

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 work.
4. Energy at Rest is potential energy
5. Energy at Motion is kinetic energy

Phases of Matter

5. Three phases of matter are solids, liquids, & 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. **H₂O** 1
- B. **6H₂O** 6
- C. **5C₆H₁₂O₆** 5
19. Calculate the number of atoms of each element present in the following compounds.
- A. **H₂O** H 2 O 1
- B. **6H₂O** H 12 O 6
- C. **5C₆H₁₂O₆** C 30 H 60 O 30

Chemical Changes & Chemical Bonds

20. Chemical Reaction: When atoms or molecules interact with each to form new combinations, a CHEMICAL REACTION takes place.
- Ex: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
21. **Name** the reactants in the above reaction. HYDRO CHLORIC 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. PRODUCT 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. AN 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 BONDS 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 HYDROGEN SYNTHESIS _____

2. HYDROSIS

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.



Hydrolysis -HYDROLYSIS (hydro = water; lyse = to split or break). When a WATER molecule is BROKEN down into TWO PARTS. Opposite of a dehydration synthesis

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



Acids, Bases, and Salts

31. **ACIDS**: Ionic compounds that release HYDROGEN IONS (H^+) into a solution

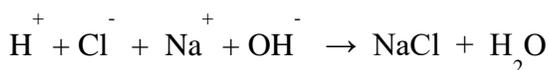
Example: HYDROCHLORIC ACID (HCl), SULFURIC ACID (H_2SO_4)

32. **BASE**: Compounds that release HYDROXIDE IONS (OH^-) into a solution.

Ex. SODIUM HYDROXIDE (NaOH), ammonia (NH_3)

33. Salts: Neither acids nor bases; Salts are formed when an ACID is mixed with a BASE.

Ex. $HCl + NaOH \rightarrow NaCl + H_2O$



34. NEUTRALIZATION it is a chemical process that occurs when acids and bases react to form SALT & WATER

35. Define pH. The degree to which a solution is acidic or basic is represented by a quantity

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

36. Molecules that do not contain carbon atoms are classified as INORGANIC molecules.

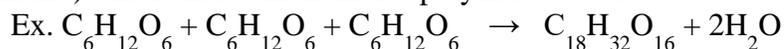
An example of an inorganic molecule is

A. $C_6H_{12}O_6$ B. $C_{12}H_{22}O_{11}$ C. HCl D. $C_{18}H_{32}O_{16}$

37. ORGANIC MOLECULES are complex structures, containing **carbon atoms**, arranged in RINGS or CHAINS.

Macromolecules of Life

38. 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



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



40. The most important organic compounds found in living things are: CARBOHYDRATES , PROTEINS , ACIDS & LIPIDS

Carbohydrates

41. Carbohydrates are composed of carbon, hydrogen, and oxygen atoms. The monomers are called SIMPLE SUGARS or MONOSACCHARIDS. 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

42. 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 (DNA) and RIBONUCLEIC ACID (RNA).

DNA serves as GENETIC MATERIAL. RNA plays a vital role in manufacturing PROTEIN.

The monomers that make the nucleic acids are called NEUCLEOTIDES

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, STERIODS

The building blocks of a fat are a GLYCEROL molecule and FATTY ACIDS Phospholipids are a class of water -INSOLUABLE 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.

