Unit M

1. Chemistry- is the study of all matter and the energy associated with physical and chemical change.

   a. Matter- occupies space

   b. States of matter-

<table>
<thead>
<tr>
<th></th>
<th>Shape</th>
<th>volume</th>
<th>Particle Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>variable</td>
<td>variable</td>
<td>Independent Trans., rot., vib.</td>
</tr>
<tr>
<td>Liquid</td>
<td>variable</td>
<td>Constant</td>
<td>limited to shape of container</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(same as container)</td>
<td></td>
</tr>
<tr>
<td>Solid</td>
<td>rigid, fixed</td>
<td>constant</td>
<td>Fixed vibration</td>
</tr>
</tbody>
</table>

2. Kinetic molecular theory- all matter is composed of tiny particles in motion.

   a. Kinetic theory- movement of particles-
      High temp. has more movement.
      Low temp. has less movement

Physical properties- description by senses.
   Ex. Color feel, smell, b.p., density

Physical change- alter physical form without a chemical change.
   Ex. Melting ice, breaking a piece of glass.
Chemical properties - reactivity
   Ex. Ability to burn

Chemical change - chemical identity of a substance is changed.
   Ex. Burning a log.

   Signs of a chemical change -
   1. Color change.
   2. Heat evolution.
   3. Bubble formation
   4. Precipitate
   5.

Types of Matter -
1. **Homogeneous** (Homo = same) Uniform composition and appearance.
   Take two samples from anyplace and they will have the same properties.
2. **Heterogeneous** (Hetero = different) Not uniform.
   Ex. Oil and vinegar dressing.
   Ex. Brass is copper and zinc, is it homogenous.

**Pure substance** - a single chemical, one kind of matter, one set of physical and chemical properties.

**Mixture** - Matter that consists of two or more chemicals. Can be separated by a physical change, no one set of properties.
   Ex. Salt water, has boiling point elevation and freezing point depression. Dependent on concentration. Put it on the roads and in spaghetti water.
   Ex. Distillation process.
Fundamentals of Matter

Elements- Cannot be decomposed or separated into other pure substances. One kind of atom that has certain physical properties.

Au- gold
Ag - silver

75 elements are solid, 11 gases, 2 liquids mercury and bromine.
Use symbols two or one letter code for the elements.

Compound- cannot be decomposed by a chemical change into two or more pure substances.

\[ \text{CO}_2 \rightarrow C + \text{O}_2 \quad \text{Fe} \rightarrow \text{Au} \quad \text{not chemical change} \]

Can tell compounds by the number of capital letters
Ex. Si, SI, Co, CO

How to write compounds-
\[ \text{BaCl}_2 \ 2\text{BaCl}_2 \ \text{Ba}_2\text{Cl}_2 \]

Thermodynamics-
Two types of energy-

1. Kinetic- motion.
2. Potential ability to do work, high potential energy is unstable,
   Ex. Gravity, two like charges close to each other.

Two types of reactions.
1. Exothermic- give off heat.
2. Endothermic- absorb heat

Ex. Mg + Se → MgSe + energy  Exothermic
Reactant product Chemical change

Energy + 2H₂O → 2H₂ + O₂  Endothermic

Mg + Se → MgSe + energy

Can say two things about the relationship of the reactants and the products.

1. Law of conservation of mass- mass is conserved, it is neither created or destroyed in chemical reactions. Start with 4.0 g end with 4.0 g. Difficult in old days due to the generation of gas.

Ex. CH₃CH₂CH₃ + 5O₂ → 3CO₂ + 4H₂O

2. Law of conservation of energy- same but substitute energy.
   You go up the stairs, go down the stairs. Amount needed to climb is the amount stored as potential energy.

Exception to these rules is in nuclear reactions.

\[ \Delta E = \Delta mc^2 \]

Here energy and mass are created and destroyed. Atomic bomb.