

Chapter 1

Heat

I. Choose the best answer

Question 1.

Heat is a form of

- (a) electrical energy
- (b) gravitational energy
- (c) thermal energy
- (d) None of these

Answer:

- (c) thermal energy

Question 2.

If you apply some heat energy to a substance, which of the following can take place in it?

- (a) Expansion
- (b) Increase in temperature
- (c) Change of state
- (d) All the above

Answer:

- (d) All the above

Question 3.

Which of the following substances will absorb more heat energy?

- (a) Solid
- (b) Liquid
- (c) Gas
- (d) All the above

Answer:

- (d) All the above

Question 4.

If you apply equal amount of heat to a solid, liquid and gas individually, which of the following will have more expansion?

- (a) Solid
- (b) Liquid
- (c) Gas
- (d) All of them

Answer:

- (c) Gas

Question 5.

The process of converting a liquid into a solid is called

- (a) sublimation
- (b) condensation
- (c) freezing
- (d) deposition

Answer:

- (c) freezing

Question 6.

Conduction is the heat transfer which takes place in a

- (a) solid
- (b) liquid
- (c) gas
- (d) All of them

II. Fill in the blanks

1. A calorimeter is a device used to measure the
2. is defined as the amount of heat required to raise the temperature of 1 kg of a substance by 1°C.
3. A thermostat is a device which maintains
4. The process of converting a substance from gas to solid is called
5. If you apply heat energy, the temperature of a system will
6. If the temperature of a liquid in a container is decreased, then the inter atomic distance will

Answer:

1. heat capacity of water
2. Specific heat capacity
3. temperature of an object constant
4. deposition
5. increase
6. decrease

III. State True or False. If false, correct the statement

Question 1.

The applied heat energy can be realized as an increase in the average kinetic energy of the molecules.

Answer:

True

Question 2.

The dimensions of a substance are increased if the temperature of the substance is decreased.

Answer:

False

Correct statement:

The dimensions of a substance are increased if the temperature of the substance is increased.

Question 3.

The process of converting a substance from solid to gas is called condensation.

Answer:

False

Correct statement:

The process of converting a substance from solid to gas is called sublimation.

Question 4.

Convection is the process by which the thermal energy flows in solids.

Answer:

False

Correct statement:

Convection is the process by which the thermal energy flows in liquids and gases.

Question 5.

The amount of heat gained by a substance is equal to the product of its mass and latent heat.

Answer:

True

Question 6.

In a thermos flask, the silvered walls reflect and radiate the heat to the outside.

Answer:

False

Correct statement:

In a thermos flask, the silvered walls reflect radiated heat back to the liquid in the bottle.

III. Match the following

Question 1.

1. Conduction	(a) Liquid
2. Convection	(b) Gas to liquid
3. Radiation	(c) Solid to gas

4. Sublimation	(d) Gas
5. Condensation	(e) Solid

Answer:

1. e
2. a
3. d
4. c
5. b

V. Read the directions given below and answer the Questions.

- (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
 (b) If both assertion and reason are true, but reason is not the correct explanation of the assertion.
 (c) If the assertion is true, but the reason is false.
 (d) If the assertion is false, but the reason is true.

Question 1.

Assertion : Radiation is a form of heat transfer which takes place even in vacuum.

Reason : The thermal energy is transferred from one part of a substance to another part without the actual movement of the atoms or molecules.

Answer:

- (b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.

Question 2.

Assertion : A system can be converted from one state to another state.

Reason : It takes place when the temperature of the system is constant.

Answer:

- (a) Both assertion and reason are true and the reason is the correct explanation of the assertion.

VI. Answer briefly

Question 1.

What are the applications of conduction in our daily life?

Answer:

1. We cook food in vessels made up of metals. When the vessel is heated, heat is transferred from the metal to the food.

2. When we iron dresses heat is transferred from the iron to the cloth.
3. Handles of cooking utensils are made up of plastic or wood because they are poor conductors of heat.
4. The temperature inside igloo (snow house) is warm because snow is a poor conductor of heat.

Question 2.

What are the effects of heat?

Answer:

1. Expansion
2. Increase in temperature
3. Change in state

Question 3.

Name three types of heat transfer.

Answer:

Three types of heat transfer are:

Answer:

1. Conduction
2. Convection
3. Radiation

Question 4.

What is conduction?

Answer:

The process of heat transfer in solids from the region of higher temperature to the region of lower temperature without the actual movement of atoms or molecules is called as conduction.

Question 5.

Write a note on convection.

Answer:

The form of heat transfer from places of high temperature to places of low temperature by the actual movement of molecules is called convection. Convection takes place in liquids and gases.

Question 6.

Define specific heat capacity.

Answer:

Specific heat capacity of a substance is defined as the amount of heat energy required to raise the temperature of 1 kilogram of a substance by 1°C or 1 K. It is denoted by the symbol C.

Question 7.

Define one calorie.

Answer:

One calorie is the amount of heat energy required to raise the temperature of 1 gram of water through 1°C .

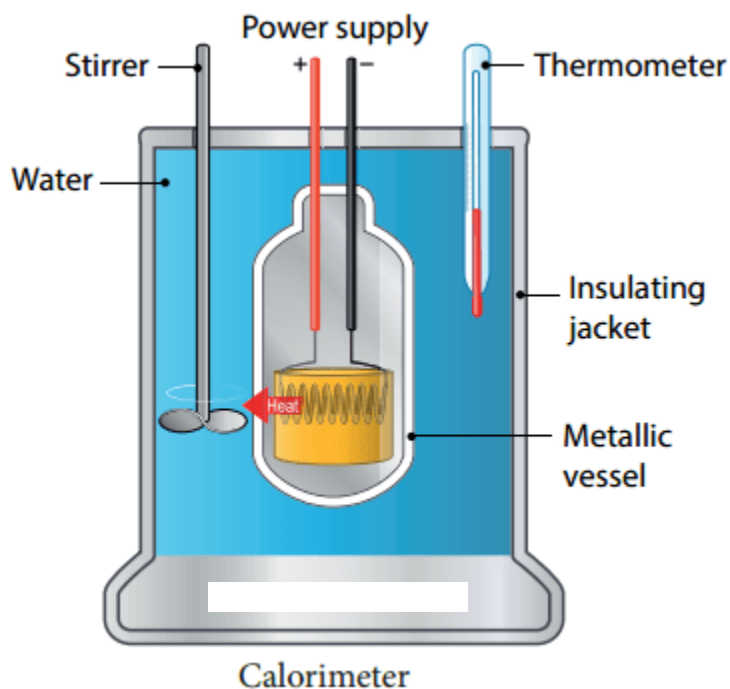
VII. Answer in detail

Question 1.

With the help of a neat diagram explain the working of a calorimeter.

Answer:

1. A calorimeter is a device used to measure the amount of heat gained or lost by a substance.
2. It consists of a vessel made up of metals like copper or aluminium which are good conductors of heat and electricity.
3. The metallic vessel is kept in an insulating jacket to prevent heat loss to the environment.



4. There are two holes in it. Through one hole a thermometer is inserted to measure the temperature Of the Contents.
5. A stirrer is inserted through another hole for stirring the content in the vessel.
6. The vessel is filled with liquid which is heated by passing current through the hating element.

7. Using this device we can measure the heat capacity of the liquid in the container.

Question 2.

Write a note on thermostat.

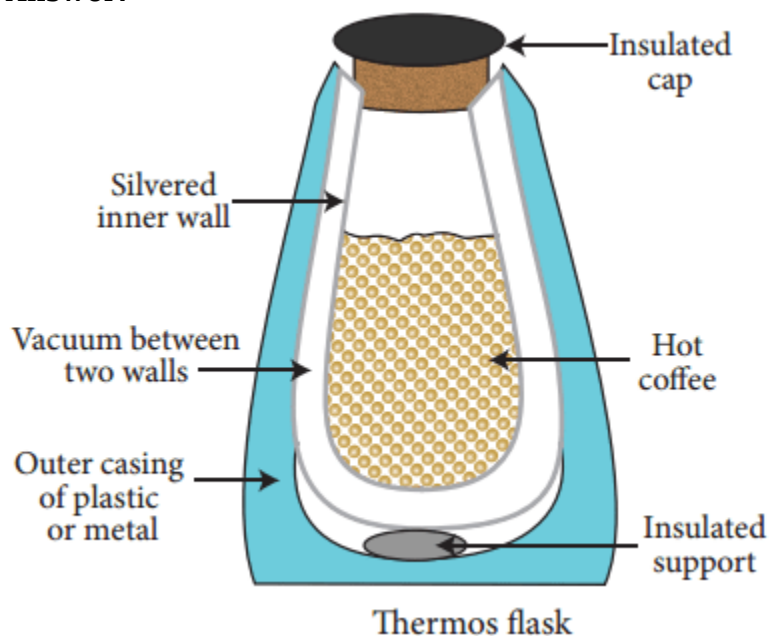
Answer:

1. A thermostat is a device which maintains the temperature of a place or an object constant.
2. The word thermostat is derived from two Greek words, 'thermo' meaning heat and 'static' meaning staying the same.
3. Thermostats are used in any device or system that gets heated or cools down – to a pre – set temperature. It turns an appliance or a circuit on or off when a particular temperature is reached.
4. Devices which use thermostat include building heater, central heater in a room, air conditioner, water heater, as well as kitchen equipment including oven and refrigerators.
5. Sometimes, a thermostat functions both as the sensor and the controller of a thermal system.

Question 3.

Explain the working of thermos flask.

Answer:



1. A thermos flask has double walls, which are evacuated.
2. It is silvered on the inside.

3. The vacuum between the two walls prevents heat being transferred from the inside to the outside by conduction and convection.
4. With very little air between the walls, there is almost no transfer of heat from the inner wall to the outer wall or vice versa.
5. Conduction can only occur at the points where the two walls meet, at the top of the bottle and through an insulated support at the bottom.
6. The silvered walls reflect radiated heat back to the liquid in the bottle.

VIII. Higher Order Thinking Questions

Question 1.

Why does the bottom of a lake not freeze in severe winter even when the surface is all frozen?

Answer:

Lakes don't completely freeze because the ice (and eventually snow) on the surface acts to insulate the water below. To freeze water into ice, a large quantity of heat is to be withdrawn. This heat cannot be

Question 2.

Which one of the following statements about thermal conductivity is correct? Give reason.

- (a) Steel > Wood > Water
- (b) Steel > Water > Wood
- (c) Water > Steel > Wood
- (d) Water > Wood > Steel

Answer:

- (b) Steel > Water > Wood

Reason:

Thermal conductivity is defined as the heat flow per unit time.

Steel has a higher thermal conductivity than water and wood.

[Thermal conductivity of steel = 50.2 w/mk

Thermal conductivity of water = 0.6 w/mk Thermal conductivity of wood = 0.12 w/mk]

IX. Problems

Question 1.

An iron ball requires 1000 J of heat to raise its temperature by 20°C. Calculate the heat capacity of the ball.

Solution:

$$\text{Heat capacity } C' = \frac{Q}{\Delta T}$$

Here, $A = 1000 \text{ J}$

$$T = 20^\circ\text{C} - 0^\circ\text{C} = 20^\circ\text{C} = 20 \text{ K}$$

$$C = \frac{1000}{20} = 50 \text{ JK}^{-1}$$

The heat capacity of the ball = 50 JK^{-1}

Question 2.

The heat capacity of the vessel of mass 100 kg is $8000 \text{ J/}^\circ\text{C}$. Find its specific heat capacity.

Solution:

$$\text{Specific heat capacity, } C = \frac{Q}{m\Delta T}$$

Here, $m = 100 \text{ kg}$

$$\text{Heat capacity} = \frac{Q}{\Delta T} = 8000 \text{ J/}^\circ\text{C} = 8000 \text{ J/K}$$

$$C = \frac{Q}{m\Delta T} = 100 \times 8000 \text{ J} = 8,00,000 \text{ JKg}^{-1} \text{ K}^{-1}$$

Activity – 2

Question 1.

Take a cup of water and note its temperature. Heat the water for few minutes and note the temperature again. What caused the temperature change?

Question (i)

Do you find any increase in the temperature?

Answer:

When the water is heated, water molecules receive heat energy, increase the kinetic energy of the molecules.

Question (ii)

What caused the temperature change?

Answer:

1. When the molecules receive more energy, the temperature of the water increases.
2. Heat energy causes increase in temperature.

Activity – 3

Question 1.

Take few ice cubes in a container and heat them for some time. What happens? The ice cubes melt and become water. Now heat the water for some time. What do you observe?

The volume of water in the vessel decreases. What do you understand from this Activity?

Answer:

1. In ice cubes, the force of attraction between the water molecules is more. So they are close together.
2. When we heat them the force of attraction decreases and the ice cubes become water.
3. when we heat the water, the force of attraction between the molecules decreases further.
4. Hence they move away from one another and become vapor.
5. Since water vapor escape to the surrounding, water level decreases.
6. From this Activity we understand that heat energy causes change in the state of the substances.

Activity – 4

Question 1.

Take hot water in a cup and put a silver spoon in it. Leave the spoon inside the water for some time. Now touch the end of the spoon. Do you feel the heat?

Answer:

1. Yes, we feel hot.
2. It is because heat in the hot water is transferred from one end to other end of the spoon.
3. In solid substances such as silver spoon, atoms are arranged very closely.
4. So heat transfer takes place from the higher temperature region to lower temperature region.
5. This is due to conduction.

Activity – 5

Question 1.

Take some water in a vessel and heat it on a stove. Touch the surface of the water. It will be cold. Touch it after some time. It will be hot now. How did the heat which was supplied at the bottom reach the top?

Answer:

1. When water in the vessel is heated, water molecules at the bottom receive heat energy and move upward.
2. Then the molecules at the top comes down and get heated.
3. This kind of heat transfer is known as convection.

Activity – 6

Question 1.

Take some amount of water and cooking oil in two separate vessels. Heat them till they

reach a particular temperature (Caution: Heat the oil under the supervision of your teacher). Which one is heated first? Water will take more time to get heated. Why?

Answer:

1. Heat transfer depends on the nature of the substance.
2. Water has high specific heat capacity than that of cooking oil.
3. A substance with high specific heat capacity absorbs a large quantity of heat.
4. Thus, it takes long time to heat up.