

Chapter 6 Energy & Changes in Matter

6-1

Potential Energy is stored energy due to the interaction between objects or particles.

- objects that can fall due to gravity.
- particles that can move because of electric or magnetic forces

Objects have gravitational potential energy if they have mass and height above Earth's surface.

$$\begin{aligned} PE_{\text{grav}} &= \text{mass} \times g \times \text{height} \\ &= \text{mass} \times 9.8 \text{ m/s}^2 \times \text{height} \end{aligned}$$

Chemical Energy is the energy stored in and released from bonds between atoms.

- our bodies convert food to energy by breaking chemical bonds

Nuclear energy is the energy stored in and released from the nucleus of an atom.

- nuclear fusion is the joining of nuclei
- nuclear fission is the breaking apart of nuclei

Kinetic Energy is energy due to motion.

$KE = \frac{1}{2} \cdot m \cdot v^2$ Looking at the formula you can see that mass and velocity (speed) play into kinetic energy, with velocity having the greater effect.

ORIGINAL: $KE = \frac{1}{2} m \cdot v^2$
 $= \frac{1}{2} \cdot 10 \text{ kg} \cdot 2^2 \text{ m/s}$
 $= 20 \text{ Joules}$

Half

	Mass
$KE = \frac{1}{2} m \cdot v^2$	
$= \frac{1}{2} \cdot 5 \cdot 2^2$	
$= 10 \text{ J}$	

	Velocity
$KE = \frac{1}{2} m \cdot v^2$	
$= \frac{1}{2} \cdot 10 \cdot 1^2$	
$= 5 \text{ J}$	

Double

$KE = \frac{1}{2} m \cdot v^2$
$= \frac{1}{2} \cdot 20 \cdot 2^2$
$= 40 \text{ J}$

$KE = \frac{1}{2} m \cdot v^2$
$= \frac{1}{2} \cdot 10 \cdot 4^2$
$= 80 \text{ J}$

ELECTRONS ARE MOVING !!!

Electrical Energy is the energy in an electric current.

Mechanical Energy is the sum of potential and kinetic energy in a system.

Mechanical energy involves motion!

Thermal Energy is the sum of the kinetic and potential energy of the PARTICLES that make up the object.

A wave is a disturbance that transfers energy from one place to another without transferring matter.

Sound energy is the energy carried by sound waves.

Radiant energy is the energy carried by electromagnetic waves:

Radio waves

Microwaves

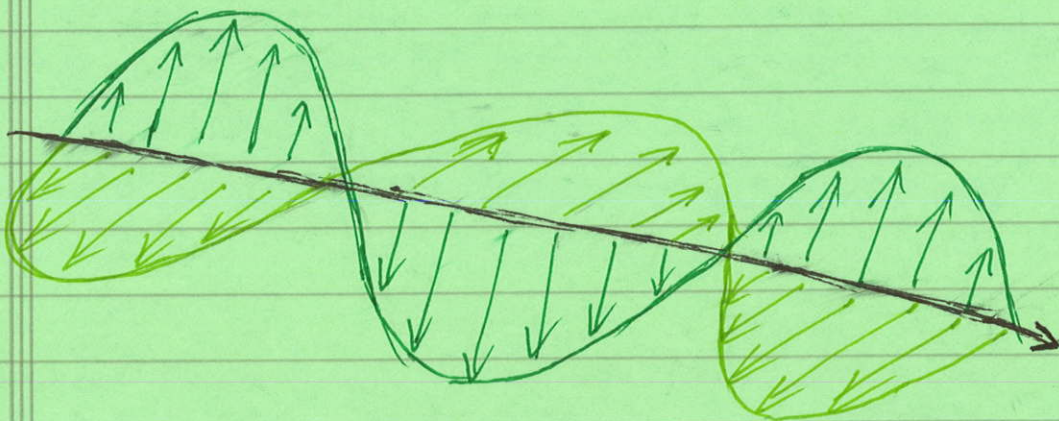
Infrared waves

Light waves

Ultraviolet waves

X-rays

Gamma rays



9-2 Matter and Energy

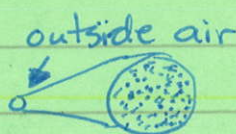
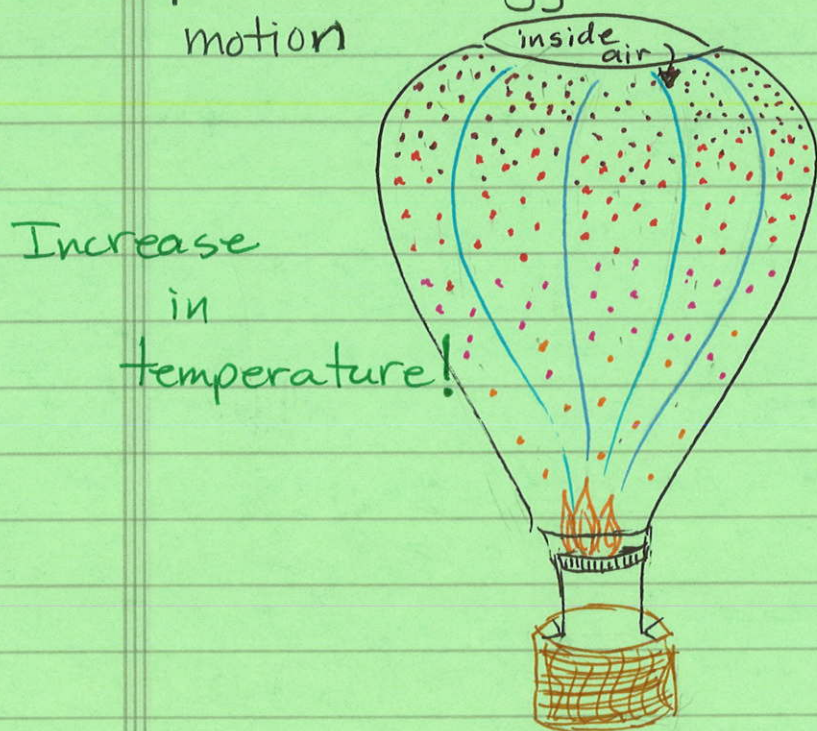
Random motion - movement in all directions
and at different speeds

States of Matter

Solid	Liquid	Gas
Definite volume	Definite volume	Indefinite volume
Definite shape	Indefinite shape	Indefinite shape
Cannot be compressed	Difficult to compress	Easy to compress

Temperature is the measure of the average kinetic energy of the particles in an object.

Thermal energy is the sum of the kinetic and potential energy in matter due to their random motion



As the air inside of the balloon heats up both the average speed of air particles and the average kinetic energy of the particles increases.

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~~Thermal~~ Thermal Energy

Heat - Thermal energy moving from a region of higher temperature to a region of lower temperature.

Objects contain thermal energy.
Heat is the transfer of thermal energy!

Thermal Equilibrium - when 2 objects in contact with each other are at the same temperature.

Conduction - the transfer of thermal energy due to collisions between particles in matter. (contact)

thermal conductor - materials where thermal heat moves quickly (ie: metals)



thermal insulator - materials where thermal energy moves slowly (ie: gases)

Convection - the transfer of thermal energy by the movement of particles from one part of a material to another

This happens in liquids and gases!



This is why warm air
and warm water currents
form.

weather patterns
ocean currents
heat pumps

The hotter water near
the "eye" expands because
it is less dense. So, it
rises. The more dense water
sinks.

Radiation - the transfer of thermal energy
from one object to another by electromagnetic
waves ... Radiation does NOT require matter!

All objects give off electromagnetic waves.
If the temperature is high enough, an object
gives off visible light.

Electromagnetic waves carry thermal energy.