Phase Changes

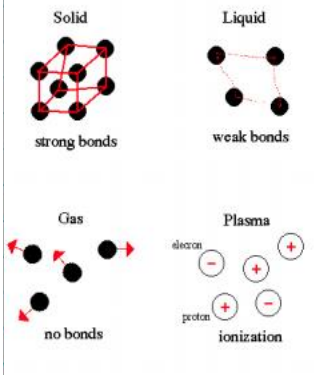
What is a Phase Change?

- Is a change from one state of matter (solid, liquid, gas) to another
- Are physical changes because:
  - It only affects physical appearance, not chemical makeup
  - Its reversible

What happens during a phase change?

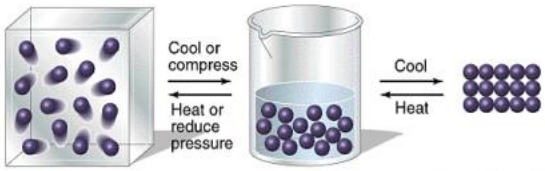
- During a phase change, heat energy/ kinetic energy is either gained or lost.
- Heat energy is lost as molecules slow down and move closer together
  - Object gets colder
- Heat energy is gained as molecules speed up and expand
  - Object gets hotter

States of Matter - Review



By adding energy, usually in the form of heat, the bonds that hold a solid together can slowly break apart. The object goes from one state, or phase, to another.

These changes are called PHASE CHANGES.



Gas
Total disorder; much empty space; particles have complete freedom of motion; particles far apart.

Liquid
Disorder; particles or clusters of particles are free to move relative to each other; particles close together.

Crystalline solid
Ordered arrangement; particles are essentially in fixed positions; particles close together.

Freezing

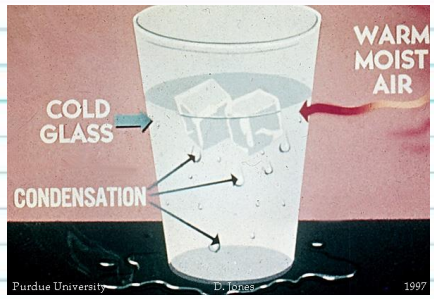
- Phase change from liquid to solid
- Molecules slow down, move closer together, and lose heat energy, become more ordered

Melting

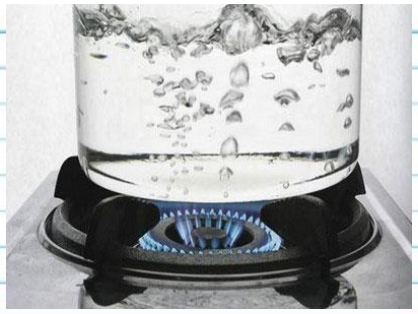
- Phase change from solid to liquid
- Molecules speed up, move farther apart, and gain heat energy, become less ordered

Condensation

- Phase change from gas to a liquid
- Molecules slow down, move closer together, lose heat energy, become more ordered



Vaporization



- Boiling
  - Phase change from liquid to gas
  - Occurs at boiling point of matter
  - Molecules speed up, move farther apart, and gain energy, become less ordered

Vaporization

- Evaporation
  - Phase change from liquid to gas
  - Occurs on the surface of a liquid (at all temperatures)
  - Molecules speed up, move farther apart, and gain energy

Sublimation

- Phase change from solid to gas
- Molecules speed up, move farther apart, and gain heat energy, become less ordered

Deposition

- Phase change from gas to solid
- Molecules slow down, move closer together, and lose heat energy, become more ordered

Description of Phase Change	Term for Phase Change	Heat Movement during Phase Change
Solid to Liquid	MELTING	Heat goes into solid as it melts.
Liquid to Solid	FREEZING	Heat leaves the liquid as it freezes.
Liquid to Gas	VAPORIZATION (BOILING and EVAPORATION)	Heat goes into the liquid as it vaporizes

Description of Phase Change	Term for Phase Change	Heat Movement during Phase Change
Gas to Liquid	CONDENSATION	Heat leaves the gas as it condenses
Solid to Gas	SUBLIMATION	Heat goes into the solid as it sublimates
Gas to Solid	DEPOSITION	Heat leaves the gas as it deposes

SOLIDS

- A solid is an ordered arrangement of particles that have very little movement.
- Particles vibrate back and forth but remain closely attracted to each other = strong bonds.

LIQUIDS

- A liquid is an arrangement of less ordered particles that have gained energy and can move about more freely.
- Particles attraction is less than a solid = weak bonds.

Gases

- By adding energy, solids can change from an ordered arrangement to a less ordered arrangement (liquids), and finally to a very random arrangement of particles (gases)
- Particles have NO bonds = free flying

Phase Changes are classified as:

1. Endothermic: The object absorbs energy from the surroundings. Think of ENDO as "entering" = energy comes into the object.

What is happening to the particles?

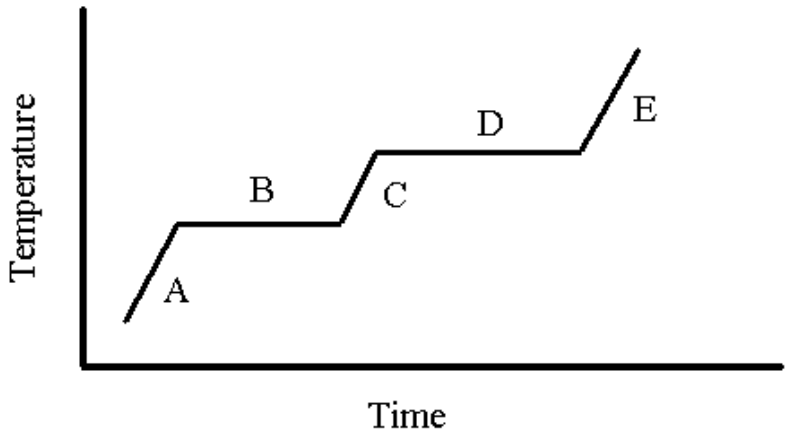
2. Exothermic: The object release energy to the surroundings. Think of EXO as "exiting" = energy goes out of the object.

What is happening to the particles now?

Temperature = Points

- Melting Point: The temperature at which a solid changes into a liquid.
- Boiling Point: the temperature at which a liquid changes into a gas
- Freezing point: temperature at which a liquid turns into a solid when cooled.
- Condensing point: temperature at which a gas turns into a liquid when cooled.

Graphing a Phase Change



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