



GURUKUL 
Pvt. Industrial Training Institute

Making Youth Employable Through Skill Development

Manglam City, Govindpura, Kalwar Road, Jhotwara, JAIPUR

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Temperature and Heat

Heat is a flow of energy due to temperature differences



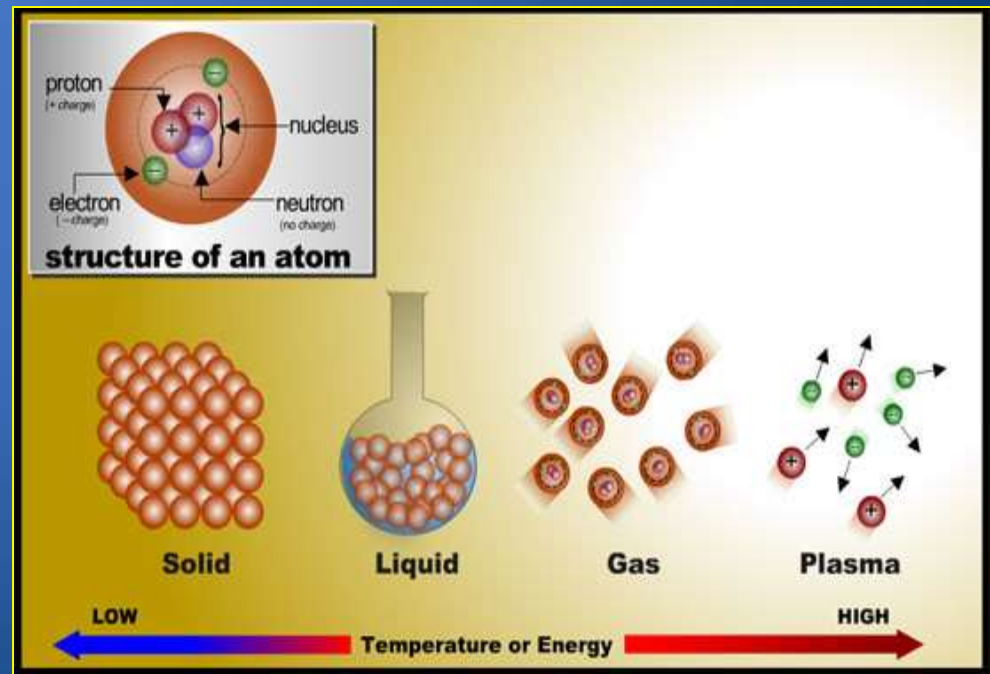
Temperature Depends on Particle Movement!

- All matter is made up of atoms that are moving...even solid objects have atoms that are vibrating.
- The motion from the atoms gives the object energy.



The Kinetic Theory of Matter

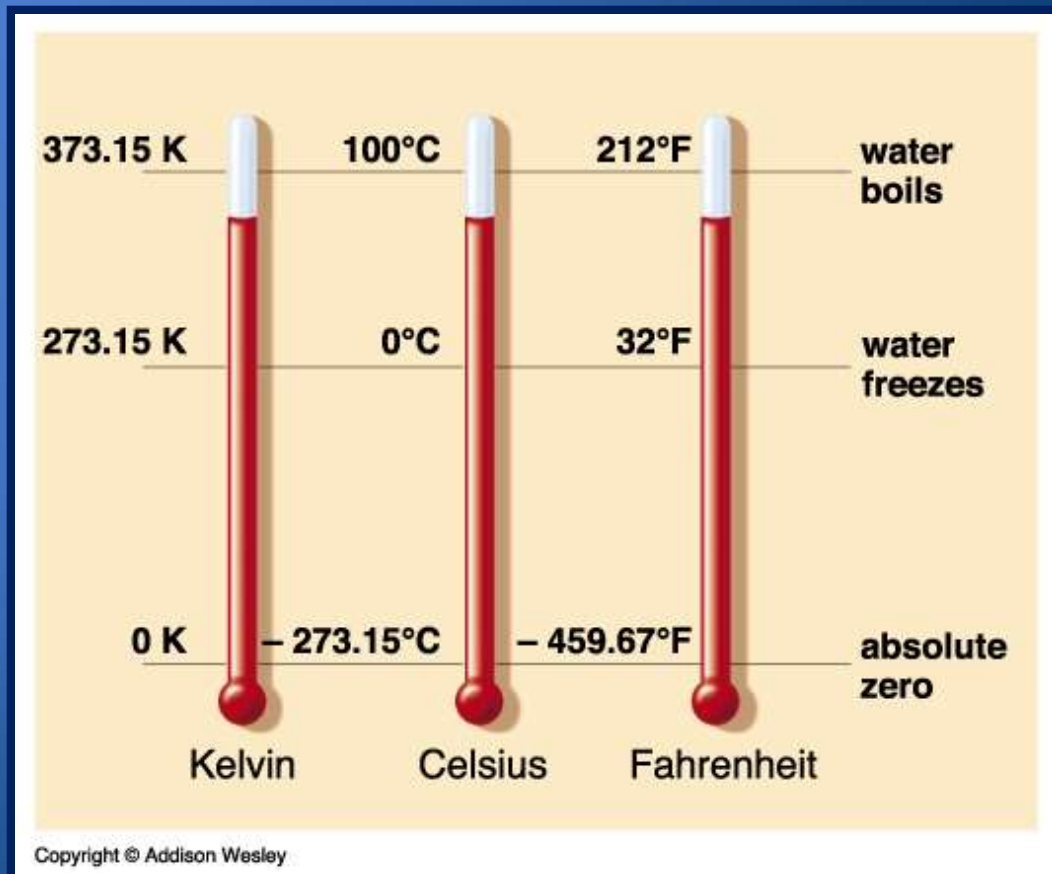
- All of the particles that make up matter are constantly in motion
- Solid= vibrating atoms
- Liquid= flowing atoms
- Gas= move freely
- Plasma= move incredibly fast and freely





Temperature

- The Measure of the average kinetic energy of all the particles in the object
- The atoms mass and speed determine the temperature of the object





Temperature

- Temperature is measured in units called degrees ($^{\circ}\text{C}$, $^{\circ}\text{F}$, K)
- Fahrenheit: Water freezes 32°F and boils at 212°F
- Celsius: Water freezes at 0°C and boils at 100°C





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How does a Thermometer Work?

- The thermometer can measure temperature because the substance of the liquid inside always expands (increases) or contracts (decreases) by a certain amount due to a change in temperature.



Thermal Expansion

- All gases, liquids, and most solids expand when their temperature increases.
- This is why bridges are built with short segments with small breaks to allow for expansion



Joints such as this one are used in bridges to accommodate thermal expansion.



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Energy Flows from Warmer to Cooler Objects

- Heat: the flow of energy from an object at a higher temperature to an object at a lower temperature.
- Thermal Energy: total random kinetic energy of particles in an object.



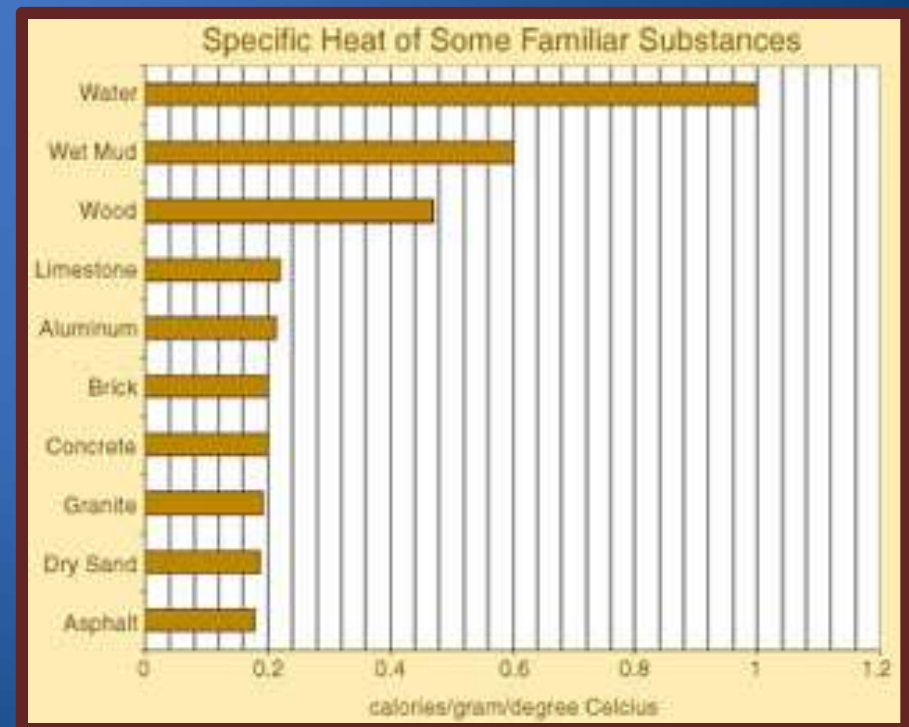
Measuring Heat

- Heat is measured by the units of calorie and joule (J).
- calorie: The amount of energy needed to raise the temperature of 1 gram of water by 1°C
- $1 \text{ calorie} = 4.18 \text{ J}$



Some substances change temperature more easily than others.

- Specific Heat: the amount of energy required to raise the temperature of 1 gram of a substance by 1°C





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The Transfer of Energy as Heat.

- Energy moves heat in three ways
 - Conduction
 - Convection
 - Radiation



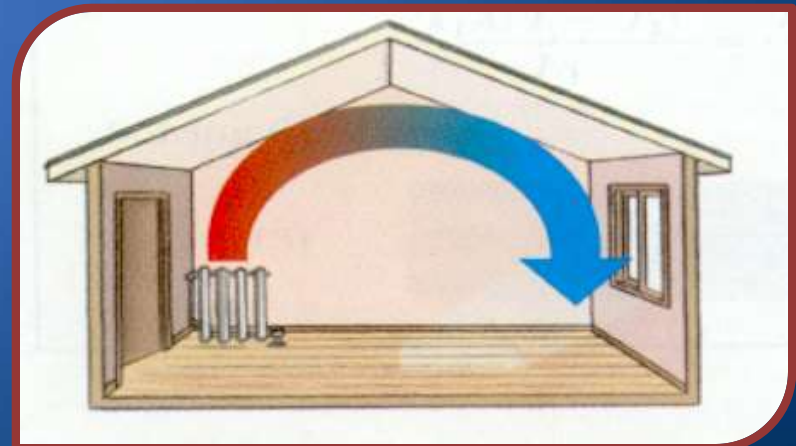
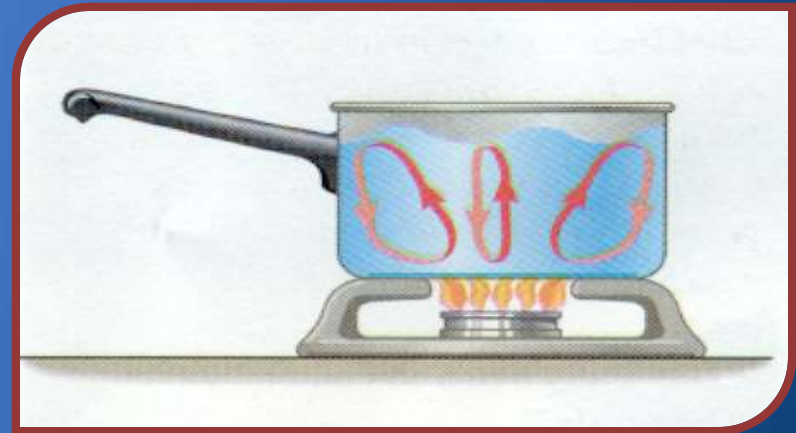
Conduction

- The process that moves energy from one object to another when they are touching physically.
- Conductors: materials that transfer energy easily.
- Insulators: materials that do not transfer energy easily.
- Examples: hot cup of cocoa transfers heat energy to cold hands



Convection

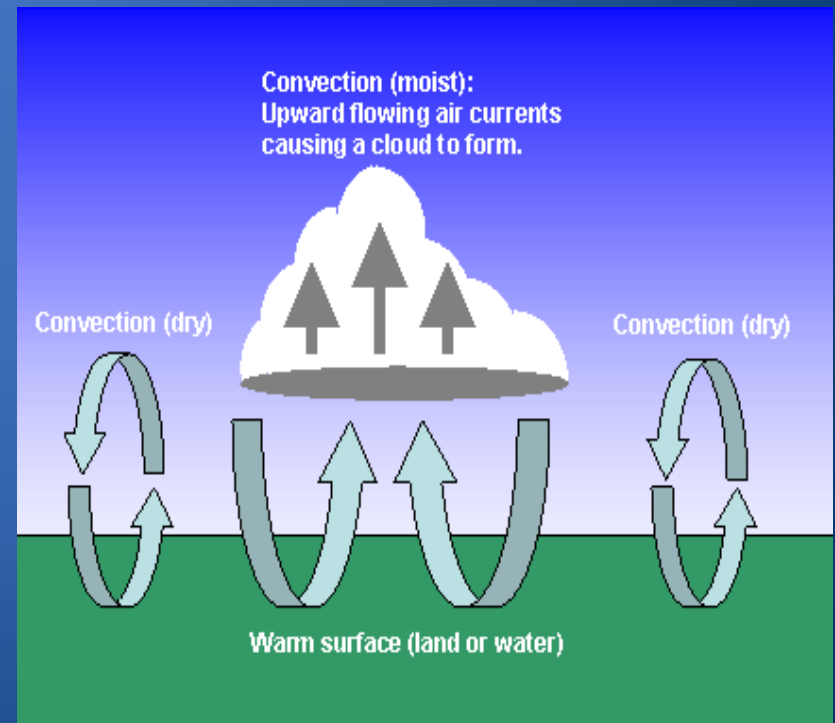
- The process that transfers energy by the movement of large numbers of particles in the same direction within a liquid or gas.
- Cycle in Nature
- Boiling water and heating a room





Convection in Nature

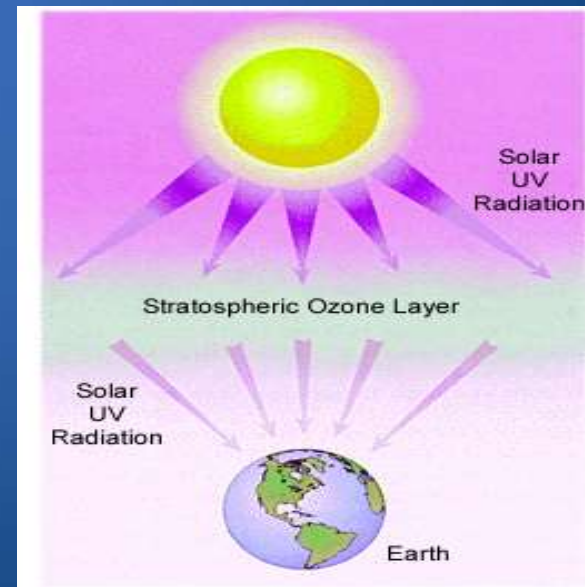
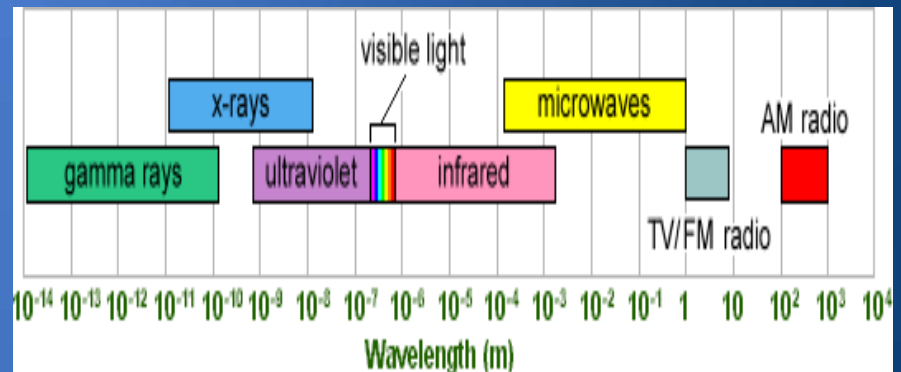
1. Cooler denser air sinks and flows under the warmer air (less dense) to push the warmer air upward
1. As the warmer air rises it cools and becomes more dense
2. This cooling and movement of warmer air upward creates the cycle of convection





Radiation

- The energy that travels by electromagnetic waves (visible light, microwaves, and infrared light)
- Radiation from the sun strikes the atoms in your body and transfers energy





Conduction	Convection	Radiation
<ul style="list-style-type: none">• Energy transferred by direct contact• Energy flows directly from warmer to cooler objects• Continues until object temperatures are equal	<ul style="list-style-type: none">• Occurs in gases and liquids• Movement of large number of particles in same direction• Cycle occurs while temperature differences exist	<ul style="list-style-type: none">• Energy transferred by electromagnetic waves (visible light, microwaves, infrared)• All objects radiate energy• Can transfer energy through empty space



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Vocabulary List

- Kinetic theory of matter
- Temperature
- Degree
- Thermometer
- Heat
- Thermal energy
- Calorie
- Joule
- Specific heat
- Conduction
- Convection
- Radiation



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The End

Thanks