Macromolecules Notes Guide: General Biology A

You are responsible not only for the material in this guide but the diagrams and pictures on the notes. The notes can be found on Mr. Walkers website: www.walkersclass.com.

This set of notes covers Unit 1: Objective 2: Classify the different types of macromolecules in the body

What is organic?
-_____ Molecule: A molecule made up a large carbon-based structure that is found in or produced by living organs (e.g. carbohydrates, lipids)

What are some examples of organic compounds?

-Macromolecule: A large molecule (polymer) composed of many smaller organic molecules called monomers. There are four types of biological macromolecules: proteins, carbohydrates, lipids, and amino acids.
---Monomer: A molecule that can chemically react with other like molecules to form a larger molecule called a polymer.
---Polymer: A large molecule composed of smaller units, called monomers, linked together by chemical bonds (e.g. proteins are polymers of amino acids).

Why study Carbon?
All of life is built on carbon.
A molecule associated with life containing carbon.

Cells made of:
~72% _____
~25% carbon compounds
carbohydrates
lipids
proteins
nucleic acids
~3% salts
Na, Cl, K…

Carbohydrates - Monosaccharides

The least complicated of all the macromolecules
Function: Provide cells with _____.
Example: monosaccharides (glucose), disaccharides (sucrose), polysaccharides (starches/cellulose).
Structure: The chemical formula for all monosaccharides is: CxH2xOx

The three most common are glucose, galactose, fructose. Each has the same chemical formula ($C_6H_{12}O_6$).

Carbs- Disaccharides: Example: Maltose ($C_{12}H_{22}O_{11}$)
-Other disaccharides are sucrose and lactose. Each has the same formula $C_{12}H_{22}O_{11}$

Carbs-Polysaccharides and Polymers
---The most complex carbohydrates which are made up of long _____ of monosaccharides (glucose-like units).

Starch, cellulose, and glycogen are examples. They differ because of how the subunits are bonded together.

How to break down a polymer
Digestion
---use H2O to breakdown polymers
---reverse of dehydration synthesis
---cleave off one monomer at a time
---H2O is split into H+ and OH– Called Hydrolysis
---H+ & OH– attach to ends
----requires _____
----releases energy

How to build a polymer
---Synthesis
---joins monomers by "taking" H2O out- Called Dehydration Synthesis
---one monomer donates OH–
---other monomer donates H+
----together these form H2O
----requires _____ & enzymes

Lipids

Function: Lipids are used to insulate cells, provide selectively permeable membranes, send messages, and provide energy for cells.
Examples: A group of organic compounds that include _____, oils, waxes, and related substances.
Structure: Made of Carbon, hydrogen, and oxygen. There is no definite ratio of hydrogen to oxygen atoms like in carbohydrates. Simple lipids are the most common and are made up of three fatty acid molecules (CnH2nCOOH) and one glycerol molecule (C3H8O3). They are held together with chemical bonds

Proteins

Function: They can be very large and complex. They play a wide variety of roles in the cell. Roles include transport of materials, providing structural support, aid in chemical reactions, support cells to carry out cell processes.
Examples: Hormones, enzymes, antibodies, Hemoglobin, Na K pump, or pigments.
Structure: Made of _____ bonded together. They are made off carbon, hydrogen, oxygen, and nitrogen; some contain sulfur. They are bonded by dehydration synthesis. Bonds between amino acids are called peptide bonds. Meat, beans, eggs, nuts, and milk contain a lot of proteins.

Enzymes- A type of protein
Enzymes act as _____ in living cells. A catalyst increases the rate of a chemical reaction, allowing it to proceed rapidly when it would otherwise occur very slowly.
Enzymes lower the activation energy needed for a reaction to occur. Each enzyme has an optimum range of temperature and pH at which is operates most efficiently.
Without enzymes in our cells, reactions would take too long and cells would die.

Nucleic Acids

Examples: DNA and RNA.
Function: Provide the code for the body to build proteins and are the genetic material which is passed down to offspring.

---RNA (three types)
---mRNA-Carries DNA code to ribosomes
---rRNA-Assembles proteins
---tRNA-Transfers amino acids to ribosomes
Structure: Consist of _____ (Sugar, Phosphate Group, and Nitrogenous base).

Chemistry Terms

-pH scale: A system of measurement ranging from one to fourteen that indicates the relative concentration of hydrogen ions in a solution. A pH of one indicates a strong acid while a pH of fourteen indicates a strong base, and pH of seven is neutral.
-Product: The substance that results from a chemical reaction.
-Reaction rate: The _____ at which a chemical reaction occurs, measured as the amount of reactant converted to product in a set period of time.

Macromolecules Summary

-Lipids: Large biomolecules that are made of mostly carbon and hydrogen with small amount of oxygen. Fats, oils, waxes, and steroids are all lipids.
-Nucleic Acids: A complex biomolecule that stores cellular information in the form of a code. They are polymers made of smaller subunits called nucleotides. A nucleotide consists of a sugar deoxyribose, a phosphate group, and a nitrogenous base.
-Proteins: A large complex polymer composed of carbon, hydrogen, oxygen, nitrogen, and sometimes sulfur. They provide structure for tissues and organs and carry out cell metabolism.
-Enzyme: A _____ that functions as a biological catalyst and accelerates the rate of a biochemical reaction by reducing the required activation energy of the reaction while remaining unchanged by the reaction.
-Catalyst: A substance that accelerates the rate of a chemical reaction by decreasing the activation energy of the reaction without being changed by the reaction (enzymes).

Carbohydrates

-Carbohydrates: A biomolecule composed of carbon, hydrogen, and oxygen with a ratio of about two hydrogen atoms and one oxygen atom for every carbon atom. They are types of _____.
---Monosaccharide: A monomer of a carbohydrate molecule, of known as a simple sugar like glucose or fructose, or ribose. $C_6H_{12}O_6$
---Disaccharides: Two-sugar carbohydrate. Sucrose (table sugar) is a combination between glucose and fructose
---Polysaccharides: Composed of many monosaccharide's subunits. Starch, glycogen, and cellulose are examples of polysaccharides. They serve as storage of energy for our cells.

Draw the basic structure of a lipid:

Draw the basic structure of a nucleic acid:

Draw the basic structure of a carbohydrate:

Draw the basic structure of a protein: