

Chemistry of life

A. atoms and elements

Elements

- Made up of one or two atoms
- 90 naturally occurring types, 25 man made
- 4 that predominate
 - oxygen, hydrogen, carbon, nitrogen

Atomic Structure

- Nucleus
 - made up of protons and neutrons
 - USUALLY same # of protons and neutrons
- Electrolytes
 - Around nucleus
- Stable atom will have same number of electrons and protons
- Atoms identified by atomic # (# of protons)

Electron shells

- Electrons at different levels around nucleus (electron shells)
- Inner shell-up to 2 electrons
- 2nd shell and any additional- up to 8 electrons
- Is empty spaces in their outermost shell, considered unstable atoms
 - React readily with other atoms

Isotopes

- Atoms with more or fewer neutrons than their atomic number

Ions

- Charged atoms
- Atom that loses one or more electrons becomes positively charged
- Atom that acquires electrons becomes negatively charged

B. Chemical Bonds

Covalent-strongest bond, sharing electrons

Ionic-negative and positive charged atoms attracted to one another, donate electrons to change other atoms charge

Hydrogen bond; H-bond- occurs between molecules (not atoms, atoms combine to form molecules) In water molecule,

oxygen's readily

pulled toward

negatively charged

bonds formed b/n

one molecule and the atom of another

8 positively charged protons attract electrons more

than single proton in hydrogen atom. Electrons

oxygen side of molecule, makes it slightly

while hydrogen side is slightly positive. H

slightly positive charged hydrogens of

slightly negatively charged oxygen

C. Biological Molecules

Water

- high surface tension
- Strong cohesiveness
- high heat capacity
 - helps maintain stable internal environment in humans
- lower density when frozen
- Good solvent
 - Ions and polar substances dissolve in water

Acids, Bases, Buffers

- Hydrogen and Hydroxide ions
 - H⁺ and OH⁻
 - if H⁺ concentration higher than OH⁻, acid
 - OH⁻ concentration higher, base
- pH scale
 - lower than 7-acid
 - higher than 7-base
 - 7= water
- Buffers
 - Help neutralize acids and bases
 - Carbon dioxide buffer for pH level of blood
 - When too acidic, buffer absorbs H⁺ ions
 - too basic, buffer releases H⁺ ions

Macromolecules (large molecules)

- Carbohydrates
 - Made up of subunits of sugar
 - Principle atoms- Carbon, Hydrogen, Oxygen
 - C₆H₁₂O₆ (glucose)
 - Simple sugars most effective source of energy
 - (monosaccharides, glucose, fructose,

galactose)

- Glucose in blood, 3 fates
 - if energy is needed, bonds broken to extract energy
 - don't need energy right away, energy stored
 - short term- glycogen, linked together
 - long term- converted into fat
- Complex carbs are time released packets of energy
 - Disaccharides and polysaccharides
 - formed by joining 2 or more simple sugars
 - Larger molecule, more energy needed to break it down
 - Starch 100's of glucose molecules joined together. Barley, wheat, rye, corn,
- Cellulose (fiber) and chitin(exoskeletons), not digestible

rice

-Lipids

- macromolecules with several functions including energy storage
- hydrophobic- fear of water (oil, non-polar)
- hydrophilic-love of water
- Non-polar that don't dissolve in water
- Greasy
- significant source of energy storage
- 3 types
 - Fats
 - Glycerol- "head" region
 - Fatty acid "tails"
 - Triglycerides
 - Saturated- each carbon bound to 2 hydrogen atoms
 - Unsaturated- Not all carbons bound to 2 Hydrogen atoms. Fatty acid become crooked.
 - Can artificially add hydrogen atoms to an unsaturated fat, improves taste and shelf life. Increase risk disease
 - Cholesterol
 - Sterols important to cell membranes in animals. Can attach to and become plaque
 - Used to produce testosterone
 - Phospholipids
 - Major component of cell membrane
 - Strongly hydrophobic tails, hydrophilic heads
- Proteins
 - Versatile macromolecules that serve as building blocks
 - Amino acids strung together to make proteins
 - 20 different types of amino acids
 - Bound together by peptide bonds
 - Hydrogen bonding between amino acids
 - Causes polypeptide chain to change shape
 - Can get multiple secondary structures that form 3d shapes, structure
 - Two or more polypeptide chains- quaternary structure
 - Denatured protein- extreme environment disrupts protein shape and function

tails

of heart

vessel walls
in arteries.
estrogen and

tertiary