

Day 3--Heat, Temperature and  
Thermal Energy

- i. Temperature-measure of the avg. kinetic energy in a sample of matter.
  1. The faster the particles, the greater the KE
  2. The slower the particles, the smaller the KE

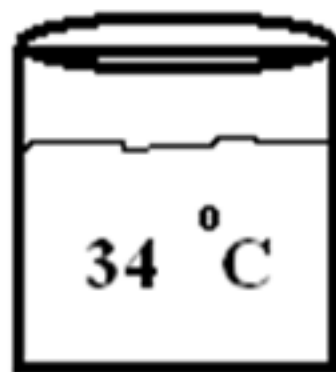
i. Thermal Energy- Total PE and KE in a sample of matter.

i. Heat—Thermal energy transferred from one body to another.

**1. Heat always flows *from* High Temp *to* Low Temp**



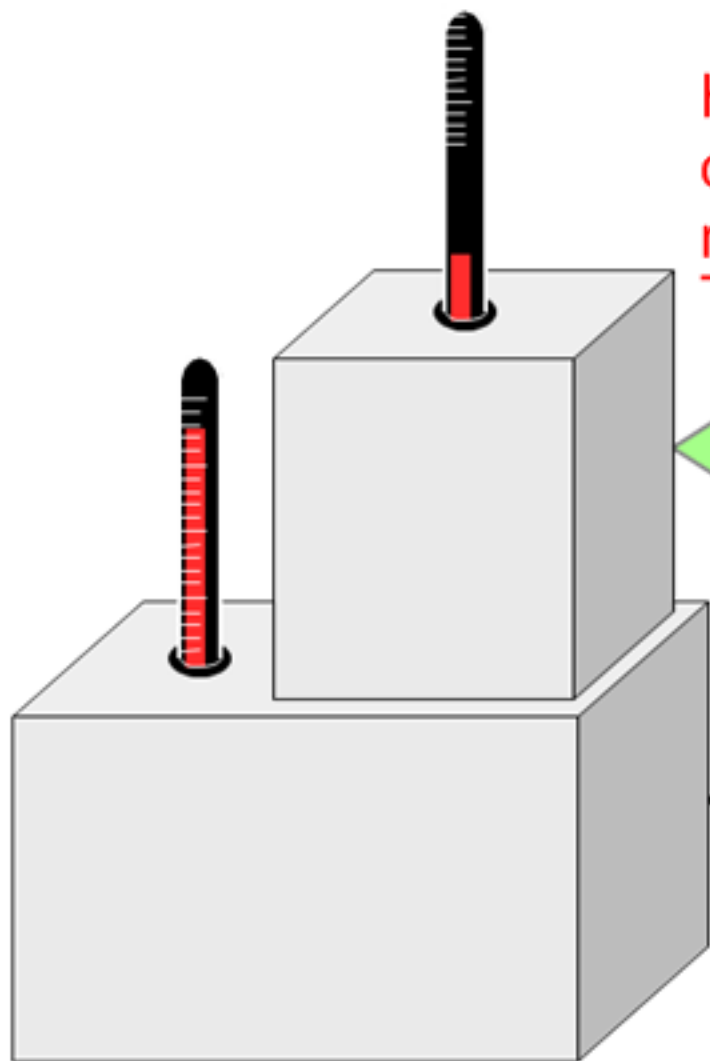
**a**



**b**

If Beaker A is mixed with Beaker B, Heat will flow from B to A !!

Beaker A will Gain heat and Beaker B will Lose heat!!



Heat will enter this block, causing the temperature to rise!!

What's going to happen to the temperature of the small block?

What's going to happen to the temperature of the large block?

Heat will leave this block, causing the temperature to fall!!

a. Discuss 3 methods in which heat is transferred:

1. conduction—direct contact
2. convection—transfer in liquids and gases
3. radiation—transfer through empty space

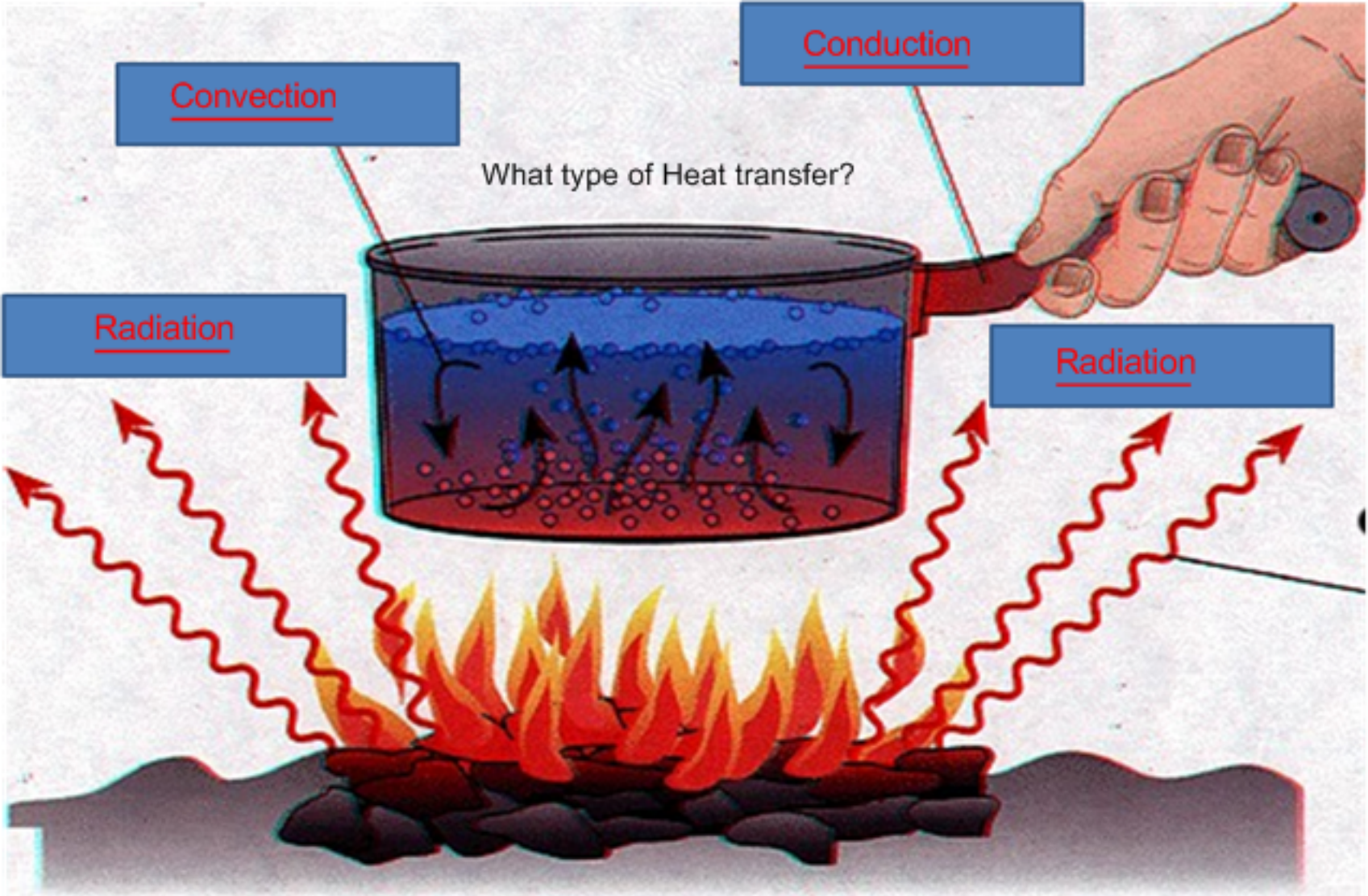
Conduction

Convection

What type of Heat transfer?

Radiation

Radiation





False--good

1. Materials that are poor conductors are *poor* insulators.

F--conduction

2. The transfer of energy through matter by direct contact of its particles is *convection*.

F--radiation

3. The transfer of energy in the form of invisible waves is *conduction*.

TRUE

4. Solids usually conduct heat *better* than liquids and gases.

~~5. The R-value of insulation indicates its resistance to heat flow.~~

True

6. Air is a *poor* heat conductor.

F--Convection

7. Wind and ocean currents are examples of *conduction* currents.

F--convection

8. Energy is usually transferred in fluids by *radiation*.

TRUE

9. As water is heated, it expands, becomes *less* dense, and rises.

F--more

10. Dark-colored materials absorb *less* radiant energy than light-colored materials.

F--absorbed 11. Only radiant energy that is *reflected* is changed to thermal energy.

F--more 12. The higher the R-value of insulation the *less* resistant it is to heat flow.

Circle the object that will take in more heat!!!

13. a silver spoon,

a wooden log

Silver will reflect heat!!

14. a white shirt,

a red shirt

Dark colors absorb heat

15. foil in the sun,

Foil will reflect heat, not absorb

a sidewalk in the sun

16. single-pane window,

Double paned windows are insulated

double-pane window

~~17. R-5 insulation,~~

~~R-35 insulation~~

# a. Laws of Thermodynamics

i. 1<sup>st</sup> Law of Thermodynamics—When heat energy is converted to other forms of energy or when other forms of energy are converted to heat, there is NO loss of energy!!

\*\*\*\*Energy will be conserved\*\*\*\*

- i. 2<sup>nd</sup> Law of Thermodynamics—Heat will not flow spontaneously from a cold body to a warm body.
  1. Entropy—the natural tendency from ever-increasing disorder.



- a. Heat Engines: convert heat energy to mechanical energy in order to do work.
  - i. 2 types of engines:
    1. External Combustion-fuel burned outside the engine  
Ex.) steam engines
    2. Internal Combustion-fuel burned inside the engine  
Ex.) gas engines

## Temperature and Heat

**Directions:** Determine whether the italicized term makes each statement true or false. If the statement is true, write **true** in the blank. If the statement is false, write in the blank the term that makes the statement true.

True

F--more

True

F--Decreases

True

F--different

True

F--Joules

F--different

True

F--high

True

1. Particles that make up matter are in *constant* motion.
2. The faster particles move the *less* kinetic energy they have.
3. *Temperature* is the measure of the average kinetic energy of the particles in an object.
4. When temperature *increases*, the kinetic energy of the particles decreases.
5. The thermal energy of an object is the *total* energy of the particles in a material.
6. A 5-kg chunk of aluminum and a 5-kg block of silver that are at the same temperature have *the same* thermal energy.
7. Heat flows from a *higher* temperature to a lower temperature.
8. Heat is measured in *newtons*.
9. Different materials need *the same* amounts of heat to have similar changes in temperatures.
10. The amount of energy it takes to raise the temperature of 1 kg of a material 1 kelvin is the *specific heat* of the material.
11. Water has a relatively *low* specific heat.
12. Materials with a high specific heat can absorb a lot of energy and show *little* change in temperature.

**Directions:** Answer the following questions about specific and thermal energy.

13. Change in thermal energy can be calculated using the equation  $Q = m \times \Delta T \times C$ .

- a. In this equation, what does  $Q$  represent? \_\_\_\_\_
- b. What does  $m$  represent? \_\_\_\_\_
- c. What does  $\Delta T$  represent? \_\_\_\_\_

\_\_\_\_\_ 11. Water has a relatively *low* specific heat.

\_\_\_\_\_ 12. Materials with a high specific heat can absorb a lot of energy and show *little* change in temperature.

**Directions:** Answer the following questions about specific and thermal energy.

13. Change in thermal energy can be calculated using the equation  $Q = m \times \Delta T \times C$ .

- a. In this equation, what does  $Q$  represent? Thermal Energy(heat)
- b. What does  $m$  represent? Mass
- c. What does  $\Delta T$  represent? Change in Temperature
- d. What does  $C$  represent? Specific Heat
- e. What does the symbol  $\Delta$  mean? Change
- f. Why is the symbol  $\Delta$  used with  $T$  but not  $Q$ ? ~~\_\_\_\_\_~~

14. What formula is used to calculate  $\Delta T$ ?  $Q = mC_p\Delta T$

**Directions:** In each of the following statements, a term has been scrambled. Unscramble the term and write it on the line provided.

Conduction \_\_\_\_\_

Convection \_\_\_\_\_

Radiation \_\_\_\_\_

Insulator \_\_\_\_\_

internal combustion \_\_\_\_\_

solar energy \_\_\_\_\_

solar collector \_\_\_\_\_

heat \_\_\_\_\_

heat engine \_\_\_\_\_

heat mover \_\_\_\_\_

thermometer \_\_\_\_\_

Thermal energy \_\_\_\_\_

specific heat \_\_\_\_\_

1. The transfer of energy through matter by direct contact of particles is called *docniotucn*.
2. The transfer of energy by the movement of matter is called *vecconniot*.
3. The type of heat transfer that does not require matter is *iadraniot*.
4. Any material that does not allow heat to pass through it easily is an *roinsulta*.
5. An *ntieanrl busmcotoin* engine burns fuels inside chambers called cylinders.
6. Energy from the sun is *Iraos neeygr*.
7. A device on a building that absorbs radiant energy from the sun is *Iraos lleocctro*.
8. The thermal energy that flows from something with a higher temperature to something with a lower temperature is called *eath*.
9. Thermal energy is converted into mechanical energy by a *thea gennie*.
10. A *thea revmo* moves thermal energy from one location and transfers it to another location at a different temperature.
11. The *pertreuamet* measures the average kinetic energy of all the particles in an object.
12. The total energy of the particles in a material is *ethrlam gyeren*.
13. The *pcciiifes thea* of a material is the amount of energy it takes to raise the temperature of 1 kg of the material 1 kelvin.