

Heat



Topics to be Covered



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1. Heat and Temperature

1.1 Hotness and Coldness

In our day-to-day life, some objects feel hot (e.g., boiling water) while others feel cold (e.g., ice). Often while deciding this, we rely on our sense of touch which is not a reliable method.



Boiling water



Ice

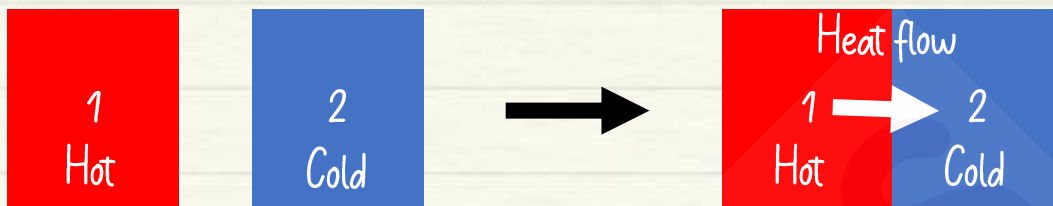
1.2 Temperature

Temperature is a measure of the degree of hotness or coldness of a body.

The temperature of a body is generally measured in degree Celsius ($^{\circ}\text{C}$) using a device called thermometer.

1.3 Heat

Heat is a form of energy that flows from a higher temperature body to a lower temperature body when they are brought in contact.



Heat flows till both the bodies attain the same temperature.

1.4 Difference between Heat and Temperature

Heat

- Heat is a form of energy that flows when there is temperature difference between two bodies in contact.
- Heat can be measured in joule (J) or calorie (cal).

Temperature

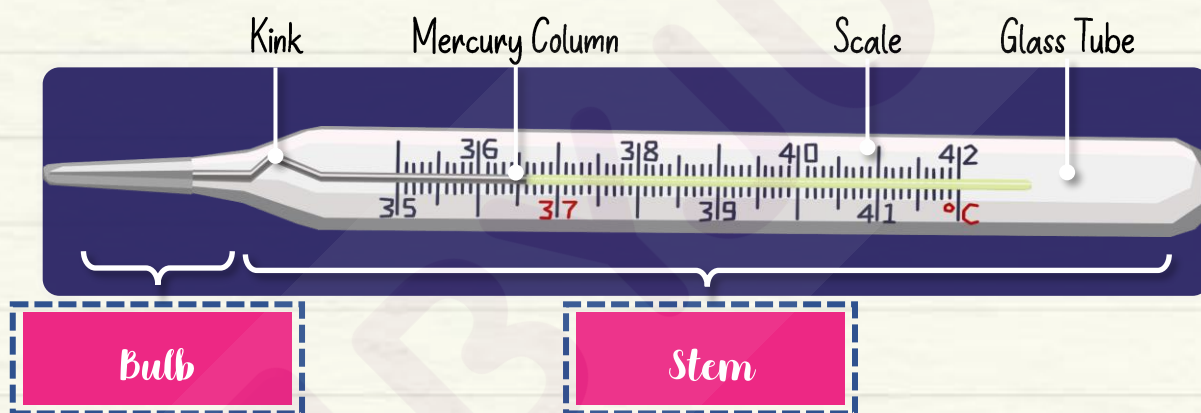
- Temperature is a measure of the degree of hotness and coldness of a body.
- Temperature can be measured in degree Celsius ($^{\circ}\text{C}$) or degree Fahrenheit ($^{\circ}\text{F}$) or kelvin (K).

2. Thermometer

A thermometer is an instrument used to measure the temperature of a body.

2.1 Clinical Thermometer

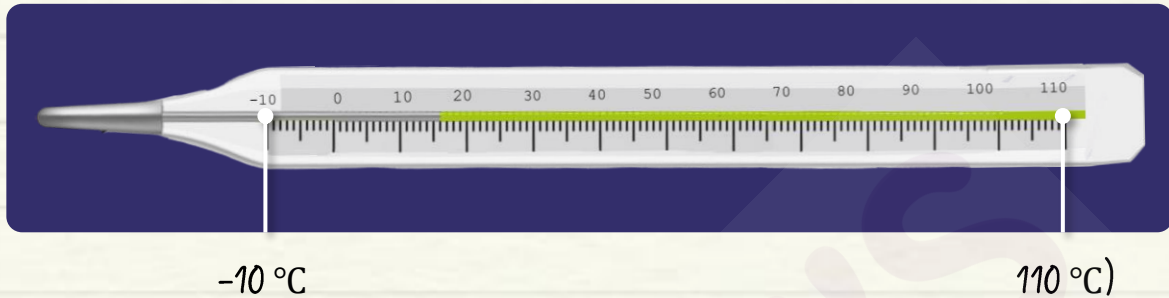
- A clinical thermometer is meant for clinical purpose – for measuring human body temperature.



- A clinical thermometer has a kink to prevent the mercury from dropping back to the bulb when the reading is being taken.
- The temperature range of a clinical thermometer is 35 °C to 42 °C as the human body temperature generally varies in this range. The average normal human body temperature is 37 °C.

2.2 Laboratory Thermometer

- A laboratory thermometer is used for measuring the temperature of an object in the laboratory.



- Unlike a clinical thermometer, the laboratory thermometer doesn't have a kink as reading is taken while the thermometer is in contact with the object.
- The temperature range of a laboratory thermometer is $-10\text{ }^{\circ}\text{C}$ to $110\text{ }^{\circ}\text{C}$.



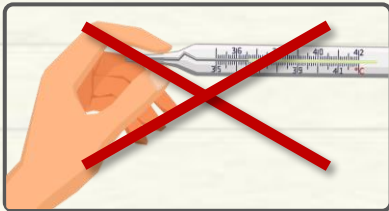
Did you know?

- As mercury is highly toxic and its disposal is a concern in case the thermometer breaks, these days digital thermometers which do not use mercury are preferred.

2.3 Precautions for Thermometers

Following precautions must be taken while using a clinical thermometer:

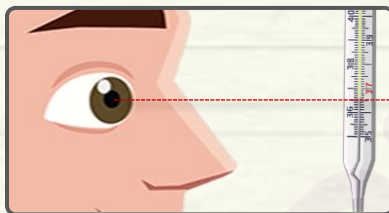
- Do not hold it by the bulb.



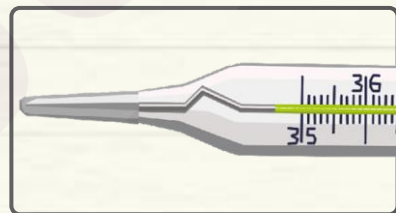
- Wash it before and after use.



- Level of mercury should be along the line of sight.



- Initial mercury level should be below 35 °C.

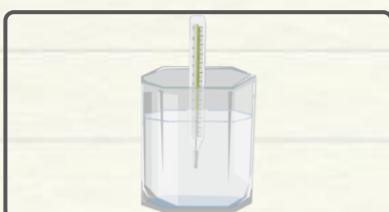


- Handle with care.



Additional Precautions for Laboratory Thermometer

- It should be upright.
- The bulb should not touch the walls of the container.

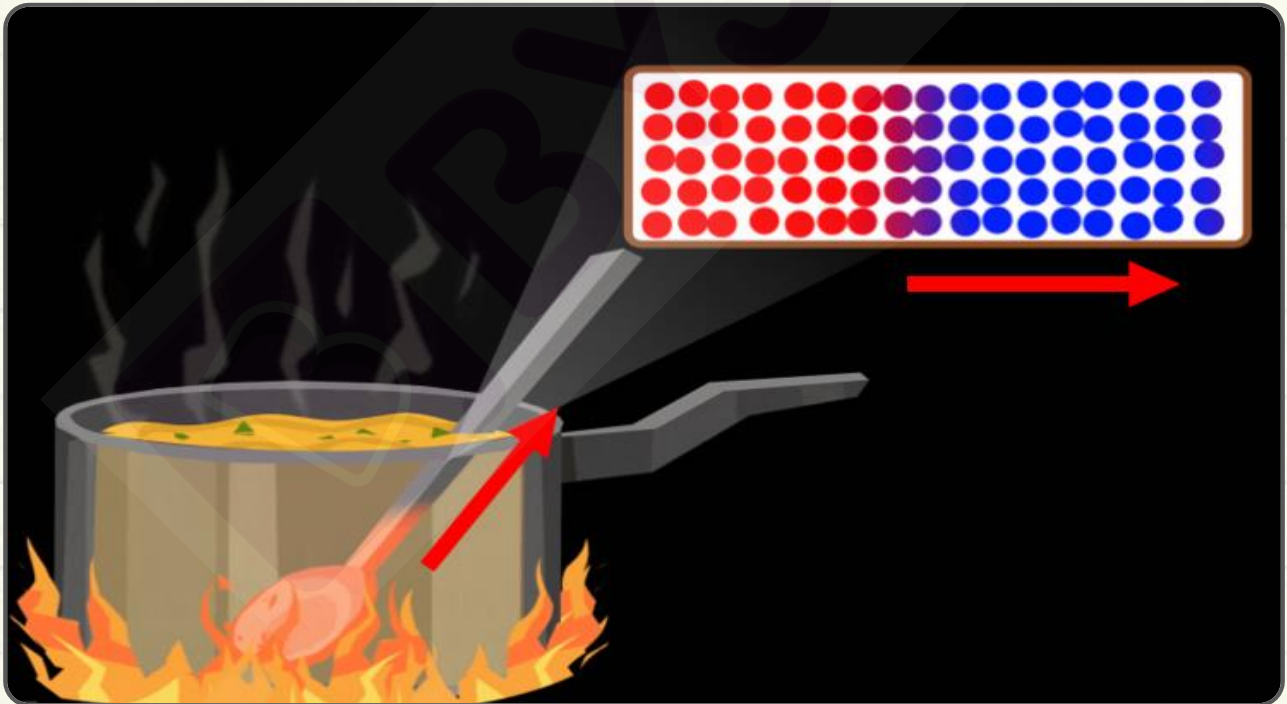


3. Modes of Heat Transfer

There are three modes of heat transfer: conduction, convection, and radiation.

3.1 Conduction

- In conduction, the particles of the medium vibrate about their mean positions during the transfer of heat.
- Conduction requires a material medium and is the prominent mode of heat transfer in solids.



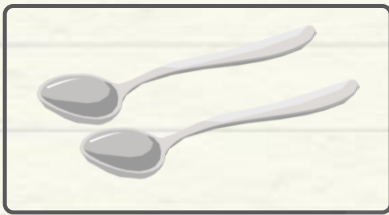
Heat transfer by conduction is possible between two objects only when:

- There is direct contact between the two objects
- There is a temperature difference between the two objects in contact

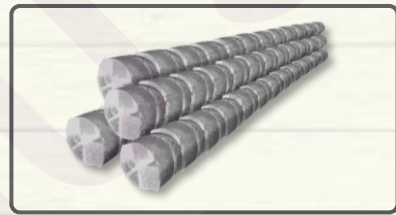
Materials are classified as conductors and insulators based on their ability to conduct heat.

Conductors

Materials which allow heat to pass through them easily are called conductors of heat.



Steel



Iron



Silver



Copper

Stainless steel pans are usually provided with copper base because copper is a better conductor of heat than stainless steel. This ensures faster cooking.



Insulators

Materials which do not allow heat to pass through them easily are called insulators or poor conductors of heat.



Wool



Glass



Plastic



Wood

Handles of cooking utensils are made of plastic or wood as they are poor conductors of heat and do not get heated up easily.



3.2 Convection

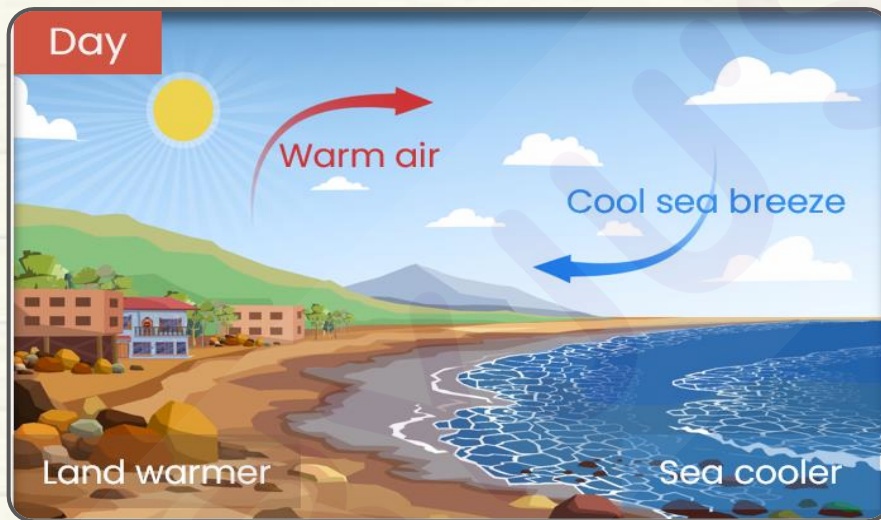
- In convection, transfer of heat takes place by the actual movement of medium particles. Fluids (liquids and gases) are predominantly heated by convection.
- The fluid near the heat source gets hot and rises up. The fluid from the sides comes in to take its place. This process continues to heat the entire fluid.



Sea breeze and land breeze are examples of convection current and happen due to uneven heating of land and water in coastal areas.

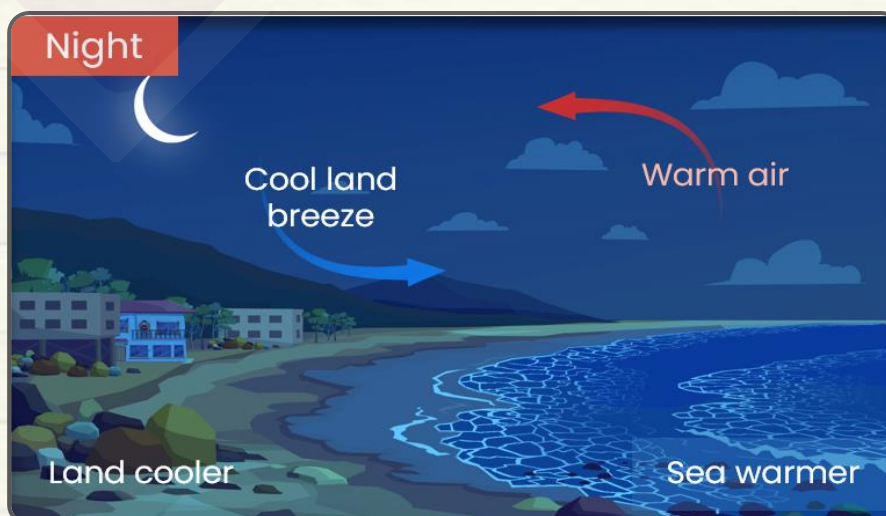
Sea Breeze

During the day, the land gets heated faster than the water. Air above the land gets heated and rises up. Cooler air from the sea moves towards the land. Warm air from the land moves towards the sea to complete the cycle. This breeze from the sea to land is called sea breeze.



Land Breeze

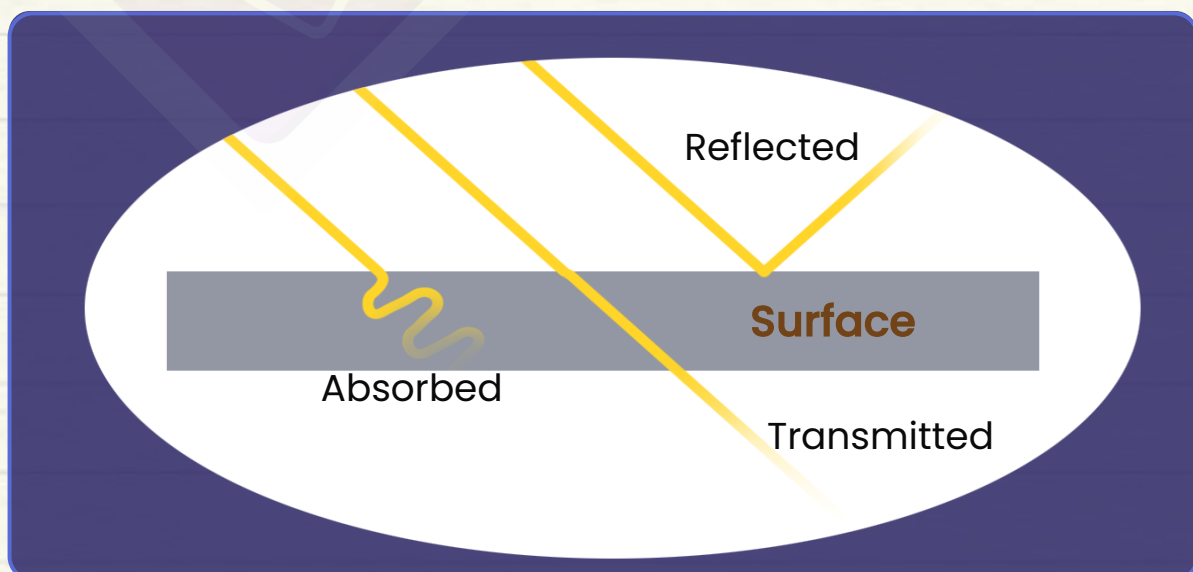
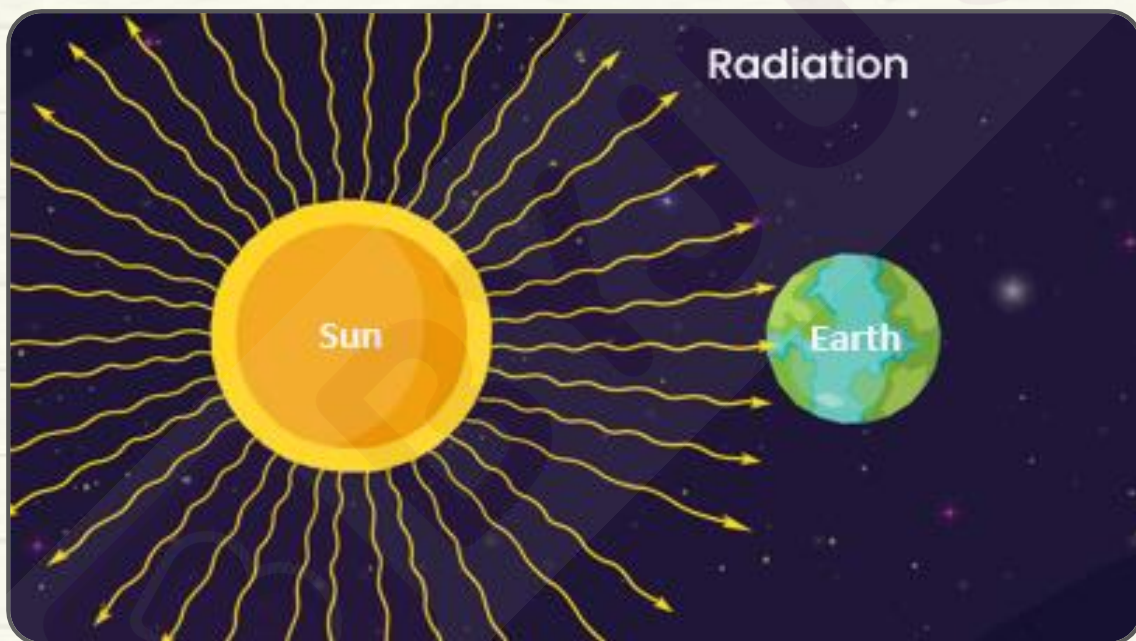
During the night, the air above sea gets cooled slowly. As a result, cool air from the land moves towards the sea. This is called land breeze.



3.3 Radiation

Radiation is a mode of heat transfer which does not need a medium. All bodies radiate heat. When this heat falls on an object:

- some part of the heat is reflected
- some part is absorbed (which increases temperature of the object)
- some part may be transmitted through the medium.



4. Heat and Fashion

Light-coloured objects reflect more heat as compared to dark-coloured ones. Therefore, we feel more comfortable wearing light-coloured clothes in summers and dark-coloured clothes in winters.



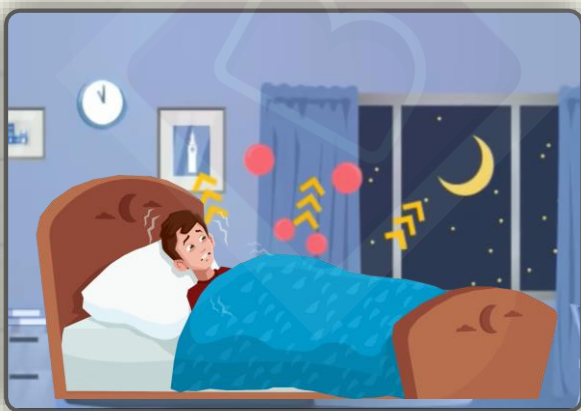
In hot climate areas, outer walls of the houses are painted with light colours as they absorb less heat, thereby keeping the house cool.



In winters, woolen clothes are preferred as they are poor conductors of heat. Moreover, air trapped in between wool fibers prevents flow of heat from our body to the cold surrounding.



In cold weathers, it is better to cover ourselves with two thin blankets rather than one thick blanket. The air trapped in between the two blankets ensures less heat loss from the body to the surrounding.



One thick blanket



Two thin blankets

Mind Map

B

