ATOMS

• __________ - the basic unit of matter.
• Contains subatomic particles
  o ______________ ( + charge)
  o ______________ (no charge/neutral)
  o ______________ ( - charge)
• Protons and neutrons have about the same mass. Electrons are much __________.
• Atoms have equal numbers of ______________ and ______________.
  o Because these particles are opposite charges, the whole atom is __________.

ELEMENTS AND ISOTOPES

• ______________ - a pure substance that consists of only one type of atom. Elements are represented by a 1 or 2 letter symbol. (ie: C = carbon)
• The number of ______________ in an element is that element’s ______________.
  o The atomic number of carbon is 6, therefore carbon has 6 protons and consequently 6 neutrons.
• Mass Number - the sum of the number of ______________ plus the number of ______________.
  o Will vary for isotopes.
• ______________ - the average weighted mass of the isotopes.

ELEMENTS OF LIFE

• ______________ Elements - required for an organism to live and healthy life and reproduce.
  o Four Elements, ___, ___, ___, ___ make up 96% of all living matter.
• __________ Elements - required by an organism, but only in very small quantities.
ISOTOPES

- ____________- atoms of the same element that have different numbers of neutrons.
  
  - Isotopes are identified by their _______________ (ie: carbon-12, carbon-13, carbon-14)

- The __________________________ of the masses of an element’s isotopes is called its ___________________.

- Isotopes have the same number of _______________, so all isotopes of an element have the same _____________________________.

RADIOACTIVE ISOTOPES

- Some isotopes are __________________________. This means that their nuclei are unstable and break down at a continuous rate over time.

IONS

- ____________- an atom that has gained or lost an electron, giving it a positive or negative charge.
  
  - ____________- a positively charged ion
  
  - ____________- a negatively charged ion

CHEMICAL COMPOUNDS

- ________________- formed by the chemical combination of two or more elements in definite proportions.
  
  - Compounds are typically written as a ____________________________ (ie: NaCl, CO₂, etc.) This gives you the ratio elements in the compound.
  
  - The physical and chemical properties of a compound are usually very different from those of the elements form which it is formed.

- Chemical compounds are held together by ________________, which are formed by the ________________ of each element.

- The electrons that are available to form bonds are called ________________, and are on the _________________.

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CHEMICAL BONDS

• __________________________ - formed when one or more electrons are transferred from one atom to another.
  o Form between a _____________ and a _______________.
    (between a _____________ and an _____________)

CHEMICAL BONDS

• __________________________ - results when electrons are shared between atoms.
  o The structure that results when atoms are joined together by covalent bonds is called a ________________.
  o Covalent bonds usually form between ___________________.
  o Covalent bonds are the _______________ bonds between atoms.

• _____________ Covalent Bond- atoms share ____ electrons.
• _____________ Covalent Bond- atoms share ____ electrons.
• _____________ Covalent Bond- atoms share ____ electrons.

CHEMICAL BONDS

• __________________________ - Hydrogen can form a special type of bonds with a couple of unique elements: ___________________
• A slight attraction that develops between ________________ charged regions of ________________.
  o Not near as strong as ionic or covalent bonds, although they can hold molecules together, especially when the molecules are large.
FORCES BETWEEN MOLECULES

- ____________________ Forces - between atoms of two different molecules.
  - Ex: ________________________________

- ____________________ Forces - between atoms of the same molecule.
  - Ex: ________________________________

THE WATER MOLECULE

- ____________ Molecule - has an overall charge that is unequally distributed.
  (due to unequal sharing of electrons).

- ____________ - the ability of like molecules to attract.

- ____________ - the clinging of one substance to another substance.
  - Adhesion and Cohesion are responsible for ________________________________.

- ____________________ - very high in water - as a result of cohesion.

- ____________________ - this allows water to stabilize temperatures. (how well a substance resists change in temperature)
  - High specific heat is a result of ________________________________

- ____________________ - amount of energy for evaporation to occur.

- ____________________ - as liquid evaporates, the surface of the liquid that remains behind cools down.

- ____________________ - 4℃, water moves too slowly to break hydrogen bonds and starts to freeze.

- ____________________ - water is a great solvent because of its polarity, allowing it to draw in and dissolve molecules with opposing charges.
  - Solute
  - Solvent
  - Solution
• Water is a great solvent because of its polarity, allowing it to draw in and dissolve molecules with opposing charges.
  - Solute
  - Solvent
  - Solution

HYDROPHILIC VS. HYDROPHOBIC
• Substance that has an affinity for water.
• Substance that seems to repel water.
  - These are nonpolar compounds. (ie: oils)

ACIDS AND BASES
• Acid- increases the _____ (hydrogen ion) concentration of a solution. (lower OH- concentration). _____________
• Base- increases the _____ (hydroxide) concentration of a solution. (lower H+ concentration). _____________
• Neutral- solution where H+ and OH concentrations are equal. _____________
  - pH = - log [H+]
  - Each pH unit represents a _______________ difference in H+ and OH- concentrations.
• ______________ - substances that minimizes changes in concentrations of H+ and OH- in a solution.
  - By accepting hydrogen ions when in excess and donating when they have been depleted.
  - Most buffers are weak acid-base pairs.
CARBON COMPOUNDS

• ____________________________ - the study of all compounds that contain carbon.

• ____________________________ - made from thousand of smaller molecules.
  o ____________________________ - large compounds called polymers are built by joining smaller compounds (called monomers) together.

• There are four groups of organic compounds found in living things:
  o ____________________________ - made of monosaccharides.
  o ____________ - made of glycerol and fatty acid.
  o ____________________________ - made of nucleotides.
  o ____________ - made of amino acids.

CARBOHYDRATES

• ____________________________ - compounds made up of carbon, hydrogen, and oxygen atoms, usually in a 1:2:1 ratio.

• Living things use carbohydrates as their main source of ____________.

• Plants and some animals also use carbohydrates for ____________________________.
  (ie: cellulose- in plant walls)

• ____________________________ - single sugar molecules
  o ie: glucose, galactose, fructose

• ____________________________ - large macromolecules formed from monosaccharides.
  o ie: glycogen (animal starch), cellulose (plant starch)

LIPIDS

• ____________ - made mostly from carbon and hydrogen atoms, which combine to form fatty acids and glycerol.

• The common categories of lipids includes ____________, ____________, ____________, and ____________.
• Lipids can be used to _________________.
• If each carbon atom in a lipid’s fatty acid chain is joined to another carbon atom by a single bond, the lipid is said to be ________________, because it contains the maximum number of hydrogen atoms. If there is at least one C=C, they are said to be _________________.

NUCLEIC ACIDS
• ______________________ - macromolecules containing hydrogen, oxygen, carbon, and phosphorous.
• Nucleic acids are polymers assembled from individual monomers known as _________________.

• Nucleotides consist of three parts:
  o ________________
  o ________________
  o ________________
• Nucleic acids store and transmit hereditary or genetic information as _______ and _______ and help control the _________________.

PROTEINS
• ______________________ - macromolecules that contain nitrogen, carbon, hydrogen, and oxygen.
• Proteins are made of molecules called ________________ which are held together by _________________.
• Amino acids are compounds with an ________________ on one end and a ________________ on the other end.
• The instructions for arranging amino acids into many different proteins are stored in _______.
• Each protein has a specific role.
Four Levels of Protein Structure

- ___________ - the series of amino acids in a unique sequence. Coded for in DNA.
- ___________ - coils and folds in the polypeptide chain. Result from ___________ between polypeptide backbone
- ___________ - results from interactions between side chains (R groups).
- ___________ - association between multiple polypeptide chains- forming a functional protein.
- ___________ - protein unravels and loses its shape.
  - Because of change in _____, __________, ______________, etc.

PROTEIN FUNCTION

<table>
<thead>
<tr>
<th>Enzymatic proteins</th>
<th>Defensive proteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function: Selective acceleration of chemical reactions</td>
<td>Function: Protection against disease</td>
</tr>
<tr>
<td>Example: Digestive enzymes catalyze the hydrolysis of bonds in food molecules.</td>
<td>Example: Antibodies inactivate and help destroy viruses and bacteria.</td>
</tr>
<tr>
<td><img src="image" alt="Enzyme" /></td>
<td><img src="image" alt="Antibodies &amp; virus" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage proteins</th>
<th>Transport proteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function: Storage of amino acids</td>
<td>Function: Transport of substances</td>
</tr>
<tr>
<td>Examples: Casein, the protein of milk, is the major source of amino acids for baby mammals. Plants have storage proteins in their seeds. Ovalbumin is the protein of egg white, used as an amino acid source for the developing embryo.</td>
<td>Examples: Hemoglobin, the iron-containing protein of vertebrate blood, transports oxygen from the lungs to other parts of the body. Other proteins transport molecules across cell membranes.</td>
</tr>
<tr>
<td><img src="image" alt="Ovalbumin &amp; amino acids for embryo" /></td>
<td><img src="image" alt="Transport protein" /></td>
</tr>
</tbody>
</table>

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CHEMICAL REACTIONS

- a process that changes, or transforms one set of chemicals into another.
  - - the elements or compounds that enter into a chemical reaction. (on the left of the equation)
  - - the elements or compounds produced by a chemical reaction. (on the right of the equation)
- Chemical reactions always involve changes in the chemical bonds that join atoms in compounds.
- Rate of Reaction can be affected by: , , , , , and .
- Chemical Equilibrium - forward and reverse rate of reactions are .
  - - reactions are still going on, but do not affect the concentration of the reactants or products, and they remain equal.
ENERGY IN REACTIONS
- Break Bonds = ______________________
- Form Bonds = ______________________
- Chemical reactions that ______________ energy often occur spontaneously.
  Chemical reactions that __________ energy will not occur without a source of energy.

ACTIVATION ENERGY
- ___________________________ - the energy that is needed to get a reaction started.
  Endergonic
  Exergonic

ENZYMES
- ______________ - a substance that speeds up a chemical reaction.
  - Catalysts work by lowering a reaction's ____________________________.
- ______________ - proteins that act as biological catalysts.
  - Enzymes _______________ chemical reactions that take place in cells.

ENZYME ACTION
- Enzymes are very ______________, generally catalyzing only 1 chemical reaction.
- __________________________ - the reactants of enzyme-catalyzed reactions.
  (what the enzyme acts on)
• _________________ - place on the enzyme where the substrate binds.

REGULATION OF ENZYME ACTIVITY
• Enzymes work best at certain _______ values.
• Many enzymes are affected by changes in _________________.
• Enzymes play essential roles in regulating chemical pathways, making materials that cells need, releasing energy, and transferring information.