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Vanessa Jason Biology Roots WHAT ARE WE MADE OF? Vanessa Jason Biology Roots Everything, living and nonliving, is made up of elements. An element is a substance that cannot be broken down into simpler chemical substances. An element is made up of only ONE type of atom. Atoms with slightly different structures make up different elements. Vanessa Jason Biology Roots ATOMS An atom is the smallest particle of an element that retains the characteristics of the element. (Example- gold atoms behave differently than carbon atoms). The different behavior of atoms is because of the different structures atoms can have. Vanessa Jason Biology Roots POSITIVE AND NEGATIVE CHARGE Though atoms can differ, atoms have the same general structure. Atoms are made up of 3 subatomic particles with different charges. Subatomic Particle Proton Charge Location Positive Nucleus Neutron Neutral Nucleus Electron Negative Orbiting the nucleus in "shells" Vanessa Jason Biology Roots ATOMIC CHARGES If an atom has an equal number of protons (+) and electrons (-), it does not have a charge (neutral). Charged particles are known as ions. Cations= positively charged atoms. Anions= negatively charged atoms. Vanessa Jason Biology Roots HOW ATOMS FORM MOLECULES The term "bonds" is used to describe how atoms stick together to form bigger things called molecules or compounds. Molecule= two or more atoms bonded together. Compound molecule= two or more different elements bonded together. Vanessa Jason Biology Roots HOW ATOMS FORM MOLECULES There are 3 general categories of chemical bonding. Atoms bond using their electrons in the outer shell. Bonding can occur by sharing or rearranging electrons. Vanessa Jason Biology Roots HOW ATOMS FORM MOLECULES Vanessa Jason Biology Roots Three General Types of Bond: Ionic bonds- (the strongest bond)- when an atom borrows an electron from another atom to fill it's outer electron shell. Covalent bond- when an outer electron is shared between two atoms. Hydrogen bond- (the weakest bond)- a specific bond in which a hydrogen atom (slightly positive atom) bonds to an electronegative (slightly negative) atom or molecule. Vanessa Jason Biology Roots WATER MOLECULES Vanessa Jason Biology Roots Water is essential to life. Water= H 2 O Though water is neutral, it is a polar molecule. Because water molecules are polar, they attract one another (slightly positive oxygen attracted to slightly negative hydrogen). This is called cohesion. O H H H= hydrogen; O=oxygen Water= H 2 O Vanessa Jason Biology Roots The hydrogen side of the molecule is slightly positive compared to the oxygen side. POLAR SOLUTIONS A solution is a type of mixture that involves a solvent and a solute (dissolving). Solute= a substance that is dissolved. Solute= the substance that dissolves the solute. Example) salt water Salt= solute Water=solvent A solute (Na, Cl) that has been dissolved is separated and incorporated evenly among the solvent (water). Vanessa Jason Biology Roots ACIDS & BASES Water can react with other compounds and may separate to form ions (charged particles): H-O-H H+ and OH- H+ = hydrogen ions OH- = hydroxide ions The p. H scale is a scale used to measure the concentration of H+ in a solution. p. H= potential hydrogen ACIDS & BASES Neutral= equal number of H+ and OH- (water) Acidic= greater number of H+ than water Basic= greater number of OH- than water Acid= any compound that forms H+ in a solution p. H= less than 7 (< 7) Base= any compound that forms OH- in a solution p. H= greater than 7 (> 7) WHAT ARE LIVING THINGS MADE OF? Though there are over one hundred types of elements, only about 25 of them are essential to living organisms. Vanessa Jason Biology Roots Vanessa Jason Biology Roots ORGANIC COMPOUNDS Sulfur, Phosphorus, Oxygen, Nitrogen, Carbon, and Hydrogen are found in all living things "SPONCH" Vanessa Jason Biology Roots MONOMERS AND POLYMERS Monomers= building blocks (units) Polymers= a larger molecule made of monomers Analogy Example. If a brick house is the "polymer", what is the "monomer"? ____ Brick ____ Monomers link together to form polymers. MONO means "one". POLY means "many". Vanessa Jason Biology Roots FOUR TYPES OF ORGANIC COMPOUNDS Organic Compounds fall into four categories: 1. Carbohydrates 2. Lipids 3. Protein 4. Nucleic Acids Organic Compounds are also known as MACROMOLECULES (macro means Vanessa Jason Biology Roots BIG) CARBOHYDRATES Vanessa Jason Biology Roots CARBO- (carbon)-HYDR- (hydrogen)-ATE (oxygen) A carbohydrate is a specific type of organic compound that is composed of carbon, hydrogen, and oxygen in a ratio of 1: 2: 1 1 part carbon 2 parts hydrogen 1 part oxygen Glucose is a type of carbohydrate. The molecular formula of glucose is C 6 H 12 O 6 Vanessa Jason Biology Roots CARBOHYDRATES Carbohydrates may have different structures: Monosaccharides - monomers of simple sugars- glucose and fructose Disaccharides - two monosaccharides combined, sucrose and lactose Polysaccharides - polymers (long chains of repeating units) of monosaccharides, starch (plant energy storage) and glycogen (animal energy storage) CARBOHYDRATES Find the monosaccharide, disaccharide, and polysaccharide: CARBOHYDRATES Polysaccharides as Structural Molecules: Cellulose - glucose bonded to form "fibers", composes cell walls in plants (cotton is almost pure cellulose); not easily digested Chitin - polymer of glucose, makes up exoskeletons of insects and arthropods such as scorpions and crabs. LIPIDS (C, H, O) Lipids are insoluble organic compounds that are made up of fatty acids. Hydrophobic- insoluble in water Hydro= water Phobic= fear Example- oil and water do not mix. Liposuction is the surgical removal of fat. Fats are a type of lipid. LIPIDS Four Types of Lipids: 1. Fats/oils- energy storage/insulation/protection 2. Waxes - mainly used for covering and protection (leaves, beeswax, earwax) 3. Phospholipids - Important structural component of the cell membrane 4. Steroids - cholesterol & sex hormones (estrogen & testosterone) LIPIDS- FATS Fats & Oils are made of subunits of 3 fatty acid chains attached to a glycerol group. LIPIDS- FATS Fats are used for energy storage (for both plants and animals- but only animals contain the fatty tissue known as adipose). LIPIDS- PHOSPHOLIPIDS Phospholipids are composed of one phosphate group plus 2 fatty acids chains. Phospholipids are arranged so that the cell can't disintegrate in water. The insoluble/hydrophobic fatty acids chains stay put because water can't pull them apart. LIPIDS- STEROIDS Phospholipids are composed of 4 carbon-based rings and do not contain any fatty acid chains. Examples of steroids include cholesterol and hormones. Cholesterol is the most common steroid in the body. Cholesterol is required to create hormones (such as estrogen and testosterone), and found in the cell membrane. LIPIDS- SATURATED VS. UNSATURATED FATS Fatty acid chains can be saturated or unsaturated (i. e. , saturated fats and unsaturated fats). Saturated fats have single bonds and are solid at room temperature (the "S" rule!) Unsaturated fats have double bonds, which create kinks (makes them loose and bendy). They are liquid at room temperature. SATURATED OR UNSATURATED? _____ (contains single bonds) _____ (contains double bonds) PROTEINS (C, H, O, N, S) Vanessa Jason Biology Roots Monomer (building block)= amino acids Polymers= chains of amino acids known as peptides or polypeptides Amino acids form a wide variety of structures, mainly building blocks for living tissue Support | Enzymes | Transport | Defense | Hormones | Motion Basic amino acid structure, containing carbon, hydrogen, oxygen, and nitrogen. The "R" group varies slightly among amino acids, making them all a bit different. There are 20 different amino acids in total. Vanessa Jason Biology Roots PROTEINS Protein structure is complex. Primary structure refers to the sequence of amino acids. Secondary structure= the folding pattern of the protein (alpha helix or beta sheet) Tertiary=the general 3 D structure of the protein Quaternary= multiple peptide chains entangled into one functioning unit. NUCLEIC ACIDS (CHONP) Monomers= a carbon ring structure known as a nucleotide. Contain genetic information or store energy. DNA (deoxyribonucleic acid) & RNA (ribonucleic acid) Each nucleotide consists of: 1. A sugar (deoxyribose or ribose) 2. A phosphate 3. A nitrogen base Vanessa Jason Biology Roots NUCLEIC ACIDS Possible nitrogen bases: • Adenine • Cytosine • Thymine • Guanine Vanessa Jason Biology Roots Different nitrogen bases create genetic variation. NUCLEIC ACIDS Vanessa Jason Biology Roots ATP (adenosine triphosphate) - high energy molecule that contains three phosphate bonds that are easily broken to release energy (this energy drives the reactions in our bodies). ATP is an RNA nucleotide with two extra phosphates- does not contain genetic information. ATP STORES ENERGY. Vanessa Jason Biology Roots

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