

~UNIT 2 CHEMISTRY OF TEST LIFE

STUDY GUIDE~

Water

Why do we need water:

1. Cells are made of 70% water
2. Helps with weight loss
3. Skin care (in and on it)
4. Reduce risk of cancers (Colon, bladder, breast...)
5. Flushes out waste that cause diseases
6. Relieves stress and fatigue
7. Helps with digestion and constipation

Chemical properties:

- A polar covalent bond is the uneven sharing of electrons. Polar covalent bonds when one atom has more are more greedy than another causing uneven sharing. The greediness of an atom is their electronegativity.

Water

- Is made of the polar covalent bond of oxygen and hydrogen, which is called a hydrogen bond.
- Oxygen has 6 valence electrons and hydrogen has one.
- Since oxygen has more valence electrons it has a stronger electronegativity creating asymmetry.
 - This uneven sharing makes the oxygen negative and the hydrogen positive.

Hydrogen bonds

- are weak bonds formed between the negative oxygen of one water molecule and a positive hydrogen of another water molecule. (two water molecules in the same area will form a hydrogen bond by itself)

Importance of hydrogen bonding

1. Allows for the movement of molecules through the bloodstream and tree truck
2. Allows formation of droplets, oceans, drops on leaves, etc.
3. Allows water to absorb large amounts of heat. Help maintain stable body's of water and body temperature.
4. Creates insulation for organisms in the ocean.

Difference between Polar and NonPolar

- **Polarity**- is caused by electronegativity(makes water the universal solvent)
- **Electronegativity**- is the attractions has for electrons(Greediness)
- **Triple Bonding**- Is a water molecule forming three hydrogen bonds at once
- **Polar**- is asymmetrical and has an uneven electron distribution, therefore is made up of different elements.
- **NonPolar**- is perfectly symmetrical distribution of electrons

Bonding

- **Cohesion**- creates high surface tension. It's the ability of water to be more attracted to itself than water. This happens when the negative pole around an oxygen atom attaches to the positive pole of a hydrogen atom of another water molecule. I
- **Importance of high surface tension**- Allows bugs to run on water and creates droplets on leaves, windows, etc. This is because the force between the water is so strong it's hard to break.
- **Adhesion**- Is the attraction of water to other surfaces.

Universal solvent

- **Solvent**- is the substance dissolving a substance
- **Solute**- is the substance that is being dissolved
- **Solution**- is a mixture of the solute and solvent
 - Water is a great solvent. Since water is polar it can pull apart ions that are in ionic bonds. The water molecules surround the ions and separate them.

Chemistry of Life

- Cells contain molecules that are directly tied to nutrition.
- **Atom**- is the smallest particle of matter that contains chemical properties.
- **Elements**- are substances composed of atoms.
- 11 common elements within living things - 99% are CHON
 - Atoms contain a nucleus with protons(+) and neutrons(0) and surrounded by moving particles called electrons(-).
 - Elements differ based on the amount of protons they contain.
 - Element is defined by the amount of protons and electrons they contain.
 - Chemical reactions occur because of atoms greed for electrons.
- **Valence Electrons**- are electrons found on the outer shell.

Two types of bonds

- **Ionic bonds**- In which electrons are gained or lost.

- **Covalent bonds-** In which the electrons are shared.
 - Shared evenly there non-polar
 - Shared unevenly there polar

Organic Molecules

- Organic molecules are derived from carbon.
- Carbon is a unique molecule that can make up 4 bonds.
- All living things are made up of organic molecules.
- Since carbon can form 4 bonds it can link together to form macromolecules.
- **Chemical Reaction-** is the forming and breaking of bonds.
 - Energy is stored when chemical bonds are formed.
 - Energy is broken when chemical bonds are broken.

*Body digests food and the energy is released from that food and is stored in a chemical form called calories.

Macromolecules

Carbohydrates

- **Carbohydrates-** can be simple like table sugar or complex like starch. The chemical bonds store a considerable amount of energy, which the body uses first and the fastest.
 - **Monomer-** monosaccharides
 - **Polymer-** disaccharides and polysaccharides
- **Types**
 - Monosaccharides- is a single sugar
 - Examples- Glucose, Fructose, and Galactose
 - Disaccharide- is a double sugar molecule
 - Examples- Lactose, Sucrose, Maltose
 - Polysaccharide- is a long chain (large ones don't dissolve in water)
 - Examples: starch and cellulose
- **Uses**
 - - Energy production
 - - Energy storage (fast energy)
 - - Cell signaling
 - - Structure (polysaccharides)
- **Structure**
 - Ring Structures

Lipids

- **Lipids**- an organic molecule that is not soluble in water or any polar substances, but is soluble in alcohol and other nonpolar substances.
 - **Monomer**- hydrocarbon chains
 - **Polymer**- triglycerides
- **Types**
 - Fats
 - Waxes
 - Oils
 - Phospholipids
- **Uses**
 - Energy storage (source)
 - Insulation
 - Shock absorbers
- **Structure**
 - Glycerol fatty acid chains
- **Fats**- have more carbon hydrogen bonds than carbohydrates causing it to contain more energy.
 - Fat molecules consist of fatty acids, which are long chains (mostly CH_2) joined to a molecule of glycerol (the backbone of the fat molecule),
- **Saturated fat**- saturated (full of) with hydrogen atoms
 - Found in: Butter, cheese, chocolate, beef, palm oil, and coconut oil
 - People with a diet that consists mostly of saturated fats are more likely to die of heart disease.
- **Unsaturated fat**- Double bonds form Kinks in unsaturated fats.
 - Found in: Olives, Olive oil, peanut oil, almonds, corn oil, and fish
 - “Kinks” make it easier for molecules to break down the fats
- Trans fats are terrible for you
- Lipids aren't bad for you as long as you have it in moderation same with carbs.

Proteins

- **Proteins**- provide structure and increase reaction rates of chemical processes in the body.
 - **Monomer**- amino acid
 - **Polymer**- amino acid chain
- A protein is composed of long chains of subunits called amino acids.
- All living things use the same 20 amino acids to construct proteins.
- A protein is determined by its 3 dimensional shape, and its amino acid sequence determines its shape.
- Diet

- proteins help you feel full longer
- proteins are essential in the digestion of food.
- proteins = carbs in energy, however it takes much longer to get energy from protein because the digestion starts later so you “feel” full longer.

Nucleic Acids

- **Nucleic Acids**- are made from nucleotides and create DNA and RNA
 - **Monomer**- Nucleotides
 - **Polymer**- Nucleic Acids
- **Nucleic Tide**
 - 1 phosphate
 - 1 Sugar
 - 1 Nitrogen Base
- they combine together to form nucleic acids
- **DNA**- is when nucleotides form a series of units called genes, which encode information, concerning how an organism will grow and develop.
 - DNA folds into a compact form (like protein)
 - Compacted “bundle” is called a chromosome
 - A living thing has 23 chromosomes
- **Contain**
 - Deoxyribose or ribose (sugar)
 - Phosphate
 - Nitrogen Bases
 - Adenine
 - Thymine
 - Cytosine
 - Guanine
- The nitrogen bases are attached to the sugar
- It's A to T and C to G
- Nitrogen bases are connected by hydrogen bonds
- The rest of DNA is connected by covalent bonds