

Heat

Heat is a form of energy that transfers from a hotter substance to a cooler substances. It is the property of a substance that helps us to understand the difference between hot and cold objects.

The S.I. Unit of heat is **Joules**.

Temperature

Temperature is a quantity (amount) that gives us the degree of hotness or coldness of an object.

Temperature can be measured by 3 different units:-

- **Degree Celsius (°C)**
- **Degree Fahrenheit (°F)**
- **Kelvin (K)**

The S.I. unit of temperature is Kelvin (k).

In Celsius the freezing point is taken as **0°C and the boiling point be 100°C. and there are 100 degrees between it.**

In Farhenheit the freezing point is taken as **32 °F and the boiling point be 212°F and there are 180 degrees between it.**

We can convert the measure of temperature from one unit to another using the following formula.

$$\frac{C}{5} = \frac{F - 32}{9}$$

Thermometer

Thermometer is a device used to measure the temperature of a body.

There are 2 types of thermometers:-

1. Mercury Thermometer
2. Alcohol Thermometer

1. Mercury Thermometer

	ADVANTAGES	DISADVANTAGES
1.	Mercury is a good conductor of heat and so quickly reaches the temperature of the surroundings.	It has a freezing point of approximately -39°C and therefore cannot be used to measure very low temperatures below that.
2.	It does not stick to the surface of the tube and therefore gives quite accurate readings.	Mercury is very poisonous.
3.	It has a high boiling point (~357°C) and low freezing point (-39°C). So it will not heat up easily and will also not freeze easily unless its really really cold! it can measure a wide range of temperatures.	It is very expensive.
4.	Its shining silver colour is easily visible.	

2.

3. ALCOHOL THERMOMETER

	ADVANTAGES	DISADVANTAGES
1.	Alcohol is cheaper, easily available, and safe to use.	Alcohol has a low boiling point (-78°C) and therefore cannot be used to measure high temperatures.
2.	It has a low freezing point (-115°C) and	It does not react quickly to changes in

	therefore can be used to measure very low temperatures.	temperature.
3.		Since alcohol is colourless, it needs to be dyed before being used as a thermometer liquid.

There are 2 types of Mercury Thermometers

- Clinical thermometers
- Laboratory thermometers

Difference between Clinical & Laboratory thermometer

Clinical Thermometer	Laboratory Thermometer
It is used to measure the temperature of human body.	It is used to measure the temperature of all substances other than the human body. It is used to measure high temperatures like that of boiling water etc.
It reads a range of 35°C to 42°C or 94°F to 108°F.	It reads a range of -10°C and 110°C.
It has a kink in the capillary tube.	It doesn't have a kink in the capillary tube.

Similarities between Clinical & Laboratory thermometer

1. They both contain Mercury.
2. Both are used to measure temperature.
3. Both have similar precautions that need to be followed.

Properties of Heat

Heat has the following effects:-

1. **Change of state**- Heating can lead to a change of state of a substance. Solid to liquid to gas
2. **Heating can lead to a chemical change-**
3. **Heat travels from hotter thing/object to a cooler thing/object through Transferring its energy**
4. **Heating causes Expansion** - Heating causes things to expand. Solids, Liquids and Gases all can expand due to heat

THERMAL EXPANSION

Thermal expansion is the tendency of substances to expand on heating. This leads to change in shape, area & volume of the object.

Metals normally expand on heating due to this thermal expansion and contract on cooling!

TRANSFER OF HEAT

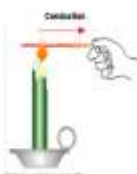
Heat gets transferred from an object at higher temperature to an object at lower temperature.

Heat gets transferred by 3 processes:-

1. **Conduction**
2. **Convection**
3. **Radiation**

1. Conduction

- A. The process of heat transfer in which heat travels from particle to particle- from the hotter end of an object to its colder end is called Conduction.
- B. Conduction of heat takes place without the actual displacement of atoms or particles.
- C. Conduction of heat also takes place when two bodies at different temperatures are brought into contact.



Conductors

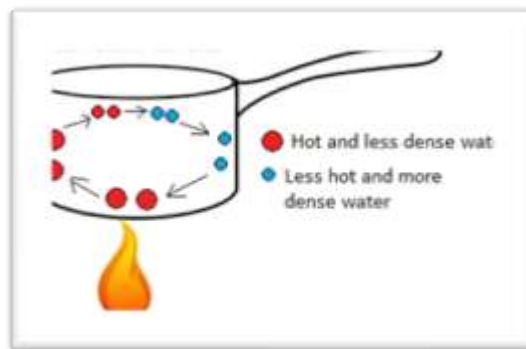
Materials or substances that conduct heat are called Conductors.

Most of the metals like iron, copper, silver and aluminium are good conductors of heat.

Insulators - Materials or substances that do not conduct heat through them are called insulators. Such as Wood, Plastic, Glass, Air.

2. Convection

- Method of heat transfer in which the molecules of a substance actually move towards the source of heat and are then displaced by cooler molecules to be heated by the source of heat is called Convection. E.g. Sea & land breezes.
- Convection only occurs in fluids and gases since their particles are free to move about.
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3. Radiation

Radiation is the mode or process of transfer of heat that does not require medium (unlike conduction & convection)

It happens through waves that require no medium. These waves are electromagnetic or EM waves (i.e. electric waves plus magnetic waves that don't need any medium to move ahead). They exist as the sun's rays, X-rays, the visible light, infra red light etc.

The EM waves travel very fast at the speed of light. ($3 \times 10^8 \text{ m/s}$)

- This is why radiation is the fastest mode of Heat transfer.

RADIATION- REFLECTION, ABSORPTION & TRANSMISSION

When radiation falls on another object, some of it gets reflected, some of it gets absorbed while some part of it gets transmitted

The colour of a body is responsible for the amount of heat it absorbs, reflects or transmits. Dark coloured bodies absorb more heat than light coloured bodies.

E.g. If we place water in 2 cans or put overhead water tanks. One painted black & other painted white in Sun. Then the can / tank painted black will absorb more heat and water in it will get more heated than that in a white can / tank.