Module 2 Class Notes (Krc)

The Basics of Life

Organic Molecules-The Molecules of Life

Instructions: Complete the class notes from the ppt slides. Use MS Words to fill in the blanks.

The Basics of Life

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Matter, Energy, and Life

1. All living things are composed of chemicals. These chemicals are known as__Matter_____.
2. ___Matter__ is anything that has mass and occupies space.
3. ___Energy___ is the ability to do work or cause things to _____Move_____.
4. Energy at Rest is ____Potential Energy_____.
   Energy at Motion is _____Kinetic Energy_____.

Phases of Matter

5. Three phases of matter are __Solid___, ___Liquid____, & ____Gas_____. 6. Solids-__Strong__ attractive forces, __Low_____ kinetic energy, little to no __Molecular_____ ___Movement_____.

7. Liquid-enough ____Kinetic energy_____ to overcome the attractive forces; more __molecular_____ ____movement_____.

8. Gas- ____high_____ kinetic energy, little to no attractive forces; _____maximum_____ movement.

The Nature of Matter

9. Basic building block of matter is _____Element_____.
   Ex. . OXYGEN (O), HYDROGEN (H), SODIUM (Na), CHLORINE (Cl), NITROGEN (N)

10. The __PERIODIC TABLE OF ELEMENTs_____ lists all elements in order of increasing atomic number.

11. Two or more elements may combine together in a certain proportion to form a _____Compound_____. Ex. Na + Cl → NaCl

12. Each unit of a compound is called a _____Molecule_____.

Atomic Structure

13. An ____Atom_____ is the smallest unit of an element.
14. It consists of 3 particles.
    a. _____Protons_____: located in the nucleus (center); positively charged particles.
    b. _____Neutrons_____: located in the nucleus; with no charges (neutral).
    c. _____Electrons_____ : move in orbits or shells around the nucleus; negatively charged.

Atomic # = # of Protons.

15. Each atom with the same element with a different number of neutrons is called an _____Isotope_____ of that element.
16. Radioactive Isotope: _AN ATOM WITH UNSTABLE NUCLEUS_____
17. **Electron Distribution**. _____Electrons_____ move in orbits or shells around the nucleus. These shells are now called _____Energy ____ _____Levels_____. **A Rule to Remember:** 2, 8, 8,……..

In Class Activity 18- 19

18. Calculate the number of **molecules** present in the following compounds.
    A. **H_2O** _____1_____
    B. **$6H_2O$** _____6_____
    C. **$5C_6H_{12}O_6$** _____5_____
19. Calculate the number of atoms of each element present in the following compounds.
    A. **H_2O** H ___2____ O ____1_____
    B. **$6H_2O$** H ___2_____ O _____1____
    C. **$5C_6H_{12}O_6$** C ___6___ H ____12____ O _____6_____

Chemical Changes & Chemical Bonds

20. Chemical Reaction: When atoms or molecules interact with each to form new combinations, a _____chemical reaction _____ takes place.
    Ex: HCl + NaOH → NaCl + H_2O
21. **Name** the reactants in the above reaction. _____Hydrochloric acid_____ & _____sodium hydroxide_____
22. Name the products in the above reaction. _____sodium chloride_____ & _____water_____
23. ___Reactants___-substances that are ___changed_____, usually on the ___left___ side of the ____equation____.
24. __Products_____-new chemical substances ___formed____, usually on the __right____ side of the __equation_____ .
25. Name the three kinds of chemical bonds. __Ionic bonds_____, ____Covalent Bonds_____, & ____Hydrogen bonds_____.
26. Atoms with charge are called ___*ions*___.
27. ___Ionic bond____ : the attraction between oppositely charged ions.
    ___Ionic___ __Compounds___ are formed after atoms transfer electrons to achieve a full outermost energy level.
28. ___Covalent_____ ____Bond_____ is a chemical bond formed by the **sharing** of a pair of electrons.
29. Hydrogen Bond: The force of attraction between ___Molecules___. EX. The positive hydrogen end of one polar molecule is attracted to the negative end of another polar molecule. This attraction is a _____hydrogen_____ ___bond_____.
    Hydrogen bonds are very important in biology. They stabilize the structure of ___DNA___ and proteins.
    ___Water____ molecules can "stick" together with __hydrogen___ bonds.

30. Chemical Reactions in Biology: 1 __Dehydration____ ____Synthesis_____

2. ___Hydrolysis_____

Dehydration synthesis – When __two___ small molecules are _joined_____ to form a larger molecule. A molecule of _water_____ is released. (de = remove; hydro = water; synthesis = combine)

Give ONE chemical equation of **Dehydration synthesis** in the box below.

$C_6H_{12}O_6 + C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{18}H_{32}O_{16} + 2H_2O$

Hydrolysis -HYDROLYSIS (hydro = water; lyse = to split or break). When a ___larger___ molecule is __broken___down into __smaller___ __parts__. Opposite of a dehydration synthesis

Give ONE chemical equation of **Hydrolysis** in the box below .

$C_{12}H_{22}O_{11} + H_20 \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$

Acids, Bases, and Salts

31. ___Acid___: Ionic compounds that release __hydrogen_____ __ions__(H^+) into a solution
    Example: ___hydrochloric acid_____(HCl), ___sulfuric acid_____(H_2SO_4)

    _____Base_____: Compounds that release __hydroxide____ _ions___(OH^-) into a solution.
    Ex. __Sodium hydroxide___ (NaOH), ammonia (NH_3)
32. Salts: Neither acids nor bases; Salts are formed when an __Acid_ is mixed with a __Base__.
    Ex. HCl + NaOH → NaCl + H_2O

$H^+ + Cl^- + Na^+ + OH^- \rightarrow NaCl + H_2O$

33. ___Neutralization___: it is a chemical process that occurs when acids and bases react to form ___Salt___ & ___Water___.
34. Define pH. __The degree to which a solution is acidic or basic is represented by a quantity known as pH__.

pH 7 is _Neutral____. The lower the pH, the more ___Acidic____ the substance is. The higher the pH is the more ____Basic___ the substance is.

Organic Molecules-The Molecules of Life

35. Molecules that do not contain carbon atoms are classified as ____Inorganic____ molecules.
    An example of an inorganic molecule is
    A. $C_6H_{12}O_6$ B. $C_{12}H_{22}O_{11}$ C. HCl D. $C_{18}H_{32}O_{16}$
36. __Organic_____ ___Molecules____ are complex structures, containing **carbon atoms**, arranged in ___Rings____ or ___Chains_____.

Macromolecules of Life

37. ___Macromolecules___ are very large organic molecules. Organic molecules are composed of subunits (__monomers_____) that are attached to each other forming a _polymer_____. The monomers in a polymer are usually combined by a ___Dehydration_____ __Synthesis_____ reaction. (de = remove; hydro = water; synthesis = combine). monomer + monomer = polymer + water

Ex. $C_6H_{12}O_6 + C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{18}H_{32}O_{16} + 2H_2O$

38. The reverse of a dehydration synthesis reaction is known as ___Hydrolysis_____ (hydro = water; lyse = to split or break).

Ex. $C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}0_6$

39. The most important organic compounds found in living things are: _____Carbohydrates_____ , _____Proteins____ , ____Nucleic Acids_____, & ___Lipids_____.

Carbohydrates

40. Carbohydrates are composed of carbon, hydrogen, and oxygen atoms. The monomers are called __Simple Sugars_____ or ___Monosaccharides_____. They have an equal # of carbons and oxygen and twice as many hydrogen. Ex. $C_6H_{12}O_6$, $C_5H_{10}O_5$. Cell energy is furnished by _____Carbohydrates_____. **Complex carbohydrates** are formed by the union of several units of ____Simple_____ ____Sugars_____, such as glucose, fructose, etc. Important components of nucleic acids __DNA_____ & ___RNA____

Proteins

41. They are made of monomers known as __Amino____ ____Acids___. These organic molecules contain _Nitrogen___ in addition to carbon, hydrogen and oxygen. The amino acids bond together by __Peptide_____ ___Bonds_____ to form proteins. Proteins are destroyed or ____Denatured_____, when exposed to excessive heat. Proteins are part of the __Cell_____ __Membrane_____. _Enzymes_____ are made of proteins, which speed up chemical reactions.

Nucleic Acids

42. _Nucleic Acids_____are complex organic polymers that store and transfer genetic information within a cell. There are TWO types of nucleic acids: __deoxyribonucleic acid___ and ___ribonucleic acid_____ DNA serves as___genetic_____ _____material_____. RNA plays a vital role in manufacturing __protein____ The monomers that make the nucleic acids are called ___nucleotides_____.

Lipids

43. Lipids do not dissolve in _water____ easily. They are also composed of _carbon____, ____hydrogen_____, and __oxygen_____.

List the three main types of lipids: A. __true fats_____, B. __phospholipids_____ & C. ___steroids_____ The building blocks of a fat are a _____glycerol_____ molecule and _fatty acids_____. Phospholipids are a class of water _____insoluble_____ molecules that are similar to fats, but contain _____phosphate_____ _____groups_____ (PO_4). Phospholipids are a major part of the _____Cell Membrane_____. Steroids are __lipid____ molecules. They often serve as _____hormones_____ that aid in regulating body processes.