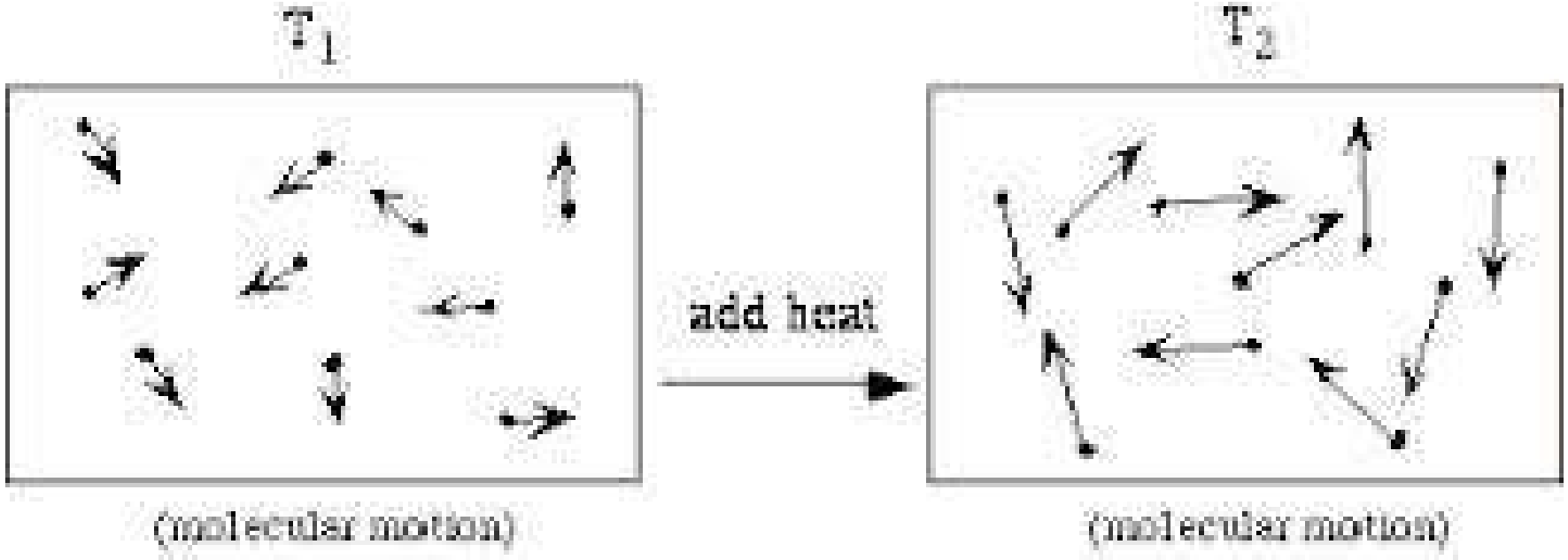
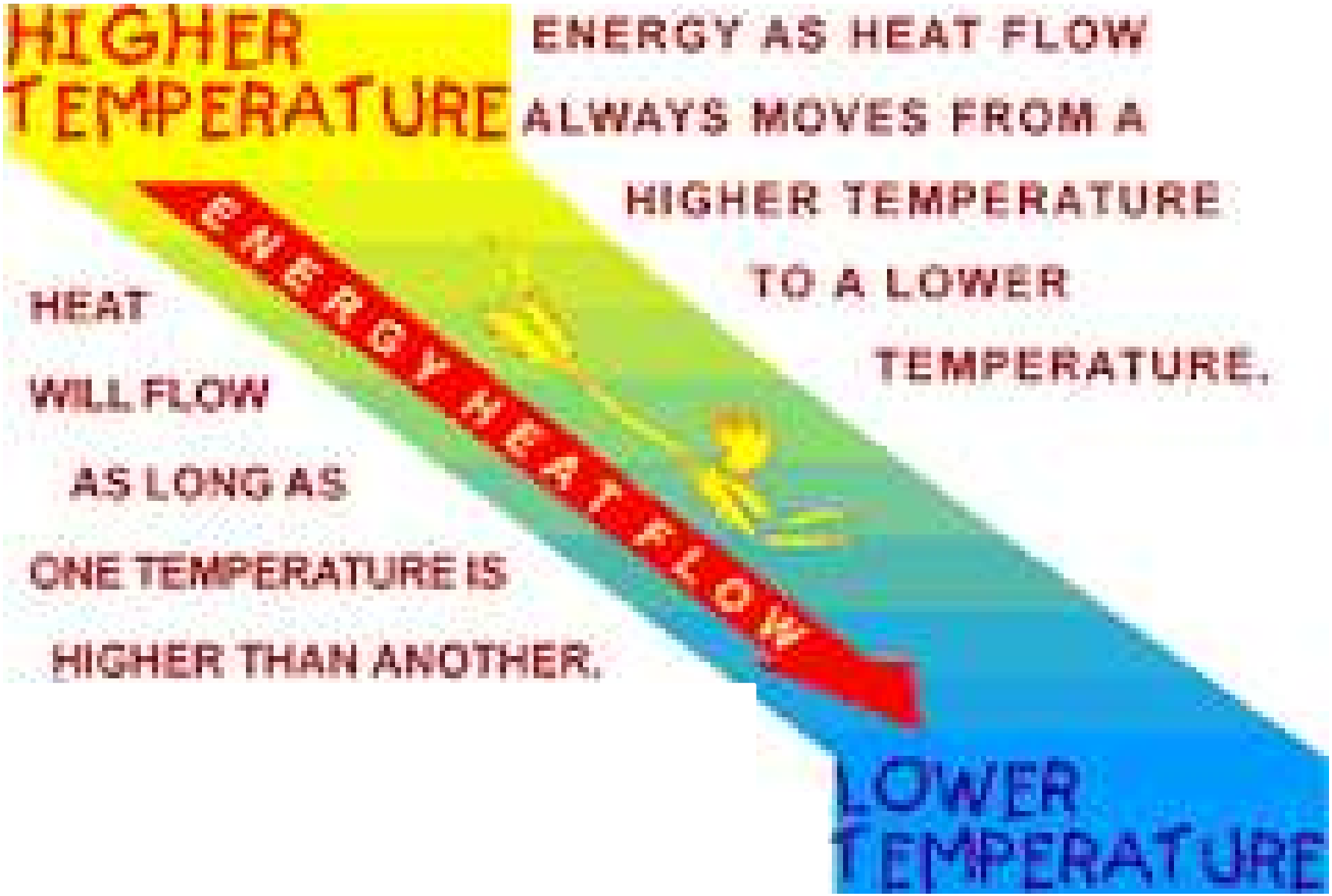
Heat Energy

Mr. Skirbst

What is heat?

Heat - the ***energy*** involved in the ***internal motion*** of particles



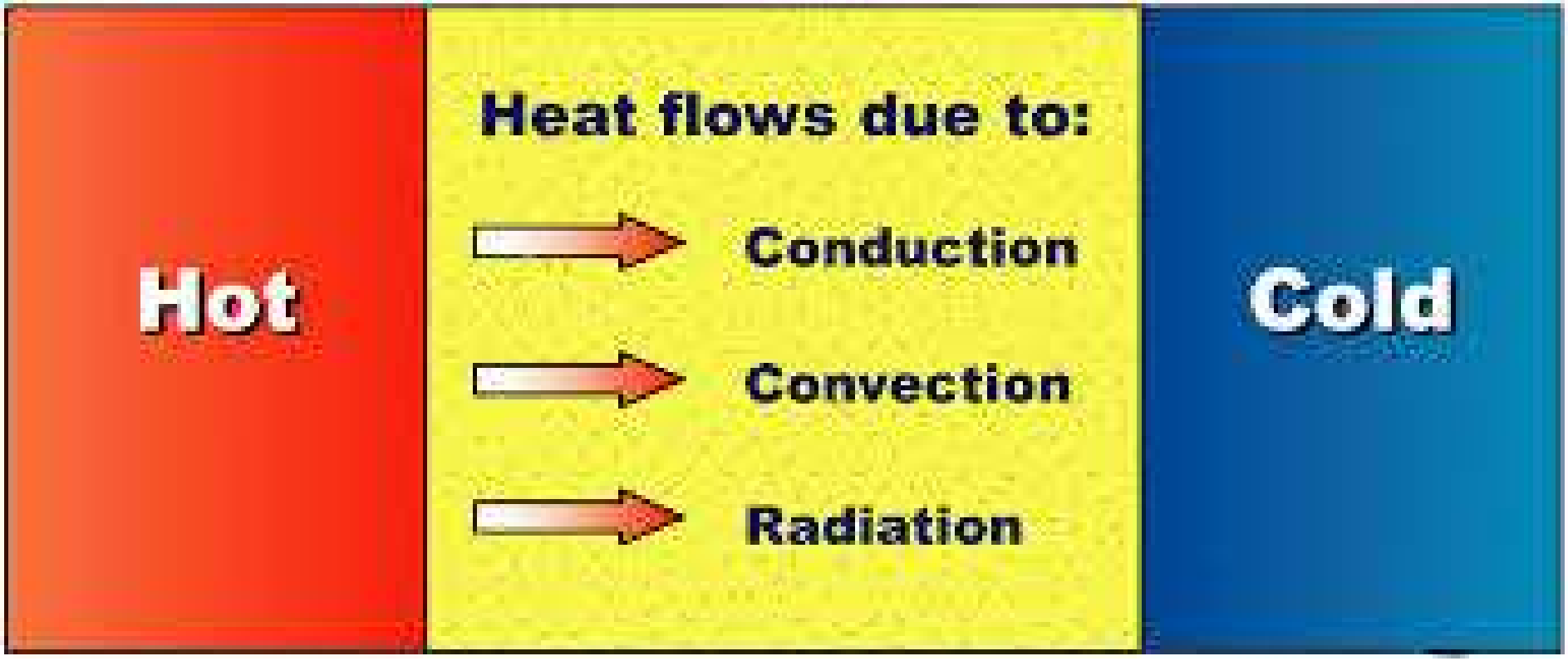

HIGHER TEMPERATURE
ENERGY AS HEAT FLOW ALWAYS MOVES FROM A HIGHER TEMPERATURE TO A LOWER TEMPERATURE.
HEAT WILL FLOW AS LONG AS ONE TEMPERATURE IS HIGHER THAN ANOTHER.
ENERGY HEAT FLOW
LOWER TEMPERATURE

Movement - from

high *energy (hot)*

to ***low*** *energy (cold)*

3 Types of Heat Transfer



1. Conduction

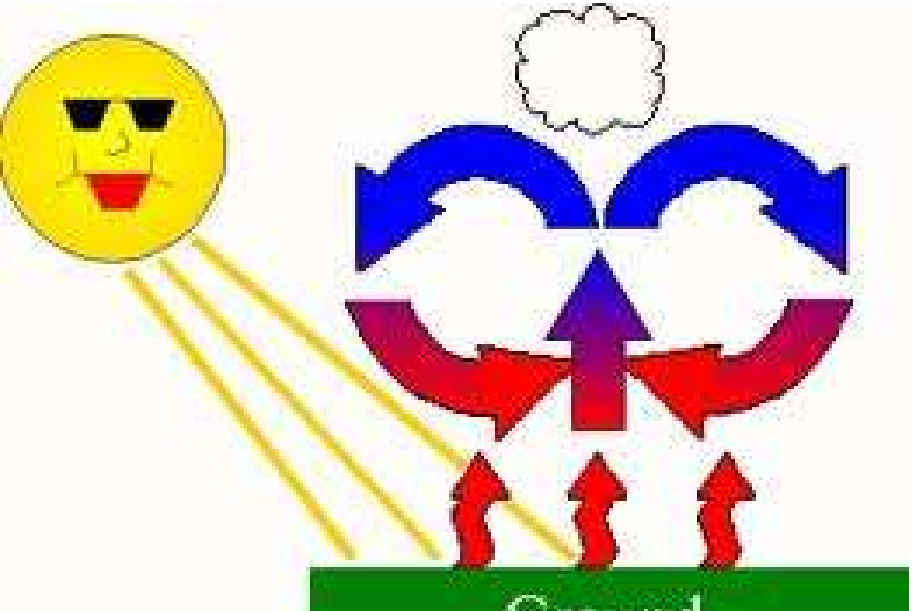
- transfer through direct *contact*
- (ex. hand on window, or pot)

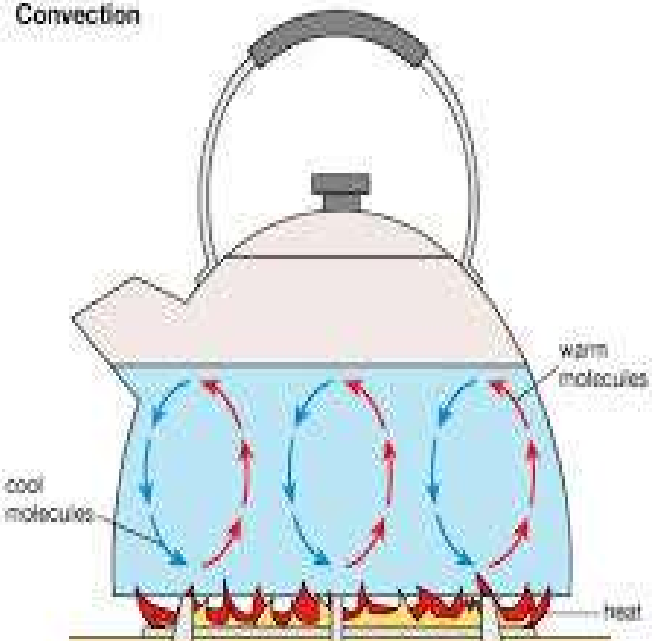
- **Conductor** – *does* transfer heat well
- (ex. metal)

- **Insulator** – does *not* transfer heat well
- (ex. styrofoam)

2. Convection

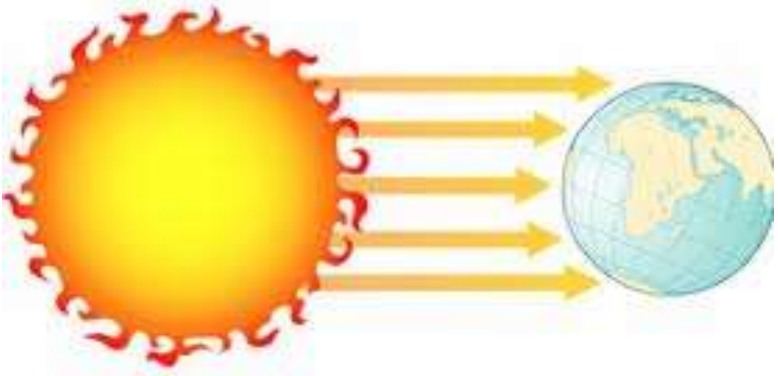
- transfer through a *liquid or gas*
- (ex. boiling water or atmosphere)

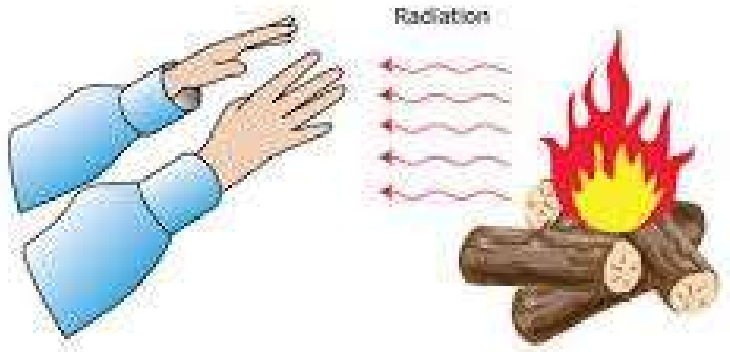




3. Radiation

- transfer through *empty space (vacuum)*
- (ex. energy from sun, infrared rays from a fire)

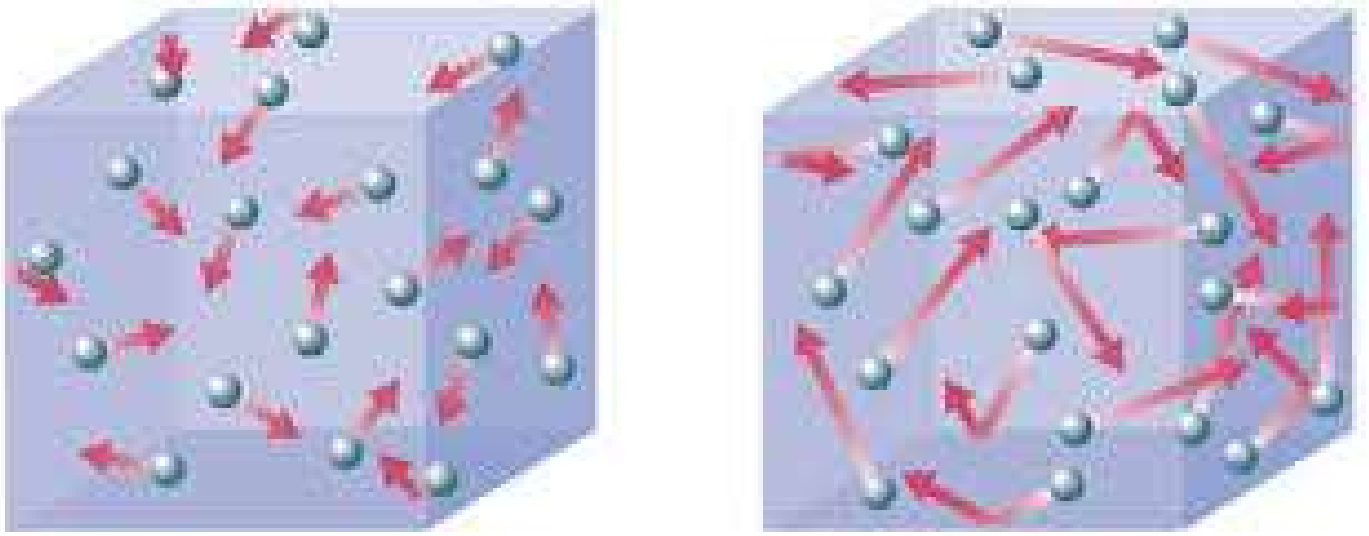




How is Heat Measured?

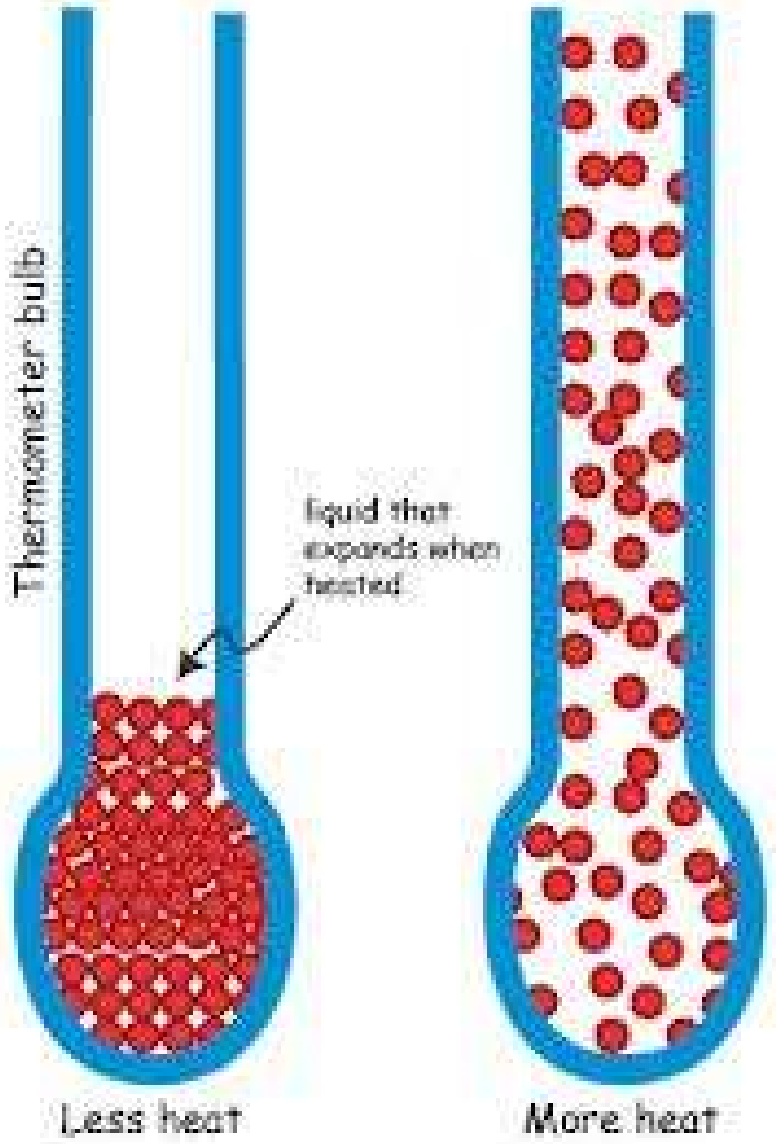
Temperature

- measures the *average kinetic energy* (energy of motion) of molecules

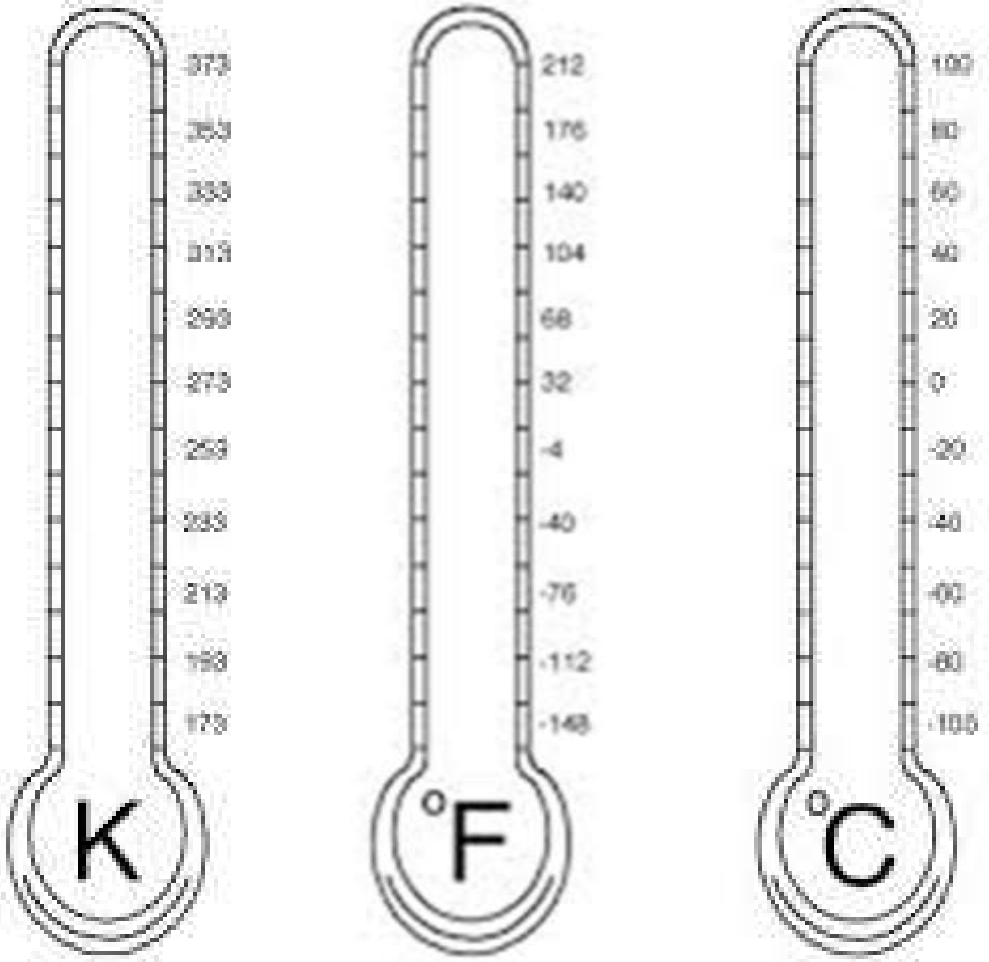


Longer arrows mean higher average speed.

Thermometer – instrument used to measure *temperature*

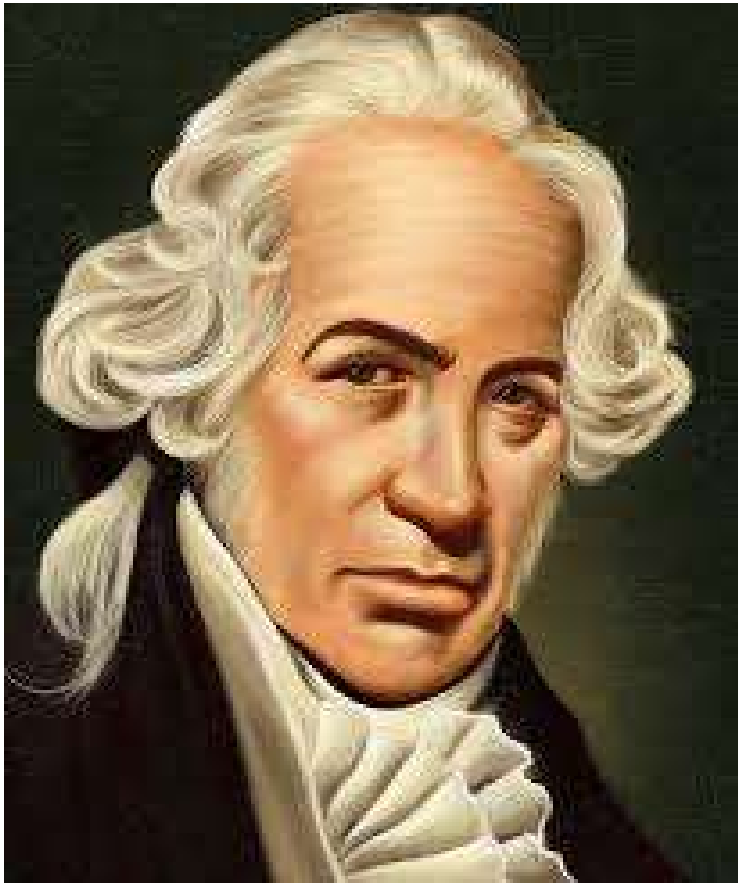


3 Temperature Scales



1. Fahrenheit

- based on an ice/salt mixture and body temperature



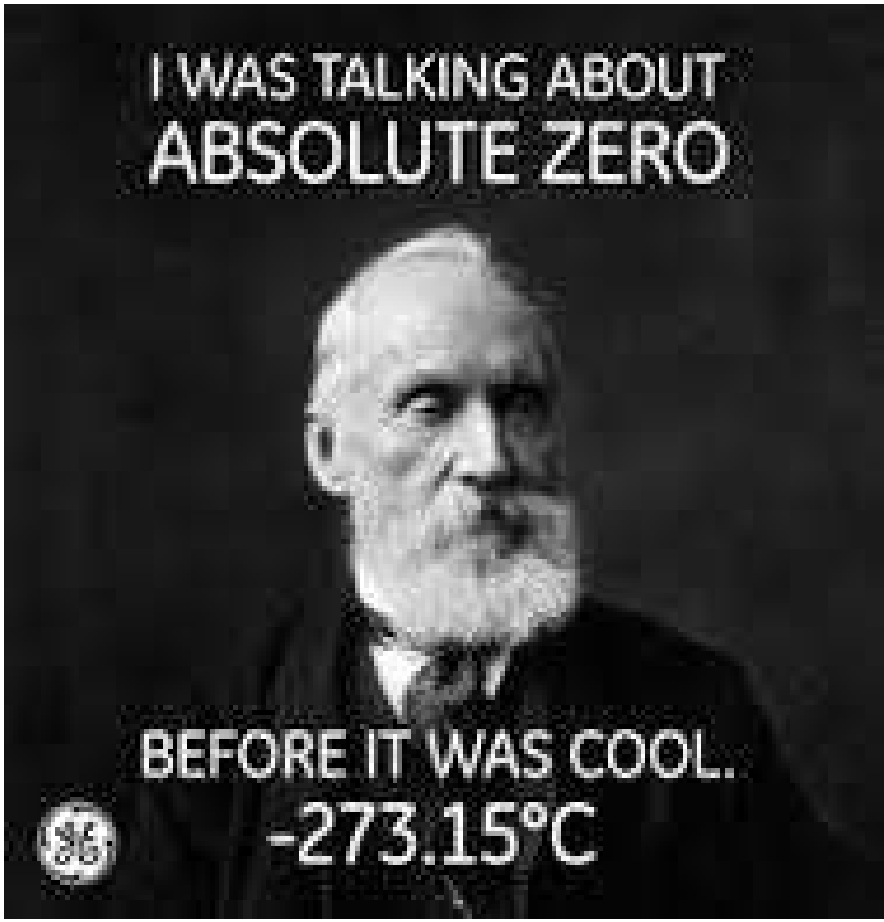
2. Celsius

- based on freezing and boiling points of water

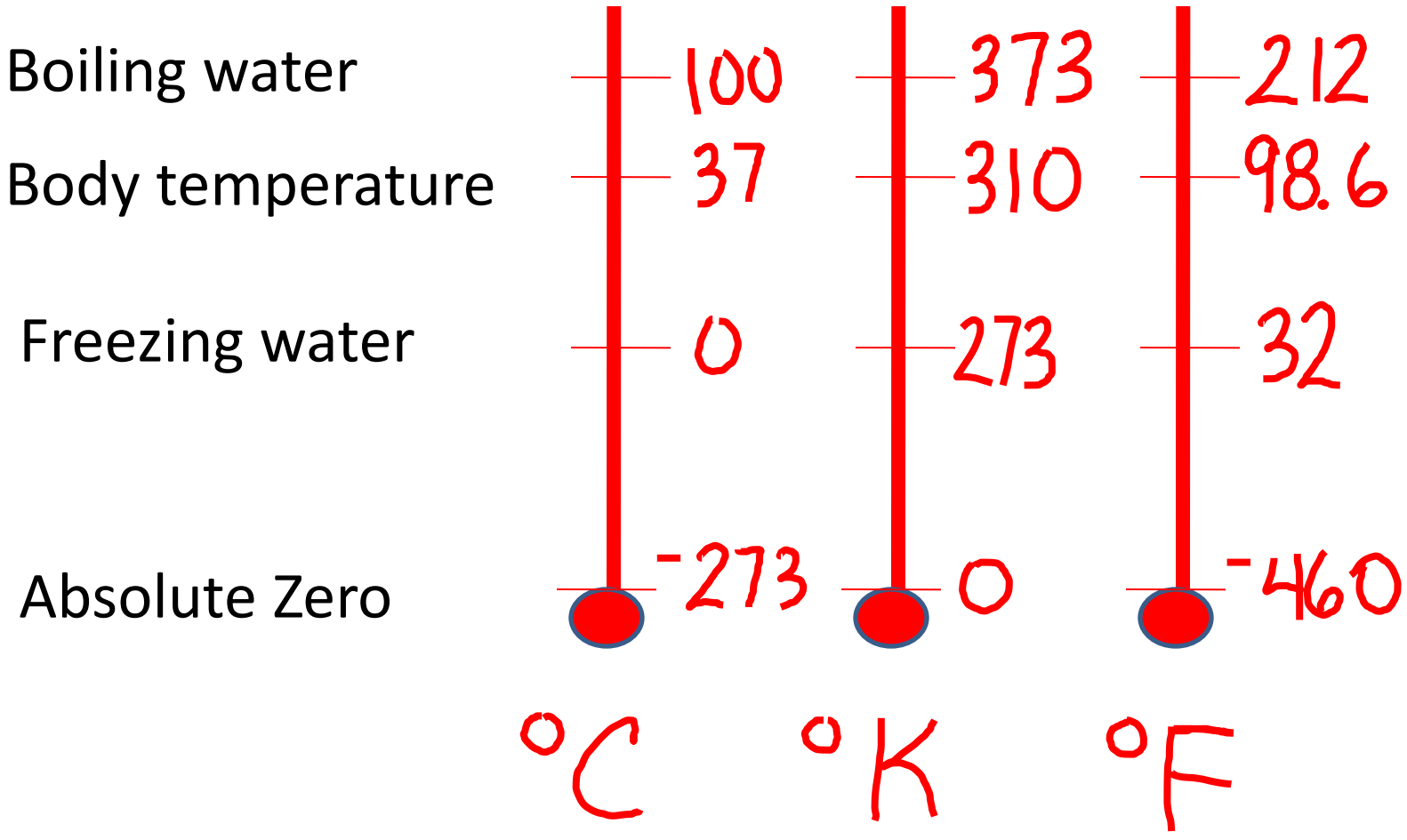
Anders Celsius
(1701-1744)

3. Kelvin

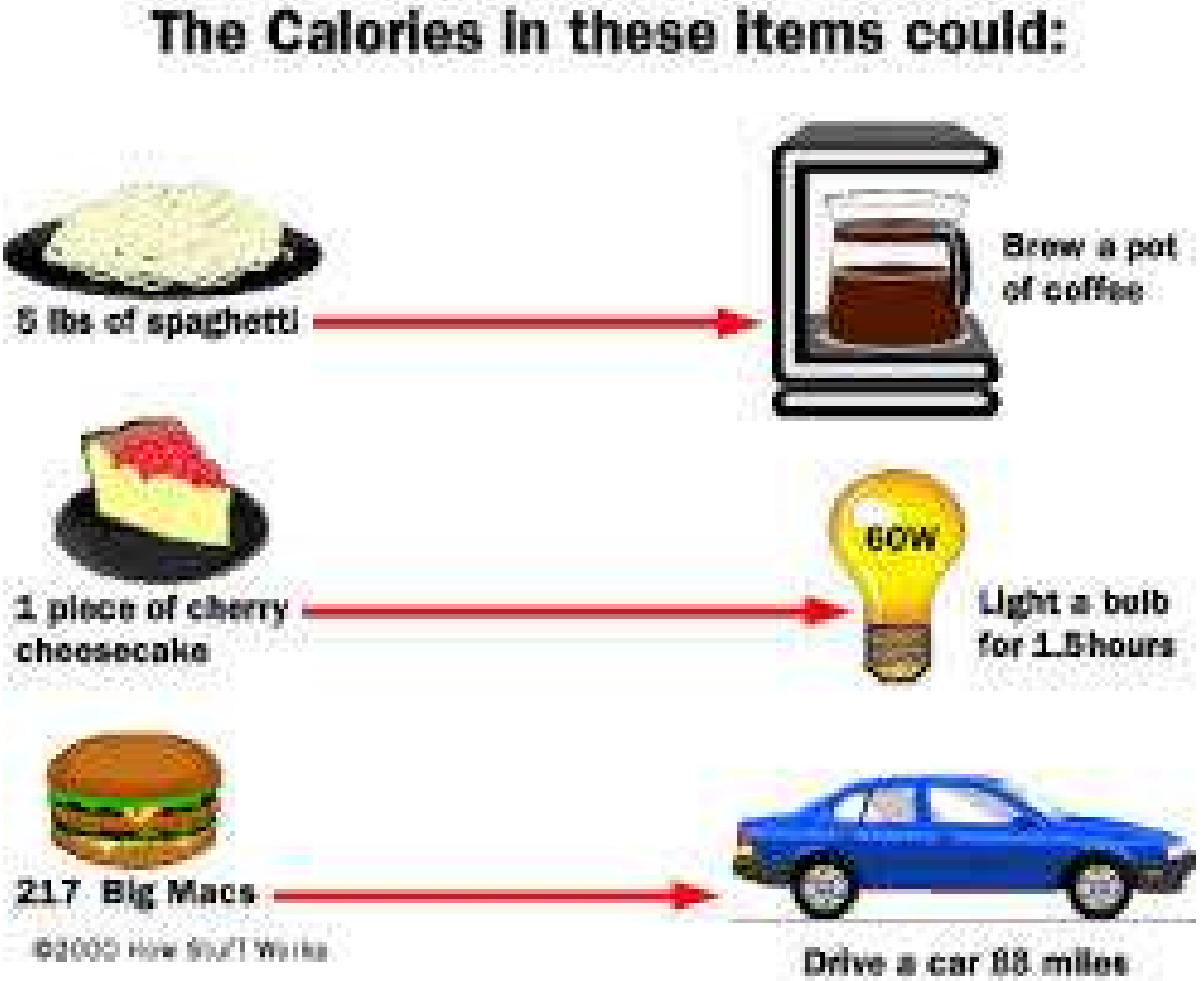
- based on absolute zero (point at which all molecular motion stops)



Comparisons:



What is the unit of heat?



calorie – unit of heat

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- the heat energy needed to raise the temp of *1 gram of water 1 degree Celsius*

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- *ex. 5 calories needed to raise temp of 1 g 5^{o}C*

Specific Heat

Specific heat

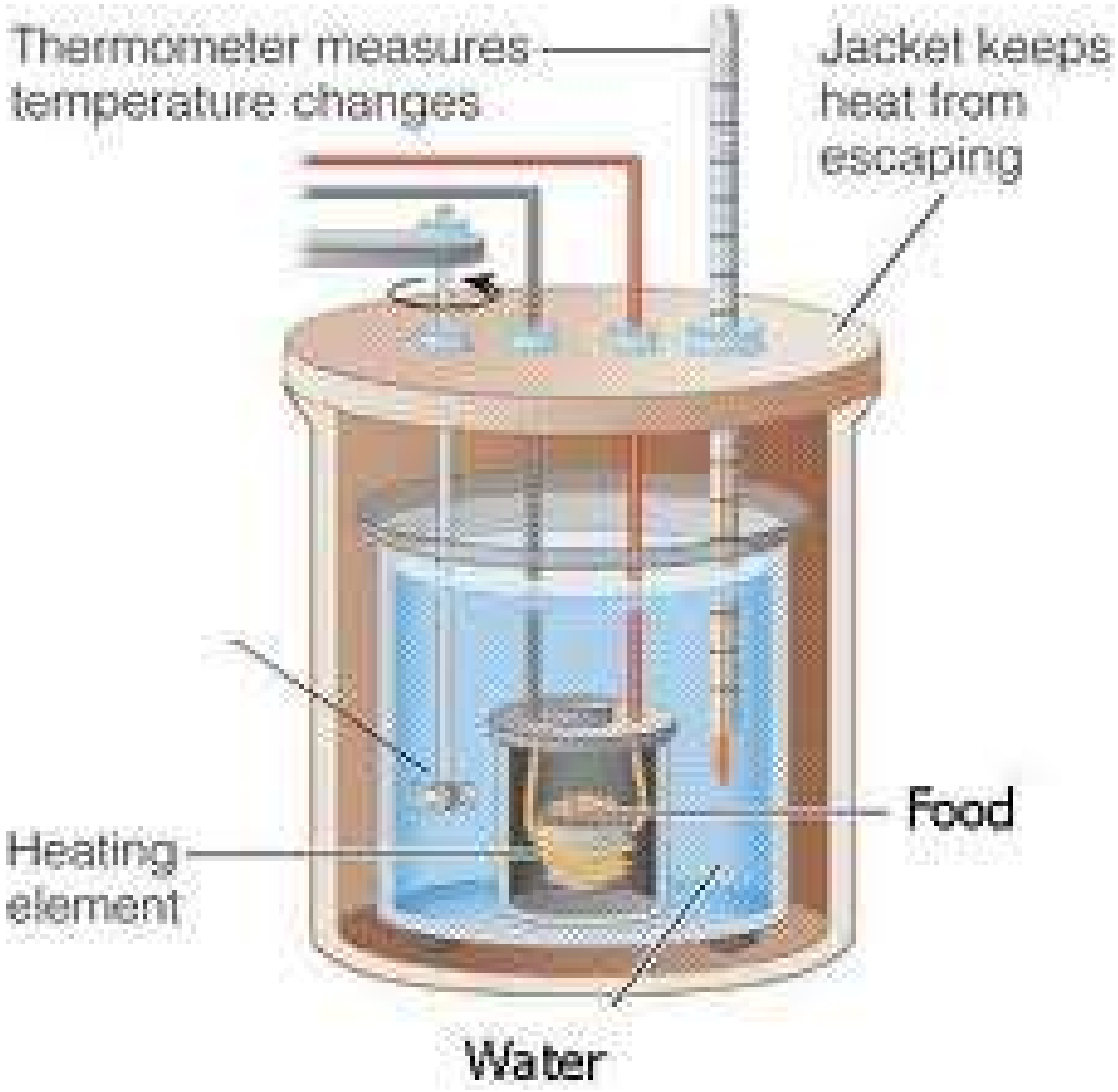
- ability of a substance to *absorb heat energy*

- number of *calories* needed to raise the temp of 1 gram of water 1 degree Celsius

Specific heat of WATER =

1.00 cal/g°C

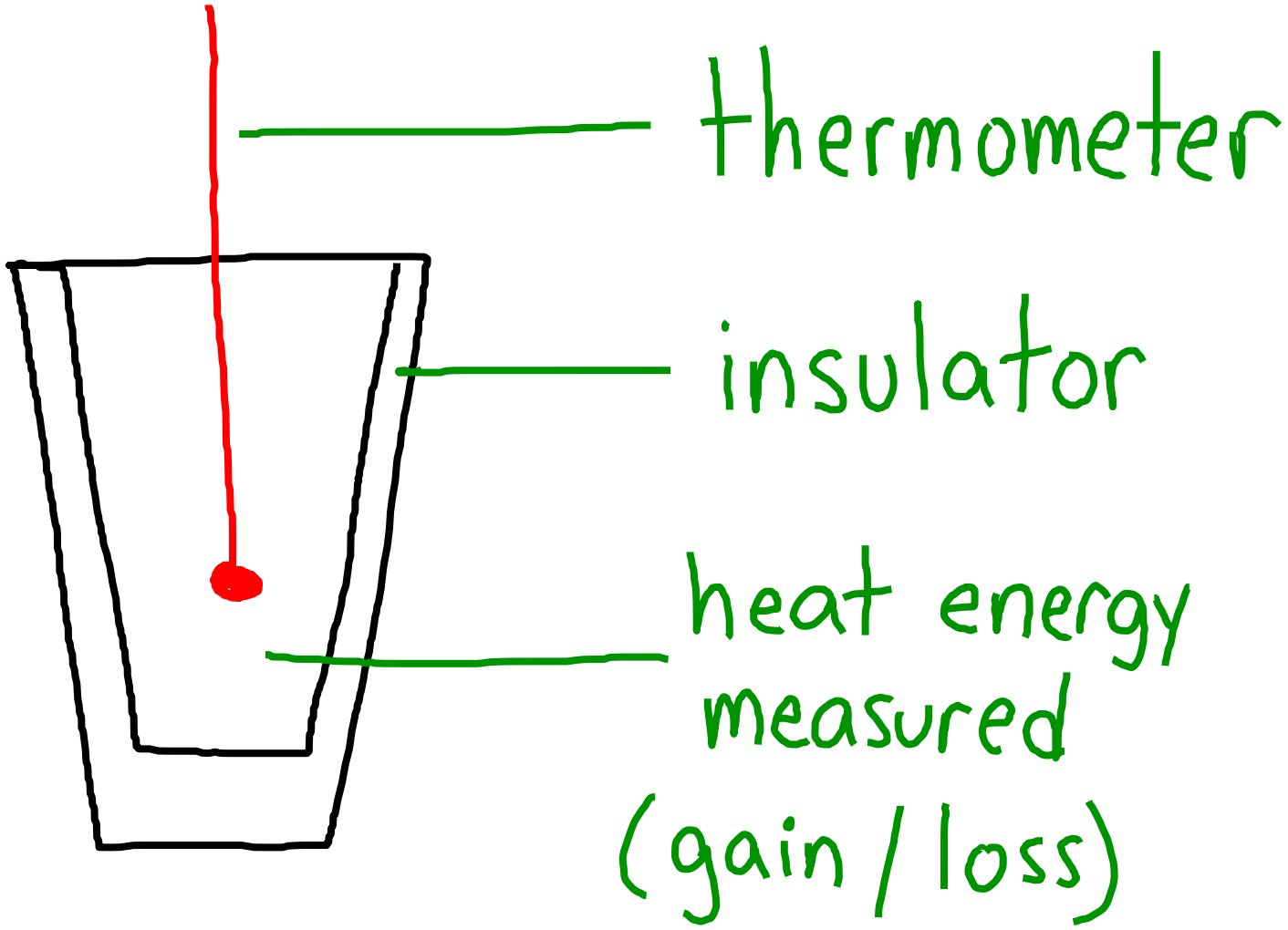
Calculating heat energy



Calculating heat energy

Calorimeter - device used to measure *heat gain / loss*

Calorimeter



Heat Equation

$$\text{Heat} = \text{mass} \times \Delta T \times \text{sp.ht.}$$

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$$\text{HEAT} = \text{mass} \times \Delta T \times \text{sp.ht.}$$

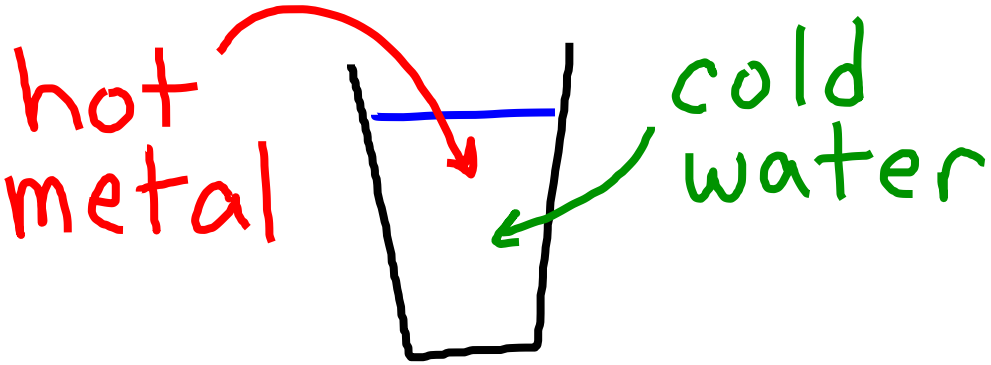
(cal.)
(gain/loss)

(g)

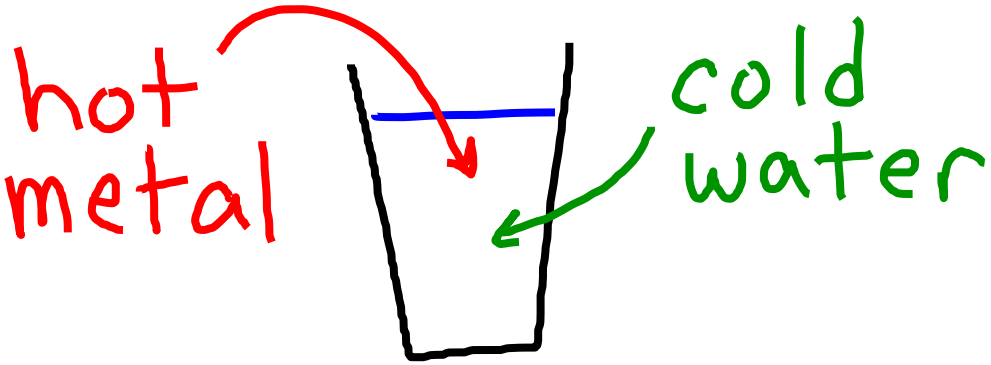
(°C)

(cal./g°C)

Lab Activity



Lab Activity



Metal (heat loss) = Water (heat gain)

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$$M_m \times \Delta T_m \times spht_m = M_w \times \Delta T_w \times spht_w$$

$$\frac{m_m \times \Delta T_m \times spht_m}{m_m \times \Delta T_m} = \frac{m_w \times \Delta T_w \times spht_w}{m_m \times \Delta T_m}$$

$$sp.ht_m = \frac{m_w \cdot \Delta T_w \cdot sh_w}{m_m \cdot \Delta T_m}$$

Water:

Mass (g): _____
Initial temp. (°C): _____
Final temp. (°C): _____
Change in temp. (°C): _____
Sp. Ht.: _____

Metal:

Mass (g): _____
Initial temp (°C): _____
Final Temp (°C): _____
Change in temp. (°C): _____
Sp. Ht.: _____

Remember:

heat = (mass) x (temp. change) x (sp.ht.)

Water

Mass = 100g

I. temp = 20°c

F. temp = ____

Δ temp = ____

Sp. Ht = 1

metal

mass = ____

I temp = 100°

F. temp = ____

Δ temp = ____

spht ____