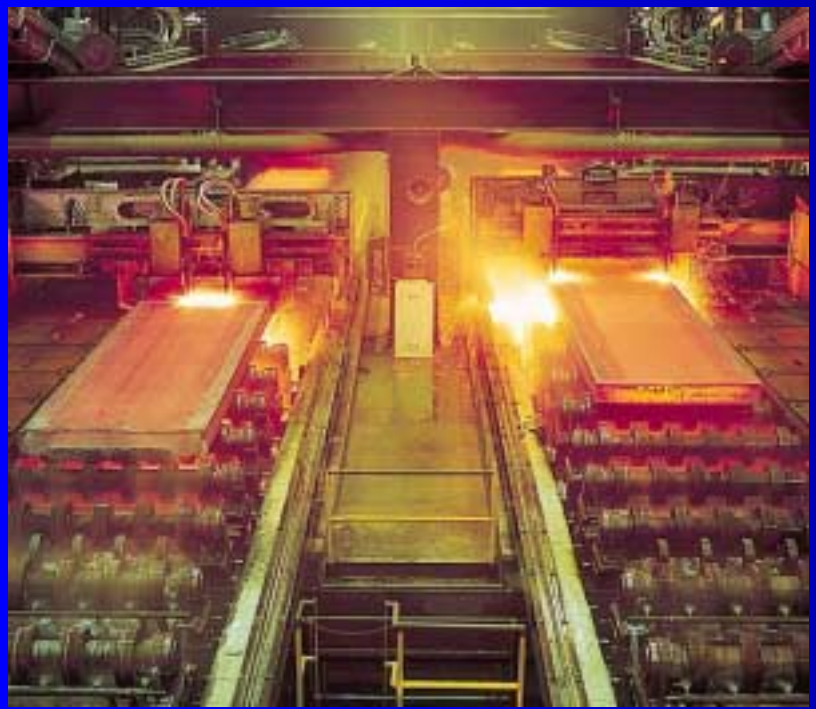
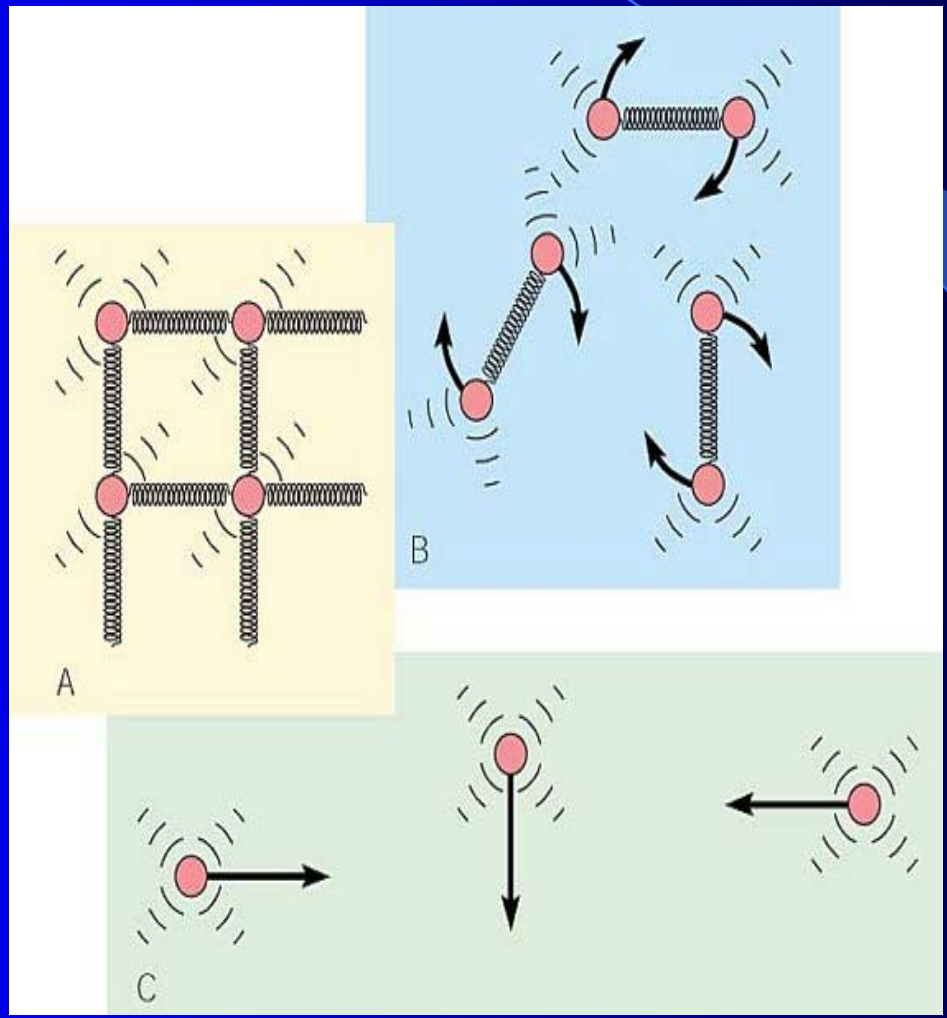
Heat Transfer



- Heat transfer
- Specific Heat
- Heat Flow
  - Conduction
  - Convection
  - Radiation
- Thermodynamics

Phases of Mater



Phases of Matter

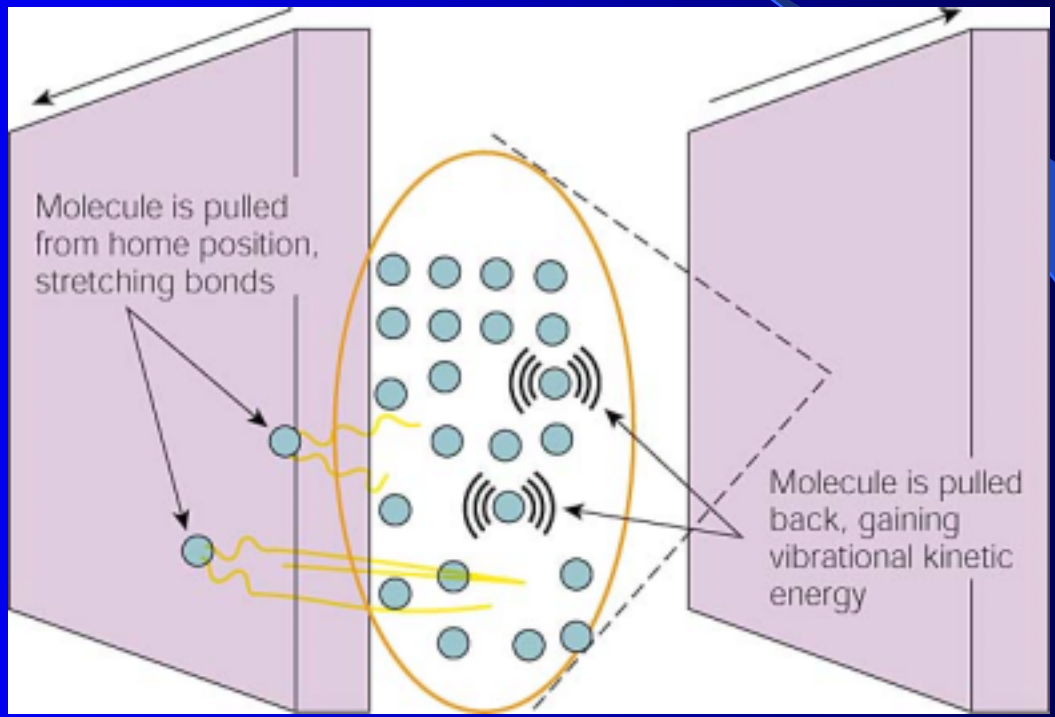
- Solids :
  - Have definite volume
  - occupy definite space
  - strong cohesive forces
- Liquids :
  - Have volume
  - Cohesive forces are intermediate in strength
- Gases :
  - Cohesive forces are the weakest
  - Molecules are free to move about in space

Measures of Heat

- Heat is a form of energy
- UNITS : Joule (SI System)
- Simpler everyday unit : calorie
- Conversion
  - 4.184 J = 1 Cal

Heat transfer

Internal Energy



Kinetic Energy

HEATING

Heat

- Heat → Energy
- Can be absorbed or liberated
- HEAT LOST = HEAT GAINED

Specific Heat

- Heat Energy $Q = m\ c\ \Delta T$
- c = specific heat capacity
- Units : J/(kg-K) or cal / (g-C)
- Water → c = 1 cal/g-C

Method of Mixtures

- Hot object + Cold object

$$(m\ c\ \Delta T)_{lost} = (m\ c\ \Delta T)_{gained}$$

- Energy is conserved

Specific Heat

- A coffee cup having a mass of 500 g is made of silver and is at an initial temperature of 20° C.
- Hot coffee at 90 ° C is poured into the cup, and the final temperature of the coffee cup is 70 ° C
- How much coffee is poured into the cup?
- (Specific heat capacity of silver is 0.056 cal/g-C and that of coffee is 0.98 cal/g-C)

Specific Heat

Heat Gained by Cup = Heat Lost by Coffee

$$(mc\Delta T)_{cup} = (mc\Delta T)_{coffee}$$

$$m_{cup}c_{cup}\left|(T_f - T_i)_{cup}\right| = m_{coffee}c_{coffee}\left|(T_f - T_i)_{coffee}\right|$$

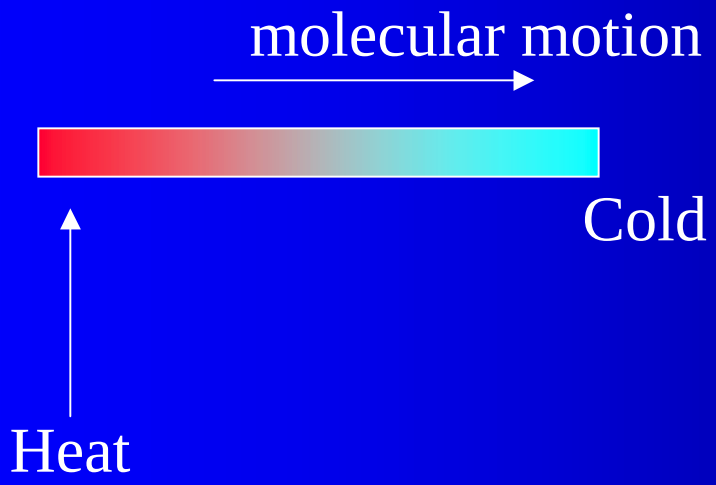
$$500g \times \left(0.056 \tfrac{cal}{g^\circ C}\right) \times \left|(70^\circ C - 20^\circ C)_{cup}\right| = m_{coffee} \times \left(0.98 \tfrac{cal}{g^\circ C}\right) \times \left|(70^\circ C - 90^\circ C)_{coffee}\right|$$

$$1400cal = m_{coffee} \times 19.6 \tfrac{cal}{g}$$

$$\therefore m_{coffee} = \frac{1400cal}{19.6 \tfrac{cal}{g}} = 71.4g$$

Conduction

- Heat transfer
- Molecular interaction



Conductors and Insulators

Convection

- Large scale molecular migration with high kinetic energy
- Happens in liquids and gases
- Molecules have more freedom for movement
- Warm, less dense gas moves upward
- Cooler, more dense gas moves downward
- Convection currents

Radiation

- Energy transfer without any medium of transfer
- Heating effects of light radiation from sun
- Radiation is electromagnetic in nature
- Infra-red lamps
- Ultra-violet radiation
- Gamma radiations, X-ray