

6.3 - Temperature, Heat & Thermal Energy

Review

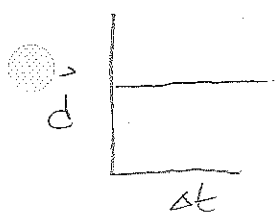
Position: ≠ shortest distance between ≠ start and ≠ finish

Displacement: a change in position  
 $\Delta \vec{d} = \vec{d}_f - \vec{d}_i$

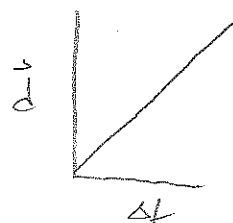
Speed: distance travelled per unit time [no direction]

Velocity: ≠ speed and direction

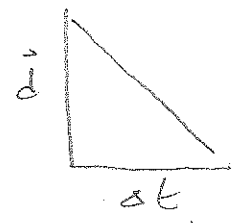
$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{\vec{d}_f - \vec{d}_i}{\Delta t}$$



0 velocity  
"stopped"

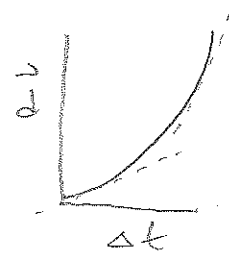


+ velocity

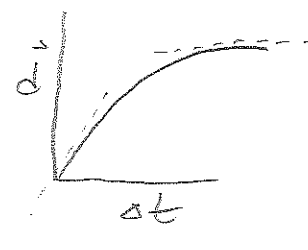


- velocity

constant velocity



speeding up



slowing down

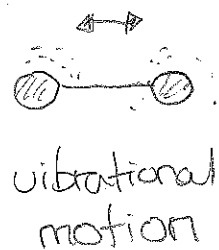
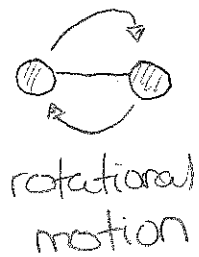
New

Thermal Energy: ≠ total molecular nrg in an amount of material

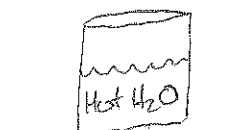
includes kinetic nrg (movement) & potential nrg (stored in bonds)

Heat: transfer of thermal nrg from one material to another

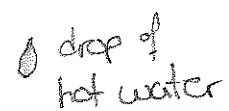
## Molecular Kinetic Energy (3)



Temperature: average translational kinetic energy



massive total kinetic energy



little total kinetic energy

} Both have  $\neq$  same average translational kinetic energy  $\rightarrow$  same temperature

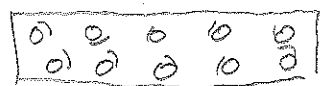
Temp Units  $\rightarrow$  Celsius ( $^{\circ}\text{C}$ ) or Kelvin ( $\text{K}$ )

$$-273^{\circ}\text{C} = 0^{\circ}\text{K}$$

$\uparrow$  absolutely no translational energy = absolute zero

## HEAT Transfer (3)

1. Conduction: heat is transferred slowly thru a metal rod from  $\uparrow$  kinetic energy from molecules to molecules (collision)



metal rod

Conductive Materials (conductors)

a) conduct heat  $\neq$  electricity

b) Metals R good, glass not so much

c) Solids R good, gases  $\neq$  liquids R not

## 2. Convection (Heat Transfer)

Gases  $\neq$  liquids don't conduct thermal energy well but can transfer energy efficiently using convection.

In convection  $\neq$  energy flows w/  $\neq$  molecules from 1 place to another.

## 3. Radiation (Heat Transfer)

Heat transfer thru a vacuum [no particles] is called Radiation  $\neq$  travels via electromagnetic waves travelling @  $\neq$  speed of light.

The Sun is our primary (1 $^{\circ}$ ) source of thermal energy and this energy is transferred via radiation. (by way of)

This energy can be in different forms including:

- radio waves
- infrared radiation (heat)
- ultra violet light
- gamma radiation
- microwaves
- visible light
- X-radiation