Matter

Physical and Chemical Changes

Physical and Chemical Changes

- Matter can change both physically and chemically.
  - Remember that water contains many molecules, each made of two hydrogen and one oxygen atom.

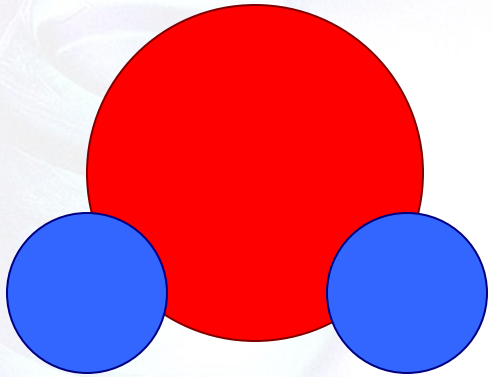
2-D Model

lines show bonds (attachments)

letters stand for atoms

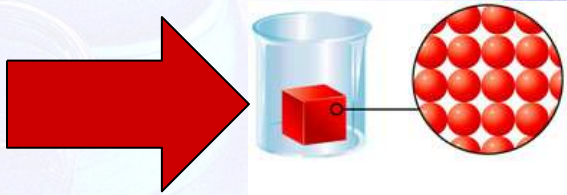
or

3-D Model

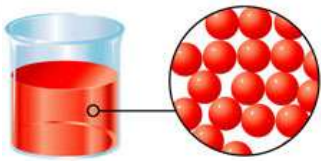


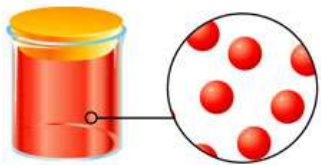
Physical and Chemical Changes

- When water changes from a solid (ice) to a liquid (water) and finally to a gas (steam), what is occurring?



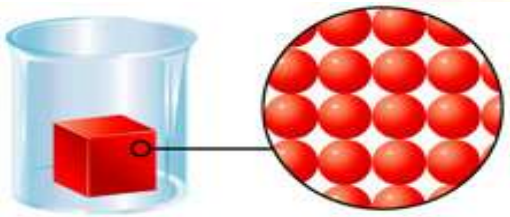
- Let's take a few minutes to review the properties of a solid, liquid, and gas microscopically, then analyze these changes.



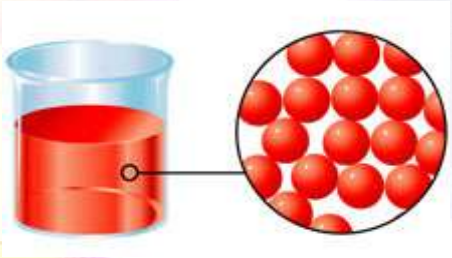


Physical and Chemical Changes

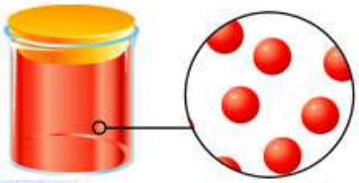
- **What are the characteristics of solids?**
  - Occupies a constant amount of space
  - Definite volume and shape



- **What are the characteristics of liquids?**
  - Occupies a constant amount of space
  - Has a definite volume
  - Has an indefinite shape

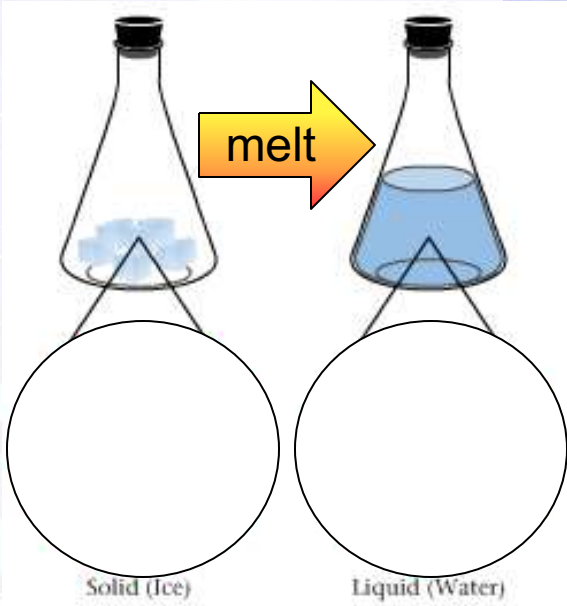


- **What are the characteristics of gases?**
  - Does not have a definite shape or volume
  - Gases fill their container, regardless of the shape and volume.



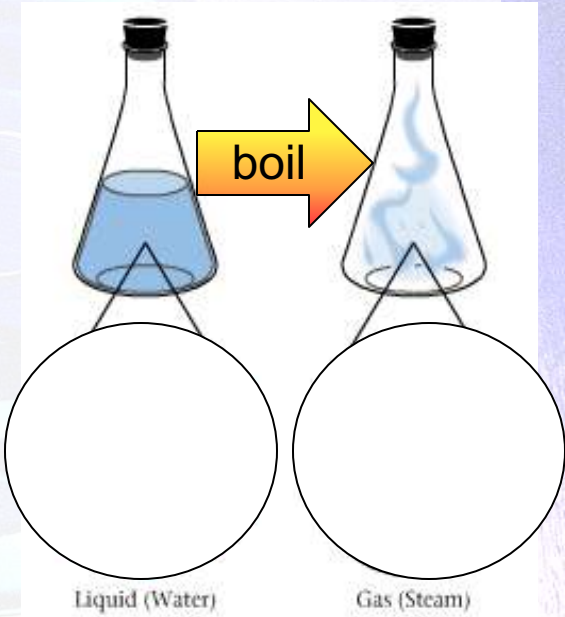
Physical and Chemical Changes

- So, when water changes from a solid (ice) to a liquid (water), what is occurring?
  - When ice melts:
    - rigid solid becomes a mobile liquid
    - liquid takes the shape of its container
  - In ice, H_2O molecules are locked into fixed positions.
  - In water, H_2O molecules are still close together, but some motion is occurring.



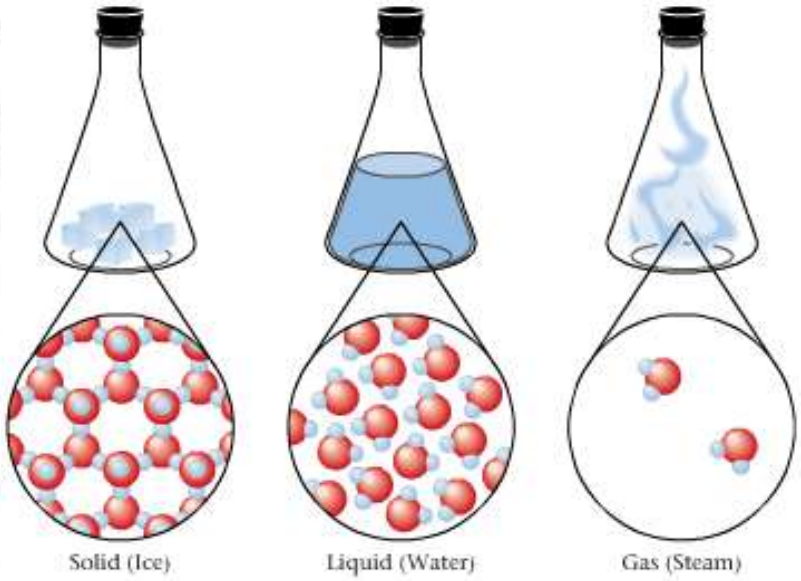
Physical and Chemical Changes

- When water changes from a liquid (water) to a gas (steam), what is occurring?
  - When heating is continued:
    - the liquid boils
    - water becomes a gas or vapor that seems to disappear into the air.
  - In water, H_2O molecules are still close together, but some motion is occurring.
  - In the gaseous state, the molecules are much farther apart and move randomly, hitting each other and the walls of the container.



Physical and Chemical Changes

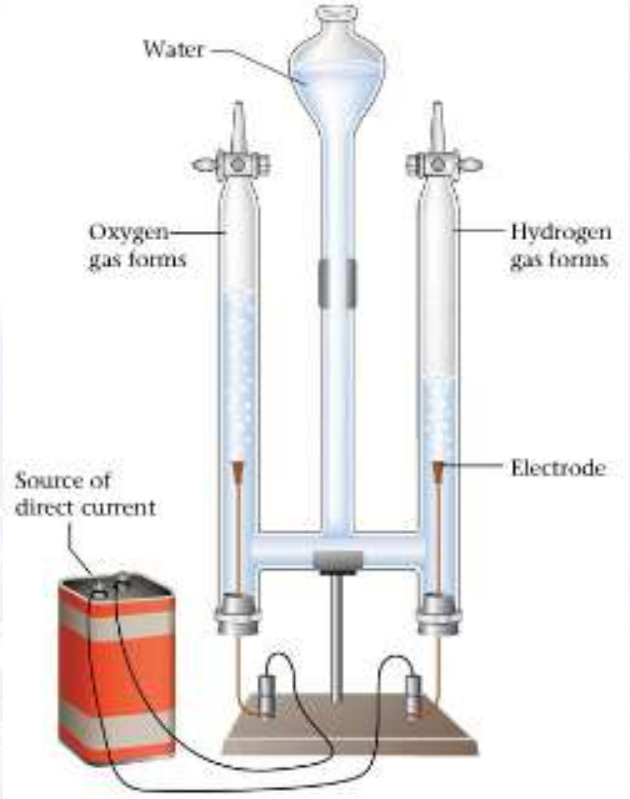
- The water molecules are still intact, only the motions of individual molecules and the distances between them change.



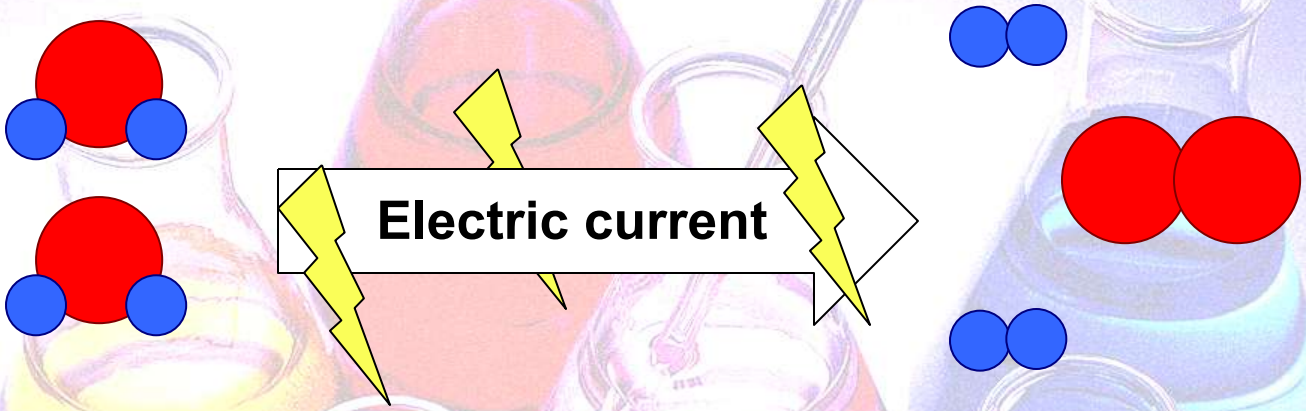
- H_2O molecules are still present!
- These are physical changes!
- **Physical change** → change that does not affect the composition of a substance.

Physical and Chemical Changes

- If we run an electric current through water, something different happens.
  - Water disappears and is replaced by 2 new gases: hydrogen and oxygen.
  - The electric current causes the water molecules to come apart (*decompose*).



Physical and Chemical Changes



- This is a chemical change because the H_2O has changed into hydrogen (H_2) and oxygen (O_2).
- **Chemical change** → change in which a substance becomes a different substance.

Physical and Chemical Changes

- The most common physical changes are changes of state:

  Solid ⟺ Liquid ⟺ Gas

- Chemical changes are called reactions.
  - Examples:
    - Silver tarnishes by reacting with substances in the air.
    - A plant forms a leaf by combining various substances from the air and soil.

Physical and Chemical Changes

Identifying Physical and Chemical Changes

Classify each of the following as a physical or chemical change.

a. Milk turns sour.

Chemical Change

Why?

Because new substances form.

Physical and Chemical Changes

Identifying Physical and Chemical Changes

Classify each of the following as a physical or chemical change.

b. Wax is melted over a flame and then catches fire and burns.

Physical then Chemical Change

Why?

Melting wax is a physical change, a change of state. When the wax burns, new substances are formed, so it is a chemical change.

- The End!