

Chemistry of Life Notes

Section 1: Matter and Substances

1. What is the difference between an atom, element, and a molecule? What occurs when different numbers of oxygen atoms combine to form molecules?
 - Atom =
 - Element =
 - Molecule =
 - O₂ =
 - O₃ =
2. Draw and label the structure of an atom (include proton, neutron, electron, energy level, and nucleus plus the charge on each subunit).
3. What are the 5 main elements found in living things?
4. What elements are found in the chemical formula: H₂O?
5. What is polarity?
6. What is the difference between the three types of bonds: covalent, ionic, and hydrogen?
 - Covalent =
 - Ionic =
 - a. What is an ion?
 - Hydrogen =

Section 2: Water and Solutions

1. **Four properties of water.**

A. Water molecules stick to each other and other things

a. Cohesion

b. Adhesion

c. Surface tension

B. Water molecules are polar (negative and positive sides) and act as a solvent

C. Water absorbs and releases heat without a large change in temperature

D. Ice floats on water

2. What is a solution?

3. What are the differences between acids and bases?

Section 3: Macromolecules

1. What is the main element of living things?

2. What are the 4 main types of macromolecules?

3. Polymers =

a. Each unit of polymer = _____

b. Synthesis of polymers

i. Dehydration synthesis: _____

1. Monomers joined by removal of water

a. One contributes -OH

b. One contributes -H

c. Together → H₂O

ii. Process requires _____ and enzymes (proteins)

c. Breakdown of polymers

- i. _____ Reaction:
1. Hydro = water and Lysis = to _____
 2. _____ of dehydration synthesis reaction
 3. Uses water to split polymer
 4. H₂O splits into -H & -OH
 5. -H & -OH bond to where _____ was before

Macromolecule	Polymer (Many monomers)	Monomer (Basic Building Block)	Functions	Examples
Carbohydrate <i>Elements:</i>			<ol style="list-style-type: none"> 1. 2. 	Glucose <u>Storage:</u> Plants - _____ and _____ Animals - _____
Lipid <i>Elements:</i>	No True Polymers		<ol style="list-style-type: none"> 1. 2. 3. 	1. Triglyceride - _____ 2. 3. Wax 4. Hormones, Steroids, and _____
Protein <i>Elements:</i>			<ol style="list-style-type: none"> 1. 2. 3. Movement 4. Transport oxygen 5. Immune system 	<ol style="list-style-type: none"> 1. 2. 3. muscle proteins 4. hemoglobin in red blood cells 5. antibiotics
Nucleic Acid <i>Elements:</i>	<ol style="list-style-type: none"> 1. 2. 3. 		<ol style="list-style-type: none"> 1. 	Same as polymers

Carbohydrate

1. Carb Structure and Energy Sources

- Structural Carbohydrates
 - Cellulose – every other glucose molecule is _____ which allows the rows to _____ (beta configuration)
 - Chitin – similar glucose arrangement to cellulose but found in _____ cell walls
- Energy Carbohydrates
 - Glycogen - _____ glucose in the liver in the alpha configuration
 - Starch – glucose molecules are all the same orientation so it forms a _____ and can be _____ (alpha configuration)

Lipids

1. Saturated Fats (triglycerides)

- Contains _____ that can be bound to the carbons in the chain
- _____ at room temperature

2. Unsaturated Fats

- _____ all the hydrogens that can be bound to the carbons in the chain which forms _____ between electrons
- _____ at room temperature

3. Phospholipids

- Make up the _____ which is the boundary of the cell
- Has two regions:
 - _____ tails that repel water
 - _____ head that attracts water

Protein

1. Amino acid structure:

- Central _____ atom
- Contains an _____ with a NH_2 , a _____ with a COOH , and a _____
- The last side group is the _____. Each amino acid has a different R group that gives the amino acid a unique characteristic

2. How to build proteins

- _____ of 2 or more amino acids
- $(-\text{COOH})$ and (NH_2) group are joined by a covalent called a _____
- The bonds create a repeated _____ which is backbone of polypeptide chain

3. Protein Structure & Function

- Function depends on structure – it all starts with amino acid sequence
 - Folded, twisted, coiled into _____
 - There are _____ levels of protein structure

Primary

- _____ based on the _____ of amino acids and peptide bonds
- Each type of protein has a unique primary structure of amino acids
- Amino acid sequence is determined by the _____
 - Small change in DNA will affect the protein and can cause serious problems

Secondary

- _____ and coiling of the amino acid chain
 - Can be an alpha (α) helix or beta (β) pleated sheet
 - Folds are result of _____ between R-groups of different amino acids

Tertiary

- Determined by interactions and bonding between _____
 - _____ & Hydrophilic interactions due to water around the protein
 - More Hydrogen bonds
 - _____ between R-groups with sulfur
 - _____ with a transfer of electrons

Quaternary

- Two or more _____ joined together causing the overall protein structure

Nucleic Acids

1. Nucleotide Structure

1. _____
 - _____: Single ring N-base
 - Cytosine (C)
 - Thymine (T)
 - Uracil (U)
 - _____: Double ring N-base
 - Adenine (A)
 - Guanine (G)
2. _____ (5-Carbon)
 - Deoxyribose in DNA
 - Ribose in RNA
3. _____

2. ATP Structure

- _____ nitrogen base
- _____ sugar
- _____ phosphate groups