

Board – ICSE

Class – 7th

Topic – Heat

Q.1 What is heat? State its S.I. unit.

Answer:

Heat is a form of energy which flows. It is the energy of motion of molecules constituting the body. The unit of heat is same as that of energy, The S.I. unit of heat is joule (abbreviated as J) and other common units of heat are calorie and kilo calorie, where 1 kcal = 1000 cal.

Q. 2 What is meant by the term temperature.

Answer:

Temperature is a quantity which tells the thermal state of a body (i.e. the degree of hotness or coldness). It determines the direction of flow of heat when the two bodies at different temperatures are placed in contact.

Q. 3 State the three units of temperature.

Answer:

The S.I. unit of temperature is kelvin or K. The other most common unit of temperature is degree Celsius (°C) and degree Fahrenheit (°F).

Q.4 Name two scales of temperature. How are they inter-related?

Answer:

Two scales of temperature are

(i) Celsius (ii) Fahrenheit

Relation:

Water freezes at 0°C or 32°F and boils at 100°C or 212°F

$$\therefore (212 - 32) ^\circ\text{F} = (100 - 0)^\circ\text{C}$$

$$180^\circ\text{F} = 100^\circ\text{C}$$

$$1^\circ\text{F} = \left(\frac{5}{9}\right)^\circ\text{C}$$

$$\text{or } 1^\circ\text{C} = \left(\frac{9}{5}\right)^\circ\text{F}$$

$$\text{or } \frac{\text{C} - 0}{100 - 0} = \frac{\text{F} - 32}{212 - 32}$$

$$\text{or } \frac{\text{C}}{100} = \frac{\text{F} - 32}{180}$$

$$\text{or } \frac{\text{C}}{5} = \frac{\text{F} - 32}{9}$$

Q.5 State the temperature of (i) ice point and (ii) steam point, on the Celsius scale.

Answer:

(i) **Ice point.** Is the the mark on Celsius scale at which ice melts. Ice point on the Celsius scale is 0°C .

(ii) **Steam point.** On the Celsius scale is the mark at which water changes into steam at normal atmospheric pressure. On Celsius scale it is 100°C .

Q. 6 Write down the temperature of (i) lower fixed point, and (ii) upper fixed point, on the Fahrenheit scale.

Answer:

Lower fixed point: On the Fahrenheit scale is the mark at which pure ice melts. It is 32°F on Fahrenheit scale.

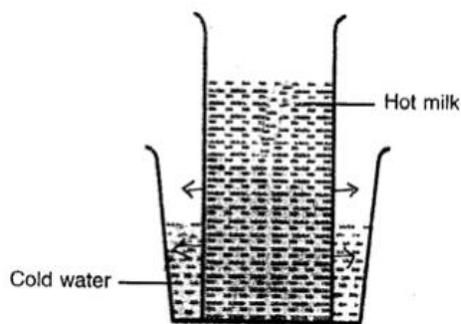
Upper fixed point: On the Fahrenheit scale is the mark at which water starts changing into steam at normal atmospheric pressure. It is 212°F .

Q. 7 What is the Kelvin scale of temperature ?

Answer:

On Kelvin scale of temperature zero mark is when no molecular motion occurs. Ice point is at 273 and steam point is at 373 K. Thus $0\text{ K} = -273^{\circ}\text{C}$ and one degree on Kelvin scale is same as one degree on Celsius scale.

Q. 8 The fig. shows a glass tumbler containing hot milk which is placed in a tub of cold water. State the direction in which heat will flow.



Answer:

When we bring two objects of different temperature together, energy will always be transferred from hotter to the cooler object.

Here, also heat will flow from hot milk tumbler to tub of cold water.

Q. 9 What do you understand by thermal expansion of a substance ?

Answer:

The expansion of a substance when, heated, is called thermal expansion.

Or

Thermal expansion is the tendency of matter to change .in shape, area and volume in response to a change in temperature.

Q. 10 Name two substances which expand on heating.

Answer:

Mercury and Aluminium wire.

Q. 11 Why do telephone wires sag in summer ?

Answer:

The telephone wires will sag in summer due to expansions and will break in winter due to contraction.

Therefore, while putting up the wires between the poles, care is taken that in summer they are kept slightly loose so that they may not break in winter due to contraction.

While in winter they are kept tight so that they may not sag too much in summer due to expansion.

Q. 12 Why are gaps left between successive rails on a railway track ?

Answer:

The rails of railway track are made of steel. While laying the railway track, a small gap is left between the two successive length of rails. The reason is that the rails expand in summer. The gap is provided to allow for this expansion. If no gap is left, the expansion in summer will cause the rails to bend sideways. This may result in a train accident.

Q. 13 Describe one experiment to show that liquids expand on heating.

Answer:

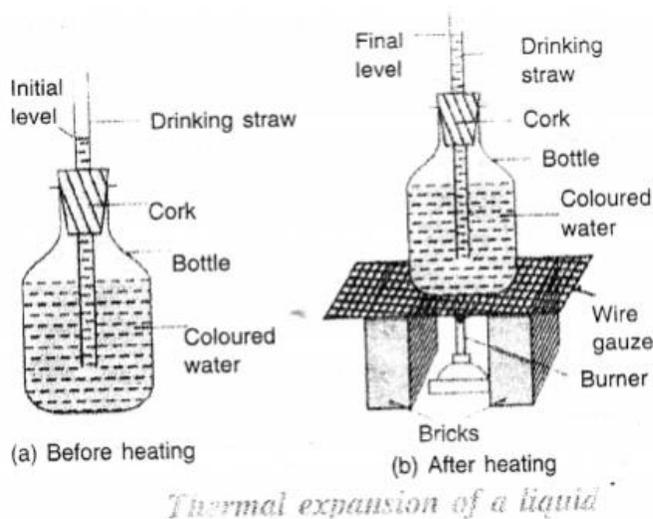
(i) Take an empty bottle with a tight fitting cork having a hole drilled in its middle, a drinking straw, two bricks, a wire gauze and a burner.

(ii) Fill the bottle completely with water and add few drops of ink in it to make it coloured.

(iii) Fix the cork in the mouth of the bottle and pass the drinking straw through the cork. Put some molten wax around the hole so as to avoid the leakage of water.

(iv) Pour some more water into the drinking straw so that water level in the straw can be seen.

Mark the water level in the straw as shown in Figure.



(v) Place the bottle on the wire gauze kept over the two bricks as shown in Figure. Then heat the bottle by means of a burner.

(vi) Look at the level of water in the straw.

You will notice that as the water is heated more and more, the level of water in the drinking straw rises. This shows that water expands on heating.

Q. 14 State one application of thermal expansion of liquids.

Answer:

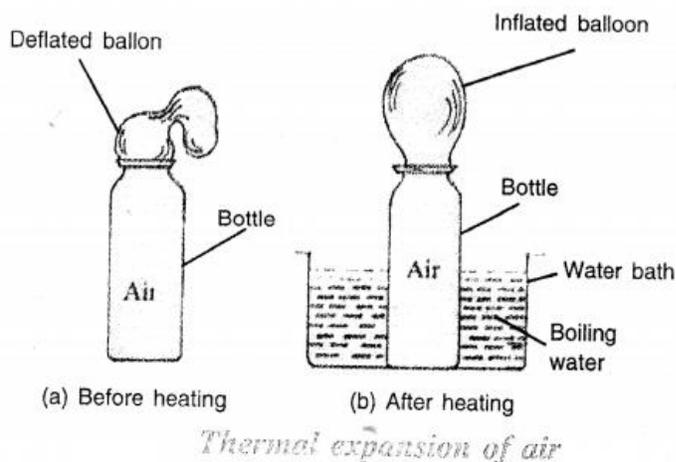
Mercury is a metal found in liquid state. It expands more and uniformly over a wide range of temperature. So mercury is used as thermometric liquid.

Q. 15 Describe an experiment to show that air expands on heating.

Answer:

(i) Take an empty bottle. Actually the empty bottle contains air. Attach a rubber balloon to its neck as shown in Figure. Initially, the balloon is deflated.

(ii) Place the bottle in a water bath containing boiling water. After some time you will notice that the balloon gets inflated as shown in Figure. The reason is that the air inside the bottle expands on heating and it fills the balloon.



(iii) Take the bottle out of the water bath and allow it to cool by itself. We will notice that the balloon gets deflated and it collapses. This is because the air inside the balloon and the bottle, has contracted on cooling. The air from balloon passes to the bottle, so the balloon gets deflated.

Q. 16 Name the three modes of transfer of heat.

Answer:

There are three modes of transfer of heat (i) Conduction (ii) Convection (iii) Radiation.

(i) **Conduction** “is that mode of transfer of heat, when heat travels from hot end to cold end from particle to particle of the medium, without actual movement of particles.”

(ii) **Convection.** “Is a process of transfer of heat by actual movement of the medium particles.”

(iii) **Radiation.** “Is that mode of transfer of heat in which heat directly passes from one body to the other body without heating the medium.”

Q. 17 Name the mode of transfer of heat in the following :

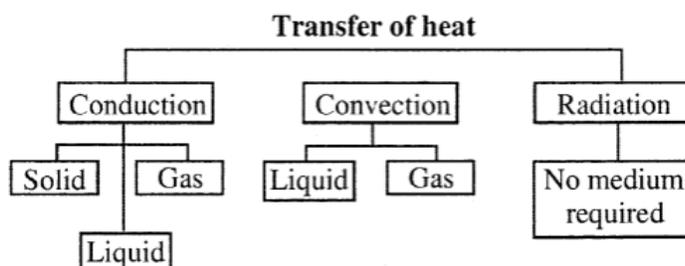
(a) solid,

(b) liquid,

(c) gas

(d) vacuum

Answer:



Q. 18 What are the good and bad conductors of heat ? Give two examples of each.

Answer:

Good conductors. “The substances through which heat is easily conducted are called good conductors of heat.”

Example : Copper, iron.

Bad conductors. “The substances through which heat is not conducted easily are called bad conductors of heat or poor conductors of heat.”

Example : Wood, cloth.

Q. 19 Why do we use cooking utensils made up of copper.

Answer:

Cooking utensils are made of metals such as copper, aluminium, brass, steel etc., so that heat is easily conducted through the base to their contents. But they are provided with handles of bad conductors (such as ebonite or wood) to hold them easily as handles will not conduct heat from the utensil to our hand.

Q. 20 State the direction of heat transfer by way of convection.

Answer:

By the process of convection, heat is always transferred vertically upwards. The reason is that the medium particles near the source of heat absorb heat from the source and they start moving faster. As a result, the medium at this place becomes less dense so it rises up and the medium from above being denser, moves down to take its place. Thus, current is set up in the medium which is called a convection current. The current continues till the entire medium acquires the same temperature.

Q. 21 Why are chimneys provided over furnace in factories ?

Answer:

Chimneys are provided over the furnace in factories. This is because the hot gases coming out of the furnace are less dense than the air. They rise up through the chimney. The smoke, fumes etc. around the furnace rush in so as to take their place and they are sucked out. Thus, the chimney helps to remove the undesired fumes, smoke etc. from the premises.

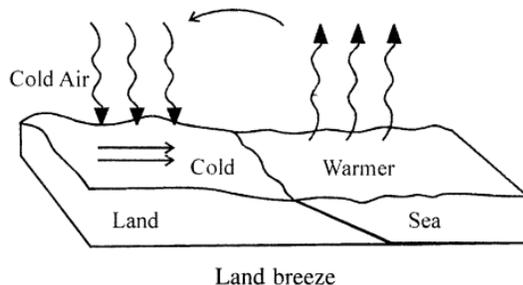
Q. 22 What are the land and sea breezes ? Explain their formation.

Answer:

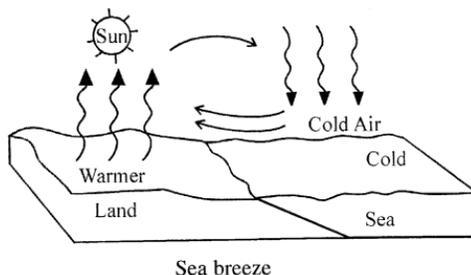
LAND BREEZE : Blowing of breeze (air) from land towards sea is called land breeze.

During night land and sea water both lose heat. Specific heat capacity of land being very low as compared to that of sea water, land loses heat energy fast and cools more rapidly as compared to sea. Sea water being at higher temperature, the air above it becomes lighter and rise up. Air from

land being at higher pressure. So air from land starts blowing towards sea and gives rise to Land Breeze.



SEA BREEZE : Blowing of breeze (cold air) from sea towards land during the day is called the SEA BREEZE. During day time land and sea both are heated equally by the sun, but land has very low specific heat capacity as compared to sea, is heated up more quickly. Thus air above land due to heat becomes lighter and rises up. Thus pressure decreases and cold and humid air above the sea starts blowing towards land, thereby giving rise to SEABREEZE.



Q. 23 Explain briefly the process of heat transfer by radiation.

Answer:

RADIATION. "The transfer of heat energy from a hot body to cold body directly, without heating the medium between two bodies is called RADIATION."

The radiant heat or thermal radiation is of the form of ELECTROMAGNETIC WAVES. These waves can travel even in vacuum in all directions in straight line with the speed of light. They do not heat the medium through which they pass. Heat radiations are also called INFRA-RED RADIATIONS because the wavelength of heat radiations is longer than that of visible light. These radiations can cause heating effect only if they are absorbed by some material.

Q. 24 Why do we prefer to wear white or light coloured clothes in summer and black or dark coloured clothes in winter ?

Answer:

We prefer to wear white clothes in summer. The reason is that the white clothes reflects most of the sun's heat and absorb very little of the sun's heat, thus they keep our body cool.

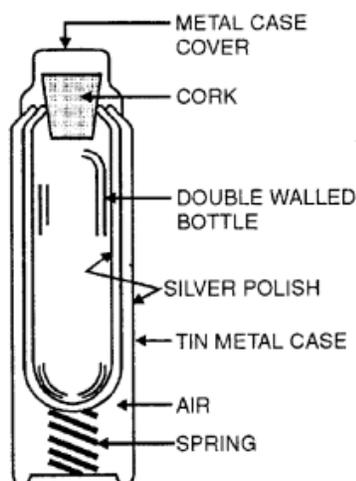
We prefer to wear black and dark coloured clothes in winter. The reason is that the black or dark colour clothes absorb most of the sun's heat and keep our body warm.

Q. 25 Draw a labelled diagram of a thermo flask. Explain how the transfer of heat by conduction, convection and radiation is reduced to a minimum in it.

Answer:

Heat transfer is minimised because of:

- (1) The vacuum between the two walls, rubber, glass, cork and air do not allow the loss of heat by conduction.
- (2) Cork in the neck of flask and the cup over it prevent loss of heat by convection.
- (3) Heat cannot be lost by conduction or convection because of vacuum between the two walls.
- (4) Heat loss is also minimised by radiation, by making outer surface of inner wall and inner surface of outer wall silvered. The inner wall is a BAD RADIATOR and the outer wall is a GOOD REFLECTOR of radiation.



Numericals

Q. 1 The temperature of a body rises by 1°C . What is the corresponding rise on the (a) Fahrenheit scale (b) Kelvin scale?

Answer:

(a) Since 100 divisions on Celsius scale = 180 divisions on the Fahrenheit scale 1 division on Celsius scale

\therefore 1 division on Celsius scale

$$= 1.80 / 1.00 \times 1$$

= 1.8 divisions in the Fahrenheit scale.

For 1°C rise corresponding rise in Fahrenheit = 1.8°F

(b) Since 100 divisions in the Celsius scale = 100 divisions in the Kelvin scale

1 division on Celsius scale = $100 / 100 \times 1$

= 1 division on Kelvin scale

For 1°C rise corresponding rise in Kelvin is 1 K.

Q.2 Convert 40°C to the (a) Fahrenheit scale (b) Kelvin Scale.

Answer:

(a) Fahrenheit scale

$$C = 40^{\circ}\text{C}$$

Substitute value of $C = 40^{\circ}$ in below equation

$$\frac{C}{5} = \frac{F - 32}{9}$$

$$\frac{40}{5} = \frac{F - 32}{9}$$

$$8 = \frac{F - 32}{9}$$

$$8 \times 9 = F - 32$$

$$72 = F - 32$$

$$F = 72 + 32 = 104$$

Solution = 104°F

(b) $t^{\circ}\text{C} = (273 + t) \text{ K}$

Given $t = 40^{\circ}\text{C}$

Substitute the value of t in above equation

$$40^{\circ}\text{C} = (273 + 40) \text{ K}$$

$$40^{\circ}\text{C} = 313 \text{ K}$$

Solution = 313 K

PHYSICS



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