

## Notes 3-1 # 3-2 Properties and Changes of Matter

Main Idea Matter can undergo physical and chemical changes

### I. Physical Properties of Matter

- i. Do not involve a change in composition
- ii. Are both qualitative and quantitative
- iii. They are characteristics that describe a substance
  1. Color, shape, size, state of matter, etc
  2. Boiling point, melting point, density, etc

### II. States of Matter

#### i. Solids

1. Fixed volume and shape
2. Particles that are arranged in tight order
3. In terms of energy, the atoms of a solid have the least amount of kinetic energy.



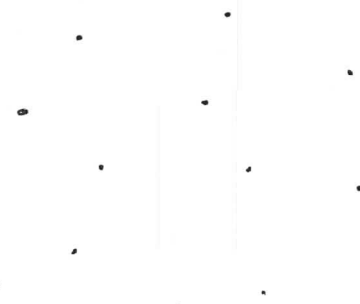
#### ii. Liquids

1. Fixed volume, but variable shape
2. Particles that are close together but can flow over one another
3. In terms of energy, the atoms of a liquid have more kinetic energy than solids, but less than that of gases



#### iii. Gases

1. Variable shape and volume



2. Particles are free to fill their spaces
3. In terms of energy, the atoms of a gas have the highest kinetic energy of the three states.

III. Changes of State are Physical Changes

- i. Because there is no rearrangement of the atoms, changes of state are considered physical changes.
  1. The kinetic energy of the atoms is increased or reduced, but the identity does not change.

IV. Density is a physical property of matter

- i. Defined as the amount of matter (mass) in a specific unit of volume
- ii. Unique to most substances, the density of a substance can be used for identification.
- iii. Density is usually reported in g/mL or g/cm<sup>3</sup>
- iv. Water has a density of 1.0 g/mL,
  1. Any substance with a density less than 1.0 g/mL will float
  2. Any substance with a density greater than 1.0 g/mL will sink

V. Chemical Properties can only be observed when a chemical change takes place.

- i. Reactivity –the ability to react with other substances
  1. Iron reacts with oxygen to form rust
- ii. The stability or instability of a substance is also a chemical property
  1. Peroxide breaks down easily when exposed to light

## VI. Chemical reactions

- i. Look for terms such as react, decompose, explode, rust, oxidize, tarnish, ferment, burn or rot. These signal a chemical reaction is occurring.
- ii. Atoms in chemical change are rearranged.
  1. New substances must be formed
- iii. Reactions that release energy are considered exothermic
- iv. Reactions that absorb energy are considered endothermic

## VII. Evidence of Chemical change

- i. The evolution of a gas
- ii. The formation of a precipitate
- iii. A change in temperature, either decrease or increase
- iv. The emission of light
- v. A color change of the system

## VIII. All chemical reactions must obey the Law of Conservation of Mass

- i. Tells us that mass is neither created nor destroyed in a reaction, atoms are just rearranged.
  1. If we begin with 10 gram of reactants, the mass of the products must also equal 10 grams.