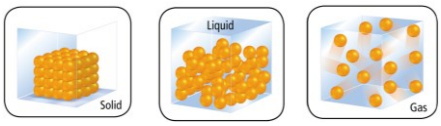
Matter: Properties & Change

Matter

- Matter – anything that has mass and takes up space
- Chemistry – the study of matter and the changes it undergoes



Four States of Matter

- Solids
  - particles vibrate but can't move around
  - fixed shape
  - fixed volume
  - incompressible

Four States of Matter

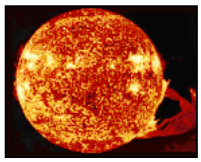
- Liquids
  - particles can move around but are still close together
  - variable shape
  - fixed volume
  - virtually incompressible

Four States of Matter

- Gases
  - particles can separate and move throughout container
  - variable shape
  - variable volume
  - easily compressed
  - vapor = gaseous state of a substance that is a liquid or solid at room temperature

Four States of Matter

- Plasma
  - particles collide with enough energy to break into charged particles (+/-)
  - gas-like, variable shape & volume
  - stars, fluorescent light bulbs, TV tubes



Changes in Matter

Matter changes

- Extensive
- Intensive
- Physical
- Chemical

Physical Properties can be Intensive or Extensive

- Examples:
  - boiling point — intensive
  - volume — **extensive**
  - mass — **extensive**
  - density — intensive
  - conductivity — intensive

Physical Properties

- Extensive Property
  - depends on the amount of matter present (example: length)
- Intensive Property
  - depends on the identity of substance, not the amount (example: scent)

Phase Changes – Physical

- Evaporation = Liquid -> Gas
- Condensation = Gas -> Liquid
- Melting = Solid -> Liquid
- Freezing = Liquid -> Solid
- Sublimation = Solid -> Gas
- Deposition = Gas - > Solid

Physical Change

- A process where a substance changes form without changing its identity
- properties remain the same
- Examples: cutting a sheet of paper, breaking a crystal, all phase changes

Chemical Change

- Process that involves one or more substances changing into a new substance
  - Commonly referred to as a chemical reaction
  - New substances have different compositions and properties from original substances

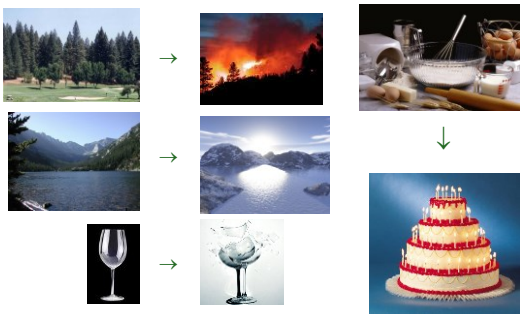
Examples of a Chemical Change

- change in color or odor
- formation of a gas
- formation of a precipitate (solid)
- change in light or heat

Physical vs. Chemical Changes

- Examples:
  - rusting iron **chemical**
  - dissolving in water physical
  - burning a log **chemical**
  - melting ice physical
  - grinding spices physical

What Type of Change?



Law of Conservation of Mass

- Although chemical changes occur, mass is neither created nor destroyed in a chemical reaction
- Mass of reactants equals mass of products

$$\text{mass}_{\text{reactants}} = \text{mass}_{\text{products}}$$

$$A + B \rightarrow C$$