ATOM

- Simplest particle of an element
- Properties of atom determine the structure and properties of elements
3 PARTS OF AN ATOM

- Proton
- Neutron
- Electrons

- Positive - nucleus
- Neutral - nucleus
- Negative - orbitals outside the nucleus
ATOMS

Carbon (C)  Oxygen (O)

outer electron shell contains 4 electrons

outer electron shell contains 6 electrons
Elements

- Pure substances
- Cannot be broken down into simpler kind of matter
- 100+ elements
- CHON (Carbon, Hydrogen, Oxygen, Nitrogen) -- 90% of living things
BALANCE

• Number of p+ is balanced by an equal number of e-

• Net charge of an atom is ZERO
EXCEPTION

- Some elements
  - different number of neutrons
  - ISOTOPES

- Same properties
**Compound**

- Combination of two or more elements
- Chemical formula
- $\text{H}_2\text{O}$
  - 2 hydrogens : 1 oxygen
What are the elements involved? 

1. NaCl 
2. CO₂ 
3. H₂CO₃ 
4. Fe₂O₃ 
5. 8H₂O 

How many of each element?
1. NaCl  1-sodium, 1-chlorine
2. CO$_2$  1-Carbon, 2-Oxygen
3. H$_2$CO$_3$  2-Hydrogen, 1-Carbon, 3-oxygen
4. Fe$_2$O$_3$  2-Iron, 3-Oxygen
5. 8H$_2$O  16-hydrogen, 8 oxygen
Compound

• Have different physical and chemical properties from individual elements

• H₂ and O₂ vs H₂O
**COMPOUND**

- Go under *chemical reaction*
  - combine atoms to become stable
- How do they stick?
Bond

- Attachment
- Glue
- Chemical Reaction (rxn)

they are either broken or created
BONDS

- Covalent Bond
- Ionic Bond
COVALENT BONDS

• Two atoms SHARE electrons

• Example H$_2$O
BALANCED

• Oxygen needs 2 more e- to be stable
• Each H needs 1 more e-
MOLECULE

• Simplest part of a substance and retains properties
• $\text{H}_2$ molecule = gas
• $\text{H}_2\text{O}$ molecule = liquid in room temp
IONIC BONDS

• Atom loses or gains electrons to another atom

• Both atoms are stable
ION

- Atom is no longer stable
- Has an electrical charge
• Lose $e^- = $ positive
• Gain $e^- = $ negative
Polarity

- Uneven distribution of electrons
- Occurs between H and O in water molecules
HYDROGEN BONDS

• Attraction of the + and -
• Water molecules to be attracted to each other
• Bonds via HYDROGEN BONDS
• Multiple bonds allow for special properties
COHESION

- Attraction between molecules of the same substance
- Surface drawn inward
- Water beads
ADHESION

• Attraction between molecules of different substances

• Water and glass
MIXTURE

• 2 or more elements (or compounds) are PHYSICALLY mixed together but NOT CHEMICALLY combined.
MIXTURES

- 2 or more compounds
- One of them is water
  - SOLUTIONS
  - SUSPENSIONS
• All components are distributed EVENLY throughout the solution
**SUGAR SOLUTION**

- **Solute** -- what is being dissolved? SUGAR
- **Solvent** -- what causes the dissolvement? H$_2$O
SUSPENSIONS

• Not all materials dissolved
• Solutes are suspended
pH Scale

- Indicates concentration of H+ in solutions
- Acids -
- Basic -
- Neutral
pH Scale Foldable

1. Fold paper in hot dog
2. Front - draw a pH scale
3. Front - simplify properties
   a) what compound forms in solution?
   b) pH values?
Carbon

- 4 valence e-
  - forms strong covalent bonds with other elements
- forms bonds with other C
MACROMOLECULES

- Giant molecules
What is it made of?
What is polymerization?
ORGANIC COMPOUNDS

• 4 kinds
  - carbohydrates
  - lipids
  - nucleic acids
  - proteins
CARBOHYDRATES

- Main source of energy
- Ex: sugars

What elements make up carbs? Ratio?
Monosaccharides

- Single sugar molecules
  - glucose - cell energy
  - galactose - milk
  - fructose - fruits
POLYSACCHARIDES

• More than one monosaccharide
  - glycogen - animal starch
  - cellulose - plants
Lipids

- Not soluble in water
- C and H
- Fats, oil, waxes

What is the purpose of lipids?
LIPIDS

- One C-C double bond
  - unsaturated
  - polyunsaturated
- All single bonds
  - saturated
NUCLEIC ACIDS

- H, O, N, C, P

What makes up the nucleotides?

What is the purpose of nucleic acid?
NUCLEIC ACIDS

What are the two kinds of nucleic acids?
What is the difference between the two?
PROTEINS

• N, C, H, O
• What are amino acids?
• What are the different parts of the amino acids?
• How many amino acids are there?
PROTEINS

• Controls the rate of reactions
• Regulate cell processes
• Form bones and muscles
• Transports substances into and out of cells
CHEMICAL REACTIONS

• 2 parts
  - reactants
  - products

\[ \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \]
REACTANTS

- left side of the equation

$\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
PRODUCTS

• right side of the equation

\[ \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \]
ENERGY

• release will occur spontaneously
• Absorption will not occur without a source
**ACTIVATION ENERGY**

- amount or energy needed to start the reaction
CATALYST

• Substance that reduces the needed activation energy
ENZYMES

• Type of catalyst
• Help speed up
• Gives additional amount of energy
ENZYMES
ENZYMES

• Type of catalyst
• Help speed up
• Gives additional amount of energy
ENZYMES

• Very specific
  - one enzyme for a specific reaction

• Name of enzyme is usually a hint
**Enzyme Substrate Complex**

- Enzyme provide a place where reactants can be brought together to react
- **Site** = lower activation energy
ENZYME SUBSTRATE COMPLEX

- Substrates
  - reactants of enzyme-catalyzed reactions
ENZYME SUBSTRATE COMPLEX

• Substrates bind on enzyme at ACTIVE SITE

• Lock and key
ENZYME SUBSTRATE COMPLEX

Lock-and-Key Model of Interaction
(a) Lock-and-key model

Enzyme → Enzyme-substrate complex → Enzyme (unchanged) + Product

Active site Substrates

(b) Induced-fit model

Substrates
ENZYME SUBSTRATE COMPLEX

- Substrates are in active sites until reaction is over