HEAT

HOT AND COLD

The hotness and coldness of an object/body is determined by its temperature.

TEMPERATURE

Temperature is defined as a measure of the degree of hotness of an object. Any object with a high temperature will feel hot and the object with a low temperature will feel cold.

Examples:

1. Hot objects

Hot Soup Bowl

Fire

2. Cold objects

Ice

Sea Water

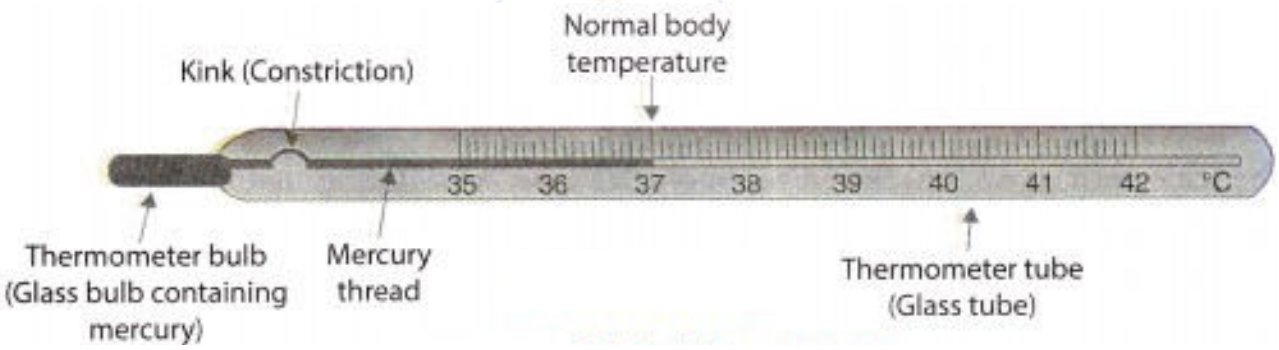
MEASURING TEMPERATURE

Thermometer – The device used to measure the temperature of a body is called the thermometer.

There are various types of thermometers that we use in our daily life such as -

1. CLINICAL THERMOMETER

- ✗ A thermometer that measures the temperature of the human body is called the clinical thermometer.
- ✗ A clinical thermometer consists of a long narrow, uniform glass tube. It has bulb on one end. The bulb contains **Mercury.**
- ✗ The movement of mercury in the thermometer indicates the temperature of the body in contact.
- ✗ The **kink** near the bulb is placed which prevents the mercury to fall back into the bulb.
- ✗ The **scale** we use is the **Celsius scale**, indicated by ° **C.**
- ✗ A clinical thermometer reads temperature **from 35° C to 42° C.**
- ✗ **The normal temperature of Human body is 37° C.**



Precautions to be observed while using a Clinical Thermometer

- ✗ Thermometer should be washed before and after use, preferably with an antiseptic solution.
- ✗ Ensure that before use the mercury level is below 35 °C
- ✗ Read the thermometer keeping the level of mercury along the line of sight
- ✗ Handle the thermometer with care. If it hits against some hard object. It can break.
- ✗ Don't hold the thermometer by the bulb while reading it.

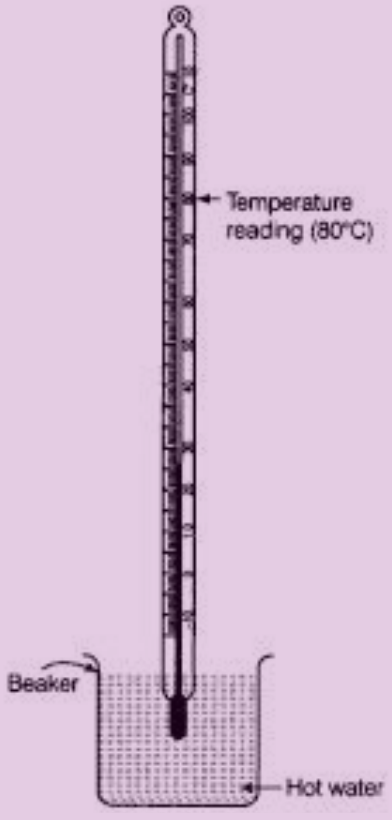
- ✗ Do not use a clinical thermometer for measuring the temperature of any object other than human body.
- ✗ Also avoid keeping the thermometer in the Sun or near a flame. It may break.

- The other scale is the Fahrenheit scale denoted by ° F and having a **range from 94° F to 108° F.**
- The **normal human body temperature** in these scales is taken as 37°C or **98.4°F**.

There are a lot of concern over the use of mercury in thermometers. Mercury is a toxic substance and is very difficult to dispose of if a thermometer breaks. So, these days **digital thermometers** are available which do not use mercury.

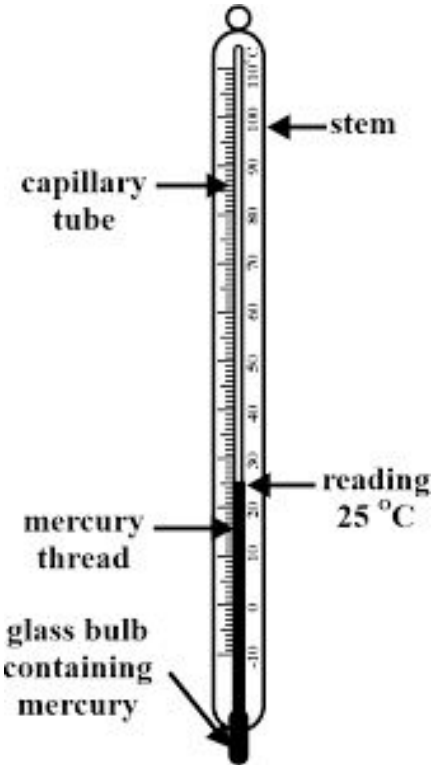
Question:
Why a clinical thermometer cannot be used to measure the boiling point of water?

Answer:
A clinical thermometer cannot be used to measure the boiling point of water because the boiling point of water is 100°C. This is a high temperature for a clinical thermometer which is designed to measure only human body temperature. A human body temperature varies over a short range from 35°C to 42°C.
Instead of clinical thermometer, **Laboratory thermometer is used to measure the temperature of water**.



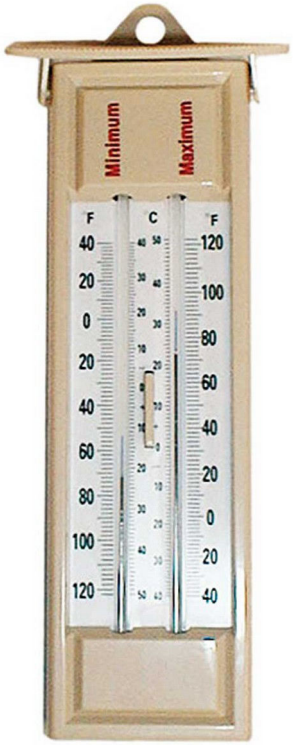
2. LABORATORY THERMOMETER

- ✗ A Laboratory thermometer is used in laboratories to measure temperatures with high accuracy.
- ✗ To measure the temperature of a substance, it is usually immersed partially or fully immersed in the substance.
- ✗ Mercury expands as the temperature increases while decreasing temperature indicates the contraction of mercury level.
- ✗ The **range of laboratory thermometer is generally from -10°C to 110°C.**
- ✗ Laboratory thermometer **should be kept upright** not tilted.
- ✗ The bulb **should be surrounded from all sides** by the substance of which the temperature is to be measured and the **bulb should not touch the surface of the container**.



3. MAXIMUM-MINIMUM THERMOMETER

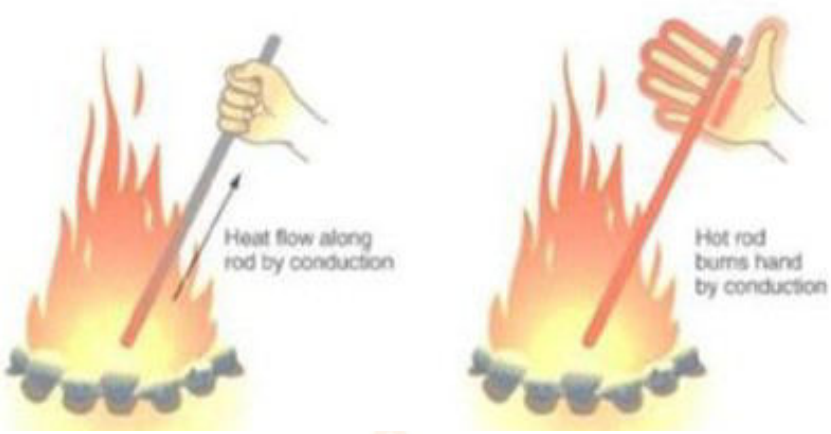
The maximum-minimum thermometer is used to measure the maximum and maximum **temperatures of the previous day reported in whether reports**.



TRANSFER OF HEAT

- The heat **flows from hotter object to colder object**.

  Example – When you hold a metal rod close to the fire, after some time the rod becomes hot and you will **feel the burn due to heat transfer by conduction**.



- **CONDUCTION** – The process by which heat is transferred from the hotter end to the colder end of an object is called conduction.

- In **solids**, heat is transferred by the process of conduction.

- The materials which allow heat to pass through them easily are called **Conductors of heat**.
  Example – Aluminium, Iron and copper.

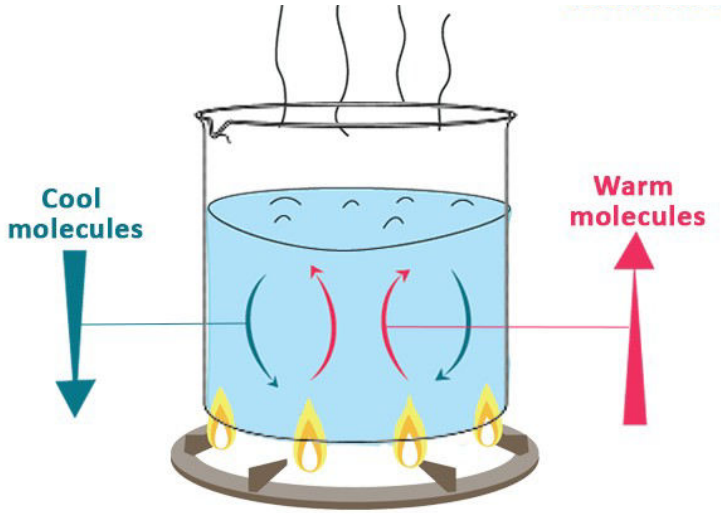
- The materials which do not allow heat to pass through them easily are called **Insulators/Poor conductors of heat**.
  Example – Plastic and wood.

- The water and air are poor conductors of heat.

Question:
A wooden spoon is dipped in a cup of ice cream. What would happen with the temperature of the other end of the spoon?

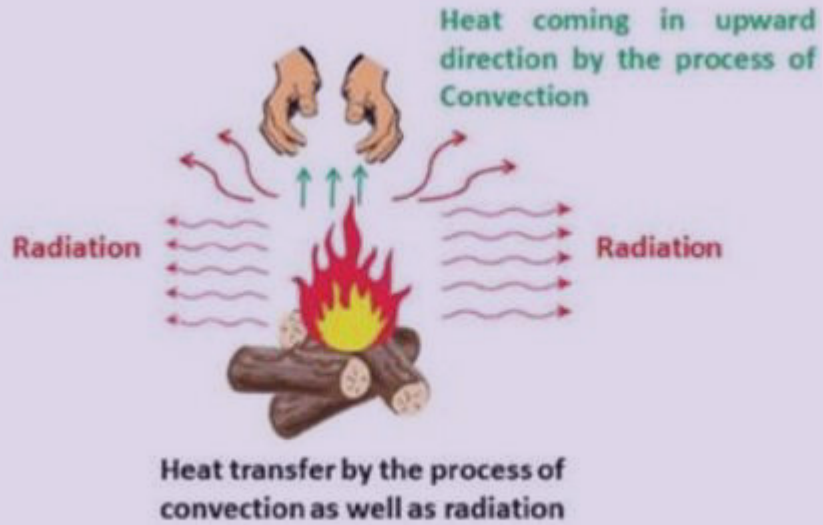
Answer:
When one end of the wooden spoon is dipped in a cup of ice-cream, there will be no change in the temperature of its other end because wood is a bad conductor of heat.

- **CONVECTION** – When water/air is heated, the water/air near the flame get hot. Hot water/air rises up. The cold water/air from the sides moves down towards the source of heat. This water/air also gets hot and rises and water from the sides moves down. The process continues till the whole water gets heated. This mode of heat transfer is known as Convection.



Question:
When you keep your hand over an open flame, then you feel warm. Why?

Answer:
When you keep your hand over an open flame, then you feel warm **due to the process of convection as well as radiation** because the air directly above the flame gets warmer and lighter in weight, as a result, it rises up and you feel warm as shown in the figure. Radiation happens in all directions and your hand fells warmer due to radiation and convection both when you keep your hand just above the flame as shown in the figure below.



Heat transfer by the process of convection as well as radiation

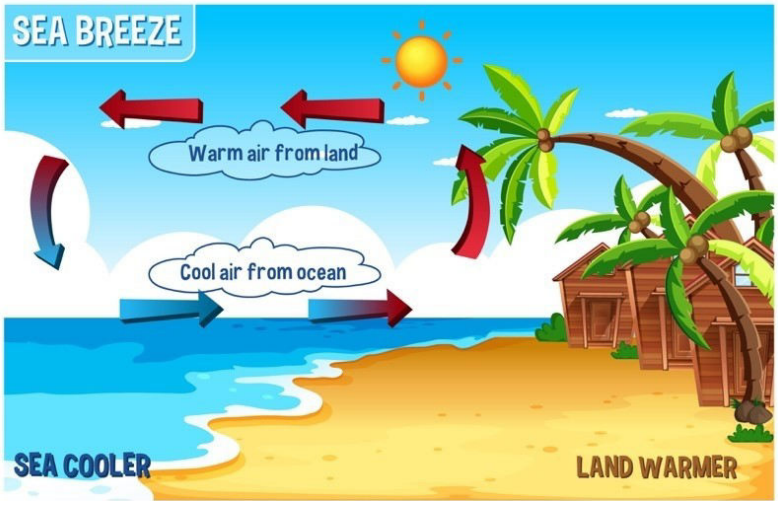
- **RADIATION** – From the sun heat comes to us by a process known as Radiation and is the **fastest mode of heat transfer**.

- The transfer of heat by **radiation does not require any medium**. It can take place whether a medium is present or not.

- All hot bodies radiate heat.

SEA BREEZE

During the day, land gets heated faster than water. Due to this air over the land becomes hotter and rises up, while cooler air from the sea rushes in towards the land to take its place. The warmer air from the land moves towards the sea to complete the cycle. The air from the sea is called the Sea Breeze.



LAND BREEZE

At night the process was exactly the reverse. The water cools down more slowly than the land. So, the cool air from the land moves towards the sea. This is called Land Breeze.

KINDS OF CLOTHES WE WEAR IN SUMMER AND WINTER

- ✗ In winters, we prefer to wear dark colour clothes because it absorbs more heat rays from the sun and keeps us warm in winter season.
- ✗ In summers, we prefer wearing light (white) coloured clothes because light coloured clothes reflect most of the heat that falls on them and, therefore, we feel cool and comfortable wearing them in the summers.

Question:
Why do we wear woollen clothes in winters?

Answer:
In winters, we use woollen clothes. Wool is a poor conductor of heat. Moreover, there is air trapped in between the wool fibre. This air prevents the flow of heat from our body to the cold surroundings. So, we feel warm.

GLOSSARY

- **Temperature** – The degree of hotness and coldness of the body is known as temperature.
- **Clinical thermometer** – It is used for measuring the temperature of human body.
- **Laboratory thermometer** – It is used for measuring the temperature in a science laboratory.
- **Conduction** – It is the process by which heat is transferred from the hotter end to the colder end without the actual movement of an object.
  Example – Hotness of Iron.
- **Conductor** – The material which allow heat to pass through them easily is called conductors.
  Example – Silver, copper.
- **Insulator** – The material which do not allow heat to pass through them easily is called insulators.
  Example – Plastic, glass.
- **Convection** – It is the process of flow of heat through a fluid from places of higher temperature to the places of lower temperature is called convection.
  Example – Boiling of water.
- **Radiation** – It is the process of the flow of heat energy from a hot body to a cold body by means of heat rays without any medium between them.
  Example – Sunlight reaches to the earth