CHAPTER 3

HEAT

2-mark questions:

1. State similarities between the laboratory thermometer and the clinical thermometer.

Answer:

Similarities

- Both are made of glass and consist of a long narrow glass tube
- At one end both of them have a bulb
- Bulbs of both the thermometers consist of mercury
- Celsius scale is present in both the thermometers

2.State differences between the laboratory thermometer and the clinical thermometer.

Answer:

Differences

Clinical Thermometer	**Laboratory thermometer**
Temperature range is 35 to 42 ^{0} c	Temperature range is -10 to 110 ^{0} c
Used to measure human body	Used to measure temperature

temperature	in the laboratory
It has kink which prevents immediate backflow of mercury	It does not have a kink

3.Give two examples each of conductors and insulators of heat.

Answer:

Conductors:

Iron and copper

Insulators:

Plastic and wood

4.Explain the difference between a clinical thermometer and a laboratory thermometer.

Answer:

A clinical thermometer is designed to measure body temperature and has a limited range, typically from 35°C to 42°C. It has a kink to prevent the mercury level from falling. On the other hand, a laboratory thermometer is used for various purposes and has a broader range, usually from –10°C to 110°C.

5.Name two conductors and two insulators of heat.

Answer:

Two conductors of heat are metals like copper and aluminum. Two insulators are materials like wood and plastic.

6.Why do we feel warmer in light-colored clothes during summer?

Answer:

Light-colored clothes reflect most of the heat that falls on them, preventing the absorption of heat. This reflection makes us feel more comfortable in light-colored clothes during summer.

7.What are the three ways in which heat can be transferred from one object to another?

Answer:

Heat can be transferred by conduction (in solids), convection (in liquids and gases), and radiation (no medium required).

8. Discuss why wearing more layers of clothing during winter keeps us warmer than wearing just one thick piece of clothing.

Answer:

More layers of clothing during winter keeps us warmer than wearing just one thick piece of clothing because air gets trapped in between the layers. As air is a bad conductor of heat it does not allow the heat to escape from the body.

5 Marks Question:

1. Explain the concept of heat transfer in different materials and its applications.

Answer:

Heat transfer plays a crucial role in our daily lives, and it occurs through three main mechanisms: conduction, convection, and radiation.

Conduction:

Definition:

Conduction is the process of heat transfer through a material without any actual movement of the material itself.

Explanation:

In solids, heat is transferred through the vibration of atoms or molecules. When one part of a solid is heated, the increased kinetic energy of the particles is transferred to neighboring particles, leading to an overall increase in temperature.

Application:

Metals, being good conductors, are used in cooking utensils to ensure even heating.

Convection:

Definition:

Convection is the transfer of heat through the movement of fluids (liquids or gases).

Explanation:

In liquids and gases, heat transfer is facilitated by the movement of the fluid. Hotter, less dense regions rise, while cooler, denser regions sink, creating a continuous circulation of fluid.

Application:

Convection is evident in natural phenomena like sea and land breezes. It's also harnessed in household heating systems.

Radiation:

Definition:

Radiation is the transfer of heat through electromagnetic waves and does not require a medium for propagation.

Explanation:

All hot bodies radiate heat. When this radiant heat falls on an object, a part is reflected, a part is absorbed, and a part may be transmitted. This process can occur in a vacuum.

Application:

Sunlight reaching the Earth is a classic example of heat transfer through radiation. It's also employed in technologies like infrared heaters.

2. Describe the impact of color on heat absorption and emission, giving examples of practical applications.

Answer:

Introduction:

Color plays a significant role in the absorption and emission of heat. The impact of color on heat is evident in everyday life and has practical applications in various fields.

Heat Absorption:

Dark Colors:

Dark or black colors absorb more heat than light colors. This is because darker colors absorb a broader spectrum of light, converting it into heat energy.

Example: On a hot summer day, wearing dark-colored clothing can make a person feel warmer due to increased heat absorption.

Heat Emission:

Light Colors:

Light or white colors reflect more heat and light, preventing the absorption of a significant amount of energy.

Example: White roofs or reflective surfaces on buildings can help in reducing indoor temperatures by reflecting sunlight.

Practical Applications:

Clothing Choice:

In cold climates, people prefer dark-colored clothing to absorb and retain heat, while in hot climates, light-colored clothing is favored to reflect heat and stay cool.

Architectural Design:

Urban planners may recommend light-colored surfaces in city planning to mitigate the urban heat island effect, reducing overall temperatures.

Conclusion:

Understanding the impact of color on heat absorption and emission is essential for making informed choices in clothing, building design, and various practical applications, contributing to energy efficiency and human comfort.

3. Fill in the blanks:

(a) The hotness of an object is determined by its _____.

(b) Temperature of boiling water cannot be measured by a _____ thermometer.

(c) Temperature is measured in degree _____.

(d) No medium is required for transfer of heat by the process of _____.

(e) A cold steel spoon is dipped in a cup of hot milk. Heat is transferred to its other end by the process of _____.

(f) Clothes of _____ colors absorb heat better than clothes of light colors.

Answer:

(a) The hotness of an object is determined by its **temperature**.

(b) Temperature of boiling water cannot be measured by a **clinical** thermometer.

(c) Temperature is measured in degree **Celsius**.

(d) No medium is required for transfer of heat by the process of **radiation**.

(e) A cold steel spoon is dipped in a cup of hot milk. Heat is transferred to its other end by the process of **conduction**.

(f) Clothes of **dark** colors absorb heat better than clothes of light colors.

4. Match the following:

Column-I	Column-II
(I) Land breeze blows during	(a) summer
(ii) Sea breeze blows during	(b) winter
(iii) Dark colored clothes are preferred during	(c) day
(iv) Light colored clothes are preferred during	(d) night

Answer:

Column-I	Column-II
(I) The land breeze blows during	(d) night
(ii) The sea breeze blows during	(c) day
(iii) Dark colored clothes are preferred during	(b) winter
(iv) Light colored clothes are preferred during	(a) summer

5. Look at Fig. 4.13. Mark where the heat is being transferred by conduction, by convection and by radiation.

Fig. 4.13

Answer:

6. One liter of water at 30°C is mixed with one liter of water at 50°C. The temperature of the mixture will be

(a) 80°C (b) more than 50°C but less than 80°C (c) 20°C (d) between 30°C and 50°C

Answer:

The temperature of the mixture will be between 30°C and 50°C because hot water loses heat and simultaneously cold water gains heat. This keeps the temperature in between 30°C and 50°C.

7. An iron ball at 40°C is dropped in a mug containing water at 40°C. The heat will

(a) flow from the iron ball to water.

(b) not flow from the iron ball to water or from water to the iron ball.

(c) flow from water to the iron ball.

(d) increase the temperature of both.

Answer:

Answer is (b) not flow from the iron ball to water or from water to the iron ball because both of them have the same temperature of 40°C.

8. A wooden spoon is dipped in a cup of ice cream. Its other end

(a) becomes cold by the process of conduction.

(b) becomes cold by the process of convection.

(c) becomes cold by the process of radiation.

(d) does not become cold.

Answer:

The answer is (d) does not become cold because wood is a bad conductor of heat.

9. Stainless steel pans are usually provided with copper bottoms. The reason for this could be that

(a) copper bottom makes the pan more durable.

(b) such pans appear colorful.

(c) copper is a better conductor of heat than stainless steel.

(d) copper is easier to clean than stainless steel.

Solution:

The answer is (c) copper is a better conductor of heat than stainless steel.

Summary:

Certainly! In this chapter, we delve into the fascinating realm of heat, temperature, and the ways in which these elements influence our daily lives. We discover that our sense of touch, while intuitive, isn't always a precise indicator of temperature. The tool we employ for this task is the thermometer, with clinical thermometers dedicated to measuring body temperature and laboratory thermometers serving broader applications.

The narrative unfolds to reveal that heat naturally flows from warmer objects to cooler ones, and it does so through three distinct mechanisms: conduction (in solids), convection (in liquids and gases), and radiation (where no medium is required). We explore the characteristics of conductors, such as metals that facilitate heat transfer, and insulators, like plastics and wood, which impede it.

A noteworthy exploration is the role of color in heat absorption and reflection. Dark-colored objects absorb more heat, making them ideal for winter wear, while light-colored clothes reflect heat, offering comfort during the summer. Woolen garments, acting as insulators due to poor heat conductivity and trapped air, become our allies in staying warm during winter.

Intriguing experiments and activities punctuate the chapter, making these scientific principles tangible and relatable. The chapter doesn't just provide knowledge but invites us to actively engage with the concepts, fostering a deeper understanding of the intricate dance of heat in our live