

### Macromolecules and Water Study Guide

Use your textbook to help you answer these questions (pg.34-60)

#### Section 2.1 The Nature of Matter

##### Atoms

The subatomic particles that make up atoms are protons, neutrons, and electrons.

1. Protons are positively charged particles (+)
2. neutrons carry no charge (0)
3. electrons are negatively charged particles (-)

#### Section 2.2 Properties of Water

4. How does the concentration of H<sup>+</sup> and OH<sup>-</sup> ions change in a base versus an acid versus a neutral solution?

Acid = Increase in H<sup>+</sup> ions      Neutral = H<sup>+</sup> ions = OH<sup>-</sup> ions  
 Base = Increase in OH<sup>-</sup> ions

5. Give the pH range for an acid, base, and neutral substances and examples of substances that are acids and bases.

Acid = 0-6.9      Neutral = 7.0  
 Base = 7.1-14

6. Identify the reactants and products in the equation:  $H_2O \rightarrow H^+ + OH^-$

Reactant  $\xrightarrow{\hspace{2cm}}$  Products

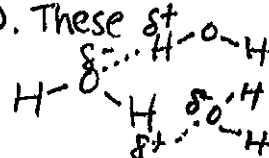
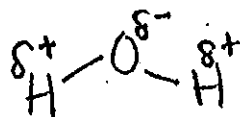
7. What does it mean when a molecule is said to be "polar"?

A molecule has charges that are unevenly distributed

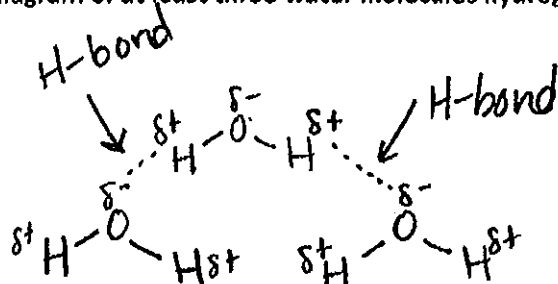
8. How do hydrogen bonds between water molecules occur?

The electrons in the bond between H and O are not shared evenly. The H has a slight (+) charge; the O a slight (-). These slight charges are attracted to one another = H-bond

9. Draw a diagram of a water molecule showing its partial charges.



10. Draw a diagram of at least three water molecules hydrogen bonding together. Label the hydrogen bond.



11. Explain how water defies gravity in plant stems (include the terms cohesion and adhesion in your explanation). Water molecules stick to themselves (cohesion) through H-bonding. Water also sticks/bonds to other molecules (adhesion). Through adhesion + cohesion, water moves upward through a plant.

12. Explain why it is possible for some bugs and lizards to walk on water.

The surface tension of water (due to H-bonds) is strong enough to hold an insect w/out breaking through the surface of water

## Section 2.3 Carbon Compounds

1. What properties of carbon make it unique compared to other elements?

Carbon has 4 valence electrons + therefore can make 4 bonds

2. Define the term organic molecule.

Organic = containing carbon

3. Name four groups of organic macromolecules found in living things. What elements are each of them made of?

carbohydrates - C, H, O

Lipids - C, H, O

Nucleic Acids - C, H, O, N, P

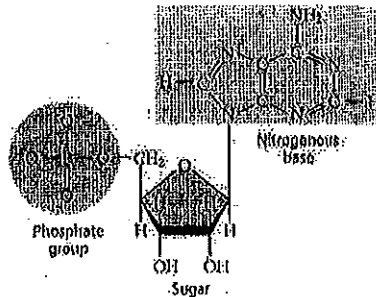
Proteins - C, H, N (primarily)

4. Why are proteins considered polymers but lipids are not?

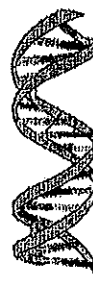
Lipids cannot create long chains (polymers) by adding a single fat molecule (monomer) to another.

5. Fill in the following table:

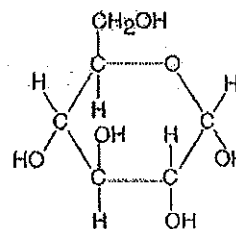
Macromolecule	Monomer	Polymer (examples)	Function
Proteins	amino acids	primary, secondary, tertiary, quaternary structure → PROTEIN	control metabolic functions, help fight disease, cell structures
Lipids	NONE	NONE	membranes / waterproof coverings chemical messengers
Carbohydrates	mono-saccharides	polysaccharides	source of energy, plants - structural function
Nucleic Acids	nucleotide	DNA, RNA	store / transmit genetic info



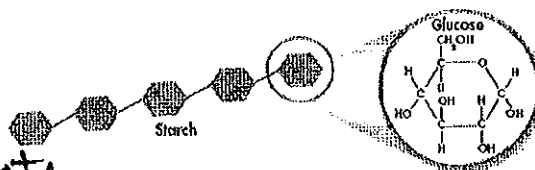
Monomer or Polymer? Macromolecule? nucleic acid



Monomer or polymer? Macromolecule? Nucleic Acid

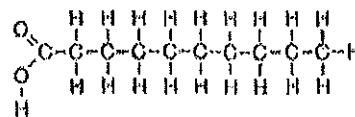


Monomer or polymer? Macromolecule? Carbohydrate (glucose)

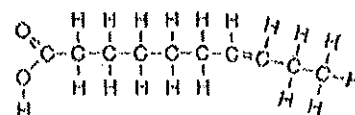


Monomer or Polymer? Macromolecule? Carbohydrate

Saturated



Unsaturated



Neither  
Monomer or Polymer? Macromolecule? Lipid

## Section 2.4 Chemical Reactions and Enzymes

8. What happens to chemical bonds during a chemical reaction?

They are formed or broken

9. What is activation energy?

The energy required to start a reaction

10. What are enzymes?

Biological catalysts (proteins). They speed up reactions by lowering the activation energy.

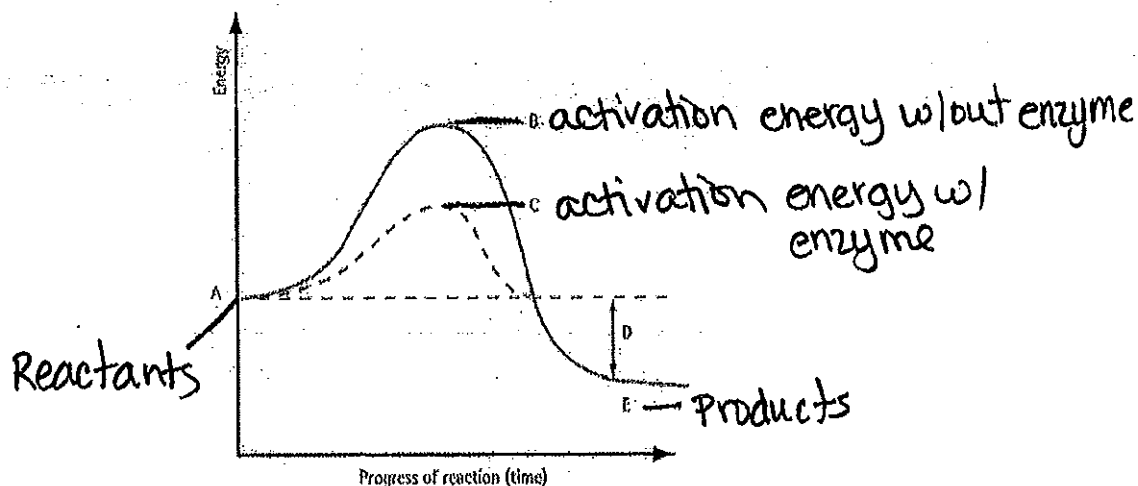
11. Explain how enzymes work.

oops 😊

12. List three factors that affect the activity of enzymes. What happens to enzymes outside their optimal range?

temperature, pH, regulatory molecules (turn enzymes 'on'/'off')  
enzymes outside the optimal range denature = DO NOT FUNCTION

13. In the following graph, label activation energy with enzyme, activation energy without enzyme, reactants, and products.



14. Respond to the unit question both as it applies in macromolecules as well as with any other ways it is relevant in your life: Why sweat the small stuff??