

CHAPTER 2 CHEMICAL BASIS OF LIFE

I. Basic Chemistry

A. *Biochemistry – Chemistry of all living systems*

B. *Matter – Anything that occupies space and has mass*

C. *Element – Consists of Matter*

1. The Periodic Table (Fig 2-1) represents all existing elements

2.Important Elements to Know:

a.Hydrogen – H

b.Helium – He

c.Carbon – C

d.Nitrogen – N

e.Calcium – Ca

f. Oxygen – O

g.Sodium – Na

h.Potassium – K

i. Magnesium – Mg

j. Chlorine – Cl

3.Elements are composed of the same type of Atoms

D. Atom – Composed of one or more Proton, Neutron, and Electron

1. Proton – Positive charged in nucleus
2. Neutron – Neutral charge in nucleus
3. Electron – Negative charge in electron cloud

a. Shells in electron cloud hold a specific number of electrons. For example

1. *First Shell = 2 electrons*

2. *Second Shell = 8 electrons*

3. *Third Shell = 8 Electrons*

II. Chemical Bonds

A. *Form because atoms try to fill in the outer electron shell*

B. *Stability – When an outer shell is filled, the element is considered stable or Inert and will not react. For Example:*

1. Neon, Ne – Has 10 total electrons, two in the first shell (full) and eight in the second shell (also full), which means it is Inert.

C. *Ionic Bonds*

1. Ion = Charged Atom

2. If outer shell is not stable,
electrons will be lost or gained

3. Cation = Positively charged ion

4. Anion = Negatively charged ion

5. Electrolytes – Ions in the body. They help maintain balance (homeostasis)

6. Ionic bonds dissolve in water.

D. *Covalent Bonds – Share electrons in the outer shell*

1. This method creates stability for all atoms in the molecule

E. *Hydrogen Bond – A covalent bond with ionic properties*

1. Polarity of water – unequal sharing of electrons

F. *Molecule – Two or more atoms of the same type*

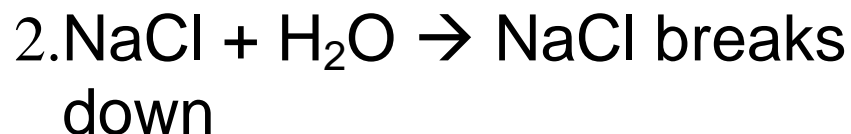
G. *Compound – Bonding of different atoms (H₂O, CO₂)*

III. Chemical Reactions

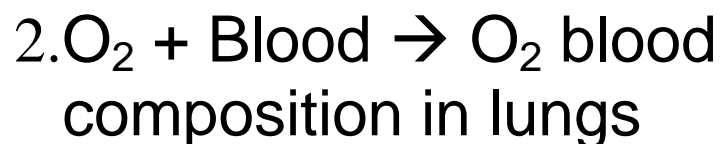
A. *Synthesis Reaction*



B. *Decomposition*



C. *Reversible*



a. Cells use reverse reactions
when maintaining proper gas
levels

IV. Powering Chemical Reactions

A. *Catalyst – Helps speed up reactions - Enzymes*

1. Specialized proteins

2. Sensitive to environmental conditions

3. Terms end in “-ase”

V. pH Scale

A. *Measures Acidity and Alkalinity*

B. *Acid*

1. Releases H^+ in solution
2. pH of 0 – 6.9

C. *Base*

1. Releases OH^- in solution
2. pH of 7.1 – 14

D. *Combining Acid and Base \rightarrow
 H_2O ; neutral (pH=7)*

E. *Optimum pH for chemical
reactions and for species survival*

1. 7.35-7.45 = normal blood pH
2. Alkalosis – blood pH is too high

F. *Buffers – Protect body from
pH that is too high or too low*

VI. Organic Compounds

- A. *C-C or C-H bonds*
- B. *Carbohydrates (Sugars)*
 - 1. Monosaccharide – Simple Sugars
 - a. Glucose
 - 2. Disaccharide – Double Sugars
 - a. Sucrose
 - 3. Polysaccharide – Complex Sugars / Starches
 - a. Absorbed Slowly
 - b. Glycogen can be made after absorbing monosaccharide
 - 1. Stored in liver and skeletal muscle
 - 2. High levels = fat storage
- C. *Lipids or Triglycerides*

- 1.Saturated vs. Unsaturated – based on presence of singlet or double bonds (Fig 2-20)

- 2.Minimize use of trans fats

D. *Proteins – large molecules made up of chains of amino acids*

- 1.Enzymes

E. *Nucleic Acids*

- 1.DNA – Deoxyribonucleic Acid

- a.Holds genetic information

- 2.RNA – Ribonucleic Acid

- a.Protein synthesis