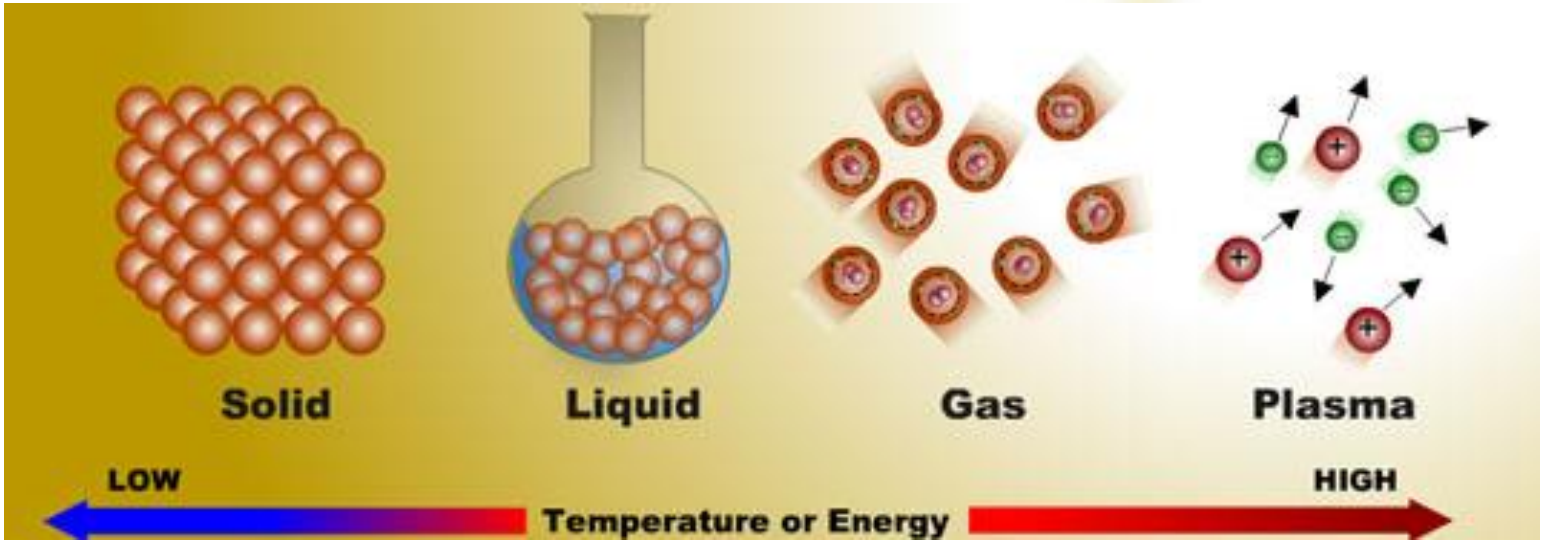
States of Matter Notes



Quick Matter Review

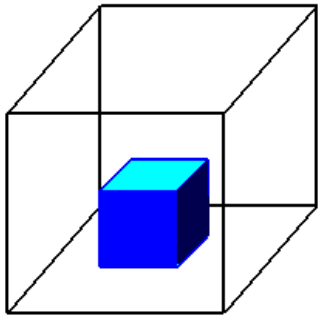
- What is Matter?
  - It's the "stuff" that makes up the whole universe
  - It has specific qualities: **volume, mass, density**
  - It may be found in up to five forms:
    - Bose-Einstein Condensate
    - Solid
    - Liquid
    - Gas
    - Plasma

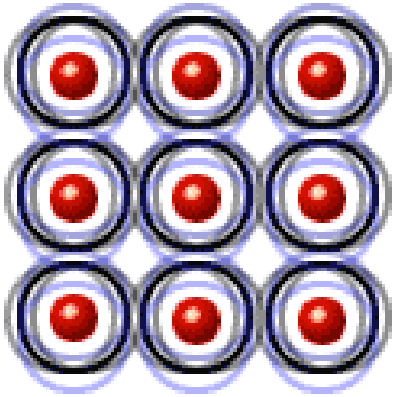
Our States of Matter

- For the purpose of this class, we'll be focusing on the three most common **phases**:
  - Solid
  - Liquid
  - Gas

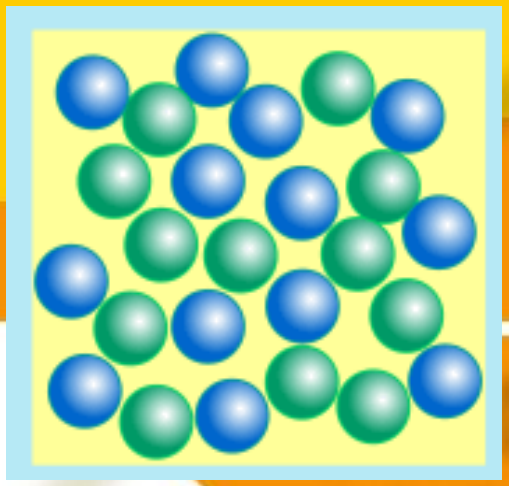
Solid Basics

- What is a solid?
  - Hard - molecules are packed together
    - the **closer** the **molecules**, the **harder** the solid
  - Hold their own shape
    - A rock will always look like a rock unless something happens to it
  - Atoms/Molecules of a solid **don't move much (they vibrate)** and have a **uniform arrangement**

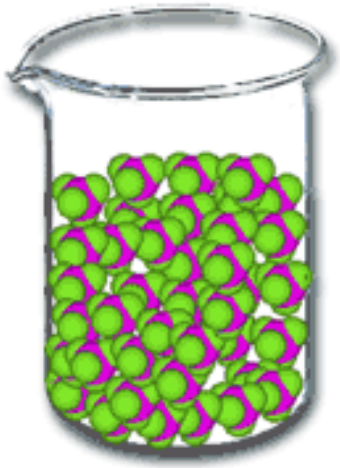




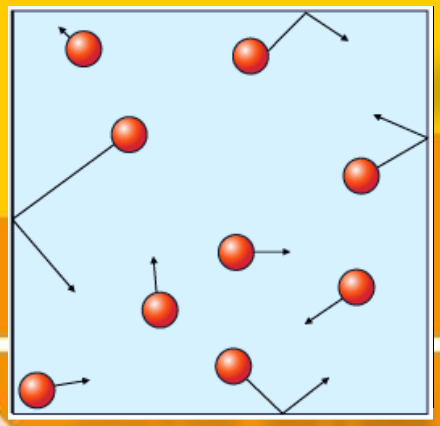
Liquid Basics



- What is a liquid?
  - Can be a **mixture of more than one element or compound**, which is called a **solution**
  - Will **take the shape of whatever container they are in** (bottom up)
  - Have a **cohesive force** (cohesion) - makes their molecules "want" to stick together
  - Atoms/Molecules in liquids are a **little more spread out** than those in a solid and **move a little faster** (slide around)



Gas Basics



- What is a Gas?
  - Gases are everywhere (air, atmosphere, etc.)
  - Atoms that are very **spread out** and **full of energy** - they're bouncing around constantly!
  - Gases **evenly fill the entire shape** of any size container
  - **Vapor** is another name for gas

Summary

Shape	Has definite shape	Takes shape of the container	Takes the shape of its container
Volume	Has definite volume	Has definite volume	Fills the volume of the container
Particle arrangement	Fixed; very close	Random; close	Random; far apart
Interaction between particles	Very strong	Strong	Essentially none
Movement of particles	Very slow (vibrating)	Moderate	Very fast
Examples	Ice, salt, iron	Water,oil, vinegar	Water vapor, helium, air

Changes in States of Matter

- Changing state = physical change
  - Ex: solid ice to liquid water
- Particles move at different rates for each state, so changing states means you must add or remove energy
  - melting adds energy (slow solid → faster liquid)
  - freezing removes energy (faster liquid → slow solid)

Types of Changes of State

Process	State Change	Add or Remove Energy?
Melting	Solid to liquid	+ Energy
Freezing	Liquid to solid	- Energy
Evaporation	Liquid to gas	+ Energy
Boiling	Liquid to gas	+ Energy
Condensation	Gas to liquid	- Energy
Sublimation	Solid to gas	++ Energy!!