HEAT

How is thermal energy transferred?

Give an example of conduction?

What is a convection current?

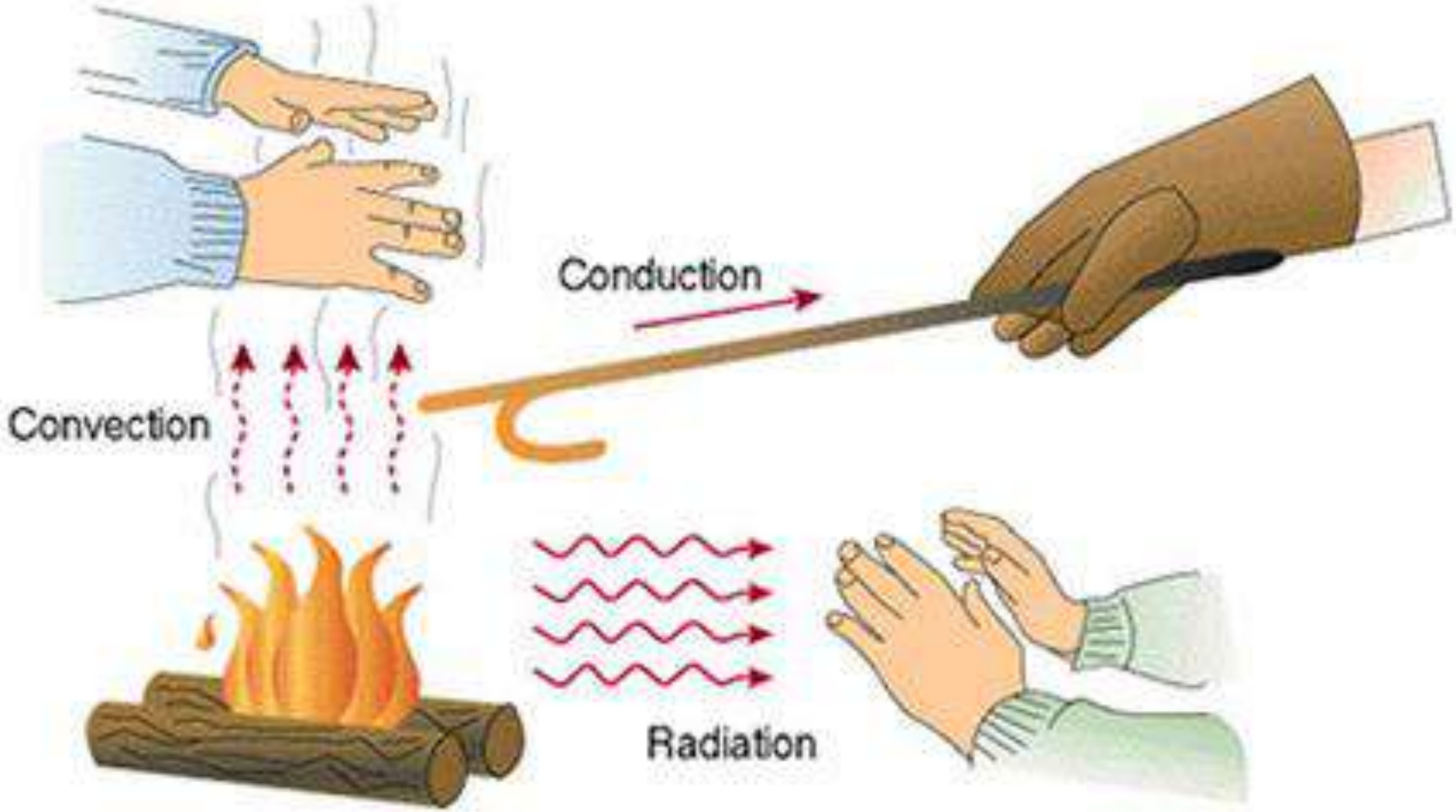
Explain radiant energy?

NEED TO KNOW VOCABULARY:

Conduction
Convection
Radiant

stay tuned
Specific Heat
Calorie

Conductor vs Insulator
Convection Cell
Radiation
heat source vs heat sink


Conduction
Convection
Radiation

Heat travels in **only one direction**, there are three processes by which heat can travel from one object or area to another. The direction is from high to low.

The **three** forms of heat energy transfer are:

1. **Conduction**
2. **Convection**
3. **Radiant**

Conduction is a form of heat transfer that occurs when two objects are in **direct contact**. Conduction is the transfer of heat between objects with different temperatures that are **touching.**

Any time objects with **different temperatures** come into contact, particles in both objects collide.

Kinetic energy flows from particles in the **warmer** object to particles in the **cooler** object, raising the temperature of the cooler object.

1. Conduction also occurs when particles in the same object are heated to different temperatures.

During this process, energy is transferred from **high energy** state particles of the object to **low energy** state particles in another part of the object.

Copper pipe, paper and torch demo
"Good idea or bad idea?"

Conduction can also occur between **multiple objects** in contact with on another.

Where is that occurring here?

Ex: Hot cup of tea

1. Spoon & cup 2. tea bag & table top

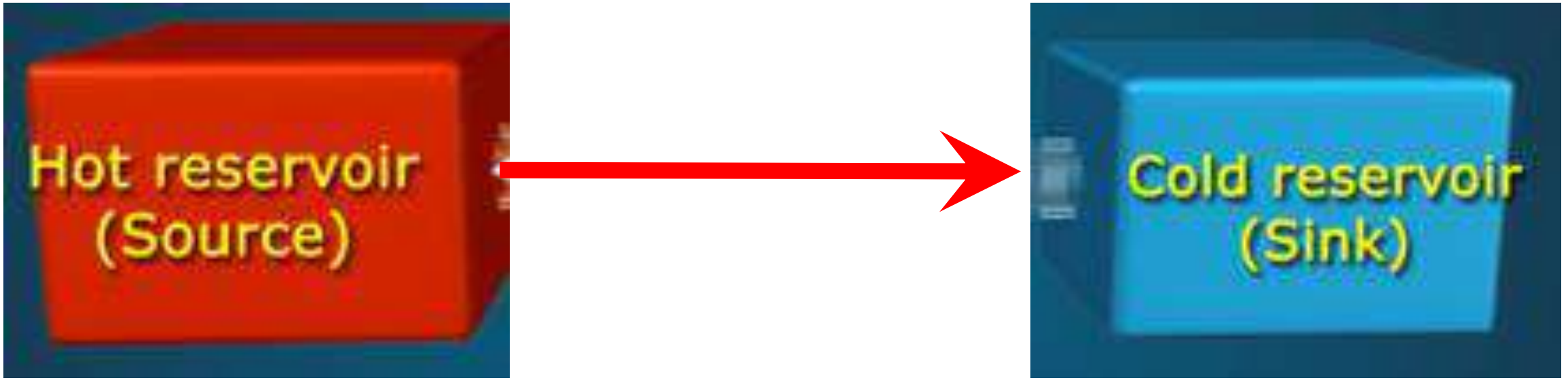
Let’s review -

What are the 2 different ways in which ***conduction*** can occur?

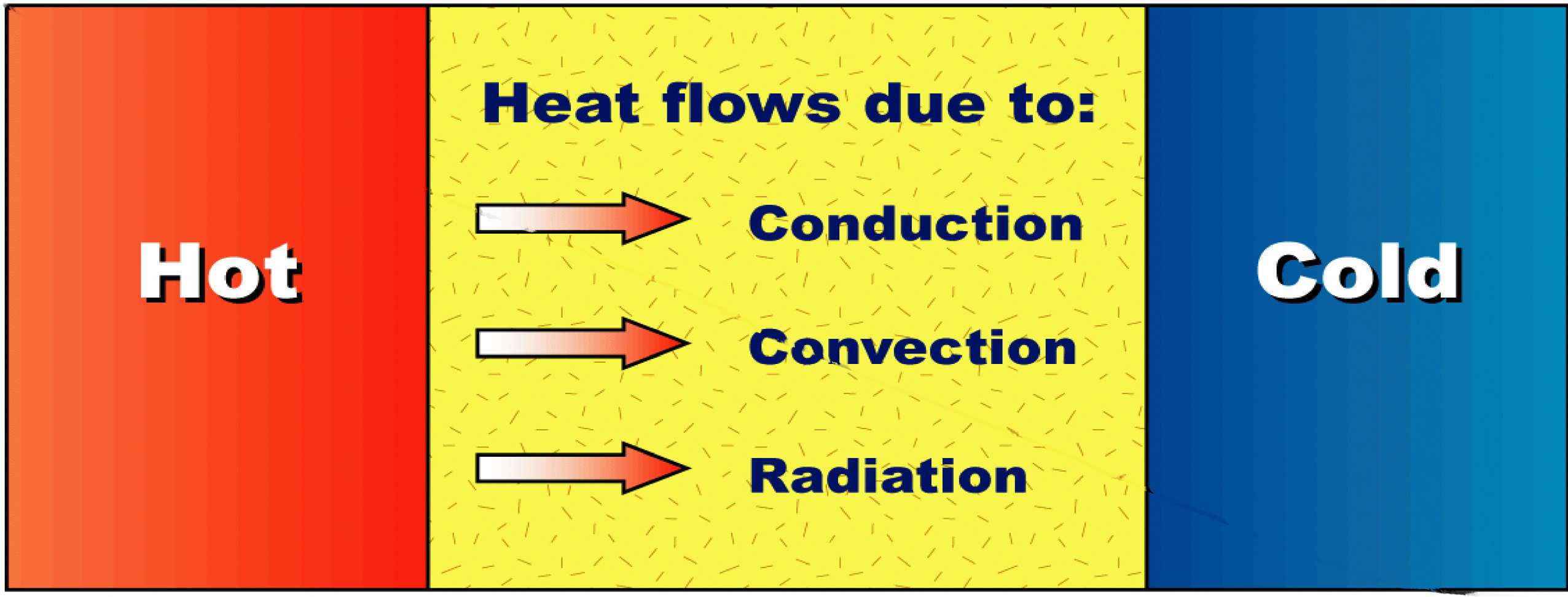
1._____

2._____

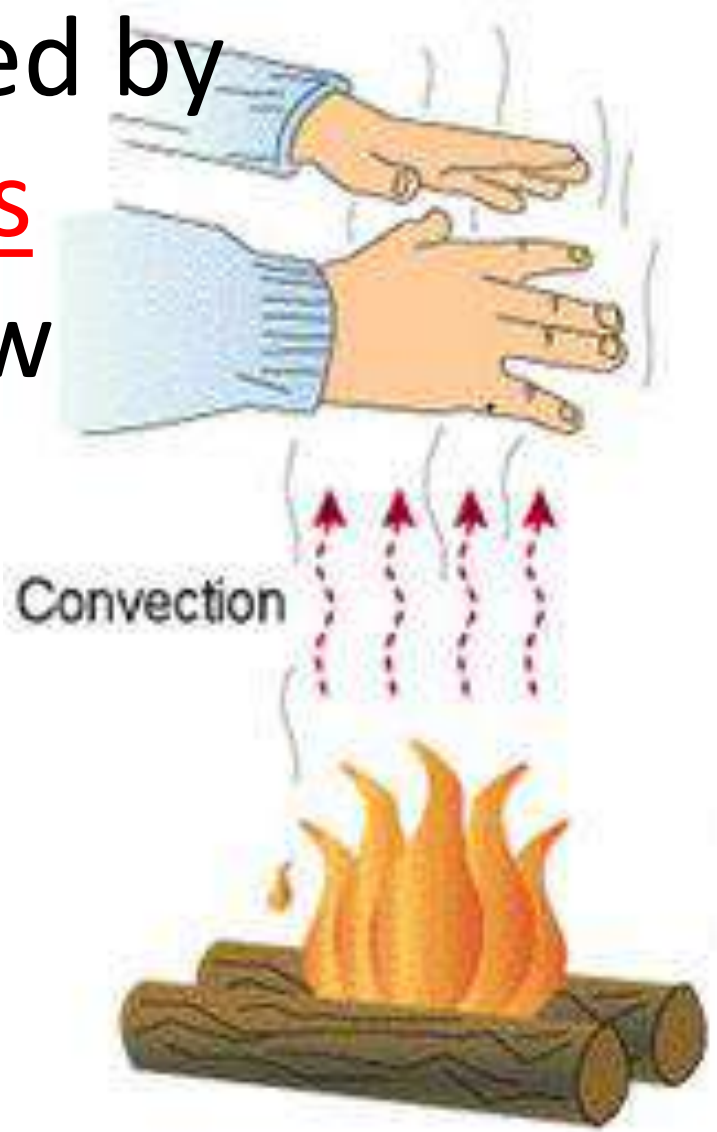
The Second Law of Thermodynamics



When heat flows from a warm object to a cool object the thermal energy of the warm object _____ and the thermal energy of the cool object _____.


Hot
Heat flows due to:
Conduction
Convection
Radiation
Cold

Convection is the flow of energy through a **liquid or gas** (fluids) caused by hot particles rising and cool particles sinking. Particles with higher KE flow through the fluid and cool particles replace the rising warm particles.

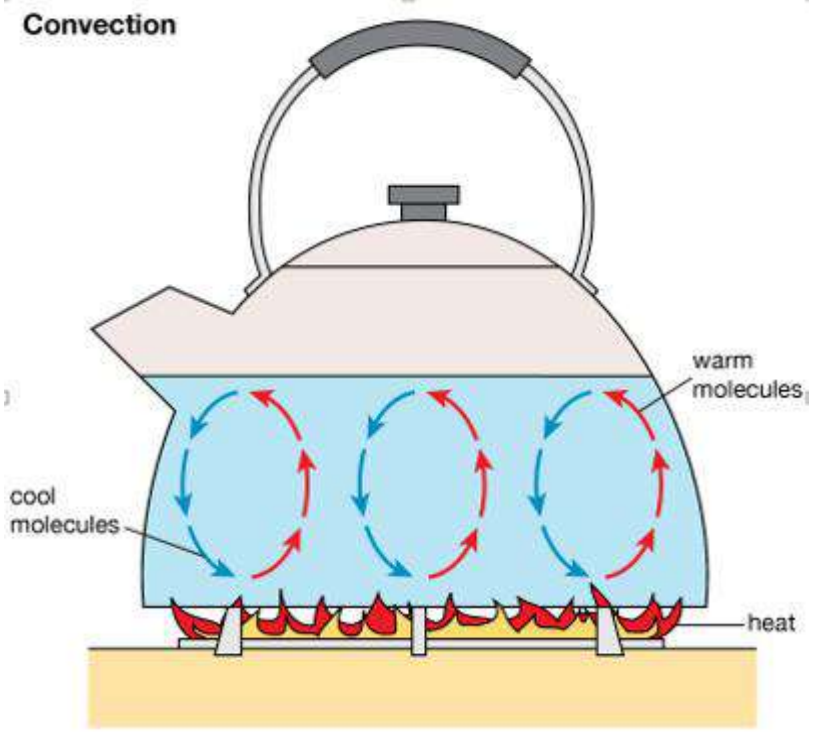


NOTE: it only occurs in a fluid

torch demo

DESCRIBING CONVECTION

As the flame touches the bottom of the kettle, conduction occurs within the metal. Inside of the kettle, convection occurs, as water swirls about.



As water near the bottom of the kettle is heated, it expands then rises and becomes less dense. Cooler water then swirls in replacing the rising hot water. Eventually another convention current occurs in the form of steam atop the kettle. This motion is referred to as a _____ or _____

DESCRIBING CONVECTION

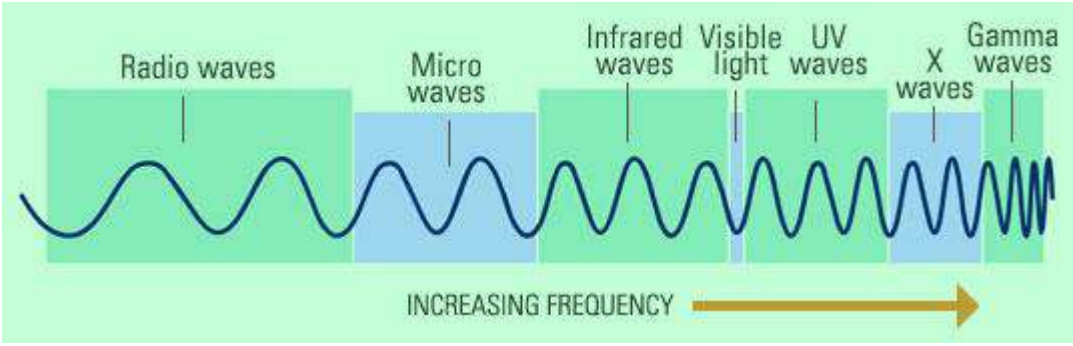
glass convection cell demo

In a convection current, regardless of the medium (water or air) heat energy cause the fluid to expand. As it does so, it becomes less dense. This lower density state causes it to rise, while higher density particles then rush in to fill the void. In a closed system the fluid which has now expanded and risen will eventually cool, thus becoming denser and then settling back down.

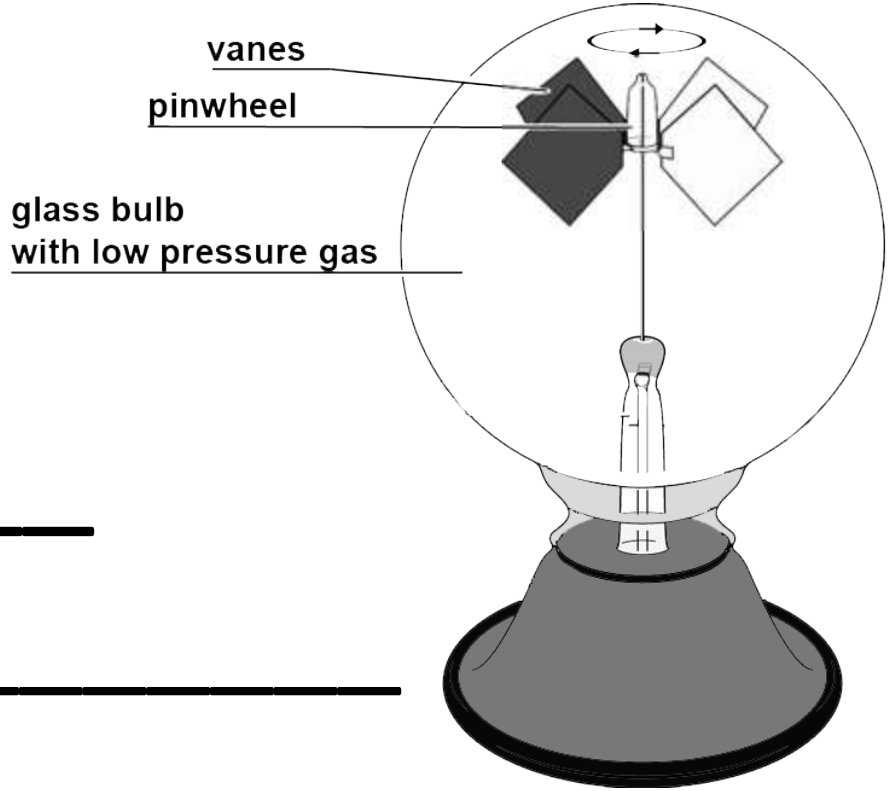
_____ currents always rise while _____ones fall.

Radiant is the transfer of heat energy in the form of **electromagnetic waves.**

With radiant heat radiation, one object **emits** heat energy and another **absorbs** it.



Radiometer



What causes it to spin?

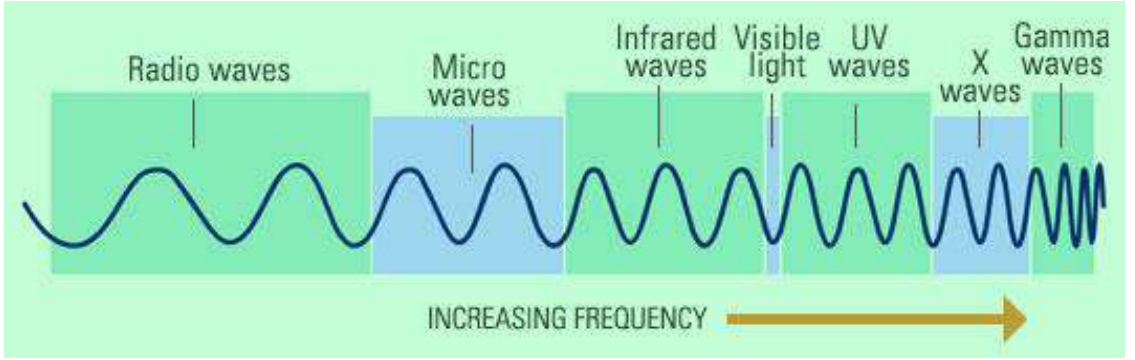
Hypothesis: _____

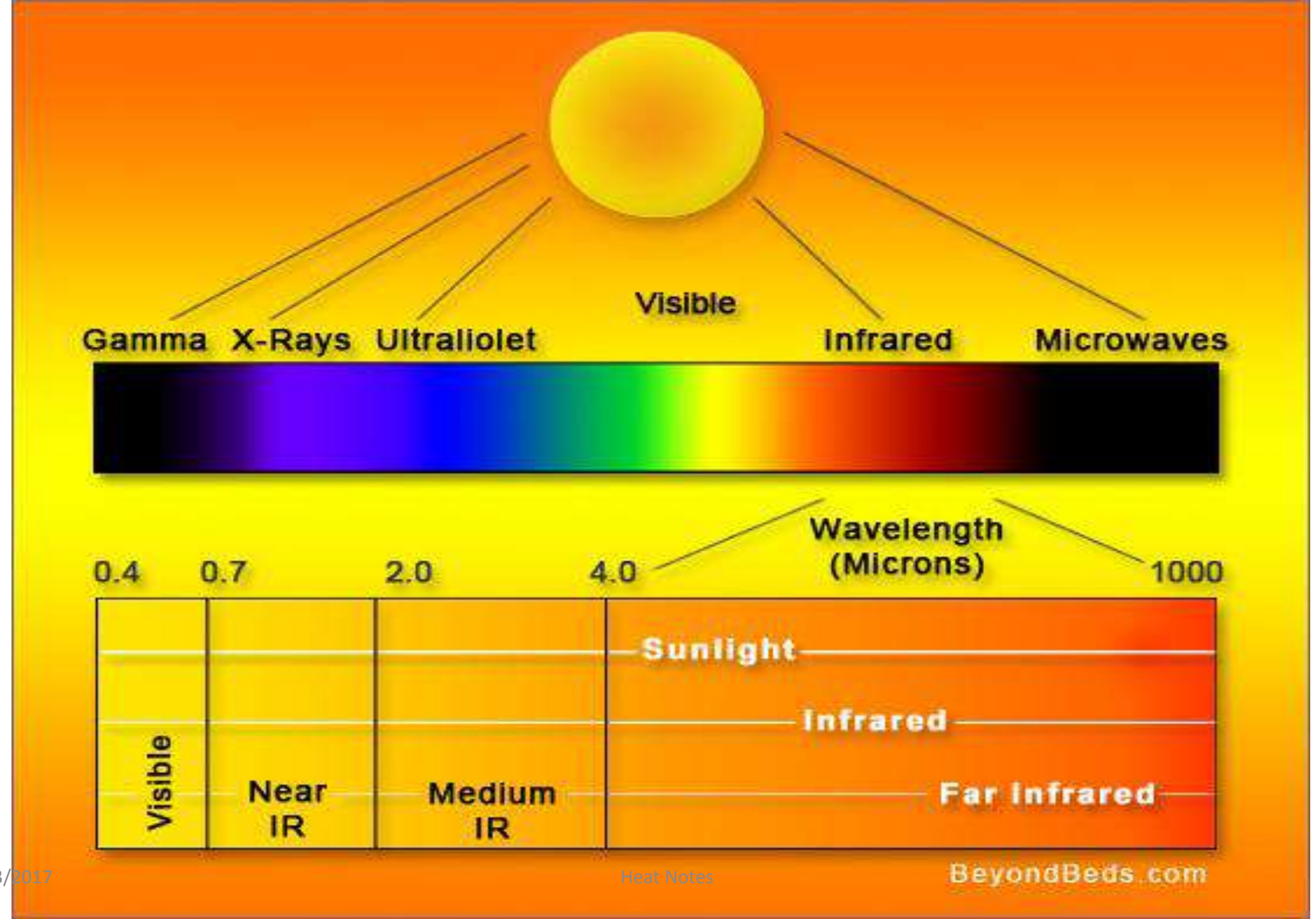
_____

_____

_____

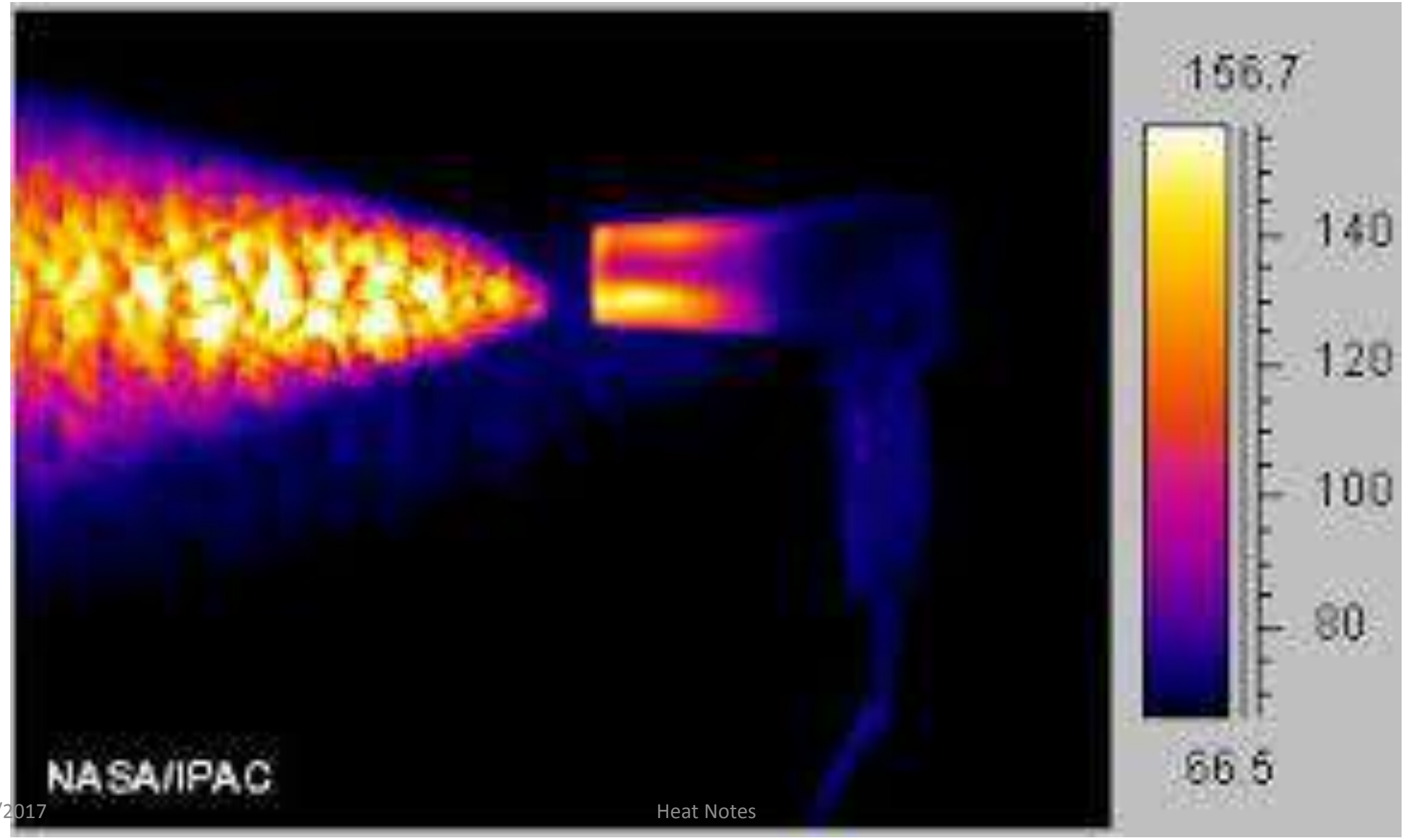
Radiometer demo

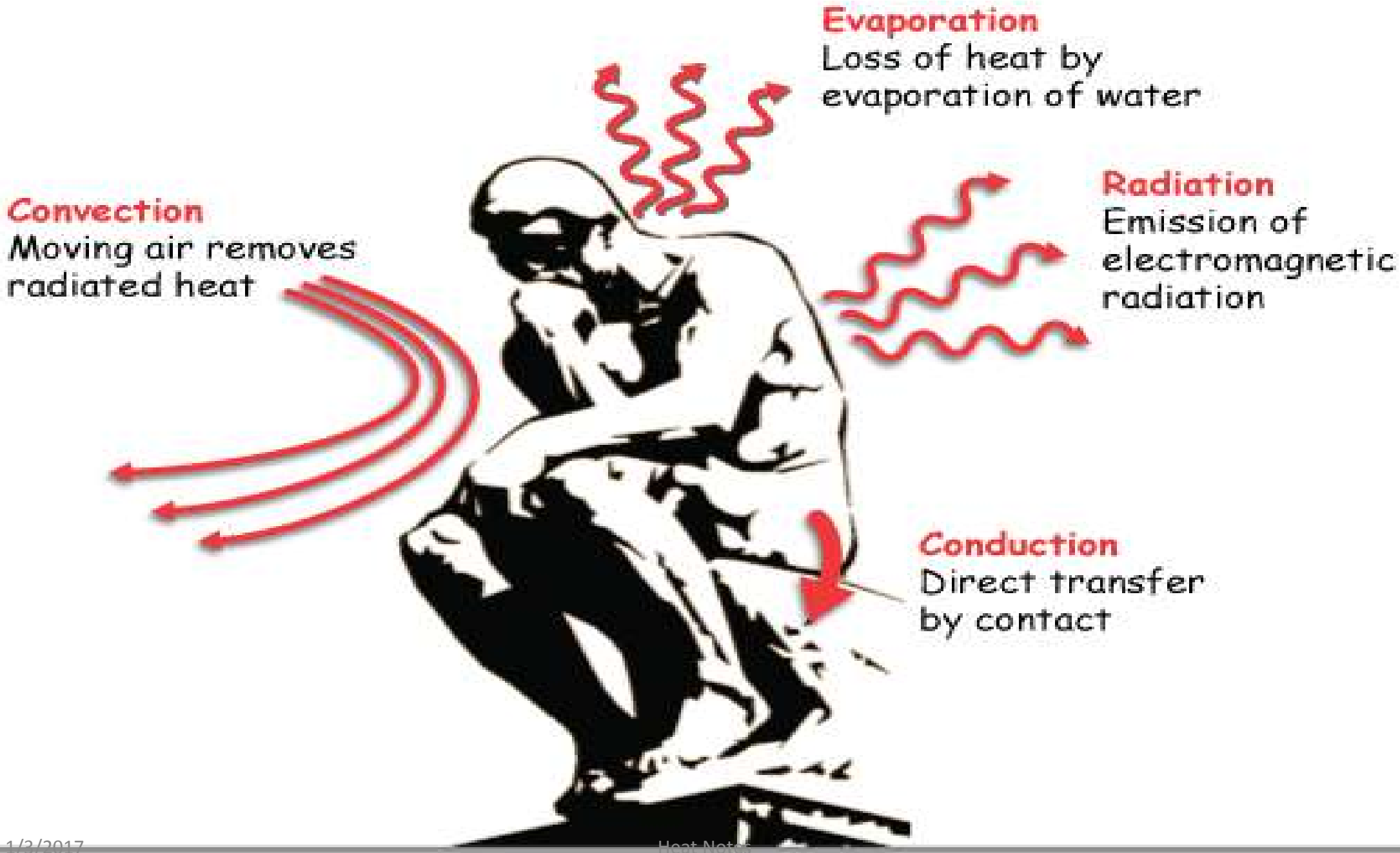



Gamma
X-Rays
Ultraliolet
Visible
Infrared
Microwaves
Wavelength
(Microns)
0.4
0.7
2.0
4.0
1000
Visible
Near
IR
Medium
IR
Sunlight
Infrared
Far Infrared
BeyondBeds.com

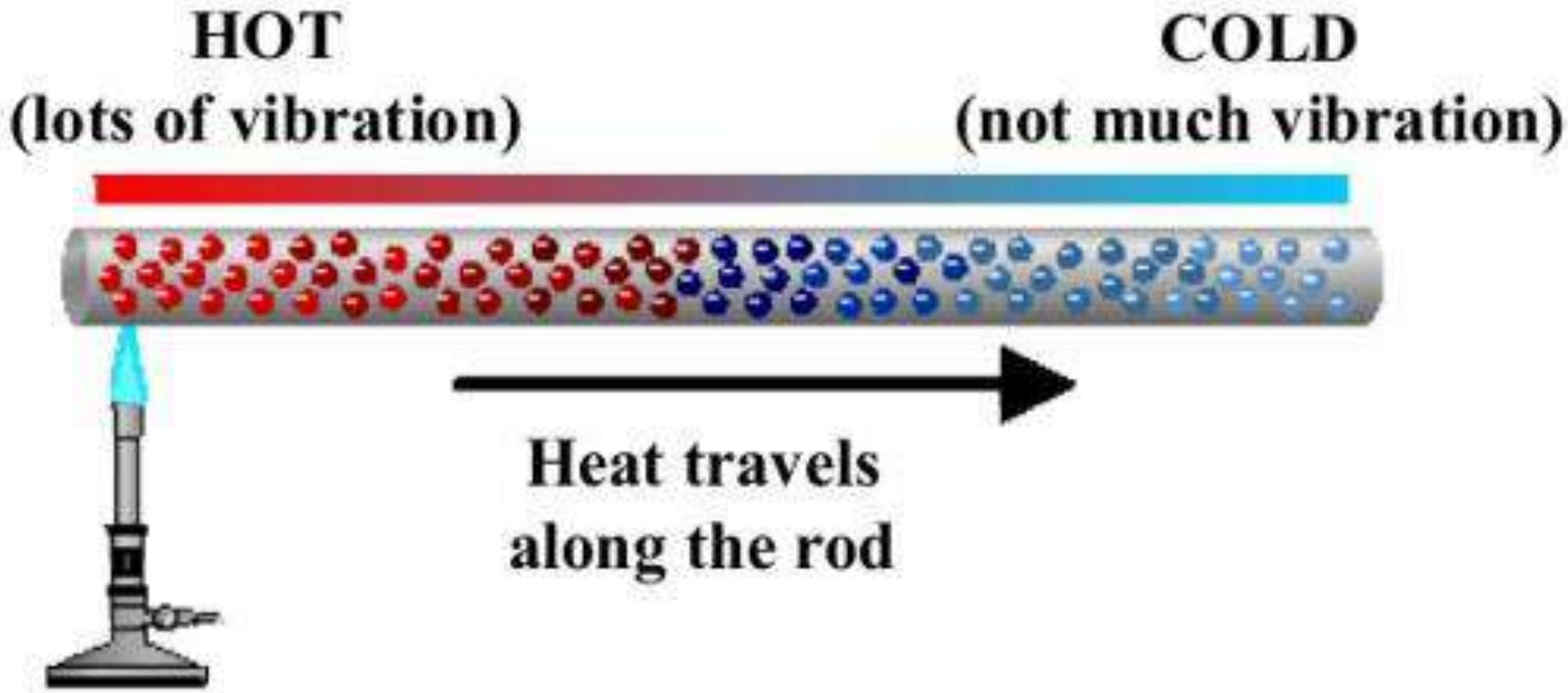
We of course cannot see infrared or radiant heat wave but if we could they might look something like this.

Can you guess what this is?




Evaporation
Loss of heat by evaporation of water
Radiation
Emission of electromagnetic radiation
Convection
Moving air removes radiated heat
Conduction
Direct transfer by contact

QUESTION 1 Which method of heat energy transference is illustrated here? _____



QUESTION 2 Number or draw arrows indicating the steps for the text boxes below.

The waves are absorbed by another object or substance.

The electromagnetic waves travel through matter or empty space.

An object emits radiation in the form of electromagnetic waves.

QUESTION 3

fluid cycle	convection cycle	cooler
warmer	boiling point	convection current

Convection occurs when _____ particles in a fluid sink to replace the rising _____ particles in the fluid.

The constant cycle of warm fluid rising and cool fluid sinking is known as a _____.

QUESTION 4 A father and son are walking along the beach. The son runs toward the water and dips his hands in the cool ocean. Then, he walks back to his dad and grabs his hand.
"Matthew, your hands are so **cold** now!" his dad exclaims.

How was the heat conducted in this scenario?
CIRCLE ALL THAT APPLY

a. From Matt's body to his now cooler hand.
b. From Matt's cold hand to his fathers.
c. From the father's hand to Matt's cold hand.
d. From the cool ocean to Matt's hand.
e. From Matt's hand to the cool ocean.

QUESTION 5 Can convection occur in solids?

- ☐ yes, because solids are fluids
- ☐ yes, because particles in solids move in the same way as particles in liquids and gases
- ☐ no, because solids are not fluids
- ☐ no, because solid particles cannot move freely

Conduction can occur even when the atoms of two different objects are not in contact with each other? T or F?

QUESTION 6 Give examples of radiant energy that we encounter every day.

List as many as you can below:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Select the model that accurately depicts how particles flow in a convection current.