Kinetic-Molecular Theory

1) All matter is make up of particles in constant motion with elastic collisions

(KE = KE')

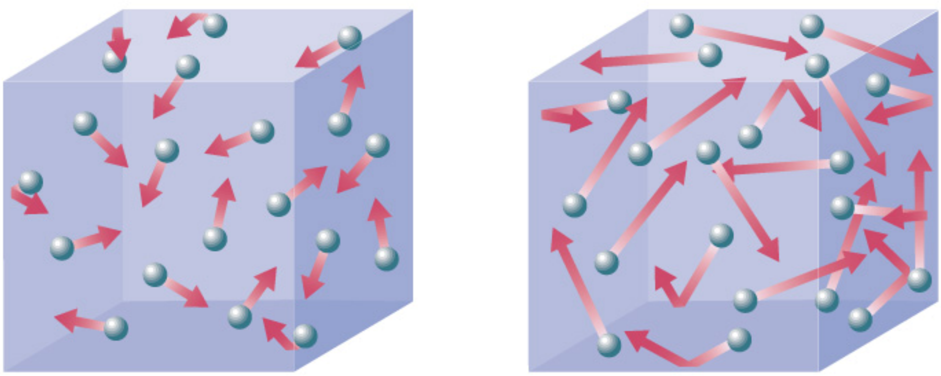
2) The: >motion >KE > Temperature

Apr 3 - 10:14 AM

http://positron.ps.uci.edu/~dkirkby/music/html/demos/PlaneWave/Temperature.html

http://lectureonline.cl.msu.edu/~mmp/kap10/cd283.htm

http://mc2.cchem.berkeley.edu/Java/molecules/index.html



Longer arrows mean higher average speed.

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Thermal Energy : total PE + KE associated with the random motion and arrangement of the particles of a material (Total Internal Energy)

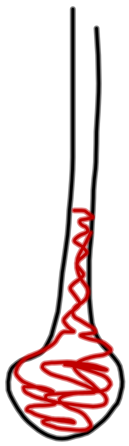
Heat: Thermal Energy that's absorbed, given up, or transferred from one body to another.
flowing

Temperature : physical quantity that is proportionate to the average (translational) KE of the particles in matter.

- a measure of a body's ability to give up or absorb TE from another body

Apr 3 - 9:23 AM

Can't measure KE (motion) directly, so we measure its effect on something else.
(indirect measurement)



> temp >motion > volume

> temp >volume

> temp > electrical resistance to current

> temp >resistance

Apr 3 - 10:19 AM

Temperature Scales

Fahrenheit - based on body temperature

(Rankine)

http://en.wikipedia.org/wiki/Fahrenheit

Celcius - based on freezing and boiling of water

http://en.wikipedia.org/wiki/Celcius

Kelvin - based on "absolute zero"

http://en.wikipedia.org/wiki/Absolute_zero

C = 5/9(F - 32) or (F - 32) /1.8
F = 9/5C + 32 or (C x 1.8) + 32
K = C + 273

180

100 x1.8

(C x1.8) 180 + 32

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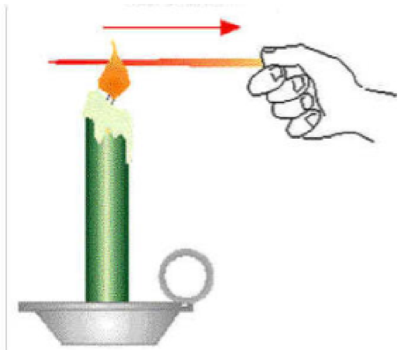
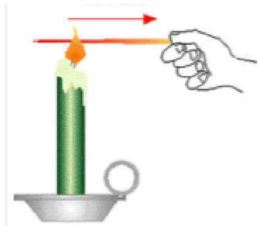
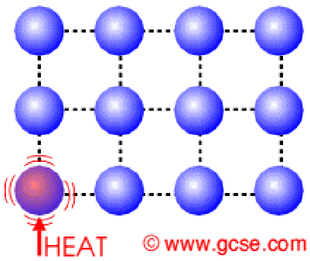
Thermal Energy Transfer



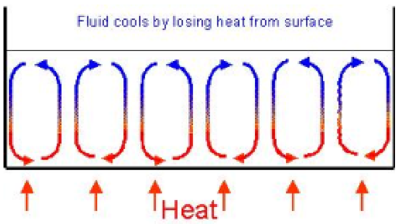
Mar 19-5:59 AM



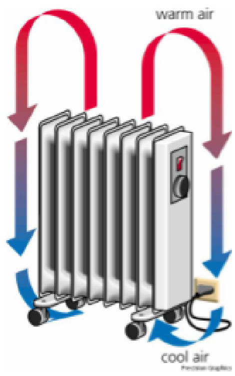


If you put a metal bar into a candle (or bunsen) flame, it gets hot quickly. Soon you can't hold it. If you put a glass bar into a candle, it won't get too hot to hold. But if you touched the end that was in the flame, you would find that it was really hot!
The process in which heat passes through a solid substance is called **conduction** . Metals are **good conductors** of heat. Non-metals are generally **bad conductors** of heat. Liquids and gases are bad conductors of heat as well. A bad conductor of heat is called an **insulator** . Your duvet traps air which is a good insulator. Conduction works like this:

Mar 19-6:23 AM



Convection cell
Warm, low density fluid rises
Cool, high density fluid sinks



Convection

Convection occurs only in **liquids** and **gases** . We call liquids and gases **fluids** . It cannot happen in solids. It needs particles to be free to move about. When a liquid is heated, the molecules at the bottom move about with bigger vibrations. They take up more space which means that the **density** goes down. The less dense fluid rises. It gives its energy to the fluid above, and cools down. It becomes denser and falls back to the bottom.
A convection current is set up.

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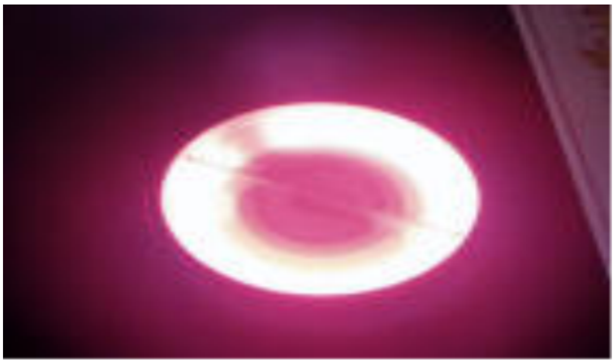

<u>Radiation</u>

Radiation passes heat on as an **electromagnetic wave** called i**nfra-red radiation** . All the heat from the Sun reaches us as electromagnetic radiation. Our eyes cannot see infra red, but a digital camera can. Here is a picture of a hot plate that appears much brighter than it actually is because of the infra red radiation.

Mar 19-6:31 AM

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$E = W = Fd$

$KE = \frac{1}{2}mv^2$

$PE \ mgh$

Q

Mar 17-11:13 AM

Specific Heat

$Q = mc\,\Delta t$

specific heat — thermal property

TE — kg — 1°C

specific heat → $c = \frac{Q}{mt} = \frac{J}{kg\,C}$

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$PE = mgh = kg\,m/s^2 \cdot m$ (J)

$TE \rightarrow Q = mc\Delta t$ — C or K

specific heat — thermal property of a substance

$Q = mc\Delta t$

$c = \frac{Q}{m\Delta t} = \frac{J}{kg\,C}$

copper 385 J/kg·C

H_2O 4180 J/kg·C

metal 450 J/kg·C

lead 135 J/kg C

ice 2060 J/kg·C

steam 2020 J/kg·C

Mar 17-1:12 PM

how much TE does it take to raise 100g of iron from 17°C to 100°C?

$$Q = mc\Delta t$$

$$Q = mc(t_f - t_i)$$

$$Q = .100\,kg\,(450\,J/kg\,°C)(100°C - 17°C)$$

$$Q = 3700\,J$$

Mar 17-1:21 PM

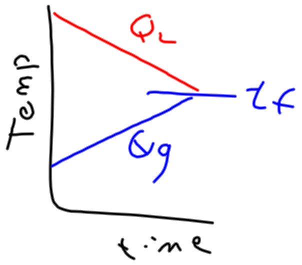
Law of Heat Exchange

$$Q_L + Q_g = 0$$

lost gained

100g of metal at 100°C

100g H_2O 60°C



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