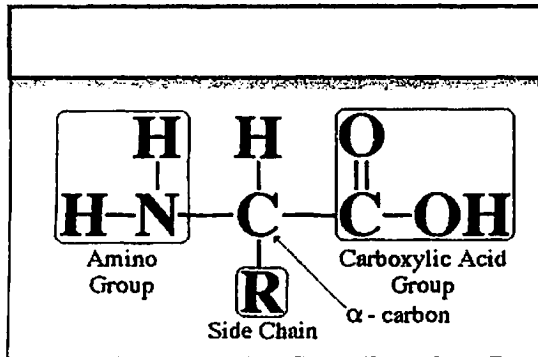


89



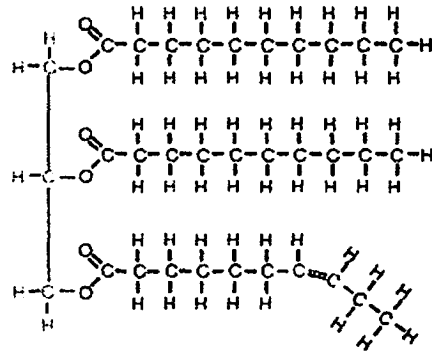
90

C



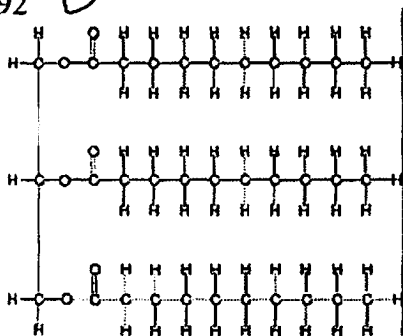
91

E



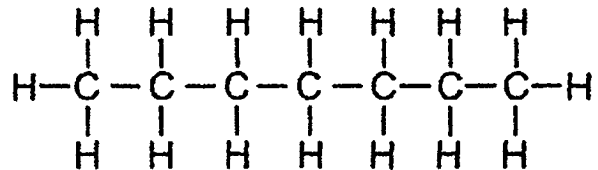
92

B



93

A

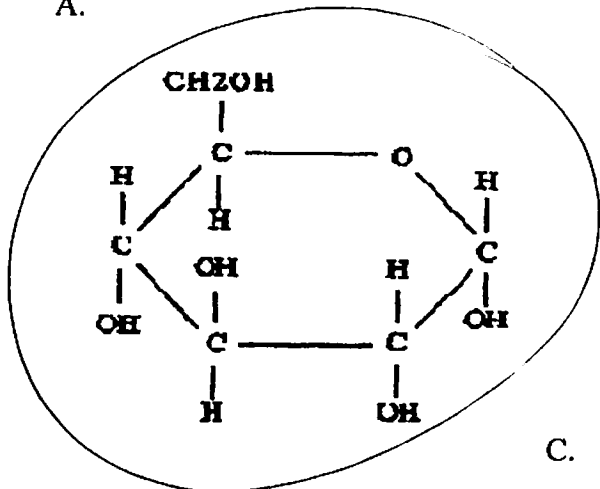


94. Is the unsaturated fat in the above choices (88-93), a saturated fat, or a polyunsaturated fat?

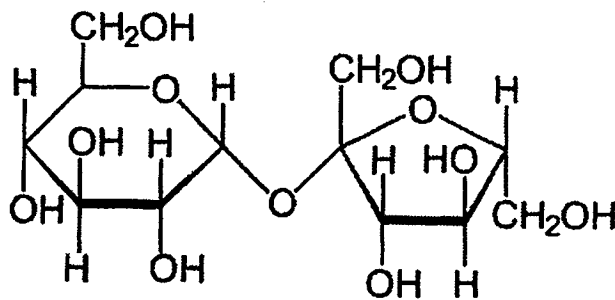
- a. unsaturated                      b. polyunsaturated

95. Circle the glucose molecule.

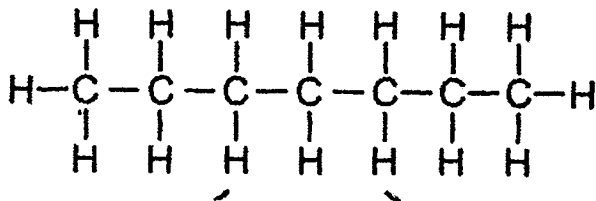
A.



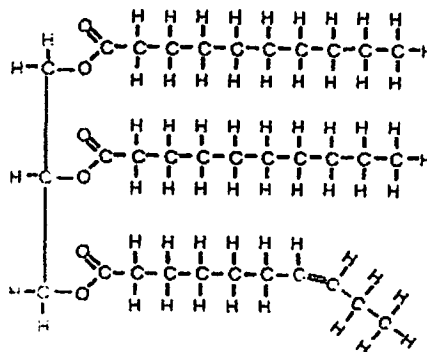
B.



C.



D.



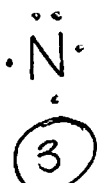
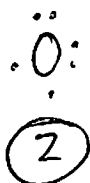
**Fill in the Blank/Short Answer:**

96. Atoms are made-up mostly of empty space.

97. What is the H:O ratio in carbohydrates?

2:1

98. Draw the Lewis dot structures for Carbon, Oxygen, Nitrogen and Sodium, and write how many available bonding sites each has.

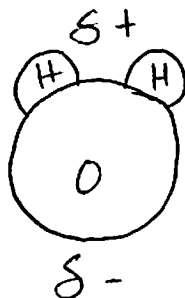


$\text{Na}$   
 1 unpaired  
 (more unlikely to give up electron & become  $\text{Na}^+$ )

99. How many protons does Phosphorus contain?

15

100. Why (structurally) is water a polar molecule? Draw a sketch of the water molecule to illustrate your point.



The shared electrons between the Hydrogen & Oxygen atoms are more attracted to the larger oxygen atom. Therefore, there is an unequal distribution of charge resulting in a slightly negative & a slightly positive end.

**Choose 2 short answer questions. Write in complete sentences and be specific (5 points each). \*\*\*Write your answers below in the empty space. You may attach a sheet if you prefer**

Option 1. What is a use of isotopes? HOW are isotopes used for this purpose?

Option 2. What actually happens at the molecular level during a chemical change? List 2 signs that a chemical change is taking place.

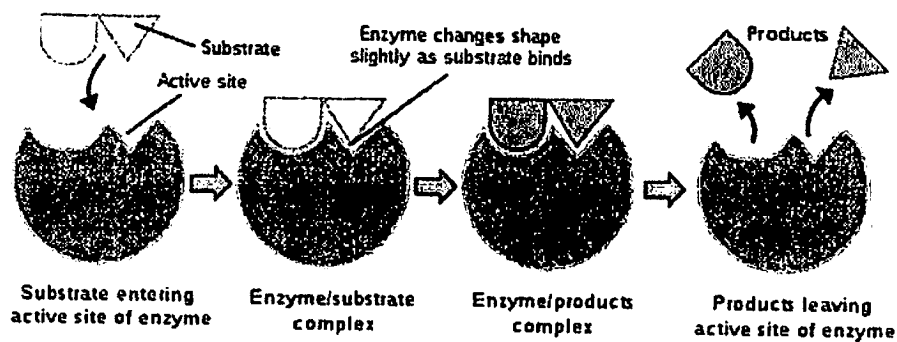
Option 3. Describe what buffers do, how they do it, and WHY this is important in living things.

Option 4. Designate the following as chemical or physical changes giving specific reasons for your answer.

- a. wood burning C
- b. salt dissolving in water P
- c. water changing from liquid to gaseous form P

Option 5. How does water's polar nature relate to cohesion, adhesion, and its ability to dissolve most any polar substance?

Option 6. Describe how the following diagram illustrates the lock and key model of enzymes.



**Bonus Questions :**

1. How many neutrons does the most abundant isotope of Fluorine have?
2. Explain one negative or positive consequence of enzyme inhibitors (make sure you state which you are explaining).

3. Give an example of isomers we discussed.

4. What is an exergonic reaction?

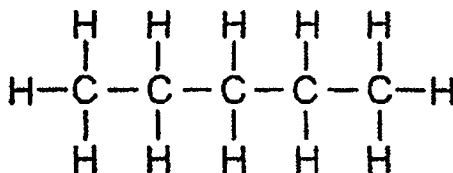
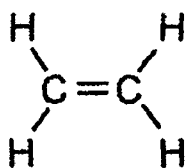
5. Which type of macromolecule building block has three parts—the nitrogenous base, the phosphate group, and a five carbon sugar?

6. What is the R-group in a structural formula of an amino acid?

7. What type of macromolecule which we discussed is non-polar? What is the term for a molecule which does not mix well with water?

8. Why (structurally) is carbon dioxide a non-polar molecule?

9. Label the below molecules as ethene and alkane.



10. Based on the structure, WHY are saturated fats solid at room temperature and unsaturated fats are liquid?

11. Write the linear structure of glucose below.

12. Label the trans fat configuration of the fatty acid chain below (the first or second diagram). How does the structural difference affect the properties of the fat?

