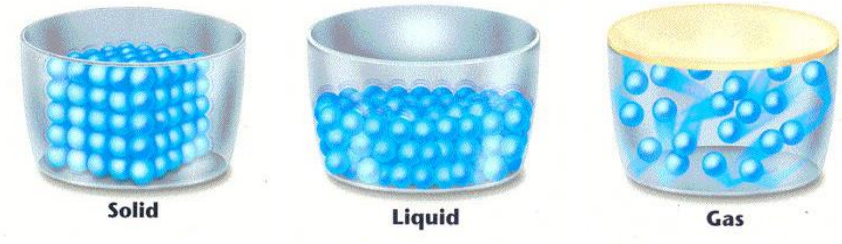
Physical Science

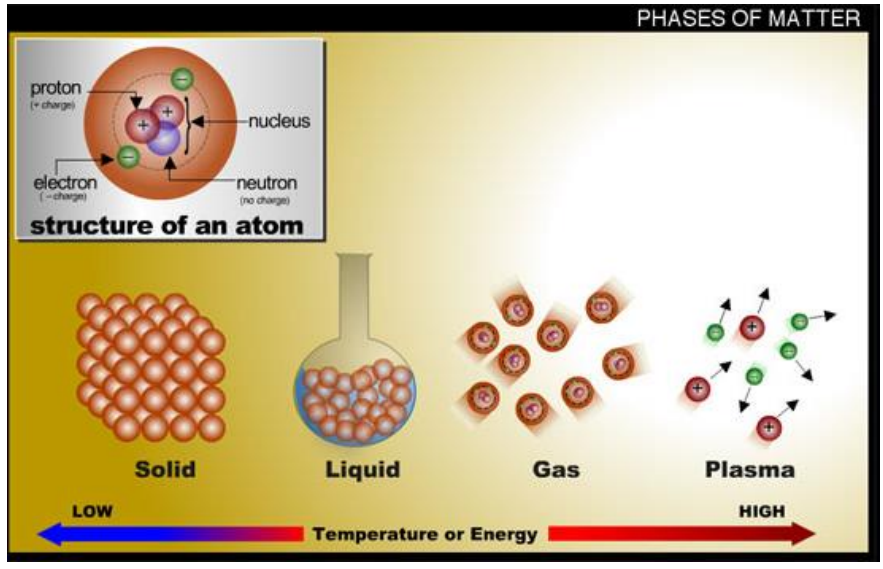
Chapter 15
Changes in Matter

Solid, Liquid, Gas or Plasma

- **Plasma** – state of matter that has had the electrons stripped away, uncommon on the Earth
- **Solid** – Definite Shape and Volume
- **Liquid** – No shape of its own, takes on the shape of the container, but it has a definite volume
- **Gas** – No shape of its own, takes the shape of the container it is in. No definite volume, easily compressed

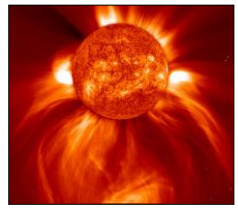


Phases of Matter



Plasma

- State of matter that has had the electrons stripped away
  - Fire is in the Plasma state
  - Glow around reentry vehicles from space
  - The Sun



Solid

- Particles (atoms or molecules) are packed closely together and stay in a fixed position
- Movement consists of vibrating particles staying in place
- Two types of Solids
  - Crystalline Solid – particles in a distinct pattern, melt at a specific distinct temperature: examples include sugar, salt, ice, quartz, etc.
  - Amorphous Solid – particles arranged in an irregular pattern, therefore no real distinct melting point. As heat is applied to an amorphous solid, the substance changes from hard to softer and softer until a liquid: examples include rubber, plastic, and Eskimo pies!





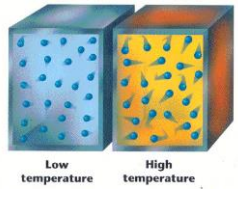

Liquid

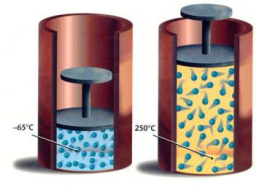
- No shape of its own, takes on the shape of the container, but it has a definite volume
- Particles in a liquid – atoms are loosely bound and are free flow and move, sliding easily over , under, and across each other but remaining in contact w/ one another.
- **Viscosity** – resistance of a liquid to flow:
  - high viscosity: slow flowing (molasses in January)
  - low viscosity: fast flowing (pouring water)

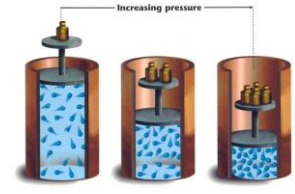


Gas

- No shape of its own, takes the shape of the container it is in. No definite volume, easily compressed
- Measuring Gases – three important measurements taken for gases. All three are closely related!! **Volume Temperature & Pressure**
- **Volume**
  - Gases dissipate to evenly fill the container they occupy
- **Temperature**
  - 1. The measurement of the average thermal energy of the particles in the gas.
  - 2. The average speed of a gas molecule at room temperature is fast!! 500
  - meters per second!
- **Pressure**
  - gas particles are in constant motion and exert pressure upon the container they occupy. Because the gas particles are in motion, they collide and bounce off each other and the sides of the container. This contact w/ the sides of the container causes and outward push.
  - **Pressure = Force / Area**



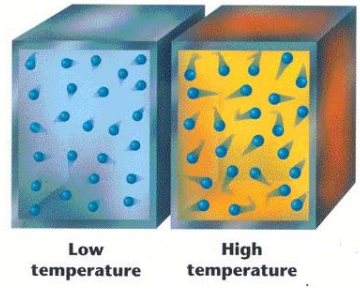




Relating Temperature & Pressure

(at a constant volume)

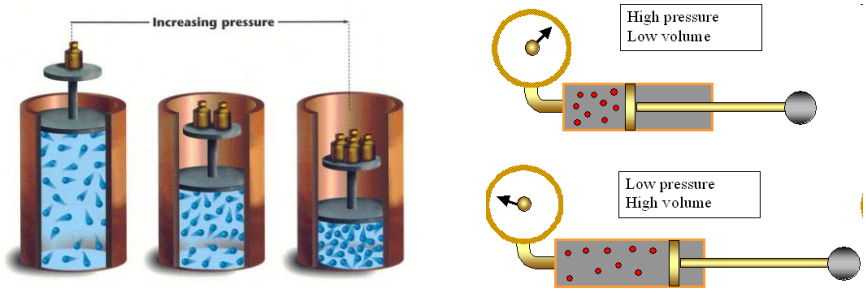
- If the temperature increases, the added thermal energy causes the particles to push harder on the inside surface of the container… this causes the pressure to also go up.
- If the temperature decreases, the pressure decreases.
- Example: leaving a basketball outside on a cold night causes the ball to go flat



Relating Pressure and Volume

(at a constant Temperature)

- **BOYLES LAW** – As pressure is increased volume will decrease, and conversely; if the pressure is decreased, the volume will increase



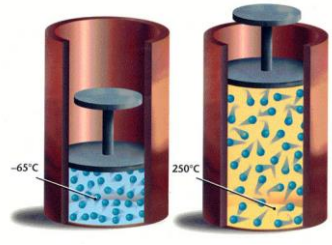
Boyles Law (Pressure goes up → Volume goes down @ constant temperature)

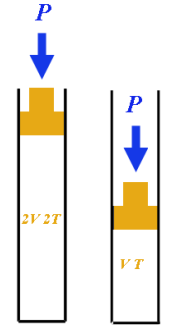
Pressure is inversely proportional to the volume

Relating Volume & Temperature

(at a constant Pressure)

- **Charles Law**- As the temperature increases the volume will also increase; conversely, as the temperature decreases the volume will also decrease.



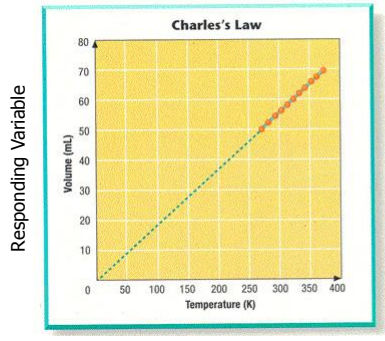


Charles Law (Temp goes up → Volume goes up @ constant pressure)

Temperature is directly proportional to volume.

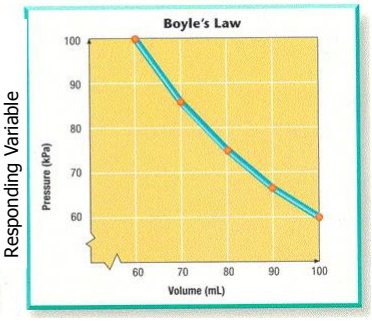
Graphing Gas Behavior

- ***variable*** – the factor that can change in an experiment
- ***manipulated variable*** – (independent variable) one variable that is changed to test the hypothesis
- ***responding variable*** – (dependent variable) the factor that changes because of the manipulated variable



Responding Variable

Manipulated Variable



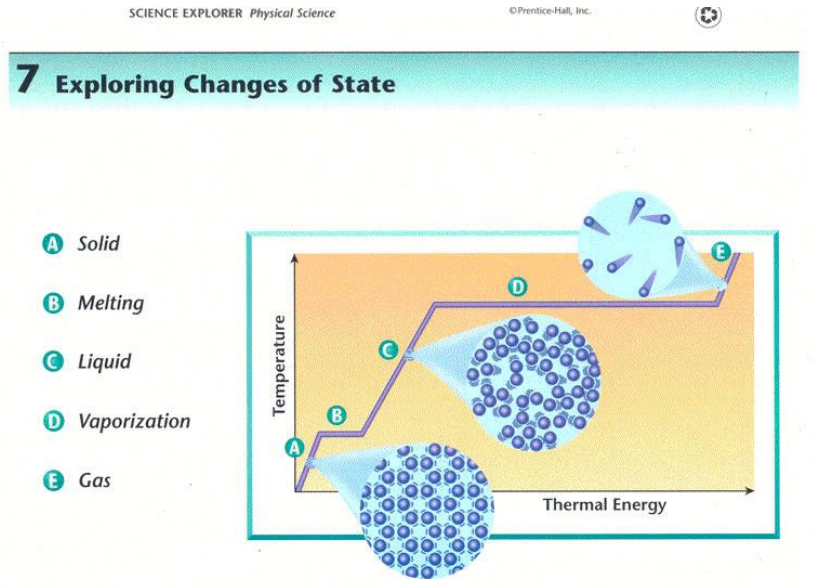
Responding Variable

Manipulated Variable

Change of State - a physical change

- Changes between liquid and solids
  - **Melting:** changing from a solid to a liquid (ice melting in a glass of iced tea)
  - **Freezing:** changing from a liquid to a solid (water turning to ice cubes in the freezer)
- Changes between Liquid and a gas
  - **Vaporization:**
    - **Boiling** - liquid changes to a gas at or below the surface of the liquid
    - **Evaporation:** liquid changing to a gas only at the surface of the liquid (a puddle drying up in the sun)
  - **Condensation**: gas vapor changing to a liquid (rain)
- Changes between a solid and a gas
  - **Sublimation**: Changing from a solid directly to a gas (dry ice turns to carbon dioxide, snow "disappears" w/out melting.
  - **Deposition**: Changing directly from a gas to a solid

Change of States



Had enough?
We can go on if you want to…..

Nah…. Let's stop here.