

3

Chapter

Heat

We'll cover the following key points:

- Heat
- Temperature and its Measurements
- Transfer of Heat



Hi, I'm EeeBee

Do you Remember:

Fundamental concept in previous class.

In class 6th we learnt

- Temperature
- Thermometer

Still curious?

Talk to me by scanning the QR code.



Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of heat, its sources, and its role in daily life.
- Differentiate between heat and temperature, and explain how temperature is measured using various instruments.
- Describe the methods of heat transfer, including conduction, convection, and radiation, with real-life examples.

Guidelines for Teachers

The teacher can begin the chapter by explaining the significance of heat and temperature in daily life and their interrelation. Encourage students to perform hands-on experiments, such as measuring temperature with a thermometer or observing heat transfer through different materials. Use visuals and animations to demonstrate conduction, convection, and radiation in real-world contexts. Linking heat transfer to practical examples, such as cooking, weather patterns, or insulation, can make the lesson engaging and relatable for students.

NCF Curricular Goals and Competencies

CG-2 (C 2.4): Develops an understanding of the principles of heat, temperature, and their measurements using scientific tools.

CG-3 (C 3.6): Analyzes the mechanisms of heat transfer and their applications in everyday life and technological innovations.

CG-5 (C 5.1 and C 5.3): Explores the relationship between thermal energy and its role in natural and human-made systems, fostering scientific inquiry and critical thinking.



Mind Map

HEAT

Hot and cold

Object	Cold/Cool	Warm/Hot
Ice cream	✓	
Spoon in a tea cup		✓
Fruit juice	✓	
Handle of a frying pan		✓

A reliable measure of the hotness of an object is called temperature.

Thermometer

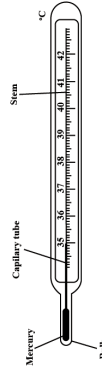
Meaning

- It is a device to measure temperature
- Kinds of Thermometer
 - Clinical Thermometer:** It measures body temperature. The range is 35°C to 42°C



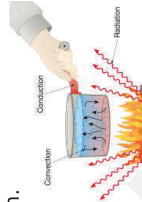
- Laboratory Thermometer:** It measures the temperature of objects. The range is -10°C to 110°C

Construction: It should be kept upright, bulb should be surrounded from all sides.



Transfer of heat

- Heat flows from Hotter objects to Colder objects.
- **Radiation:** It is generated by the emission of electromagnetic waves.
- **Conduction:** Transfer of heat from one particle to the adjacent particle without the actual movement of the particle.
- **Convection:** This transference of heat allows actual movement of particles. This transfer is convection.



Warm air from land
Sea
Cool air from sea

Warm air from sea
Land
Cool air from land

Warm air from sea
Land
Cool air from land

Warm air from sea
Land
Cool air from land

Kinds of clothes for summer and winter

In Summer : light coloured clothes reflect most of the heat that falls on them.



In Winter : Dark coloured clothes absorb most of the heat that falls on them and wool is a poor conductor of heat.



Heat

Riya and Kabir are sitting outside on a warm day.



Heat is one of the forms of energy. Different types of energy change into heat. When you rub your hands, they become warm because friction generates heat. When you run or do any other strenuous exercise, heat is generated in your body and you start sweating. Burning of fuels also generates heat. In water heater, electricity is used to heat up water. Hence, we can see that heat or thermal energy can be produced from different types of energy and it can transform into other types of energy too.

In history...

- **Development of the Thermometer (1593):** Galileo Galilei invented an early version of the thermometer called the thermoscope. It laid the foundation for measuring temperature.
- **Discovery of Conduction, Convection, and Radiation (19th Century):** Scientists like James Prescott Joule and Benjamin Thompson (Count Rumford) studied how heat moves through different materials and identified the processes of conduction, convection, and radiation.

Hot and Cold Objects

In our daily life, we come in contact with so many objects. Some of them are hot and others are cold. For example : tea is hot and ice is cold, here tea gives us the sensation of heat and ice gives the sensation of coldness.

Sometimes our sense of touch fails to estimate the degree of hotness of an object and hence, we cannot always rely on our sense of touch to decide whether an object is cold or hot.

GOOD AND POOR CONDUCTORS OF HEAT

Some materials allow heat to pass through them easily while other materials do not. So, on the basis of conduction of heat, all the materials are classified into two groups:

- **Good conductors of heat i.e., conductors**
- **Bad conductors of heat i.e., insulators.**

The materials which allow heat to pass through them quickly are called good conductors of heat. All the metals like silver, copper, aluminum, iron and alloys like brass, stainless steel, etc., are good conductors of heat.

On the other hand, the materials which do not allow heat to pass through them quickly are called poor conductors of heat or insulators. Paper, wood, leather, clothes, asbestos, brick, rubber, plastics, glass, bakelite, etc., are all bad conductors of heat. Most liquids and gases are poor conductors of heat.

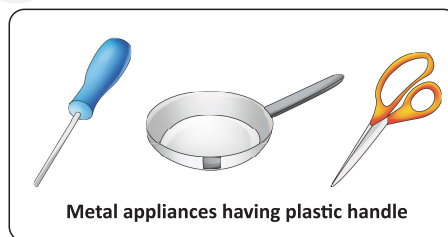
Uses of Good Conductors of Heat

In our daily life, we use so many objects which are good conductors of heat. Good conductors are used to carry heat quickly wherever it is wanted.

Some of the examples of good conductors of heat are: cooking utensils which are usually made of metals like copper and aluminium and alloys like brass and stainless steel as they are all good conductors of heat.

Cooking utensils are made of metal which transfer the heat from the gas stove quickly to the food placed inside the utensil (through their bottom). Aluminium metals are good conductors of heat which conduct the heat from the gas burner of stove quickly through their bottom to the food kept inside.

Another use of a conductor is, mercury metal, used in thermometers, because it is a good conductor of heat.



Uses of Poor Conductors of Heat

Insulating handles : Appliances like cooking pan, pressure cooker, electric iron, electric kettle, etc are provided with a wooden or **bakelite** (plastic) handles because these materials are poor conductor of heat. Hence, the heat from these hot appliances doesn't flow into our hands. As a result, we can hold the appliances by their handles even when they are hot.

KEYWORDS

Bakelite: It is a durable, non-conductive, and heat-resistant synthetic plastic made from phenol and formaldehyde, often used in electrical and industrial applications.

Let's recall what we know

Apply Concept in Context

Apply

- Why does a metal spoon feel hotter than a plastic spoon when both are left in the sun?
- How would you use different materials to make a thermos that keeps drinks warm?

Skills Covered: Critical and logical thinking, Applicative thinking, Problem-solving

Examine Further

Analyse

- Research why cooking pots are often made of metals but have wooden or plastic handles.
- How do the thermal properties of conductors and insulators affect their daily use in homes?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define what a conductor and an insulator are. Give two examples of each.
- Find two objects in your home that are good conductors and two that are insulators.

Skills Covered: Evaluation, Logical thinking, Observation

Creative Insight

Create

Create a table listing ten common items, classify them as conductors or insulators, and provide reasons for each classification.

Skills Covered: Creativity, Critical and logical thinking, Observation, Organization

SCAN TO ACCESS



Take a Task

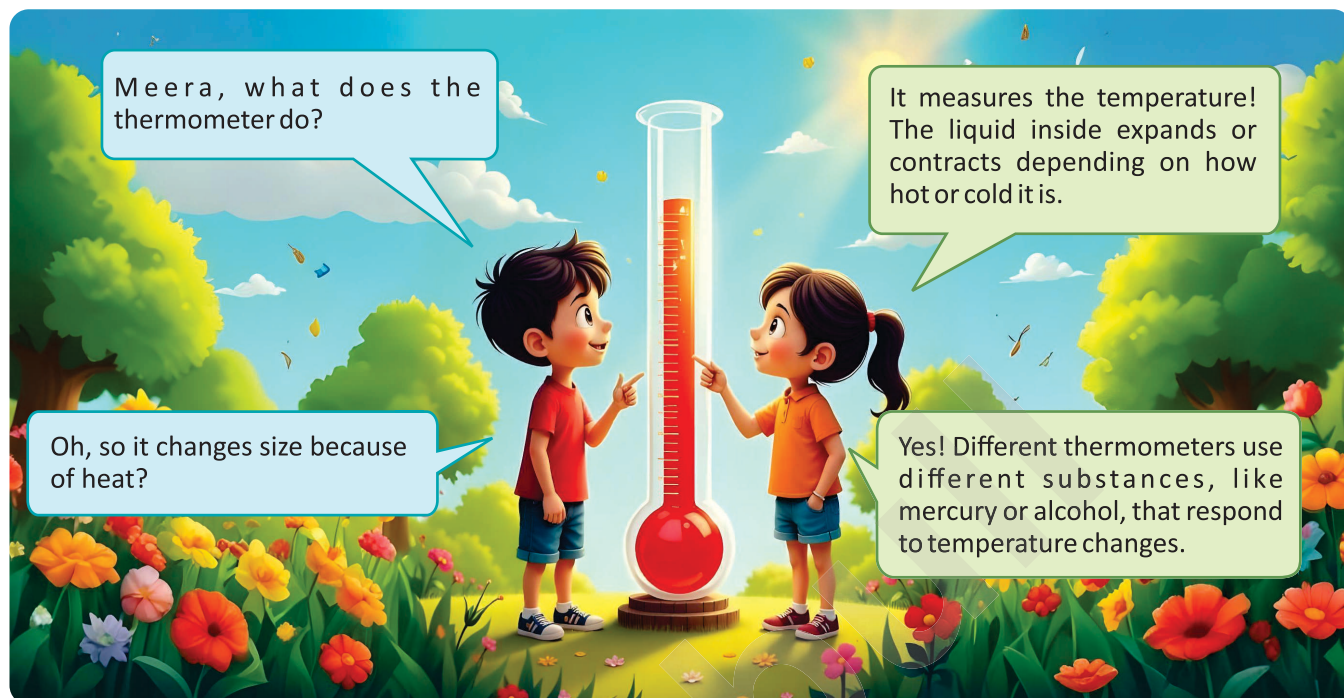


Watch Remedial

**Bloom's
Taxonomy**

Temperature and its Measurement

Aryan and Meera are looking at a thermometer.



Temperature is a measure of hotness and coldness of a body. The **SI unit** of temperature is Kelvin (K). But temperature is also measured in degree Celsius ($^{\circ}\text{C}$) and Fahrenheit (degree F) scales.

The most commonly used thermometer to measure the temperature is a thick walled, uniform glass tube to which a bulb containing mercury is attached at one end. A **capillary tube** is inside the glass stem in which **mercury** expands when the bulb is kept in contact with a hot body. Mercury is toxic and it is very difficult to dispose it when the thermometer breaks. So, nowadays digital thermometers are used to measure the temperature as they do not contain mercury.

Did You Know ?

The instrument used to measure the temperature is called a thermometer.

KEYWORDS

SI Unit: The International System of Units is the standard unit system used globally, e.g., meter (m) for length.

Capillary Tube: A thin tube used to observe the rise or fall of liquids due to surface tension.

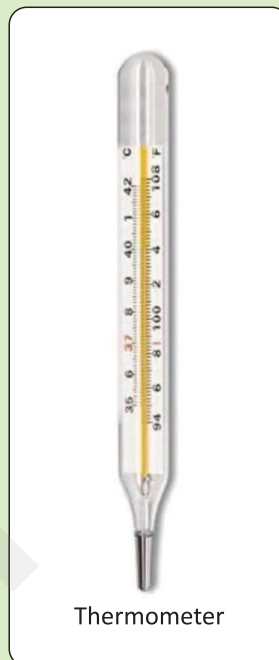
Mercury: A dense, silvery liquid metal, often used in thermometers and barometers.

Instrument for Measuring Temperature

Temperature is measured by a thermometer. A thermometer is a device which detects the change in temperature of an object. It works on the principle that liquids expand on heating. When a liquid is heated, its particles move faster and spread over a larger area. This is called expansion. When a liquid is cooled, its particles slow down and come closer. Hence its volume decreases. This is called contraction. In the beginning, alcohol was used as the liquid in thermometers. Now a days it is replaced by mercury. A thermometer consists of the following parts :

- There is a thin glass tube of very small diameter (capillary) with a bulb at one of its ends.
- The bulb is filled with the liquid and air is removed from the upper part of the capillary and its open end sealed.
- The capillary is surrounded by a glass tube on which a scale is etched to read the temperature. In an alcohol thermometer, the scale is usually from -10°C to 75°C . In a mercury thermometer, scales can vary up to much higher temperatures.

When the bulb of the thermometer comes into contact with an object at higher temperature, the liquid in the bulb expands and rises up in the capillary. The level of the liquid is read on the scale and it gives the temperature reading.



Thermometer

Types of thermometers:

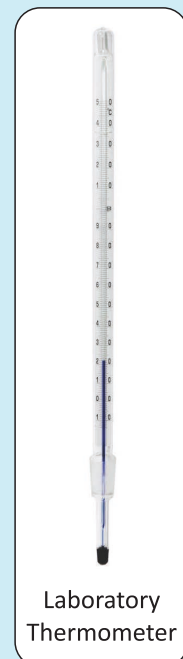
Laboratory Thermometer

The laboratory thermometer is used for measuring temperature of substances in science experiments, performed in a laboratory.

A common laboratory thermometer can measure temperature from 10°C to 110°C . This is called the range of a laboratory thermometer. This means that a common laboratory thermometer can measure a lowest temperature of 10°C , and the highest temperature of 110°C .

Precautions in Using a Laboratory Thermometer

- The thermometer should be washed before and after use.
- A thermometer is delicate and should be handled with care to avoid breakage.
- It should not be held by the bulb while reading the temperature.
- It should not be kept tilted, it should be kept upright.



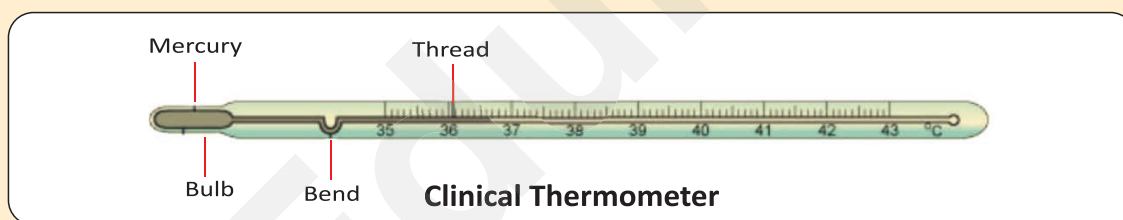
Laboratory Thermometer

- The bulb should be completely surrounded by the substance whose temperature is being measured and the bulb should not touch the sides of the container.
- While reading the thermometer, the level of mercury should be at the same level as the eye.

Clinical Thermometer

The human body temperature can't be measured by using a laboratory thermometer. This is because as soon as we take out the bulb of the laboratory thermometer from our mouth, the level of the mercury in its tube will start falling quickly, this is due to the cooling of its bulb by air. This will give wrong temperature of the body.

Now, in order to measure the temperature of a body, we should choose a thermometer, whose mercury doesn't fall quickly even when its bulb is removed from the mouth. Such type of thermometer which is used for measuring the temperature of a body is called a **clinical thermometer**. Before describing the clinical thermometer, we should know the meaning of the term 'kink'. The kink is a narrow and sharp bend in the bore of a clinical thermometer just above the bulb. Kink is also known as **constriction**. The clinical thermometer is well known as **Doctor's thermometer**.



To check the body, we use a clinical thermometer, which is placed in your mouth or in your armpit. This thermometer is used by Doctor or at home. A clinical thermometer is shown in the figure.

A clinical thermometer consists of a long glass tube having a thin and uniform bore. There is a glass bulb at one end of the glass tube. This glass bulb contains mercury. There is a small, shining thread of mercury which can be seen in the thermometer tube, and the other end of the glass tube is sealed. Also a temperature scale is marked on the glass tube of the clinical thermometer. The clinical thermometer has a temperature scale marked from 35°C to 42°C.

This thermometer has a slight bend or kink in the stem just above the bulb. When the thermometer is taken out of your mouth, the liquid in the bulb contracts and the mercury column breaks at the kink. Therefore, the level of the mercury in the stem remains the same.

Precautions in Using a Clinical Thermometer

- The clinical thermometer should be washed before and after use, with an antiseptic solution.
- We should ensure that the level of the mercury is below 35°C before using the thermometer.
- Read the clinical thermometer by keeping the level of mercury along the line of sight.
- Don't hold the thermometer by the bulb while reading it.
- Do not sterilise the thermometer in boiling water as it will break the bulb.

Let's recall what we know

Apply Concept in Context

Apply

- Provide two examples of instruments used to measure temperature. How do they differ in their usage?
- How does the liquid in a thermometer help measure temperature?

Skills Covered: Critical and logical thinking, Applicative thinking

Examine Further

Analyse

- Research the difference between digital and mercury thermometers.
- Compare how different types of thermometers are used in different situations, like medical vs. weather measurements.

Skills Covered: Critical and logical thinking, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define temperature and explain why it's important to measure it.
- Identify different types of thermometers. How do they help in daily life?

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

Create a chart with columns for thermometer type, substance used, and where it is commonly used. Include digital, mercury, and alcohol thermometers in your comparison.

Skills Covered: Creativity, Critical and logical thinking, Observation, Organization

SCAN TO ACCESS



Take a Task

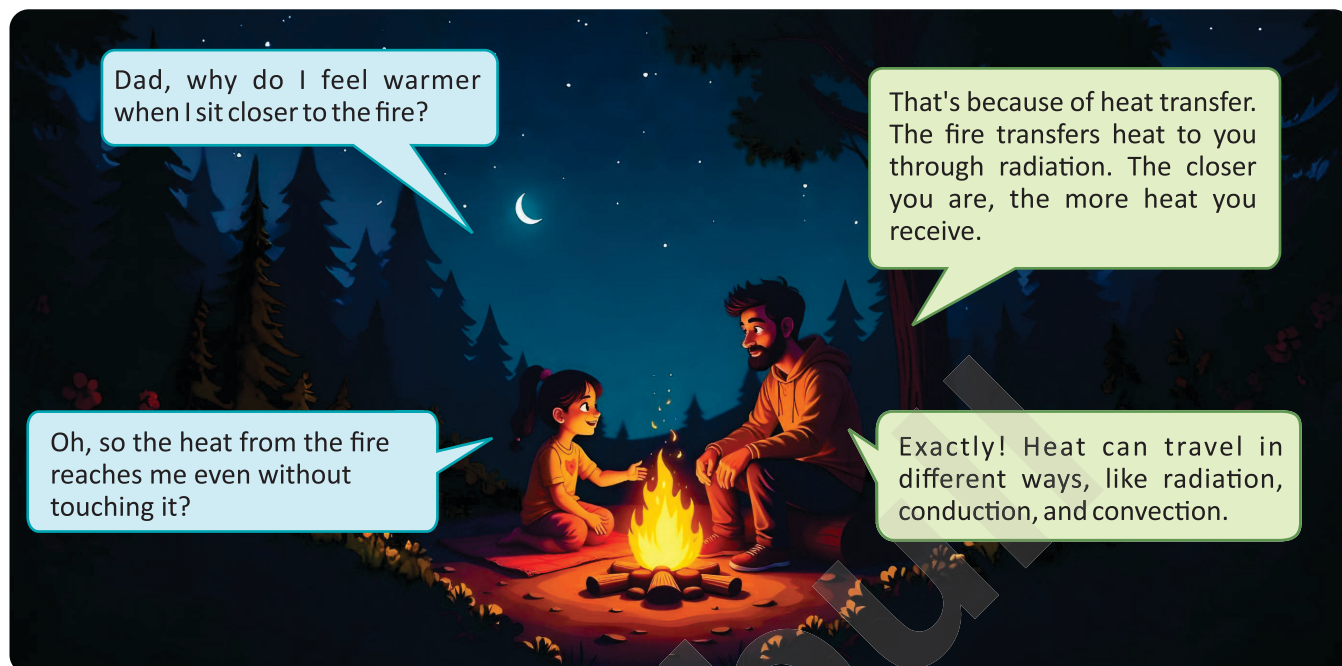


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**Bloom's
Taxonomy**

Transfer of Heat

Riya and her father are sitting by a campfire on a cold night.

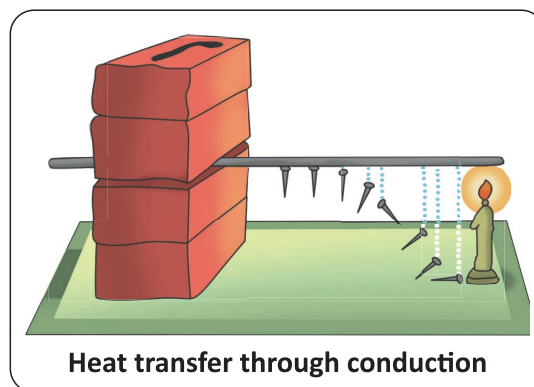


We have read earlier that heat always transfers from a body at higher temperature to a body at lower temperature. This transfer of heat takes place in three ways. These are conduction, convection and radiation.

Conduction

Take a metal rod, and fix pins using wax along its length at different intervals, as shown in Fig. Heat one end of the rod and observe.

You will notice as the rod gets hot, the wax melts and the nails start falling off. The nail which is closest to the flame falls off first, while the nail farthest from the flame falls off the last. This shows that the heat is being transferred from the end of the rod that is being heated (hot end) to the other end (cold end).



This process of heat transfer from the hotter end of an object to the colder end is called conduction. The conduction of heat takes place without the actual displacement of particles.

Conduction of heat also takes place when two bodies at different temperatures are brought into contact. In this case, the heat is transferred from the hotter object to the colder object. Let us perform an activity to understand the types of materials on the basis of their ability to transfer heat.

Activity

Aim: To distinguish various materials on the basis of their ability to transfer heat

Things required: A beaker of hot water, a piece of metallic wire, a pencil, a plastic scale, a metallic spoon, a glass stirrer, and a wooden spoon

Method: Put the available things in the beaker of hot water and observe after 3-4 minutes by touching the various objects.

Observation: Some objects like the metallic wire and metallic spoon feel hot to touch, whereas the wooden spoon, plastic scale, and glass stirrer feel the same as they were earlier.

Conclusion: Some objects (usually metals) allow heat to pass through them. They are referred to as conductors. Some objects do not allow heat to pass through them. They are referred to as insulators.

Did You Know ?

Silver metal is the best conductor of heat. Copper is also one of the best conductors of heat. Aluminium is also a good conductor of heat.

Convection

Convection is mode of transfer of heat in liquids and gases. Convection is based on the principle that not particles of liquids and gases move faster and rise up letting the cooler particles to move down towards the source of heat. In liquids and gases, heat is transmitted by convection because their molecules are quite free to move about. The **molecules** of solids are closely packed and their movement is not possible. Hence, convection does not take place in solids. The transfer of heat by convection also cannot take place in empty spaces (or vacuum) because there are no particles of any kind in empty space which can move and transfer heat.

Convection in Water

Since water is a poor conductor of heat, so it cannot transfer heat by conduction, water transfers heat by the process of convection. For heating water, we keep the vessel containing water over a gas burner. Since, the burner is kept at the bottom of the vessel, it still heats all the water in the vessel. Actually, when water is heated in a vessel, it transfer heat from its hotter parts to its colder parts by a process called 'convection'.



Hot water rises upwards in a vessel

KEYWORDS

Molecule: A molecule is the smallest unit of a chemical substance that retains its chemical properties, consisting of two or more atoms bonded together.

The process of hot water rising upwards and cold water sinking downwards takes place again and again due to which the whole water in the vessel gets heated uniformly. The circulatory movements of water in the vessel in which hot water rises and cold water sinks again and again are called convection currents. These convection currents transfer heat from water at the bottom of vessel to the top of vessel rapidly. Hence, we can say that water in a beaker is heated by convection currents.

Activity

Aim : To show that liquids transfer heat by convection

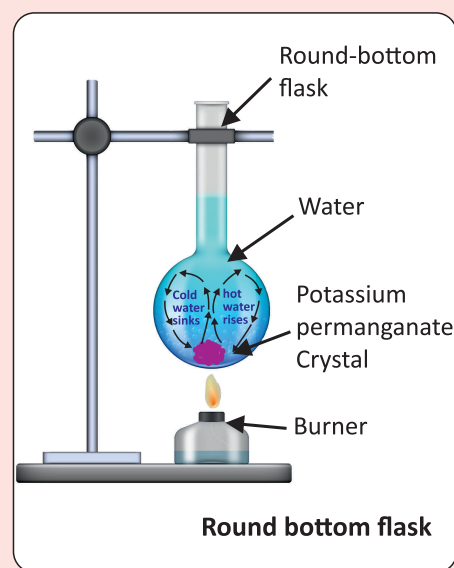
Materials Required: A round-bottom flask, potassium permanganate, burner, retort stand.

Method : Take a round-bottom flask and fill it two-third with water. A small crystal of potassium permanganate is dropped gently using a spatula at the bottom of this flask. This potassium permanganate crystal dissolves slowly and forms a purple coloured solution around it self. Heat the water at the bottom of the flask by using a burner and observe the movement of the purple coloured solution.

Observation : The purple coloured solution rises from the bottom of the flask upto the surface of water and then moves downward near the walls of the flask.

Conclusion: When water at the bottom of the flask near the flame gets heated, it expands and becomes lighter. So, hot water rises upwards and carries heat to the surface.

Water can transfer heat by convection only in upward direction because hot water rises upwards in the vessel. This is why we heat the vessel containing water from below by keeping a burner at its bottom. The heating element of an electric kettle is also fixed at the bottom of the kettle. Note that if water is heated at the top (rather than at the bottom), convection doesn't occur. If the water taken in a vessel is heated by a burner at the top, then the hot water (being lighter) stays at the top of the vessel. Since no hot water from the top can sink downwards towards the bottom of the vessel, the water at the bottom of such a vessel will remain cold.



Convection in Air

Air transfers heat from its hotter parts to the colder parts by the process of convection or by moving itself. In winters, when we heat air in a room, we keep the heater at the floor in a corner. Now, though the heater is placed on the floor at the bottom of the room but it still heats all the air

in the room. Actually, when air is heated by the heater in one part of the room, it transfers heat by convection. This happens as follows:

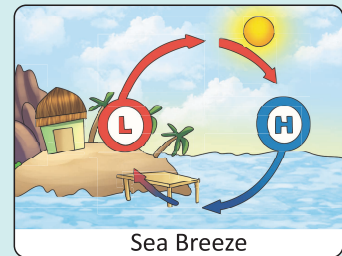
When the heater kept on the floor, in a room is switched on, the air near the heater gets heated, expands and become lighter. This hot air rises above the top of the heater and carries its heat along with it (see fig.). Like water the cold air from above sinks downwards to the bottom of the heater to take the place of the hot rising air. This cold air also gets heated by the heater and rises upwards carrying its heat upwards. And more cold air sinks downwards to the heater. This process of hot air rising upwards and cold air sinking downwards takes place again and again due to which all the air in the room gets heated uniformly after some time. The circulatory movements of air in the room in which hot air rises and cold air sinks again and again are called convection currents. Thus, a room heater heats all the air in a room by setting up convection currents in the air.



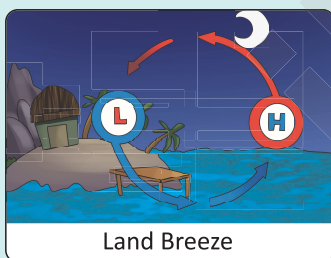
Heater in room

Convection Current in Nature

Land and sea breeze that occur near the coastal areas are a result of the convectional currents set up in the air. As land surface is a better **conductor** of heat than water, it is heated up faster during the day. This makes the air close to the land surface warmer. The warmer air rises up and the cool air from the sea rushes in to take its place. This gives rise to the sea breeze.



Sea Breeze



Land Breeze

At night, the land cools faster than water in the sea. So, the air above the sea is warmer than the air above the land surface. The **warmer air** over the sea being lighter rises up and the cool air from the land takes its place. This gives rise to land breeze.

KEYWORDS

Conductor: A material that allows heat or electricity to pass through it easily, such as metals like copper and aluminum.

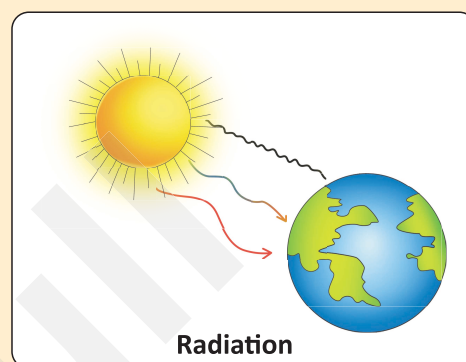
Warmer Air: Warm air is less dense and rises upward due to convection, creating space for cooler air to move in.

Did You Know ?

Air conditioners are installed near the roof. The cool air moves down and the warm air near the surface of the room rises up, thereby setting up convectional currents which cool the whole room effectively.

RADIATION

Have you ever wondered how the sun makes you warm. The energy of Sun reaches us in the form of waves. These waves are absorbed by all matter. For example we feel warm when we sit in front of an electric heater, heat from the Sun reaches us to make us feel warm. How does this heat reach us without any matter or medium present between the Sun and ourselves? The heat from the Sun is neither transferred by conduction nor by convection because the space between our atmosphere and the Sun is empty. The process, through which the heat from the Sun or heat from a heater reaches us is called radiation. Thus radiation can be defined as "The process of transfer of heat from a hot body to a cold body without affecting the medium and no material medium is required, is called radiation. The energy radiated is called radiant energy.



Every hot object emits invisible heat rays in all directions. The heat rays carry heat energy. When a cold object receives these heat rays, then the object gets heated. In this way heat energy is transferred from hot object to cold object by means of heat rays.

Absorption of Radiant Heat:

Light, which is a form of radiant energy, also travels at a great speed in all directions from the body emitting it, and does not need a material medium.

When light falls on a body, it is partly absorbed and partly reflected. Similarly, when radiant heat falls on a body a part of it is absorbed by the body and the remaining part is reflected back. The objects having dark colours absorb more heat radiations than the objects having light colours. The absorbing power or reflecting power of any substance depends upon:

- The nature of its surface.
- The colour of the object.

Shiny smooth surfaces are better reflectors, while dull, rough surfaces are better absorbers.

Thermos Flask

A hot object loses heat to the surroundings by conduction, convection and radiation. Similarly, a cold object gains heat from the surroundings by these three modes. So, to keep a hot body hot or a cold body cold, we need to reduce the loss or gain of heat respectively due to these three modes. This is done with a container called **thermos flask**.

Thermos flask or vacuum flask is a container which keeps hot liquids hot and cold liquids cold. The basic principle of the thermos flask is that heat gained or heat lost by conduction, convection and radiation is maintained at a minimum level. This flask consists of a double-walled bottle made of glass with the inner surfaces of the walls silvered. The air between the two walls is removed to create vacuum by using a vacuum pump and then sealed. The mouth of the flask is closed with cork or plastic. The double walled glass bottle is placed in a metal or plastic case with a support on corks at the bottom.

- Heat loss due to conduction is prevented because:
 - (a) Glass and cork are poor conductors of heat.
 - (b) Conduction cannot take place in vacuum as it requires a medium.
- The stopper and the vacuum prevent heat loss due to convection.
- The highly polished silver walls prevent heat loss due to radiation.

The substance in the flask therefore-retains its temperature as hot or cold for a longer time.

Let's recall what we know

Apply Concept in Context

Apply

- Explain why we feel warm standing near a fire but not near a block of ice.
- How does heat from the sun reach the Earth if space is mostly empty?

Skills Covered: Critical and logical thinking, Applicative thinking

Examine Further

Analyse

- Research the difference between conduction, convection, and radiation.
- How does wearing multiple layers of clothing help in keeping us warm?

Skills Covered: Critical and logical thinking, Brainstorming, Applicative thinking, Research

Self-Assessment Questions

Evaluate

- Define heat transfer and describe the three methods by which heat can travel.
- Give one example of each type of heat transfer from your daily life.

Skills Covered: Evaluation, Logical thinking

Creative Insight

Create

Create a diagram to show the three methods of heat transfer. Illustrate each method with an example from everyday life.

Skills Covered: Creativity, Critical and logical thinking, Observation, Organization

SCAN TO ACCESS



Take a Task



Watch Remedial

**Bloom's
Taxonomy**

SUMMARY



Heat

Heat is a form of energy that is transferred from one object to another due to a difference in temperature. It always flows from a hotter object to a cooler one until both reach the same temperature. We experience heat in our daily lives—whether it's warming our hands by a fire, cooking food, or feeling the sun's warmth on our skin. The study of heat involves understanding how it is transferred, measured, and felt by different objects. Heat energy is measured in units called calories or joules. Understanding how heat works helps us make the best use of it in heating our homes, cooking, and creating energy-efficient systems.

Temperature and Its Measurement

Temperature is a measure of how hot or cold something is. It is related to the movement of particles in a substance—the faster they move, the higher the temperature. Temperature is measured in degrees Celsius ($^{\circ}\text{C}$) or Fahrenheit ($^{\circ}\text{F}$).

- **Clinical Thermometer:** Used to measure body temperature, it has a narrow temperature range (35°C to 42°C). It features a constriction in the tube to retain the measured temperature. Clinical thermometers are commonly used for checking fever.
- **Laboratory Thermometer:** Used in laboratories to measure temperatures of substances, with a wider range (usually -10°C to 110°C). It does not have a constriction and is not suitable for measuring body temperature. Laboratory thermometers are used in experiments and research.

Transfer of Heat

Heat can be transferred from one object to another in three main ways—conduction, convection, and radiation.

- **Conduction:** Heat transfer through direct contact between particles, usually in solids. Example: Heat moving through a metal spoon in a hot pot.
- **Convection:** Heat transfer through the movement of fluids (liquids or gases) as warm fluid rises and cool fluid sinks, creating a cycle.
- **Radiation:** Heat transfer through electromagnetic waves, without needing a medium. Example: The warmth felt from the sun or a campfire.

Applications of Heat and Temperature in Daily Life

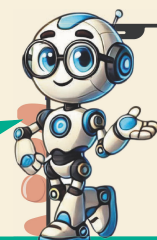
- **Cooking:** Conduction and convection are commonly used in cooking food to ensure it's evenly cooked.
- **Weather:** Convection currents in the atmosphere help determine weather patterns, such as winds and storms.
- **Safety:** Thermometers help us monitor body temperature to detect fever or ensure the safety of food storage.

EeeBee: Your AI Buddy

Explore! **Heat** with EeeBee AI Buddy.

Hi Friend! Use prompts to ask me questions about the chapter we just finished! eeee, lets go!

Start by
Scanning this
QR Code:





EXERCISE

That turn curiosity into confidence—let's begin!



Gap Analyzer™
Take a Test

A. Choose the correct answer.

1. Which of the following is a method of heat transfer?

- | | | | |
|----------------|--------------------------|----------------|--------------------------|
| (a) Absorption | ☐ | (b) Conduction | ☐ |
| (c) Digestion | ☐ | (d) Reflection | ☐ |

2. What is the best conductor of heat?

- | | | | |
|-----------|--------------------------|-------------|--------------------------|
| (a) Wood | ☐ | (b) Plastic | ☐ |
| (c) Metal | ☐ | (d) Air | ☐ |

3. What process allows warm air to rise and cool air to sink?

- | | | | |
|----------------|--------------------------|----------------|--------------------------|
| (a) Conduction | ☐ | (b) Convection | ☐ |
| (c) Radiation | ☐ | (d) Insulation | ☐ |

4. Which method of heat transfer does not require a medium?

- | | | | |
|----------------|--------------------------|----------------|--------------------------|
| (a) Conduction | ☐ | (b) Convection | ☐ |
| (c) Radiation | ☐ | (d) Insulation | ☐ |

5. Which of these is an example of radiation?

- | | | | |
|-------------------------------------|--------------------------|----------------------------|--------------------------|
| (a) Heat moving through a metal rod | ☐ | (b) Boiling water in a pot | ☐ |
| (c) Heat from the sun | ☐ | (d) Warm air from a heater | ☐ |

B. Fill in the blanks.

- Heat always moves from a _____ object to a _____ object.
- The process of heat transfer through direct contact is called _____.
- The movement of warm water in a pot is an example of _____.
- Heat from the sun reaches us through _____.
- _____ are materials that do not conduct heat well.

C. Write True or False.

- Conduction occurs in gases. _____
- Convection is the transfer of heat in liquids and gases. _____
- Radiation does not require a medium to transfer heat. _____
- Metals are poor conductors of heat. _____
- Heat flows from cooler objects to hotter objects. _____

D. Define the following terms.

1. Heat
2. Conduction
3. Convection
4. Radiation
5. Insulators

E. Match the columns.

Column A

1. Conduction
2. Convection
3. Radiation
4. Insulators
5. Metal

Column B

- (a) Transfer of heat through waves
- (b) Currents in liquids and gases
- (c) Heat transfer by contact
- (d) Materials that block heat
- (e) Good conductor of heat

F. Give reasons for the following statements.

1. Metals are used to make cooking utensils.
2. Heat from the sun reaches the Earth through radiation.
3. Convection helps distribute heat in a pot of boiling water.
4. Woolen clothes keep us warm in winter.
5. Pot handles are often made of plastic or wood.

G. Answer in brief.

1. What is heat?
2. How does conduction differ from convection?
3. Why do we feel warm sitting near a fire?
4. How does convection help in heating water?
5. What is radiation?

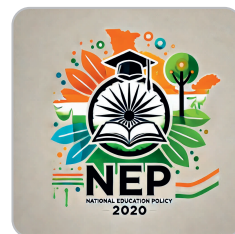
H. Answer in detail.

1. Explain the three methods of heat transfer with examples.
2. Describe the role of conductors and insulators in our daily lives.
3. How does convection work in heating liquids and gases?
4. Discuss the importance of radiation in our environment.
5. How is temperature measured, and what are the common units?



**Cooler Report Cards!**

Your report cards will now reflect not just your marks but also your skills, values, and teacher's and peer's feedback. It's all about the real you!



Skill-based Activity

**Curious Minds at Work****STEM**

Observe the process of heating a pot of water on the stove. Write a question about how heat travels from the stove to the water. Using the scientific method, describe the steps you would take to answer your question.

Skills Covered: Critical and logical thinking, Brainstorming, Analytical thinking, Problem-solving, Curiosity, Observation, Decision-making skills

Wonders of Heat Transfer**Art**

Create a detailed sketch showing the digestive system of a grass-eating animal or the process of phagocytosis in amoeba. Write a description explaining how food is processed in the digestive system. Present your work to the class.

Skills Covered: Creativity, Critical and logical thinking, Applicative thinking

Comparing Heat Transfer Methods**Group Activity**

In groups, create a chart comparing the three methods of heat transfer. Present your findings, highlighting similarities and differences between conduction, convection, and radiation.

Skills Covered: Critical and logical thinking, Brainstorming, Teamwork, Communication, Applicative thinking, Decision-making skills

Technology in Focus**Case to Investigate**

Research how heat transfer is applied in everyday technology, such as home insulation or cooking appliances. Write a short report on how these technologies make our lives more comfortable or efficient.

Skills Covered: Critical and logical thinking, Brainstorming, Research, Applicative thinking

Sustainable Energy

Aligning with SDGs

Research a program or initiative that focuses on renewable energy sources that use heat, such as solar thermal energy. Highlight its key features and how it aligns with sustainable development goals. Present your findings to the class.

Aligned with: SDG 7 – Affordable and Clean Energy, SDG 13 – Climate Action

Skills Covered: Critical and logical thinking, Brainstorming, Research, Problem-solving, Ethics

Mapping Heat Transfer

Integrated Learning

Using the Internet, create a map showing different regions where heat transfer technologies are applied, such as geothermal heating or solar energy. Explain how these adaptations help people survive in their environments.

Integrated Learning: Geography and Physics

Skills Covered: Critical and logical thinking, Brainstorming, Analytical thinking, Applicative thinking