Lesson 4. Heat.

Grade VII

Basic concepts – A Flow Chart

HEAT

Temperature

- It is the degree of hotness or coldness of a body
- It determines the direction of flow of heat.
- Heat flows from a body at a higher temperature to that at some lower temperature until both objects reach the same temperature.
- Heat is the cause of temperature.

Measurement of Temperature

- Temperature of a body is measured by an instrument called thermometer.
- Unit of temperature is degree celsius ('C) or degree centigrade.

Clinical Thermometer

- It is a thermometer used to measure the temperature of our body
- It consists of a long, narrow, uniform glass tube with a bulb containing mercury at one end.
- It reads a range of temperatures from 35^{O} C to 42^{o}C.

Laboratory Thermometer

- It is a thermometer used to measure the temperature of objects other than our body.
- It consists of a column of mercury enclosed in a glass casing. The column is continuous without any link.
- It measures a range of temperature from – 10^{o}C to 110^{o}C.

Transfer of Heat

Heat flows from a hotter object to a colder object until both objects reach the same temperature.

Conduction

- It is the process by which heat is transferred from the hotter end to the colder end of an object.
- Materials that allow heat to pass through them easily are called good conductors of heat.
- Example: Metals.
- Materials that do not allow heat to pass through them easily are called insulators or poor conductors of heat.
- Example : Wood, paper, etc.

Convection

It is the flow of heat through a fluid from places of higher temperature to places of lower temperature by movement of the fluid itself.

Radiation

- It is the mode of transfer of heat in which energy is directly transferred from one place to another.
- It does not need any material medium.
- Dark – coloured objects absorb radiation better than the light-coloured objects.

Sea Breeze

- During the day, the land heats up faster than the sea.
- Warm air above the land rises and colder air from the sea takes its place.
- Warm air from the land moves towards the sea to complete the cycle.
- This produces a sea breeze from the sea to the land.

Land Breeze

- At night the land cools faster than sea.
- The warm air above the sea rises.
- This warm air is replaced by colder air from the land producing a land breeze.

Kinds of Clothes We Wear

In Summers : Light coloured. Cotton Clothes absorb less heat and keep body cool.

In Winters : Dark – coloured, woolen cloths absorb more heat and trap air between fibres to prevent escape of body heat and keep it warm

Know the Terms

- **Celsius scale** : The scale in which the temperature is represented in 0^0C is called celsius scale.
- **Conductor** : The process by which heat is transferred from the hotter end to the colder end of an object is known as conduction.
- **Convection** : Those materials which allow heat to pass through them easily are called the conductors of heat.
- **Insulator** : Those substances which do not conduct heat well are called insulators.
- **Land Breeze** : After sunset, the air above the sea is warmer which makes the air rise and the cooler air above the land, moves our towards the sea. This is called 'Land Breeze'.
- **Radiation** : Radiation is the process by which heat travels without the help of a material medium.
- **Sea Breeze** : During the day the air in contact with the land becomes hot and rises. Then the cooler air above the sea rushes in towards the land to occupy its space. This set-up is known as sea breeze.
- **Temperature** : The temperature of a substance is the measure of degree of hotness of a substance.
- **Thermometer** : This instrument which is used to measure the temperature is called thermometer.

Objective Type Questions

(1 Mark each)

I. Multiple choice questions

1. Heat is

a. A form of energy b. A type of matter

c. Neither energy nor matter d. None of these

2. The device which is used to measure the degree of coldness or hotness of an object.

a. Manometer b. Barometer c. Thermometer d. Voltmeter

3. Convection may occur through

a. Solids, liquids b. Liquids, gases c. Solids, gases d. Solids, liquids, gases

4. Which one of the following is a poor conductor of heat?

a. Silver b. Aluminium c. Glass d. Brass

5. A wooden spoon is used to prepare vegetables. Its

a. Becomes hot due to conduction b. Becomes hot due to convection

c. Does not become hot d. Both a and b

6. Heat is a form of

a. Energy b. Light c. Electricity d. Work

7. Cooking utensils are made of metals because they are

a. Durable b. Malleable

c. Good conductors of hear d. Do not break on heating

8. Heat from sun reaches us by

a. Conduction b. Radiation c. Convection d. All of these

9. A marble tile would feel cold as compared to a wooden tile on a winter morning, because the marble tile. **[NCERT Exemplar]**

a. Is a better conductor of heat than the wooden tile

b. Is polished while wooden tile is not polished

c. Reflects more heat than wooden tile.

d. Is a poor conductor of heat than the wooden tile

10. A beggar wrapped himself with a few layers of newspaper on a cold winter night. This helped him to keep himself warm because.

a. Friction between the layers of newspaper produces heat.

b. Air trapped between the layers to newspaper is a bad conductor of heat.

c. Newspaper is a conductor of heat.

d. Newspaper is at a higher temperature than the temperature of the surrounding.

11. Paheli and Boojho measured their body temperature. Paheli found her's to be 98.6 ^{0}F and Boojho recoreded 37^{0}C. Which of the following statement is true? **[NCERT Exemplar]**

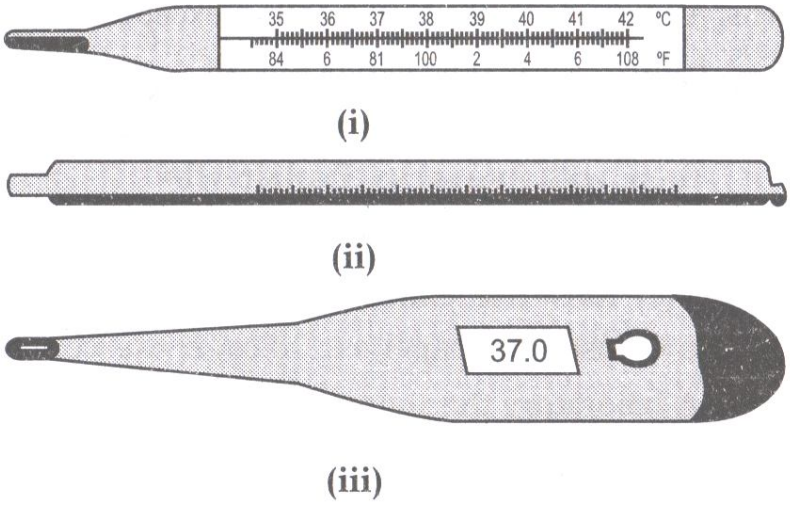
a. Paheli has a higher body temperature than Boojho.

b. Paheli has a lower body temperature than Boojho.

c. Both have normal body temperature.

d. Both are suffering from fever.

12. Boojho has three thermometers as shown in figure. He wants to measure the temperature of his body and that of boiling water. Which thermometer (s) should he chose? **[NCERT Exemplar]**



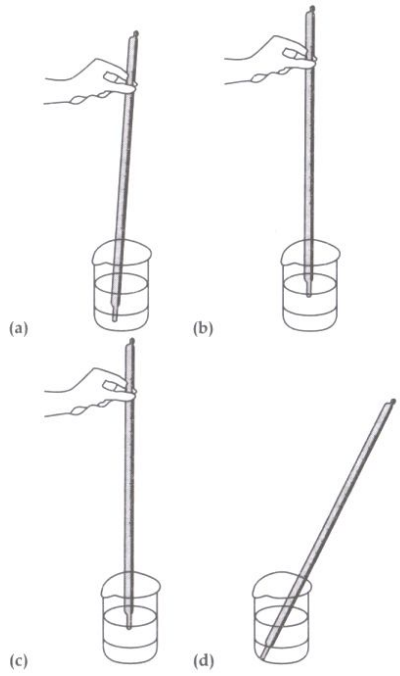
a. Thermometer (i) or (ii) for measuring body temperature and (iii) for measuring the temperature of boiling water.

b. Thermometer (i) for measuring temperature of both.

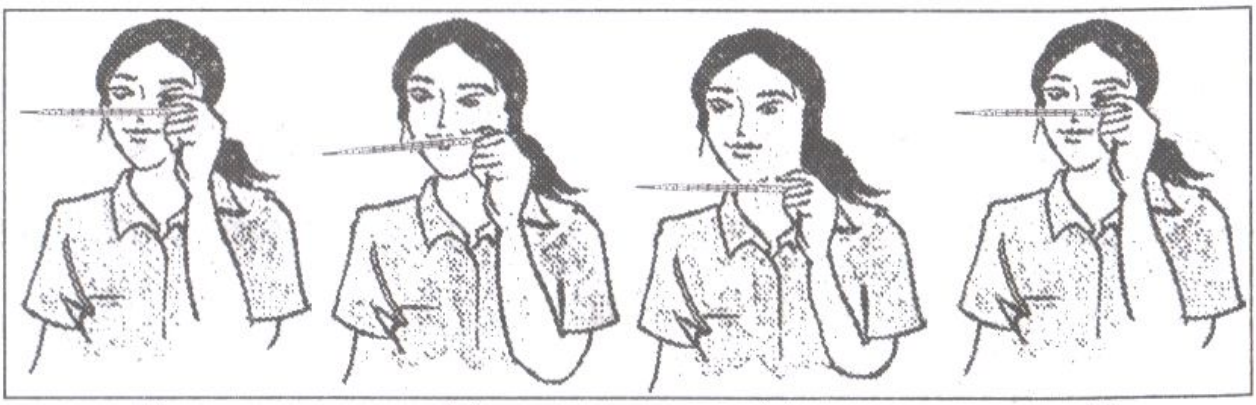
c. Thermometer (ii) for measuring temperature of both.

d. Thermometer (iii) for measuring temperature of both.

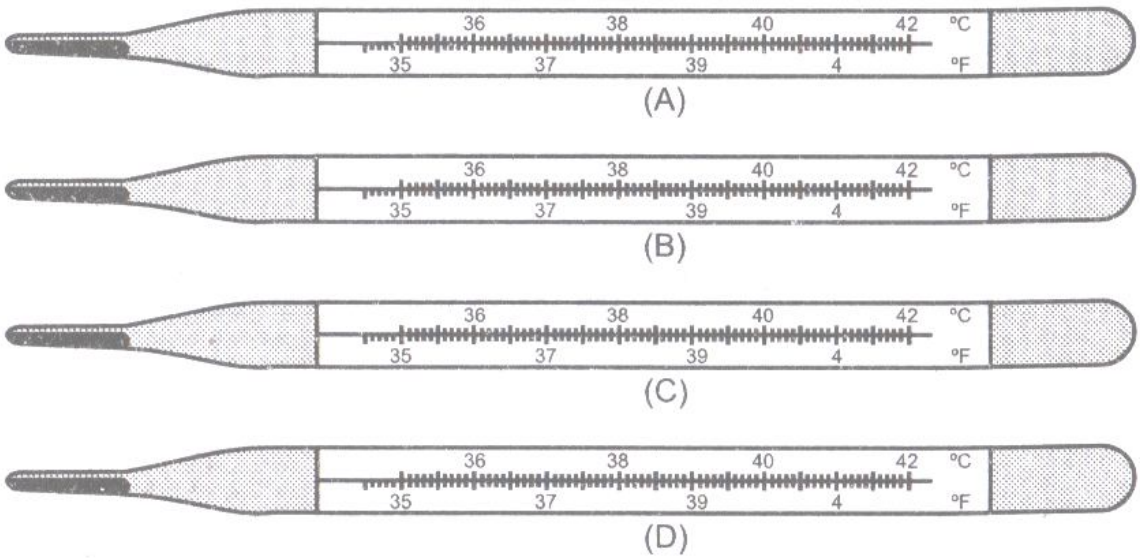
13. Four arrangement to measure temperature of ice in beaker with laboratory thermometer are shown in Figure (a, b, c and d). Which one of the them shows the correct arrangement for accurate measurement of temperature? **[NCERT Exemplar]**



14. Figure shows a student reading a doctor's thermometer. Which of the figure indicates the correct method of reading temperature? **[NCERT Exemplar]**



15. Figure shows the readings on four different thermometers. Indicate which of the reading shows the normal human body temperature?



1. a	2. c	3. b	4. c	5. c	6. a	7. c	8. b
9. a	10. b	11. c	12. a	13. a	14. a	15. c	

II. Multiple choice questions

1. The normal temperature of human body is

a. 37 K b. 37^0 C c. 37^0 F d. All the these

2. The heat reaches to us from the sun in the form of

a. Convection b. Radiation c. Conduction d. All of these methods

3. Heat always flows.

a. From hotter body to a colder body b. From colder body to a hotter body

c. In both the directions d. Never flows from one body to other

1. b	2. b	3. a

I. Fill in the blanks

1. The temperature of boiling water cannot be measured by a _____ thermometer.
2. No medium is required for transfer of heat by the process of _____.
3. Clothes of _____ colour absorb heat better than clothes of _____ colours.
4. Temperature is measure in degree _____.
5. All hot bodies _____ heat.
6. _____ has highest specific heat.
7. Heat flows from a _____ surface to _____ surface.
8. The three modes of heat transfer are radiation _____ and conduction.

1. clinical	2. radiation	3. dark, white	4. kelvin
5. radiate	6. water	7. hotter, colder	8. convection

II. Fill in the blanks

1. Wool is a _____ conductor of heat.
2. When we come out in the sun we feel _____.
3. The hot bodies radiate _____.
4. The water and air are _____ conductors of heat.
5. Temperature is a measure of _____ of an object.

1. poor	2. warm	3. heat
4. poor	5. hotness	

I. Match the following

Column A	Column B
i. Thermometer	a. Poor conductor of heat
ii. Dark coloured object	b. A form of energy
iii. Water and air	c. SI unit of temperature
iv. Kelvin	d. The device used to measure temperature
v. Heat	e. Good absorber of heat

i. d	ii. e	iii. a	iv. c	v. b

II. Match the following

Column A	Column B
a. Required no medium	i. Poor conductor of heat
b. Movement of molecules of liquid	ii. Night
c. Poor conductor of heat	iii. Radiation
d. Land Breeze	iv. Convection
e. Hair and fur of animals	v. Glass

a. iii	b. v	c. iv	d. i	e. ii

I. True or False

1. Woollen clothes keep us warm during winter.
2. Normal temperature of human body is 37^0 F.
3. Water at higher temperature feels more hot.
4. The thermometer has a shining thread of water.
5. Water and air are good conductors of heat.

1. True	2. False	3. True	4. False	5. False

Quiz Time

1. **Name the form of energy which causes the sensation of hotness or coldness?**
2. **What is the normal temperature of human body?**
3. **Name the device which is used to measure temperature.**
4. **What are insulators?**
5. **Is iron rod conductor or insulator?**
6. **Name the thermometer which is used to measure human body temperature.**
7. **Do all hot bodies radiate heat?**
8. **Which metal is used in the bulb of a common thermometer?**
9. **What is SI unit of temperature?**
10. **What type of clothes we should wear in the summer?**

1. Heat	2. 37^0C
3. Thermometer	4. The materials which do not allow heat to pass through them are called insulators.
5. Conductor	6. Clinical thermometer
7. Yes	8. Mercury
9. Kelvin (K)	10. Light coloured clothes

NCERT Corner

Intext Question

1. **List in table some objects which you use commonly mark these objects as hot or cold.**

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

2. **Do both hands get the same feeling?**

No.

3. Boojho says, "My left hand tells me that the water in mug C is hot and the right hand tells me that the same water is cold. What should I conclude?

Both conclusions are correct relative to each hand. But a single conclusion be drawn from the given information.

Body temperature of some person

Name	Temperature (^{0}C)
Varun	37.1^{0}C
Anwar	36.9^{0}C

4. Boojho now understands why clinical thermo-meter cannot be used to measure high temperatures. But still wonders whether a laboratory thermometer can be used to measure his body temperature.

Laboratory thermometer can also be used for measuring body temperature. But, it is not convenient for this purpose.

5. Boojho wonders why the level of mercury should change at all when the bulb of the thermometer is brought in contact with another object ?

The temperature of other object may not be the same as that of the bulb of the thermometer. When bulb is brought in contact with that object, the temperature of the bulb changes. So the level of mercury also changes.

6. Are there any variations in the readings ?

Yes

7. Why does the mercury not fall or rise in a clinical thermometer when taken out of the mouth?

The kink prevents the mercury level from falling down.

8. What is the use of the kink ?

It prevents mercury level from falling on its down.

9. Why does it cool down ?

Because the heat is transferred from the pan to the surroundings.

10. How does the heat from the sun reach us ?

By radiation.

11. Why are you advised to use an umbrella when you go out in the sun ?

The umbrella protects us from heat rays of the sun.

12. What happens to the wax pieces ? Do these pieces begin to fall ? Which piece falls the first? Do you think that heat is transferred from the end nearest to the flame to the other end ?

The wax pieces start to melt and fall down. Yes. The piece nearest to the flame fall first. Yes, heat is transferred from the end nearest to the flame to the other end.

13. Do all substances conduct heat easily ?

No.

14. Can you lift a hot pan by holding it from the handle without getting hurt ?

Yes. If the handle in insulated with the help of a cloth the pan can be lifted.

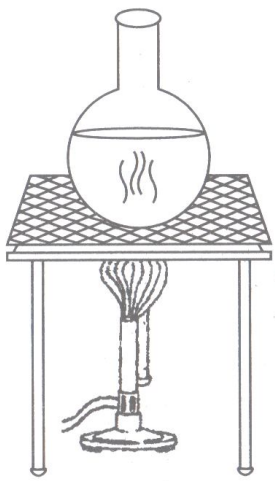
15. Heat water in a small pan or a beaker. Collect some articles such as a steel spoon, plastic scale, pencil and divider. Dip one end of each of these articles in hot water. Wait for a few minutes. Touch the other end. Enter your observation in Table 4.3

Table 4.3

Article	Material with other which the article is made of	Does the other end get hot Yes Yes/No
Steel spoon	Metal	Yes
Plastic scale	Plastic	No
Pencil	Wood	No
Divider	Steel	Yes

16. Write your observation in your notebook and also draw a picture of what you observe.

We observe that the hot water rises up. The cold water from the sides moves down towards the source of heat. As this water also gets hot and rises, water from the sides moves down. This process continues till the whole water gets heated.



17. How does heat travel in air? In which direction does the smoke go?

Heat moves in air by convection. The smoke moves in the upward direction.

18. Do you hands feel equally hot? If not which hand feels hotter? And why?

No. The right hand which is over the flame gets more heat. Because hot air moves in upward direction.

19. Do you find any differences in the temperatures?

Yes.

20. In which can is the water warmer ?

The can whose outer surface is painted black is hotter.

21. Does the temperature of water in both the cans fall by the same amount ?

No. The container with black surface is more cold.

22. Do these activities suggest to you the reason why it is more comfortable to wear white or light coloured clothes in summer and dark-coloured clothes in winter ?

Dark surfaces absorb more heat and therefore, we feel comfortable with dark coloured clothes in winter. Light coloured clothes reflect most of the heat that falls on them and, therefore, we feel more comfortable wearing them in summer.

23. Suppose in winter you are given the choice of using one thick blanket or two thin blankets combined together. What would you choose and why ?

I would choose two thin blankets joined together. This is because there would be a layer of air in between the blankets. The trapped air, which is a bad conductor of heat, keeps it warmer.

Textbook Question

1. State similarities and 4 differences between the laboratory thermometer and the clinical thermometer.

Laboratory Thermometer	Clinical Thermometer
Similarities (i) In this thermometer, mercury is used. (ii) In this thermometer, the scale is denoted in celsius.	In this too, mercury is used. In this also, the scale is denoted in celsius.

Dissimilarities	
(i) Besides body temperature, it is used for measuring the temperature of other objects.	This is used only for measuring human body temperatures.
(ii) Its temperature measuring capacity ranges from -10^0C to 100^0C.	Its temperature measuring capacity ranges from 35^0C to 42^0C only.

2. Give two example of insulators and conductor of heat.

Conductors : Aluminium and copper. Insulator: Plastic and wood.

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. It transfers heat to its other end by the process of _____.

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

(a) temperature

(b) clinical

(c) celsius

(d) radiation

(e) convection

(f) black or dark.

4. Match the following:

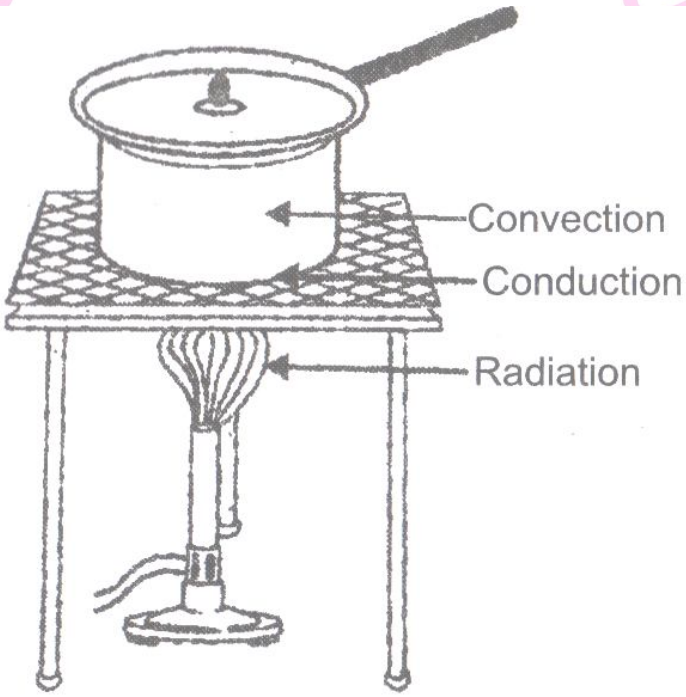
(i) Land breeze blows during	-	(a) summer
(ii) Sea breeze blows during	-	(b) winter
(iii) Dark coloured clothes are	-	(c) day preferred during
(iv) Light coloured clothes are	-	(d) night preferred during

i. d	ii. c	iii. b	iv. a

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

During winter, when we have so many layers of clothing on our body, the air trapped in between two layers of cloth acts as an insulator. This is the reason why wearing more layers of clothing keeps our body warm in winter.

6. Look at Figure. Mark where the heat is being transferred by conduction, by convection and by radiation.



7. In places of hot climate it is advised that the outer walls of houses be painted white. Explain.

In hot season, the outer walls of the houses should be painted white, because white colour reflects back the heat radiation which falls upon it. That is why the rooms remain cool, they do not warm up in summer.

8. One litre of water at 30°C is mixed with one litre 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.

(d) between 30°C and 50°C.

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

(a) flow from iron ball to water.

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

(c) flow from water to iron ball.

(d) increase the temperature of both.

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

10. 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.

(d) does not become cold.

11. 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 colourful.

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

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

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

I. Very Short Answer Type Questions

1. Why do we wear woollen clothes during water?

The wool is a poor conductor of heat. So, woollen clothes keep us warm during winter.

2. Why do we wear light coloured cotton clothes when it is hot?

Light coloured cotton clothes give us a feeling of coolness by reflecting heat.

3. What is heat?

Heat is a form a energy. It help us to feel hotness and coolness.

4. What is temperature?

The measure of hotness or coldness is called temperature.

5. Name the device which is used to measure temperature of an object.

Thermometer.

6. What is clinical thermometer?

The thermometer which is used to measure our body temperature is called clinical thermometer.

7. Name another type of thermometer.

The other type of thermometer is called laboratory thermometer.

8. Which metal is used in the bulb of a thermometer?

Mercury

9. What is the SI unit of temperature?

The SI unit of temperature is kelvin.

10. What is the range of clinical thermometer?

35^0C to 42^0C.

11. What is the normal temperature of our body?

37^0C

12. Is the body temperature of every person 37^0C?

No, the temperature of every person may not be 37^0C.

13. What is laboratory thermometer?

The thermometer used to measure the temperature of various objects in laboratory is called laboratory thermometer.

14. What is the range of laboratory thermometer?

-10^0C to 110^0C

15. What is the use of kink in clinical thermometer?

It prevents mercury level from falling on its own.

16. What do you mean by the transfer of heat?

The heat flows from a hotter object to a colder object. This process is called transfer of heat.

17. What are the various methods of transfer of heat?

There are three methods of transfer of heat.

i. Conduction ii. Convection iii. Radiation

18. The heat is transferred from the sun to us. Name the method.

Radiation.

19. What type of clothes should we wear in the summer?

Light coloured cotton clothes.

20. Why should we wear dark coloured clothes in winter?

Dark coloured clothes absorb most of the heat falling on them and keep us warm.

21. How does heat transfer in water or air?

By convection

22. How does heat transfer in solids?

By conduction

23. What are conductors?

The substances which allow heat to pass through them are called conductors.

24. Give two examples of good conductors of heat.

Copper and iron

25. What are insulators?

The materials which do not allow heat to pass through them are called insulators.

26. Give two examples of insulators.

Plastic and wood.

27. What is sea breeze?

The movement of air from the sea towards the land in coastal areas during day time is called the sea breeze.

28. What is land breeze?

The cool air from the land moves towards the sea in coastal areas during night. This is called land breeze.

29. Name the form of energy which causes hotness or coolness.

Heat.

30. What is the degree of hotness called?

Temperature.

31. Name the scale used either but the doctor.

Fahrenheit scale.

32. What is the range of Fahrenheit scale?

94 to 108 degree.

33. How is the temperature indicated by this scale?

^0F

34. What is the normal temperature in Fahrenheit scale?

98.6^0F

35. What happens when two bodies having same temperature come in contact?

The heat is not transferred if temperature is same.

36. How does heat flow?

Heat flow from hotter object to the colder object.

II. Very Short Answer Type Questions

1. Name the three modes of transfer of heat.

Conduction, convection and radiation.

2. Name four insulators.

Wool, plastic, cotton, glass.

3. What is radiation ?

Radiation is a process of heat transfer which does not require any medium.

4. Which type of heat transfer is minimized when using a thermo flask.

Mostly radiation.

5. Which is the bad conductor of heat ?

Wood is a bad conductor of heat.

6. Do all liquids expand on heating ?

All liquids expand on heating except water which contracts when heated below 4°C.

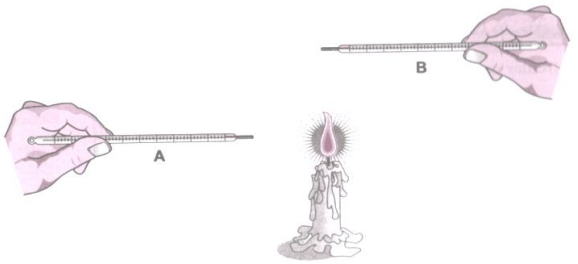
III. Very Short Answer Type Questions

1. Shopkeepers selling ice blocks usually cover them with jute sacks. Explain why.

[NCERT Exemplar]

They must use some insulating material like, sack, saw dust, newspaper, et. to cover the ice.

2. A laboratory thermometer A is kept 7 cm away on the side of the flame while a similar thermometer B is kept 7 cm above the flame of a candle as shown in the figure below.



Which of the thermometers, A or B, will show greater rise in temperature? Give reason for your answer.

Thermometer B will show a greater rise in temperature because hot air rise up or air on the top of the candle flame is getting heated by convection.

3. To keep her soup warm Paheli wrapped the container in which it was kept with woollen cloth. Can she apply the same method to keep a glass of cold drink cool? Give reason for your answer. [NCERT Exemplar]

Yes. Wool is a poor conductor of heat.

4. In a mercury thermometer, the level of mercury rise when its bulb comes in contact with a hot object. What is the reason for this rise in the level of mercury? [NCERT Exemplar]

Mercury expands when heated. Hence, it rises in the capillary tube.

5. Define temperature.

Temperature is defined as the degree of hotness or coldness of a body.

6. At what temperature will the reading on the Fahrenheit scale be double of the reading on the Celsius scale?

At 160^0C, the reading on Fahrenheit scale would be double, i.e., 320^0F.

7. Why is it advised not to hold the thermometer by its bulb while reading it?

If we hold a thermometer by its bulb, the mercury in the bulb will expand due to our body temperature.

8. Convert 8^0C to ^{0}F.

F $= \left(\frac{9}{5}\ x\ C\right) + 32$

0F $= \left(\frac{9}{5}\ x\ 8\right) + 32 = 46.4\ ^0$F.

9. Convert 90^0F to ^{0}C.

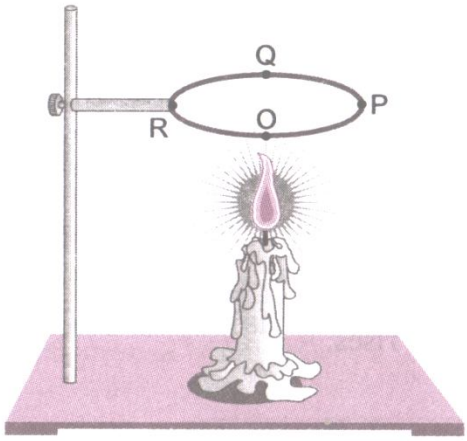
C $= \left(\frac{5}{9}\right)(F - 32)$

^{0}C $= \left(\frac{5}{9}\right)(90 - 32) = 32.2\ ^0$F.

I. Short Answer Type Questions.

1. A circular metal loop is heated at point 0 as shown in the figure below.

[NCERT Exemplar]



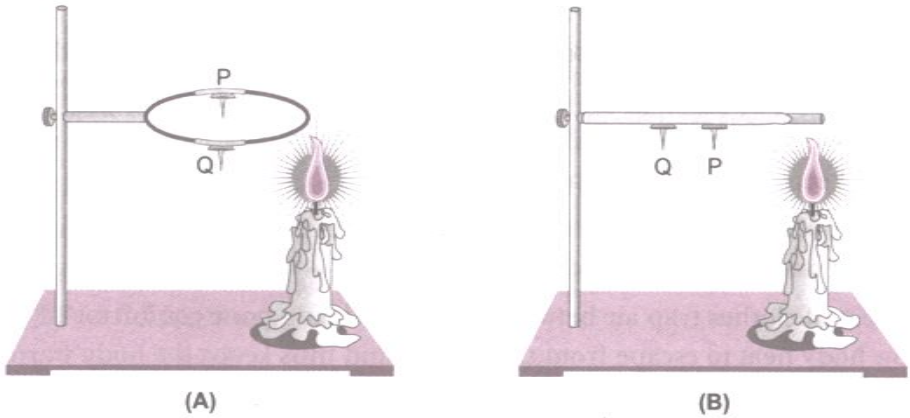
a. In which direction would heat flow in the loop?

b. In which order the pins at points P,Q and R fixed with the help of wax fall if point O, P, Q and R are equidistant from each other?

a. The heat will flow in both the direction, i.e., from O to P to R.

b. A first the pins at R and P will fall simultaneously followed by the pin at Q.

2. In the arrangements A and B shown in the figure below, pins P and Q are fixed to a metal loop and an iron rod with the help of wax. In which case are both the pins likely to fall at different times? Explain. **[NCERT Exemplar]**



In case 'B', the P will fall before the pin Q because the heat will reach pin P first In case 'A' the heat travels in both in both the direction, therefore pins P and Q will fall simultaneously.

3. For setting curd, a small amount of curd is added to warm milk. The microbes present in the curd help in setting if the temperature of the mixture remains approximately between 35°C to 40°C. At places, where room temperature remains much below the range, setting of curd becomes difficult. Suggest a way to set curd in such a situation. **[NCERT Exemplar]**

(a) In order to maintain the desired temperature of the mixture, the container can be wrapped either by woollen material or any other poor conductor of heat. Alternately, the mixture can be kept in a heat resistant container.

(b) The container can be kept in the sun or near the gas stove while cooking.

4. A few sharp jerks are given to clinical thermometer before using it. Why is it done so? **[NCERT Exemplar]**

The jerk to the thermometer will allow the mercury in or above the kink to flow into the bulb so that the mercury level is below normal temperature.

5. Give two examples each of conductors and insulators of heat. **[NCERT]**

Conductors of heat: copper, iron. Insulators of heat: plastic, rubber.

6. Why is mercury used as an indicator in a thermometer?

(i) Mercury expands evenly as the temperature rises.

(ii) It is a good conductor of heat.

(iii) It is silvery white and can be seen from outside the glass.

(iv) It does not stick to glass.

7. At a camp site there are tents of two shades one made with black fabric and the other with white fabric. Which one will you prefer for resting on a hot summer afternoon? Give reason for your choice. Would you like to prefer the same tent during winter? **[NCERT Exemplar]**

On a hot summer afternoon the tent made up of white fabric will be preferred as white colour is a bad absorber and good reflector of heat. No, the black fabric tent will be preferred during winter.

8. While constructing a house in a coastal area, in which direction should the windows preferably face and why? **[NCERT Exemplar]**

The windows of houses in coastal areas should preferably face towards the sea as sea breeze will keep it cool during day time.

9. Discuss why wearing more layers of clothing during winter keeps us warmer than wearing just one thick piece of clothing. [NCERT]

More layers of clothes trap air between them. Air being poor conductor of heat does not allow body heat to escape from the clothes and thus keeps the body warm.

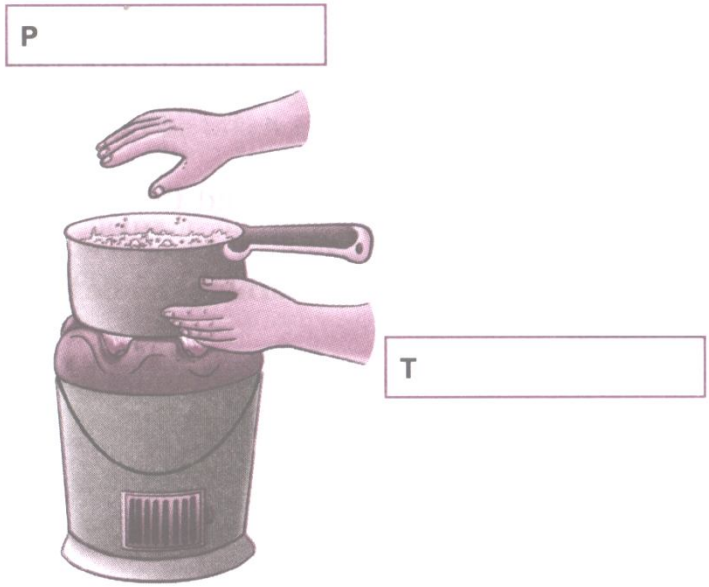
10. Look at figure given below. Mark where the heat is being transferred by conduction, by convection and by radiation. [NCERT]

Conduction: From pan to water

Convection: From pan to water

Radiation: Within water

11. Observe the picture given below. Water is being boiled in a pan of wide base. [NCERT Exemplar]



(a) Which position P or T will feel warmer?

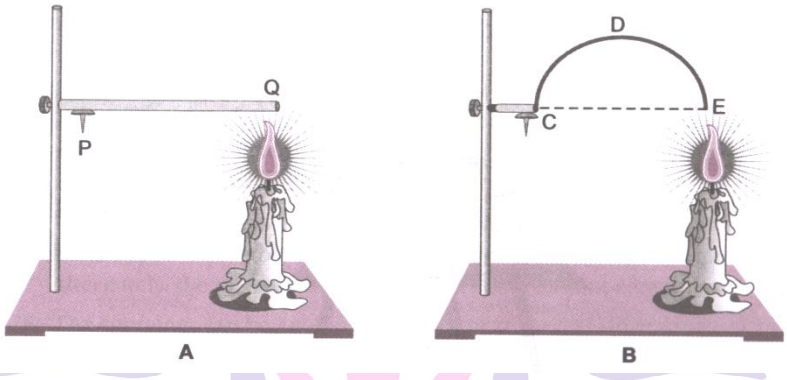
(b) Fill up the boxes P and T to indicate the mode of flow of heat to the hand.

(a) Position `p' will feel warmer due to the hot air rising up.

(b) P → Convection

T → Radiation

12. Look at figures given below. [NCERT Exemplar]



The length of wire PQ in case of A is equal to the diameter of the semicircle formed by the wire CDE, in case B. One pin is attached to each wire with the help of wax as shown in figure above. Which pin will fall first? Explain.

The pin on the wire in case A will fall first as heat will reach to it before it reaches the pin in case B.

13. Why does mercury not fall or rise in a clinical thermometer when taken out of the mouth?

The kink in the capillary tube of the thermometer allows mercury to rise but does not allow it to fall.

14. Why can you not use a clinical thermometer to measure the temperature of a candle flame?

The clinical thermometer has a maximum temperature range of 100°C and the temperature of flame is more than that.

15. Why do gases expand more than liquids?

The molecules in gases are more loosely packed than liquids so, they move more freely and expand more.

16. Why can you not keep your palm above a burning candle but you can keep it on the sides of a candle flame?

This is because the hot air from the candle rises up and is hot air whereas on the sides, there is no hot air.

II. Short Answer Type Questions.

1. What are the effects of heat?

Heat energy can cause many changes in an object. On heating, object become hotter, they may expand. Heat may change state of the body. For example, ice changes into water. Heat can also increase the speed of chemical reactions. Heat even kills harmful bacteria. That is why boiled water is generally given to a patient suffering from water borne disease.

2. Complete the following table.

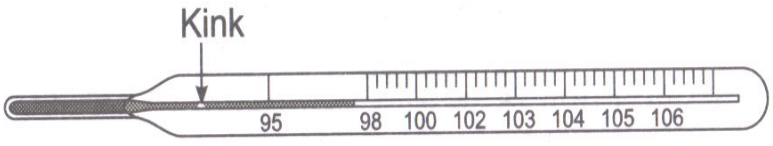
Hot and cold objects

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

Object	Cold / Cool	Warm / Hot
Ice Cream	✓	-
Spoon in a tea cup	-	✓
Fruit Juice	✓	-
Handle of a frying pan	-	✓

3. What is clinical thermometer? Explain with diagram.

The most common thermometer used almost in every house is clinical thermometer. We use it to measure the temperature of human body, when someone has fever. The normal temperature of body in clinical thermometer is 37^0C (98.4^0F)

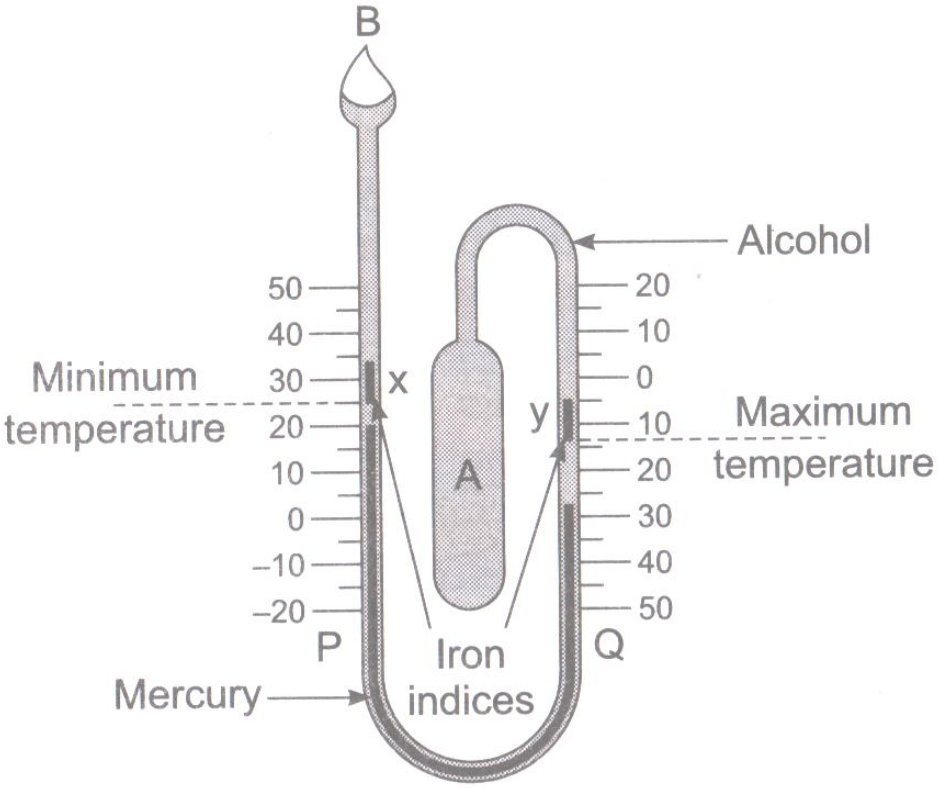


4. What is the limitation of clinical thermometer?

We cannot use clinical thermometer for measuring the temperature of any object more than 42^0C (more than body temperature). It may break if kept in the sun or near a flame.

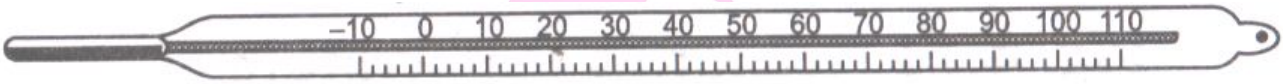
5. What is maximum minimum thermometer?

A thermometer used to measure the maximum and minimum temperature of previous day is called maximum-minimum thermometer. It is used by the weather department to report / predict the weather.



6. What is laboratory thermometer?

The thermometer which is used to measure the temperature of objects in laboratory is called laboratory thermometer. The range is -10^{0}C to 110^{0}C. It also contains a thread of mercury.



7. What are the precautions needed while reading a laboratory thermometer?

i. The thermometer should be kept upright not tilted.

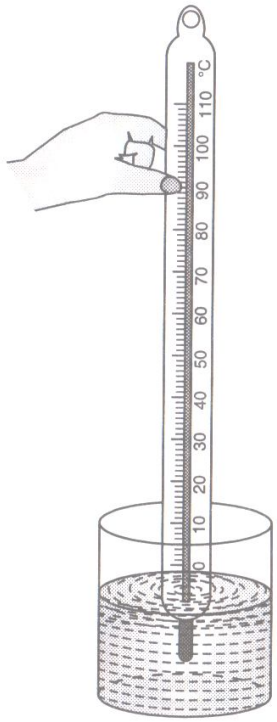
ii. Mercury does not stick to the walls of the thermometer like water.

iii. Mercury can be easily collected when thermometer breaks.

iv. It shines more than water and can be seen easily in thin glass tube of the thermometer.

8. Explain an activity to show the measuring of temperature of water with laboratory thermometer.

Take some hot water in a beaker. Dip the thermometer in water as shown in the figure. Keep it for some time in the water till the mercury thread becomes steady.; Note the temperature of hot water.

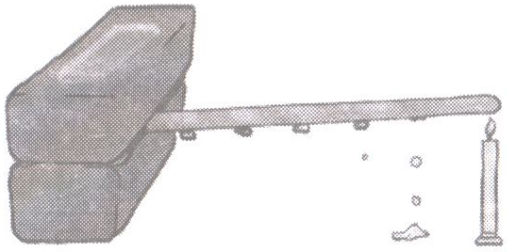


9. What are the various modes of transfer of heat?

The heat energy flows from a point of higher temperature to a point of two points become equal, the flow of heat energy is stopped. There are following three modes of transfer of heat energy: (i) Conduction (ii) Convection (iii) Radiation.

10. What do you mean by conduction mode of transfer of heat energy?

The process by which heat is transferred from hotter end to colder end of metal is called conduction. In this process, molecules of substance do not move but heat energy is transferred. In solids generally, the heat is transferred by the process of conduction.



11. How does the heat travel in water?

When water is heated, the water at the bottom gets hot. Hot water rises up from the sides. The cold water from the sides moves down towards the bottom or source of heat. This water also gets hot and rises up and cold water again moves down. This process continues till the whole water gets heated. This mode of transfer of heat is known as convection.

12. What is convection?

The mode of transfer of heat in which molecules of a fluid actually move after taking heat is called convection. Mostly in liquids and gases (including air) heat is transmitted by the process of convection.

13. Why is it more comfortable to wear white or light coloured clothes in summer and dark coloured clothes in winter?

Light coloured clothes reflect most of the heat that fall on them and we feel more comfortable wearing them in summer. Dark clothes absorb more heat so we feel comfortable with dark coloured clothes in winter.

14. Why is the handle of a metallic kettle covered with strips of cane?

Handle of metallic kettle is covered with strips of cane because when kettle is heated, the heat does not pass through strips of cane. The strips of cane are bad conductor of heat and we may hold the handle with our bare hands.

16. How do woollen clothes keep us warm in the winter?

Wool is a poor conductor of heat. In the winter, we use woollen clothes. The wool fibres trap the air in between them. This air prevents the flow of heat from our body to the cold surroundings. So, we feel warm.

17. How does the heat comes towards us from the sun?

When we come out in the sun, we feel warm. The heat cannot reach us by conduction or convection because there is no any material medium such as air in most part of the space between the earth and sun. Therefore, heat comes to us by the process called radiation from the sun. It can take place whether a medium is present or not.

18. You are given a thick blanket or two thin blanket joined together. Which one of these two blankets you choose?

Suppose we are given the choice in winter of using either a thick blanket or two thin blankets joined together, then we select the blanket which is formed by the joined of two blankets because there would be layer of air in between the blankets. The air is poor conductor of heat. So this blanket gives more warmness.

III. Short Answer Type Questions - 1

1. Why convection is not possible solids ?

The molecules of solid are held strongly due to intermolecular forces and thus cannot move from one place to another place of the solid. So, convection is not possible in solids.

2. What are insulators ?

Materials which do not allow heat to pass through them easily are poor conductors of heat and are called insulators. e.g., wood, plastic.

3. Why ice is wrapped in gunny bags ?

Gunny bags have a number of fine pores filled with air. Air being a bad conductor of heat does not allow heat from outside to go to the ice and melt it.

4. Why sense of touch is not a reliable technique to measure hotness or coldness?

Touching objects with your hands is not a measure of hotness and coldness because if you take your hand from a cold water to normal water, it appears warm. On the other hand, if you take your hand from warm water to normal water, it appears cold. Thus the same water may give you different feeling thus deceiving you.

5. Write a short note on temperature.

Temperature is the degree of hotness and coldness of a body. The SI unit of temperature is Kelvin (K). It is a measure of heat energy. Thermometer is a reliable device to measure temperature of a body.

6. Give a make up of thermometer.

A thermometer is made up of a thin, long and uniform glass tube called capillary tube. It has a bulb at one end. A silver coloured liquid mercury is placed in the bulb which rises up when temperature rises and falls when temperature falls. The capillary tube is calibrated by a set procedure and markings are given in degrees. Celsius degrees or Fahrenheit. The level of mercury thread gives the temperature.

7. What are the two scales of measurement of temperature? How are these related?

Celsius scale and Fahrenheit scale are the two scales used for measurement of temperature. Temperature in Celsius scale (C) is related to Fahrenheit scale (F) by the following formula :

$$C = \frac{5}{9}(f - 32)$$

or $$f = \frac{9}{5}C + 32$$

8. Distinguish between clinical and laboratory thermometer.

Clinical thermometer : It is used to measure the body temperature of a human body. The scale on its stem shows temperature from- 35°C to 42°C. It has a slight 'bent' or 'kink' in the capillary tube just above the bulb.

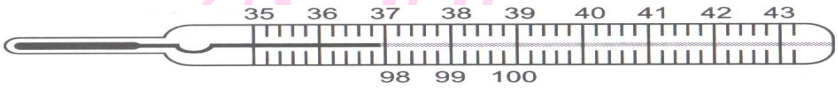
Laboratory thermometer : It is used to measure the temperature of different objects in the laboratory. The scale on its stem shows temperature from-10°C to 110°C. A laboratory thermometer is bigger in size than clinical thermometer and kept upright and not tilted when making measurement.

9. How are the lower and upper scale of a thermometer fixed ?

In Celsius scale, the temperature at which pure water freezes at sea level is taken as the lower fixed point whereas, the temperature at which pure water boils at sea level is taken as the upper fixed point. The lower and upper fixed points are marked as 0°C and 100°C respectively. The scale between these points is then divided into 100 parts.

10. Give a make up of clinical thermometer. **(NCERT)**

A clinical thermometer consists of a long narrow, uniform glass tube. It has a bulb at one end which contains shining liquid mercury. Outside the bulb a small thread can be seen in which mercury can flow. It has scale marked from 35°C to 42°C.



11. Why are handles of most utensils made up of plastic and wood ?

The handles of most utensils are made of plastic and wood because plastic and wood are poor conductors of heat. We can easily hold the handle with bare hands even if the utensils are hot. This helps us to remove hot utensils from the flame.

12. It is observed that two thin woollen blankets are warmer than a thick woollen blanket. Comment.

Two thin woollen blankets shall be warmer than a thick woollen blanket because more air is trapped between the two thin blankets than a single woollen blanket. Air is a poor conductor of heat and does not allow the heat to pass from the body.

13. We wear light coloured clothes in summer and dark coloured clothes in winter. Comment.

Dark coloured clothes absorb more heat and, therefore, we prefer to wear dark coloured clothes in winter. On the other hand light coloured clothes reflect most of the heat that falls on them. Therefore, we prefer to wear light coloured clothes in summer.

14. Give two examples of conductors and insulators of heat.

Conductors of heat—Aluminium, copper. 1 Insulators of heat—Glass, paper.

15. Why mercury is used as an indicator in thermometers ?

Mercury is used as thermometric fluid because :

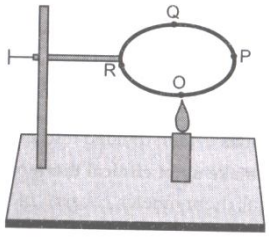
(i) It expands easily and uniformly on heating.

(ii) It can be used over a wide range of temperature.

(iii) It is easily visible, being opaque and shining.

(iv) It does not stick to the sides of a glass tube.

16. A circular metal loop is heated at point 0 as shown in following figure.



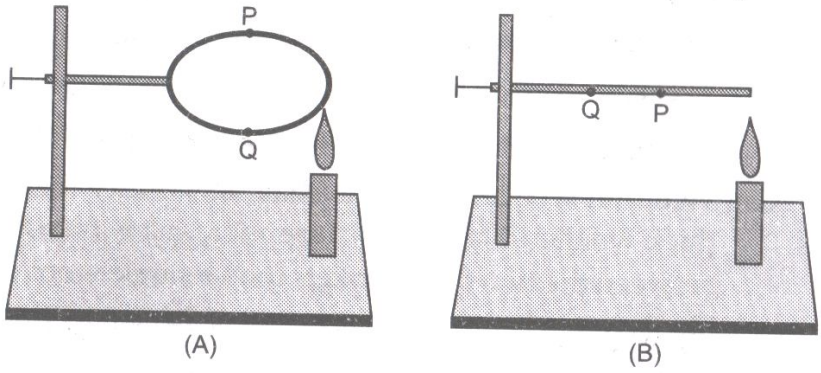
(i) In which direction would heat flow in the loop ?

(ii) In which order the pins at points P. Q and R fixed with the help of wax fall if points 0, P, Q and R are equidistant from each other ? [NCERT Exemplar]

(i) The heat will flow in both directions i.e., from 0 to P and 0 to R.

(ii) At first the pins R and P will fall simultaneously followed by Q.

17. In the arrangements A and B following figure, pins P and Q are fixed to a metal loop and an iron rod with the help of wax. In which case are both the pins likely to fall at different times ? Explain.



[NCERT Exemplar]

In case 'B' the pin P will fall before the pin Q because the heat will reach pin P first. In case 'A', the heat travels in both the directions and pins P and Q will fall simultaneously.

18. For setting curd, a small amount of curd is added to warm milk. The microbes present in the curd help in setting if the temperature of the mixture remains approximately between 35°C to 40°C. At places where room temperature remains much below the range, setting of curd becomes difficult. Suggest a way to set curd in such a situation. [NCERT Exemplar]

(i) In order to maintain the desired temperature of the mixture, the container can be wrapped either by woollen material or any other poor conductor of heat. Alternately, the mixture can be kept in a heat resistant container.

(ii) The container can be kept in the sun or near the gas stove while cooking.

19. You may have noticed that a few sharp jerks are given to clinical thermometer before using it. Why is it done so ? **[NCERT Exemplar]**

The jerk to the thermometer will allow the mercury in or above the kink to flow into the bulb so that the mercury level is below normal temperature.

20. Why is it advised not to hold the thermometer by its bulb while reading it? **[NCERT Exemplar]**

If we hold a thermometer by its bulb, the mercury in the bulb will expand due to our body temperature.

21. At a camp site there are tents of two shades—one made with black fabric and the other with white fabric. Which one will you prefer for resting on an hot summer afternoon? Give reason for your choice. Would you like to prefer the same tent during winter ? **[NCERT Exemplar]**

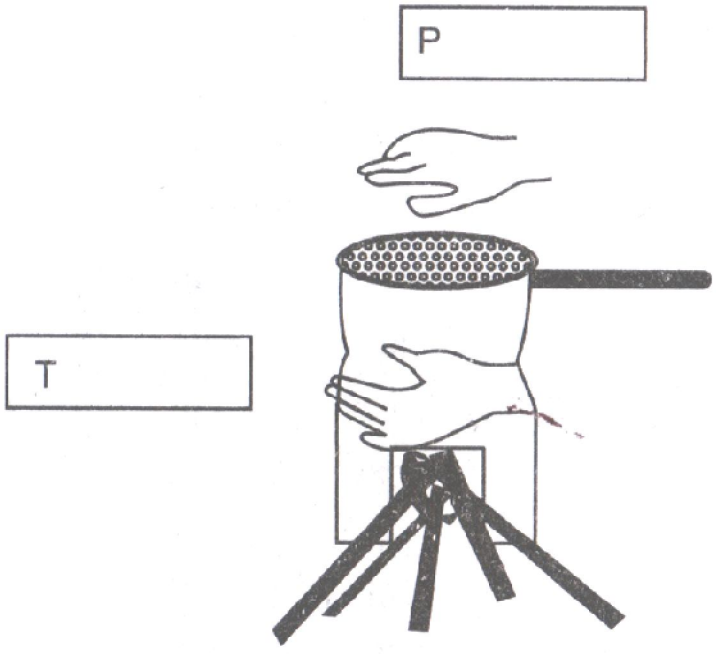
(i) On a hot summer afternoon the tent made up of white fabric will be preferred as white colour is a bed absorber and good reflector of heat.

(ii) No, the black fabric tent will be preferred during winter.

22. While constructing a house in a coastal area, in which direction should the windows preferably face and why ? **[NCERT Exemplar]**

The windows of houses in coastal areas should preferably face towards the sea as sea breeze will keep it cool during day time.

23. Observe the following Figure : Water is being boiled in a pan of wide base.



(i) Which position P or T will feel warmer ?

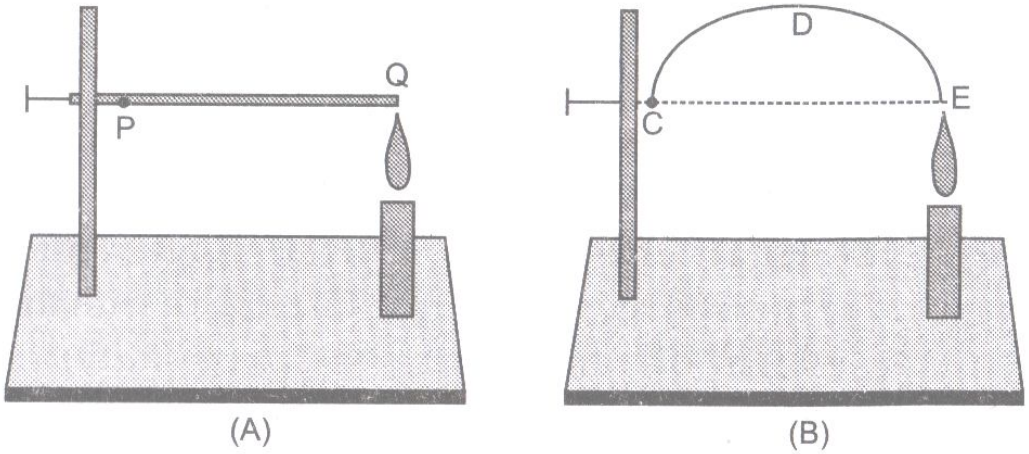
(ii) Fill up the boxes P and T to indicate the mode of flow of heat to the hand.

Position 'P' will feel warmer due to the hot air rising

up

P —> Convection T —> Radiation

24. Look at following figure.



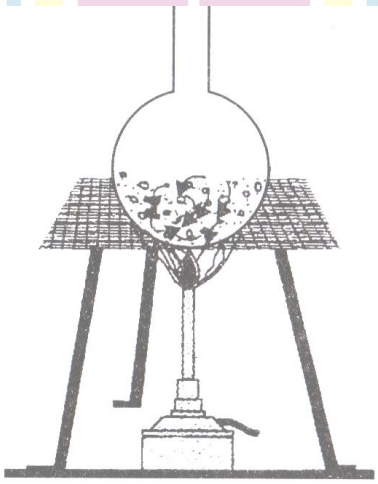
The length of wire PQ in case of A is equal to the diameter of the semicircle formed by the wire CDE, in case B. One pin is attached to each wire with the help of wax as shown in figure. Which pin will fall first? Explain. [NCERT Exemplar]

The pin on the wire in case A will fall first as heat will reach to it before it reaches the pin in case B.

III. Short Answer Type Questions - 2

1. Describe the mode of heat transfer in water or gases.

Take water in a flask and heat it. It is seen that water near the flame gets hot and it rises up. The cold water from the side moves down, towards the source of heat. This water also



gets hot and rises and more water moves down from the side. This process continues till the whole water gets hot. This mode of heat transfer is called convection. Similar process happens in gases.

2. Enumerate the precautions to be taken while reading a clinical thermometer.

The following precautions are to be taken while reading a clinical thermometer :

(a) Thermometer should be washed before or after use, preferably with an antiseptic solution.

(b) By giving a jerk, ensure that before use the mercury level is below 35°C.

(c) Keep the thermometer below the tongue of the person for 30-60 seconds. 1/2 level

(d) Read the thermometer keeping the of mercury along the line of sight.

(e) Do not hold the thermometer by the bulb while reading the temperature.

3. How does heat travel in air ? Give any two such instances.

The air near the heat source gets hot and rises. The cold air from sides takes its place. In this way air gets heated. This gives interesting phenomenon in coastal regions.

(i) During the day, land than water. The air becomes hotter and air from sea rushes gets heated faster over the land rises up. The cooler in towards the land to take its place. The warm air from land moves towards sea to complete the cycle. The air ' from sea is cool and is called sea breeze.

(ii) At night, it is exactly the reverse. The water cools down more slowly than land. So, the cool air from land moves towards sea. This is called land breeze.

4. Give three points to show that radiations is different from conduction or convection.

Radiation	Conduction or Convection
1. No medium is needed.	A medium is needed.
2. Heat energy is transferred in the form of electro-magnetic waves.	Heat energy transfer takes place with the help of material particles.
3. Heat transfer is a fast mode.	It is a slow mode of heat transfer.

5. Show that water is a bad conductor of heat.

Take a test-tube. Half fill it with cold water. Now drop in it a cube of ice wrapped in a wire gauze. It sinks to the bottom. Hold the top end of the test-tube with a test-tube holder. Heat it over a flame. It will be noticed that water starts boiling but ice is not fully melted. It

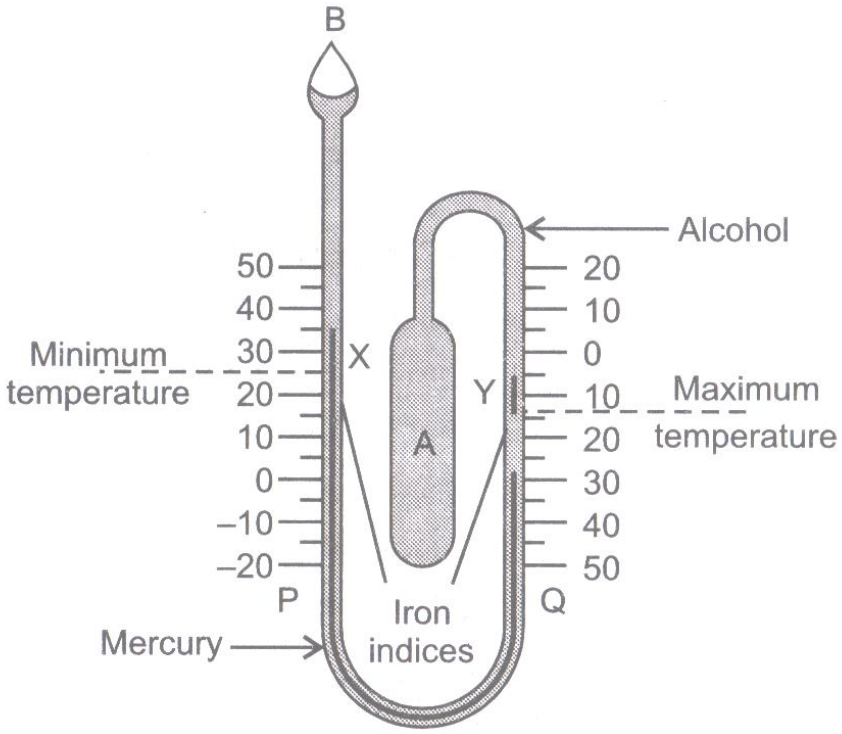
means that heat has been transferred through the molecules of water. This shows that water is a bad conductor of heat.

6. Show that air transfers heat via convection.

Take a rectangular box with a glass front. Make a small window on one of its sides and a hole on the top. Fix a paper pipe into the hole of the top to form a chimney. Now keep a candle in the box below the chimney. Keep your hand above the chimney. It will be observed that hot air is coming out of chimney. Now put a lighted incense stick near the window. Soon you will notice that incense smoke comes out of the window. This happens due to the convection current set up inside the box.

7. What is a Maximum Minimum thermometer ?

A thermometer used to measure the maximum and minimum temperature of previous day is called Maximum-Minimum thermometer. It is used by the weather department to report/predict the weather.



8. Why is the handle of a metallic kettle covered with strips of cane ?

Handle of a metallic kettle is covered with strips of cane because when kettle is heated, the heat does not pass through strips of cane. The strips of cane are bad conductor of heat and we may hold the handle with our bare hands.

9. What is convection ?

The mode of heat transfer in which molecules of a fluid actually move after taking heat is called convection. Mostly is liquids and gases (including air) heat is transmitted by the process of convection.

10. What precautions are needed while reading a laboratory thermometer ?

(i) The thermometer should be kept upright not tilted.

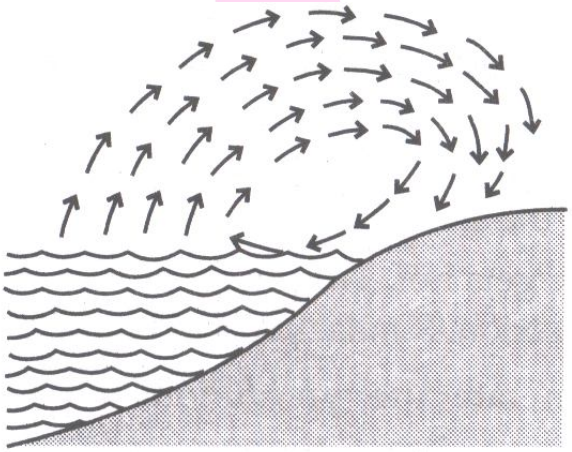
(ii) Bulb should be surrounded from all sides by the substance by which the temperature is to be measured.

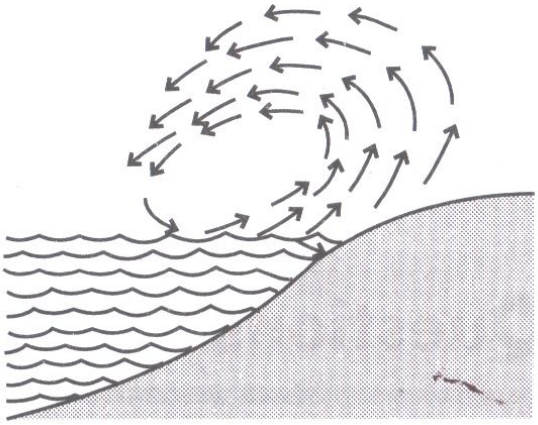
(iii) The bulb should not touch the surface of the container.

I. Long Answer Type Questions.

1. Explain the sea breeze and land breeze.

At sea-shore during the day cold air from the sea moves towards the beach because the land gets more heated than the sea water. Hot air above the land rises up, and cold air from the sea moves towards the land beach. This is called sea breeze as shown in fig. (a). 1 During the night, cold air from the land moves towards the sea because the land cools more quickly than the sea water. So hot air above the sea rises up and cold air from the land moves towards the sea. This is called land breeze as shown in fig. (b).





2. Differentiate between heat and temperature.

Difference between heat and temperature :

Heat	Temperature
1. It is a form of energy.	1. It is a thermal condition of body.
2. It flows from one object to other object when there is a difference in temperature.	2. It is a quantity that indicates whether or not and in which direction heat will flow.
3. It is the total amount of internal energy of a body.	3. It is proportional to average kinetic energy of the mole clues of a body.
4. In the transmission of heat, total amount of heat remains unchanged.	4. In the transmission of heat, temperature does not remain same.
5. It is a cause	5. It is an effect.
6. Its SI unit is Joule	6. Its SI unit is Kelvin (K)

3. Write a short note on radiation.

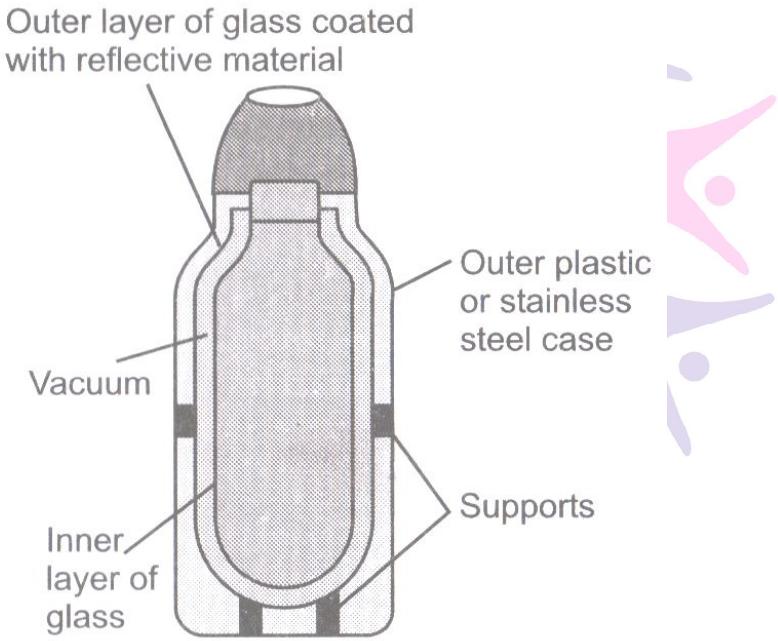
The solar energy cannot reach to us by the process of conduction or convection as there is no medium such as air, in most part of the space between the earth and the sun. This process of heat transfer is called radiation. The transfer of heat by radiation does not require any medium. When you sit in front of a room heater or bonfire you feel warm. We get heat by radiation because air is a poor conductor of heat, heat is not transferred through conduction. Convection is also not possible in this case as convection current rise upwards and not sideways. Further if we put an insulating material like a cardboard between the fire and ourselves, we no longer feel hot. This shows air around us remains cold and is not involved in transferring heat to

us from the heat source. Further heat is transferred to us by radiation only in the straight path.

4. Explain the working of a thermo flask.

Thermo flask is a special kind of flask for keeping liquids. It prevents loss or gain of heat by any of the three methods. It keeps liquid warm or cold for a long time. It was invented by Sir James Dewan in 1893.

It consists of a double-walled glass-cylinder. A vacuum is created in the space between the double walls. The two inner surfaces of glass walls are silvered. The flask is placed on a spring within a non-conducting cylindrical case to protect it from jerks and breakages. The gaps between flask and outer casing is packed with felt pads. The mouth of the flask is finally closed with a cork.



Since the container is made of glass which is a bad conductor of heat and therefore, the loss or gain of heat due to conduction is prevented. As there is vacuum between the double walls, it prevents transmission of heat by convection. Due to silvering of the inner surfaces, the heat loss by radiation is prevented. The cork and the felt pads also help to preserve the heat inside the flask. So, the hot liquids like tea, coffee, etc., remain hot and cold liquids like water, juice, etc., remain cold for a long time.

5. What are conductors of heat and insulators ? Discuss their practical applications.

Substances that allow heat energy to flow through them are called good conductors of heat. e.g., metals. Substances that do not allow heat energy to flow through them are insulators. e.g., wood, plastic, glass, etc.

(a) Practical applications of good conductors of heat :

(i) Cooking utensils are made of metals so that heat can easily get transferred to food.

(ii) Coils of refrigerators and air conditioners are made of copper to conduct away heat.

(iii) Mercury is used as a thermometric liquid in thermometers.

(b) Practical applications of insulators.

(i) Hand of cooking utensils are made of insulators like bakelite, wood, etc.

(ii) Woollen clothes are insulators and keep us warm in winter.

(iii) Hair and fur in animals are insulators. So they keep them warm during winter.

II. Long Answer Type Questions.

1. Explain radiation.

The mode of transfer of heat energy in which no medium is needed to transfer heat from a hotter body to a colder body is called radiation. The heat from the sun comes to the earth without any medium thereby using the mode of radiation.

2. Write the differences between heat and temperature.

Heat	Temperature
1. It is a form of energy	i. It is a thermal condition of body.
2. It flows from one object to other object when there is a difference in temperature.	ii. It is a quantity that indicates whether or not and in which direction heat will flow.
3. It is total amount of internal energy of a body.	iii. It is proportional to average kinetic energy of the molecules of a body.
4. In the transmission of heat total amount of heat remains unchanged.	iv. In the transmission of heat temperature does not remain same.
5. It is a cause	v. It is an effect
6. Its SI unit is Joule	vi. Its SI unit is Kelvin (K).

3. What is heat? How is it transferred from one body to other body? Explain various methods.

Heat is the form of energy which causes sensation of hotness or the coolness.

Heat is transferred from hotter body to colder body till the temperature becomes same.

There are following three ways of the transfer of heat.

(i) Conduction : The process by which heat is transferred from hotter end of the object to the colder end of an object, is called conduction.

(ii) Convection: The process in the particles come in contact of source of heat and become hotter than others. The hotter particles rises up and colder particles take their place. This process continues till the whole body gets heated is called convection.

(iii) Radiation : The process of transfer of heat in which transfer of heat does not require any medium is called radiation. It can take place whether a medium is present or not.

III. Long Answer Type Questions.

1. State similarities and differences between the laboratory thermometer and the clinical thermometer. [NCERT]

Similarities:

(a) Bulbs contain mercury.

(b) Glass tubes are long, narrow and uniform.

Differences:

(a) Clinical thermometer is used to measure body temperature however laboratory thermometer is not used for the purpose of measuring body temperature.

(b) The temperature range of clinical thermometers laboratory thermometers is —10°C-110°C.

(c) The least count of both the thermometers is different.

2. Distinguish between the following.

(a) Land breeze and Sea breeze

(b) Convection and Conduction

(a)

S.No	Land Breeze	Sea Breeze
i.	This is produced from the land to the sea.	It is produced from the sea to the land.
ii.	It occurs at night.	It occurs during the day.

(b)

S.No	Convection	Conduction
i.	A method of heat transfers through fluids, i.e., liquids and gases.	A method of heat transfers through solids.
ii.	In convection, the transfer of heat is by the movement of the fluid itself.	In conduction, the transfer of heat is without movement of matter as a whole.

3. What precautions should you take while reading a clinical thermometer?

(a) The reading should be taken by keeping the level of mercury along the line of sight.

(b) Before use, the mercury level should be below 35°C.

(c) Wash the thermometer with water or an antiseptic solution before and after use.

(d) Never hold the thermometer by the bulb while reading it.

(e) Handle the thermometer with care, it can break if hit against hard object.

4. What precautions should you take while using a laboratory thermometer?

(a) Never hold the thermometer by the bulb while reading it.

(b) Wash the thermometer with water or antiseptic solution before and after use.

(c) While performing the experiment, don't touch the bulb of the thermometer with the wall of the beaker.

(d) Read the thermometer keeping the level of mercury along the line of sight.

I. High Order Thinking Skills (HOTS) Questions.

1. Which will cool faster-water kept in a black pot or kept in silver pot?

Water kept in a black pot will cool faster because blackened surface is a good radiator than a silvered surface.

2. It is preferred to use two thin blanket rather than one thick blanket. Explain the reason.

In case of two thin blankets there is an air gap which does not allow heat pass out from the body and it is not as such as in case of one thick blanket.

II. High Order Thinking Skills (HOTS) Questions.

1. Which will cool faster-water kept in a black pot or kept in silver pot?

Water kept in a black pot will cool faster because blackened surface is a good radiator than a silvered surface.

2. In places of hot climate it is advised that the outer walls of house be painted which explain.

Light colour are good reflectors of light and white is the best reflector of light. A wall painted with white colour reflects back most of the sun rays falling on it and thus keeps the houses cool.

I. Value Based Questions.

1. Seema's family is shifted from Masouri to Mumbai, She saw the outer walls of their houses were painted white. Moreover, she noticed that it is better when she is out of the house in comparison to inside of the house. Her mother gave here some light cotton clothes to wear.

i. How does the heat reach us from the sun?

ii. Why is the wall painted white but not with any other colour?

iii. Why did her mother prefer cotton clothes?

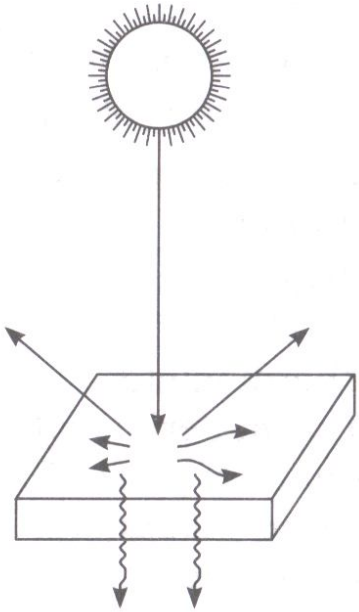
i. The radiation of the Sun gives us heat which do not require any medium.

ii. White colour absorbs less heat coming from Sun and more it reflects. The temperature of any object increases due to absorbed part of the heat, in case of white colour it is least.

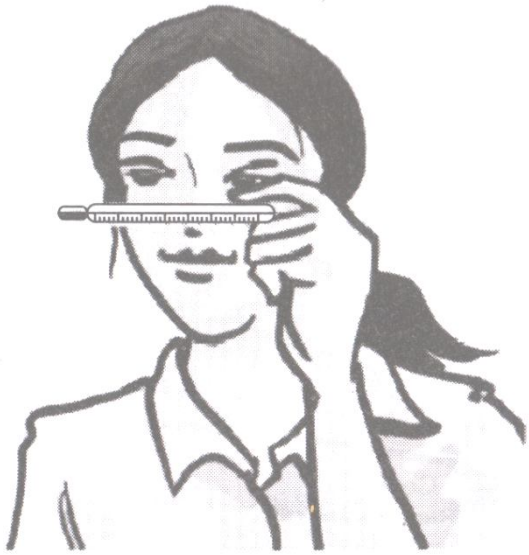
iii. Her mother preferred cotton clothes as they are light and porous through which air can pass easily and make our body cool, as the climate of Mumbai is temperature.

Skill Based Questions.

1. Draw a diagram to show the radiation by the sun.



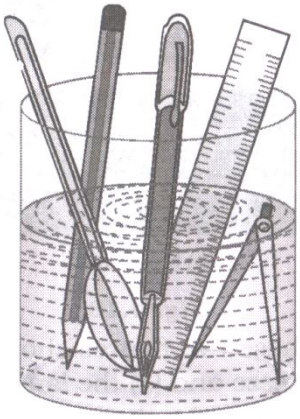
2. Observe the following figure and tell what does this figure show?



i. In the figure, we see that a girl is reading the temperature in a thermometer.

ii. This is a correct method of reading a clinical thermometer.

3. What do you observe in the following figure?



i. Here we observe that a beaker contains various types of things.

ii. The materials are of two types.

a. Some are metallic and

b. Some are made up of plastic.

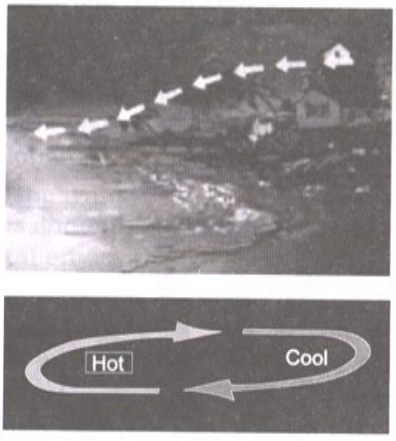
iii. This figure shows that all materials are not good conductor of heat.

4. Observe the following figure and answer the questions.

i. What do these two figures show?

ii. What is the indication of these two figures?

(a) Day time

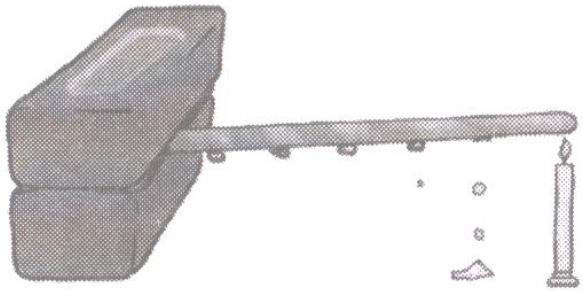


(b) Night time

i. These two figures show (a) the sea breeze and (b) the land breeze.

ii. During the day the air flows from the sea to land, hence called sea breeze. During the night time the air flows from land to sea, hence called land breeze.

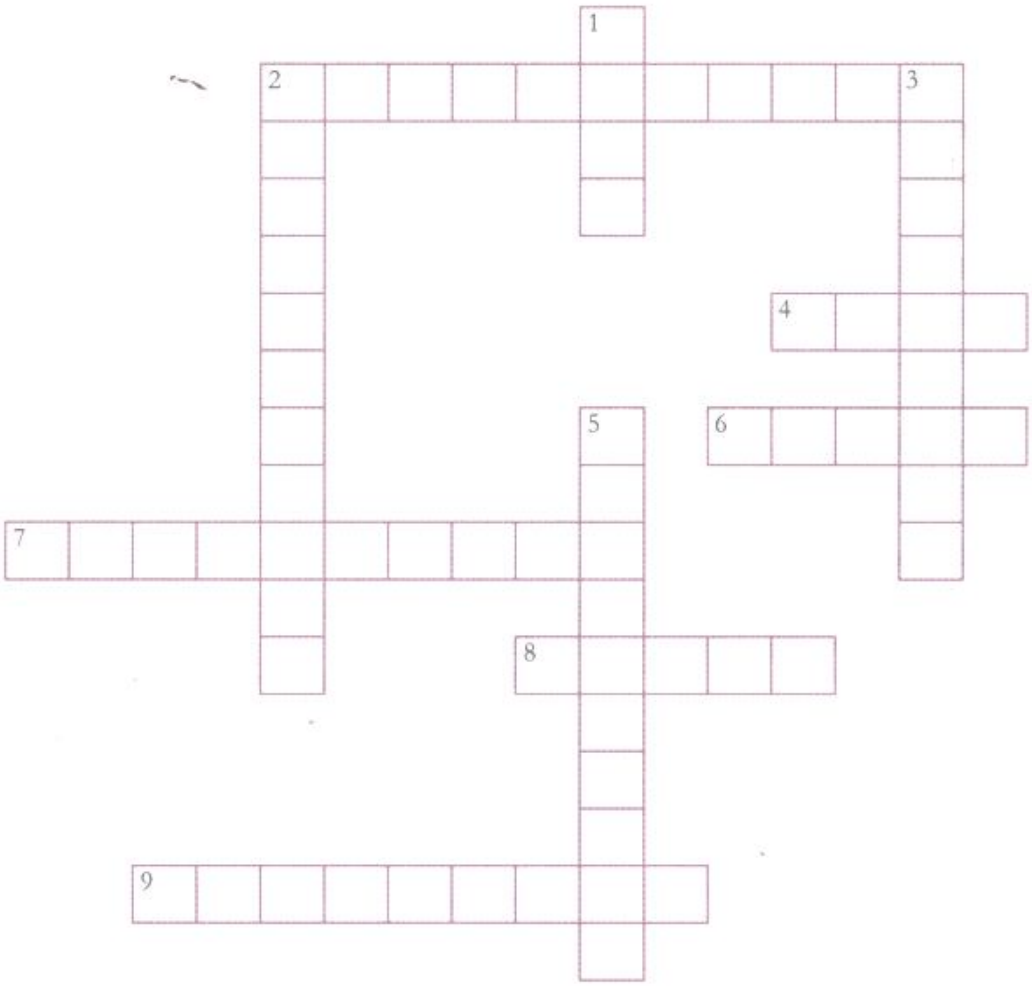
5. Draw a diagram to show the conduction.



6. Draw a diagram to show the convection.

Cross word puzzle

1.



Across

2. An instrument used to measure temperature.

4. A form of energy that enables us to feel hotness or coldness.

6. Anything that can flow

7. Mode of transfer of heat from one particle to another in solids.

8. An example of a good conductor of heat.

9. A material that conducts hear.

Down

1. An example of a bad conductor of heat

2. The degree of hotness of a body

3. Mode of transfer of heat from a source to a cold object without there being a direct contact between them.

5. Mode of transfer of heat through liquids and gases by the actual movement of heated particles with the medium.

Across

2. thermometer

4. heat

6. fluid

7. conduction

8. metal

9. conductor

Down

1. wood

2. temperature

3. radiation

5. convection