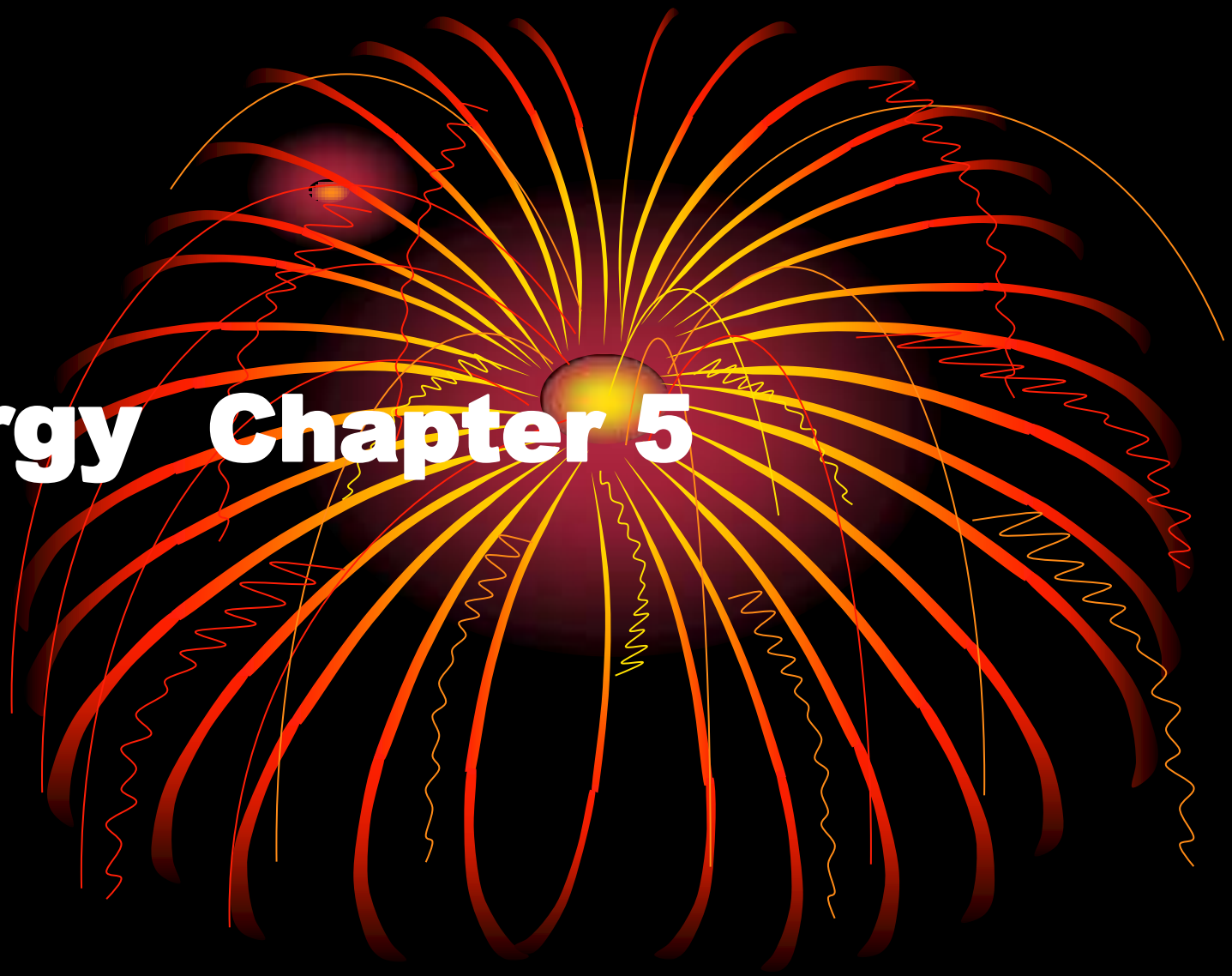
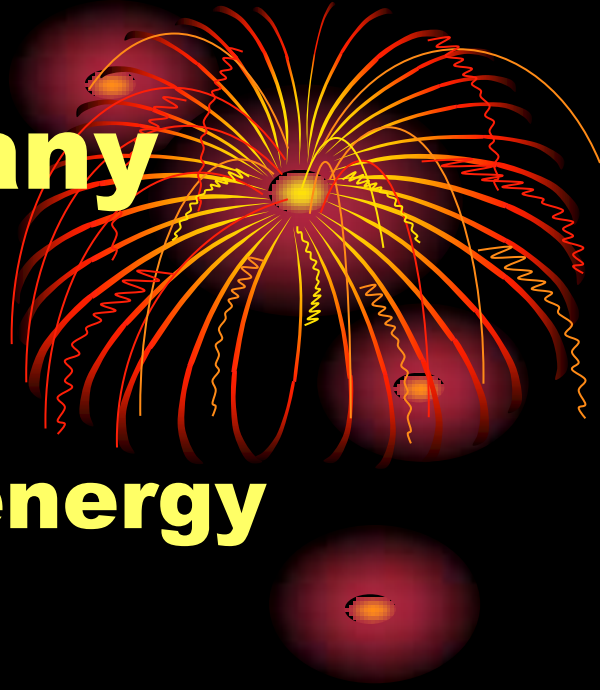
Energy Chapter 5



The seven types of energy…

- Chemical - gasoline,
- Light – flash light,
- Heat – burner on a stove,
- Nuclear - sun,
- Mechanical - car,
- Sound – music on the radio,
- Electrical - lightning

Energy comes in many different forms



- Kinetic Energy
- Gravitational potential energy
- Thermal Energy (heat)
- Nuclear Energy (nuclear power, atomic bomb)
- Electrical Energy (electricity)
- Chemical Energy (food, fire, …)

Energy

- **Ability to do work and cause motion (The ability to cause change)***
  - **Kinetic* – energy in the form of motion**
    Kinetic energy is a product of its mass and velocity squared
    $E=1/2m \times v^2$
  - **Potential* – is stored energy**

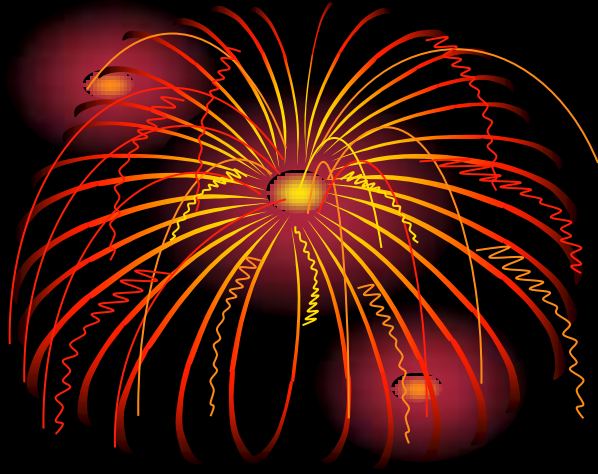
The Law of Conservation of Energy

- **Energy can be neither created nor destroyed by ordinary means.**
  - **It can only be converted from one form to another.**
  - **If energy seems to disappear, then scientists look for it – leading to many important discoveries.**

Work*

- transfer of energy through motion
- For work to take place there has to be a force applied over a distance
  - Work = Force X Distance (FxD=W)*
  - Work is measured in joules
  - Newton X Meter = Joule

Potential Energy



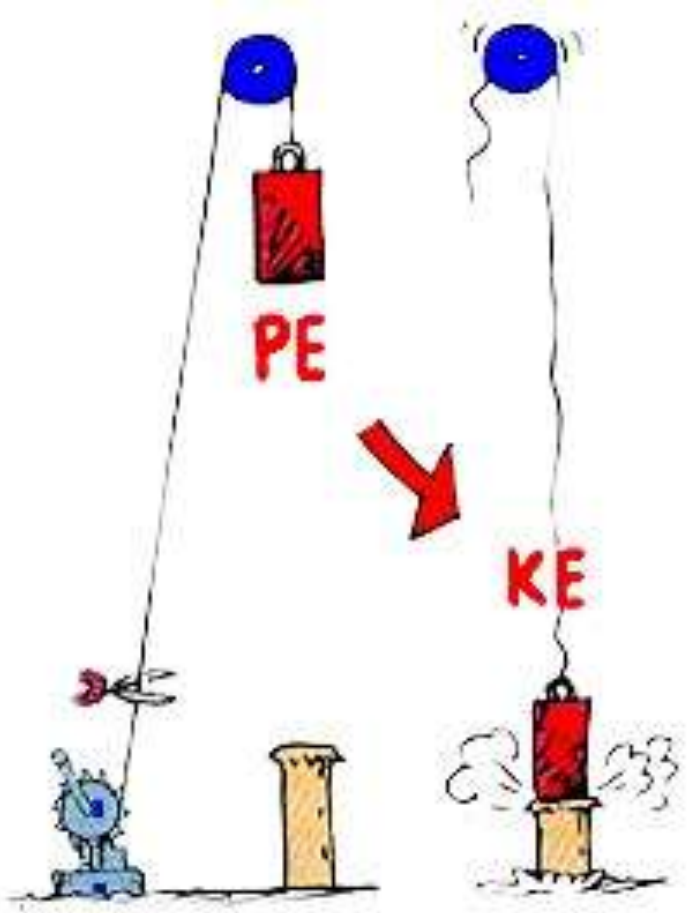
Gravitational Potential Energy is energy due to an objects height above the ground

m = mass

g = acceleration due to gravity

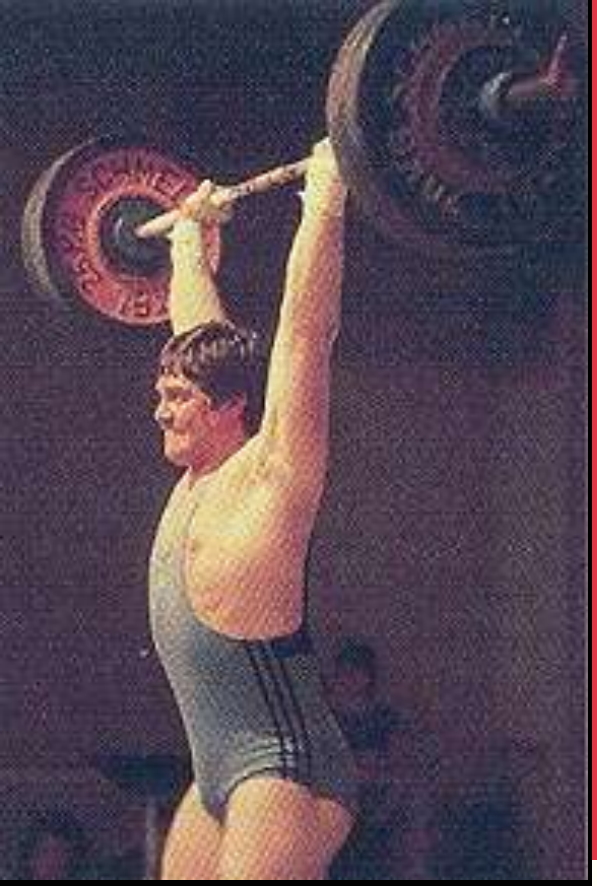
h = height

http://gaaf.com/pictures/200406_utah/image009.htm



The work done in lifting the mass gave the mass gravitational potential energy.

Potential energy then becomes kinetic energy.
Kinetic energy then does work to push stake into ground.



F = 500 pounds (2000 N)

D = 8 feet (2.5 meters)

-

W = 2000 N x 2.5 m

= 5000 N-m

-

Alternative unit: *Joule*

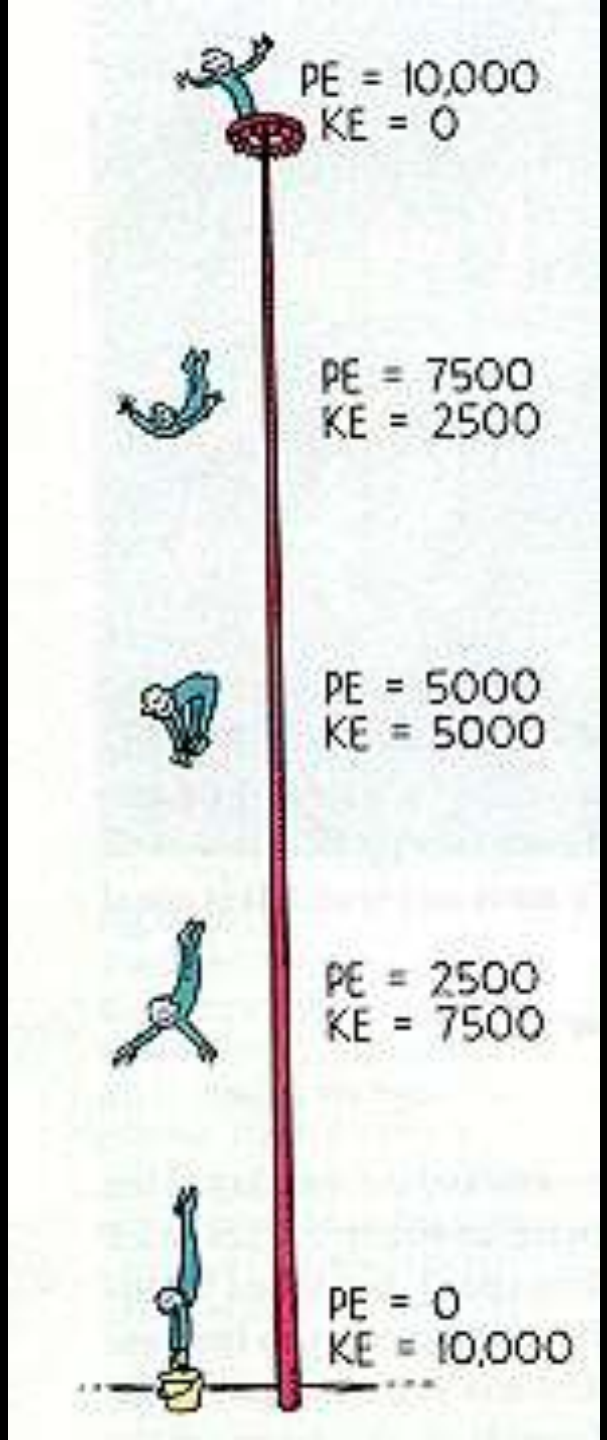
1 N-m = 1 joule (J)

Work = Force x Distance

If the wall doesn't move, the prisoner does no work.

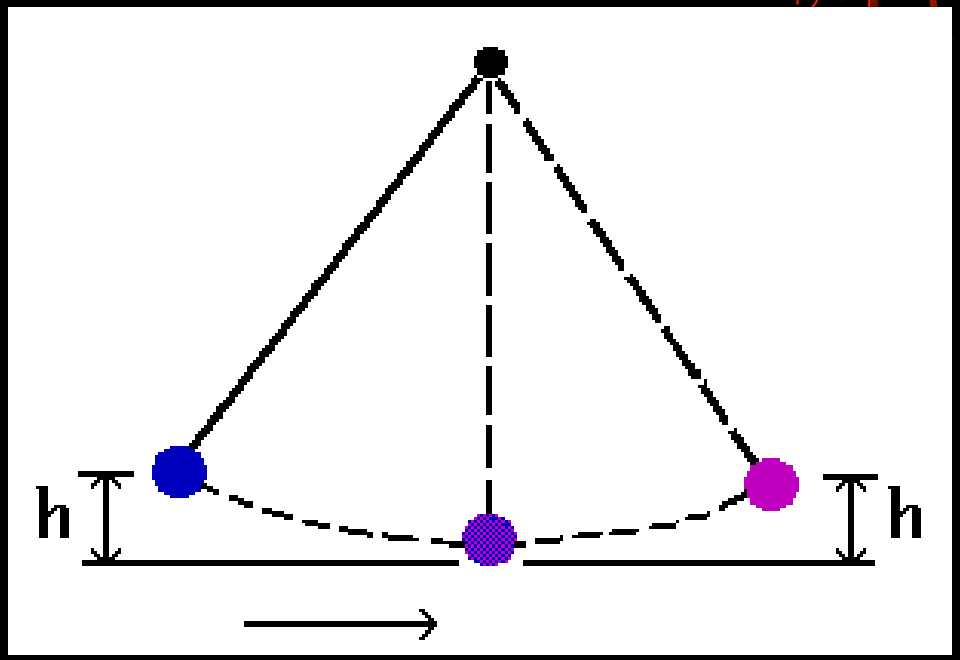
Conservation of energy

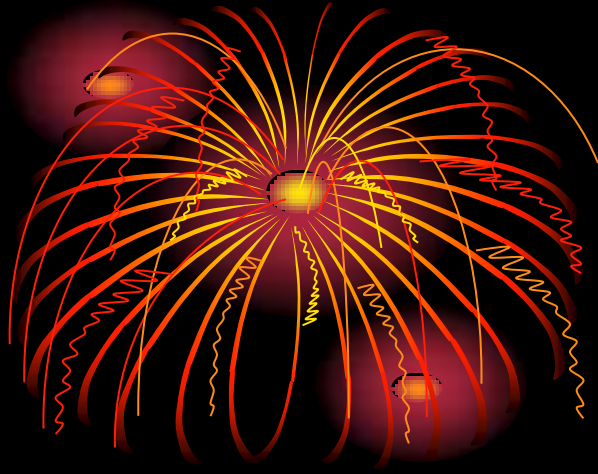
- **Mechanical energy is the total amount of kinetic and potential energy in a system***
- **Law of Conservation of Energy* – Energy may changed but is not created or destroyed**



Total energy is the sum of both types of energy.

Conservation of Energy





Human body and energy output and intake p. 130

Temperature and Heat

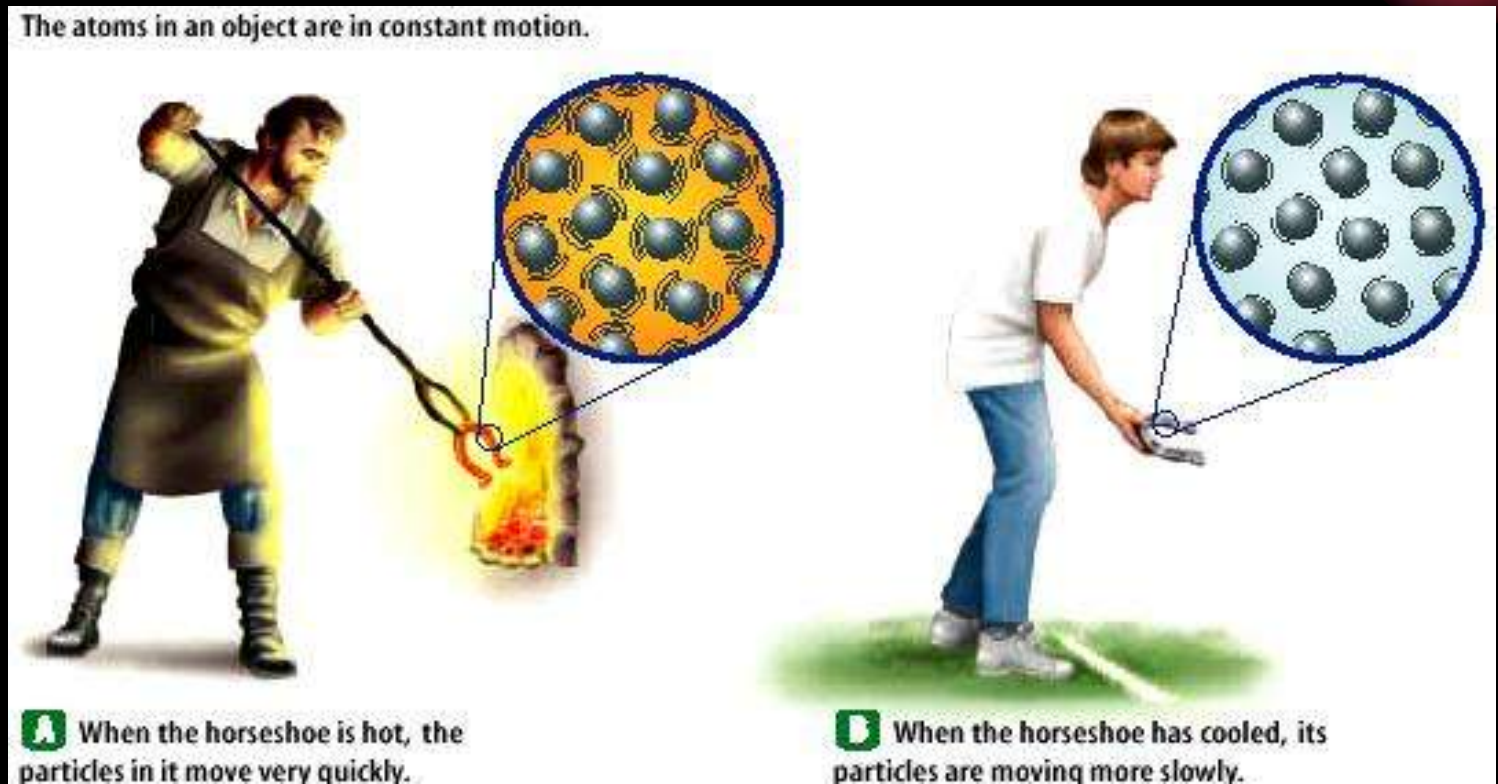
- **Matter and motion**
  - **Matter is made up of small particles and particles are in constant motion (kinetic theory of matter)***
- **Thermal energy* is the total amount of energy in an object or material**
- **Thermal energy depends on the total energy of all of the particles**
- **Heat *– is the thermal energy that flows between things of different energy**
- **Temperature *is the average kinetic energy of the particles in a volume of matter (Sample of matter)**

Know the difference between thermal energy heat and temperature

-Thermal Energy

-Temperature & Heat

*Temperature is related to the average kinetic energy of the particles in a substance.

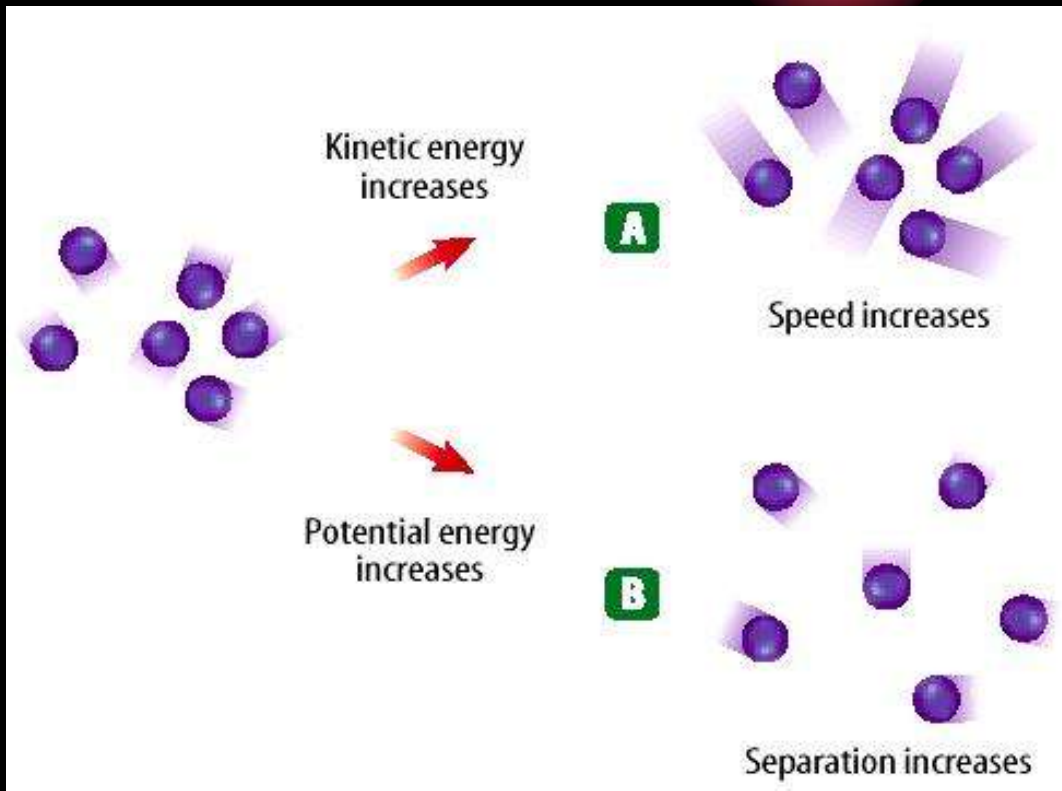


SI unit for temp. is the Kelvin

a. K = C + 273 (10C = 283K)

b. C = K – 273 (10K = -263C)

Thermal Energy – the total of all the kinetic and potential energy of all the particles in a substance.



Thermal energy relationships

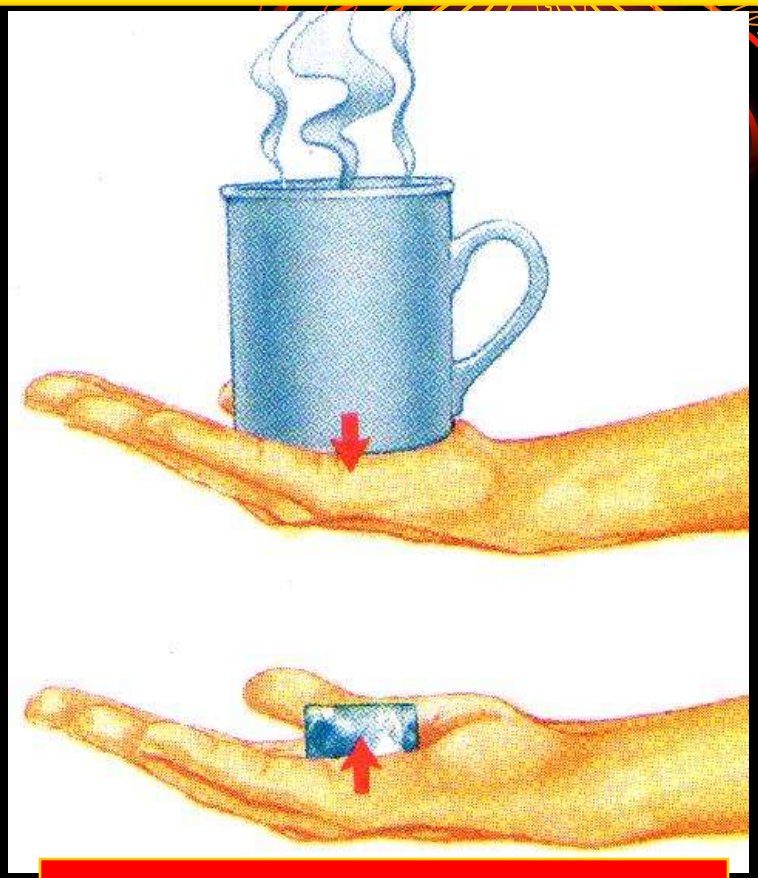
- As temperature increases, so does thermal energy (because the kinetic energy of the particles increased).
- Even if the temperature doesn't change, the thermal energy in a more massive substance is higher (because it is a total measure of energy).

5. Heat

- The *flow* of thermal energy from one object to another.

- Heat ***always*** flows from warmer to cooler objects.

Cup gets cooler while hand gets warmer



Ice gets warmer while hand gets cooler

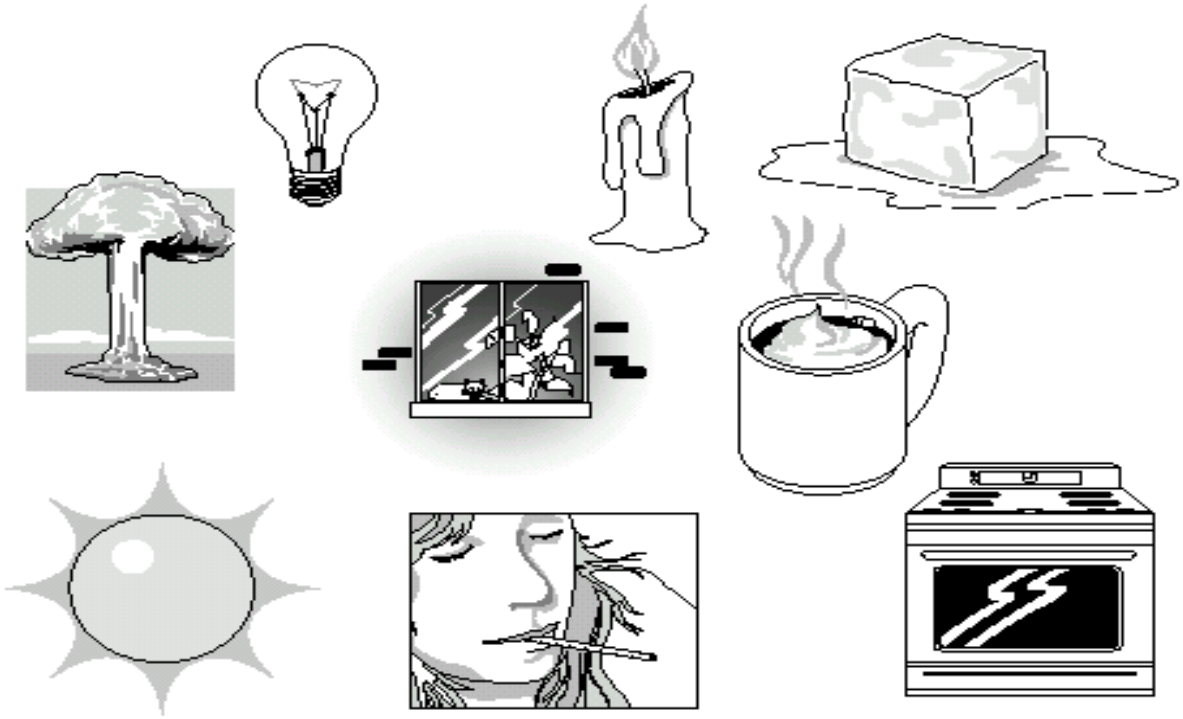
NAME _____ DATE _____ CLASS _____

SECTION FOCUS ACTIVITY **Use with Section 5-2**

Student Activity for Transparency 19

HOW HOT IS IT?

How good are you at guessing temperatures? You see many of the objects or situations below every day, but do you know how hot or cold they are?



1. Try to list the items from coldest to hottest.

_____

_____

2. Which items did you have trouble classifying?

_____

_____

Thermal pollution

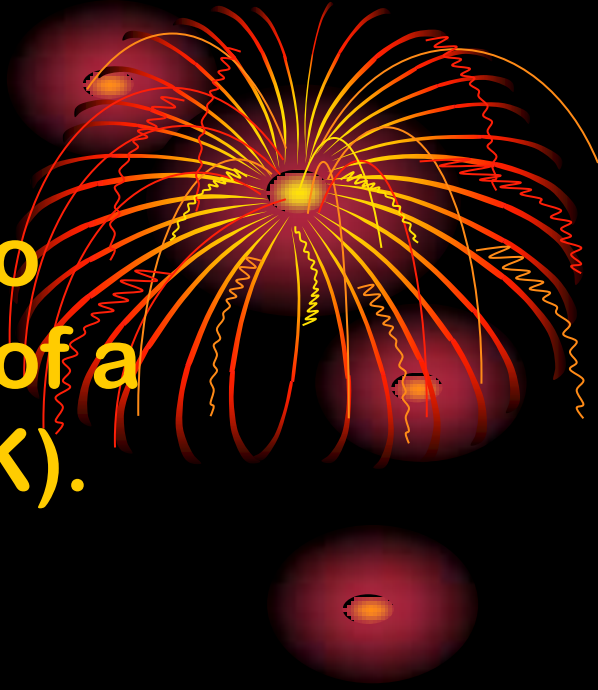
- **waste heat that changes the temperature of the environment read p. 139 & 140**

Specific Heat

- Some things heat up or cool down faster than others.

Land heats up and cools down faster than water

Specific heat



is the amount of heat required to raise the temperature of 1 kg of a material by one degree (C or K).

1) $C_{water} = 4184$ J / kg C

2) $C_{sand} = 664$ J / kg C

This is why land heats up quickly during the day and cools quickly at night and why water takes longer.

How to calculate changes in thermal energy

$$Q = m \times \triangle T \times C_p$$

Q = change in thermal energy

m = mass of substance

$\triangle$**T** = change in temperature ($T_f - T_i$)

C_p = specific heat of substance

A calorimeter is used to help measure the specific heat of a substance.

Knowing its Q value, its mass, and its $\triangle T$, its C_p can be calculated

- **(Do sample problem p. 143)**

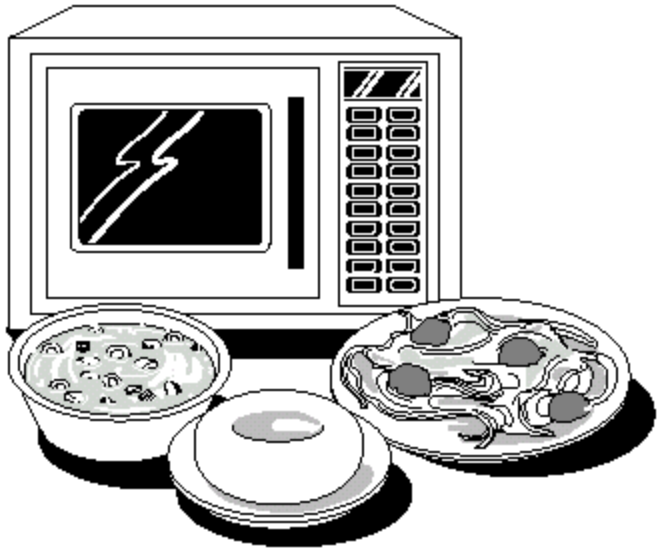
NAME _____ DATE _____ CLASS _____

SECTION FOCUS ACTIVITY **Use with Section 5-4**

Student Activity for Transparency 21

WHY WON'T THIS HEAT FASTER?

Why does it take longer to heat one food than another? A bagel takes only a few seconds to warm up, a bowl of soup a few minutes.



1. List some foods that heat up quickly in a microwave.

_____

_____

2. List some foods that heat up slowly in a microwave.

_____

_____

3. Based on your answers to questions 1 and 2, express a hypothesis that accounts for the observation that some foods heat up faster in a microwave oven than others.

_____

_____

Insulator and conductors

- Insulators *don’t allow heat to transfer easily
- Conductors *allow thermal energy to flow easily