Laboratory thermometer

- Clinical thermometer can never be used for measuring the temperature of any object other than human body.
- It is used to measure the temperatures in school or other laboratories for scientific purpose as they measure temperatures to a range higher than clinical thermometers.
- One such thermometer is known as the laboratory thermometer with a scale generally ranging from –10°C to 110°C. It has a long stem with a silver bulb at the end unlike clinical thermometer.
- The silver colour at the bulb normally points toward the presence of mercury which expands with the rise in temperature thereby raising the reading and contracts on lowering of temperature thereby lowering the reading.

Class 7 Chemistry Heat

Introduction

Introduction

It is from our day to day observation that in winter we feel cold whereas in summer we feel hot. People avoid getting out of their houses during the scorching summer due to excessive heat outside. When you boil water it becomes hot and is hard to dip finger in it but as soon as you blow off the flame and keep it aside for some time it gets easy to dip your finger.

Fig. Boiling Water

During fever our body gets hot but as soon as we take medicine the body becomes cool.

Ice melts when kept outside but remains in cold solid form as long as kept inside the deep freezer. Have you ever wondered what changes or phenomenon makes this happen.

It is all due to temperature.

Class 7 Chemistry Heat Temperature

Temperature

A measure of hotness or coldness of an object that can be relied upon is known as temperature.

Fig. Measure of temperature during fever using thermometer.

Fig. High temperature due to burning of Wood

It can be measured using three different units namely-

Degree Celsius: It is denoted as °C and read as degree Celsius or Celsius. For instance, 20°C will be read as twenty degree Celsius.
Fahrenheit: It is denoted as °F and read as degree Fahrenheit. For instance, 25°F will be read as twenty five degree Fahrenheit.
Kelvin: It is denoted as K. For instance, 100K will be read as hundred Kelvin.

Temperature can be sensed by touching but we cannot rely upon it. Therefore a device called thermometer is used to get the exact value of temperature.

Thermometer

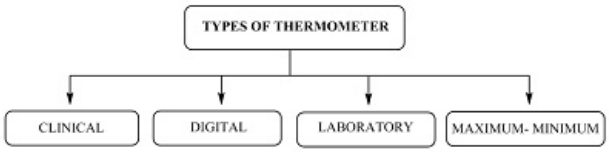
Thermometer is a device used to measure temperature of a body. It can be used to measure the temperature of the body during fever. It can also be used to measure the atmospheric temperature and temperature during chemical reactions. It consists of a long narrow glass tube appearing as a continuous silver line because it is filled with mercury readily expands or contracts at the slightest change in temperature and a bulb at one end.

Class 7 Chemistry Heat

Types of thermometers

Types of thermometers

Thermometers can be classified as follows:



Clinical thermometer

Clinical thermometer is used to measures the human body temperature.

Digital thermometer

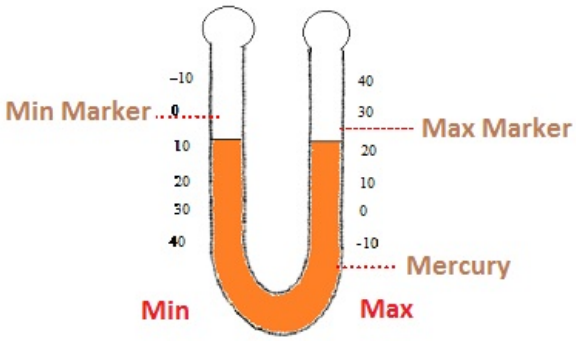
- Digital thermometers are an advance to the existing clinical thermometers;
- Due to high toxicity of the Mercury present in clinical thermometers and difficulty in its disposal in cases when the thermometer breaks digital thermometers are manufactured that can measure the accurate temperature without the use of mercury.
- Digital thermometers do not use mercury and hence safe to use.

Laboratory thermometer

Laboratory thermometer is used to measure the temperature of things other than human body.

Maximum minimum thermometer

The daily maximum and minimum temperatures reported in weather reports, are all measured by a thermometer known as the Maximum minimum thermometer.



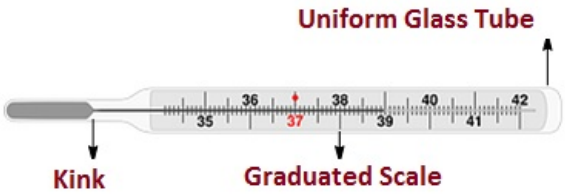
Class 7 Chemistry Heat

Clinical Thermometer

Clinical Thermometer

- The thermometer used by us or doctors to measure the body temperature when we have fever is a clinical thermometer.

- The scale used to measure the temperature is known as Celsius scale denoted by °C or Fahrenheit denoted by °F.
- It reads temperature from 35°C to 42°C or from 94°F to 108°F.
- It consists of a long, slender and uniform glass tube with a bulb at one end containing mercury.
- There is a small shining thread of mercury outside the bulb.
- There is a kink near the bulb which prevents mercury level from falling on its own.



Reading a Clinical thermometer

While using the clinical thermometer to measure the human body temperature some measures must be followed to ensure proper reading of temperature.

The measures are as follows:

- Wash the thermometer properly with an antiseptic solution.
- Hold it definitely and give a few jerks which will bring the level of mercury down below 35°C.
- Place the bulb of the thermometer under the tongue.
- Wait for one minute, take the thermometer out and note the reading keeping the level of mercury along the line of sight.
- This reading gives the exact body temperature.
- It is necessary to state the temperature with its unit denoted by °C.
- It should be handled with care as on hitting against some hard object it can break.

Class 7 Chemistry Heat

Human body temperature

Human body temperature

- The normal temperature of human body is 37°C which may differ from person to person. It may be either slightly higher or slightly lower.

Normal Human Body Temperature

- This value is derived from the average body temperature of a large number of hale and hearty persons.
- The temperature of human body normally does not go below 35°C or above 42° If the body temperature goes beyond the defined value then it is necessary to consult a doctor.
- That is the reason that clinical thermometer has scale ranging from 35°C to 42°

Precautions to be observed while reading a Laboratory thermometer

Precautions involved while observing the readings of laboratory thermometer are similar to those followed while measuring temperature using a clinical thermometer. But in addition to few other steps must be followed.

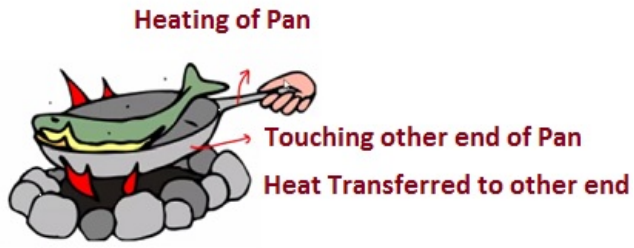
- Should be kept vertical without tilting.
- The thermometer should be dipped in such a manner that the bulb should be entirely surrounded by the substance of which the temperature is to be measured.
- At the same time bulb should not touch the surface of the container.

Class 7 Chemistry Heat

Heat transfer

Heat transfer

It is common phenomenon and you all must have observed that when one end of utensil is heated, soon the other end also becomes hot.



You also must have observed that while boiling water we heat the utensil only at bottom but the water at the top also becomes hot. Have you ever wondered why does this happen??

Another phenomenon that may make you wonder is the transmission of heat from the sun to the earth. It is a well-known fact that sun is far away from earth but still how can the heat travel such a huge distance and reach us.

These are all due to some phenomenon that transfers the heat from one end to the other. Heat always transfers from the hotter end to the colder end. There are three modes through which the heat transfers from one end to the other, namely conduction, convection and radiation.

Class 7 Chemistry Heat Conduction

Conduction

- The process of transferring of heat from the hotter end to the colder end of an object is known as conduction. Whenever a utensil is kept on flame it becomes hot and the heat travels from the base of the utensil to its handle. This is due to the transfer of heat from the hotter base of the utensil to cold handle. When this pan is removed from the flame and kept aside soon the utensil cools down. This is again due to transfer of heat form the hot utensil to cold surrounding.

- Generally, the heat is transferred in solids by the process of conduction. It is the most important mode of heat transfer in solids than in liquids and gases.
- But it is not necessary that all solids will conduct heat because there are many solids that are poor conductors of heat.
- Materials that allow heat to pass through them easily are known as conductors of heat. For instance, all metals like aluminium, iron and copper are conductors of heat.
- Whereas those materials which do not allow heat to pass through them easily are known as poor conductors of heat. For instance, plastic, wood, water and air. They are also termed as insulators.

Therefore the concept of conduction is applicable to solids and that to only those solids which are good conductors of heat.

There is another term called thermal conductivity which refers to the ability of conducting heat. It is maximum in solids that are good conductors than liquids which in turn has greater thermal conductivity than gases. i.e. solids > liquids > gases.

Here temperature at side A is T_A and the temperature at side B is T_B.

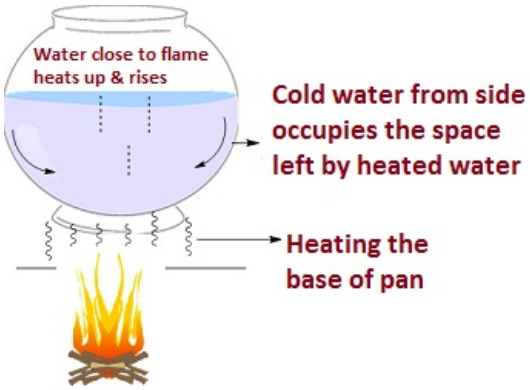
- There is a temperature difference as $T_A > T_B$.
- So in this heat transfer will take place from A to B because we already learnt that heat transfers from the higher temperature to lower temperature.
- Heat From side A starts losing heat and side B will gain heat.
- So temperature at side A will decrease and that on side B will increase because it is gaining heat. But after sometime time the temperature will become equal on both the sides.
- This situation is called steady state and after this no transfer of heat will take place because conduction comes into act only if there is a temperature difference.

Class 7 Chemistry Heat

Convection

Convection

- The method of transferring heat by the movement of the particles of substance away from the source of heat is known as convection. It takes place only in liquids and gases.
- On heating the water, the part of it near the flame gets heated up and expands due to which it becomes less dense and consequently rises up.
- This creates a vacuum and the cold water from the sides slides down to occupy the space near the flame.
- This water also gets heated up and rises.
- Again the cold water slides down. So it is like a cycle that continues again and again until and unless the entire water is heated up.
- This process continues unless the whole water present in the beaker gets heated up.
- The air too gets heated up by this process. The air near the heat source gets heated up and rises. The cold air from the sides slides to occupy the space. In this way the air gets heated.



- Due to this reason the air just above the flame of candle is hotter than the air at the side.

Class 7 Chemistry Heat

Sea Breeze and Land Breeze

Sea Breeze and Land Breeze

The land gets heated up by the heat radiated by the sun, much faster than the water during daytime. This heats up the air over the land and it expands and hence the hot air rises up and creates a vacuum. The cool air from the sea occupies the space left by the hot air. The warm air from the land moves towards the sea to complete the cycle. The air from the sea is called the sea breeze.

But the reverse process takes place at night. The land cools down quickly and sea water remains hot. This heats up the air over the sea and it expands and hence the hot air rises up and creates a vacuum. The cool air from the land occupies the space left by the hot air. And hence the cool air moves from the land to the sea and is known as the land breeze.

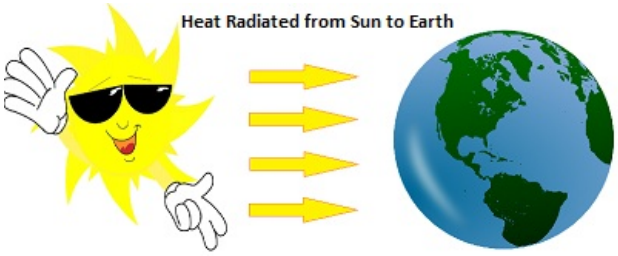
Day time

Night time

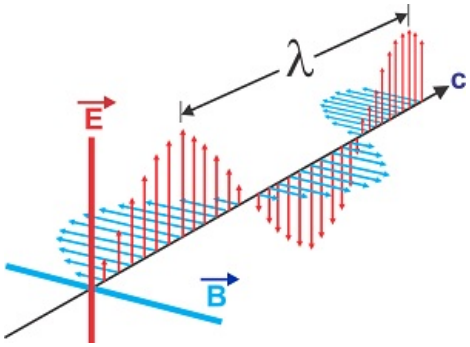
Class 7 Chemistry Heat Radiation

Radiation

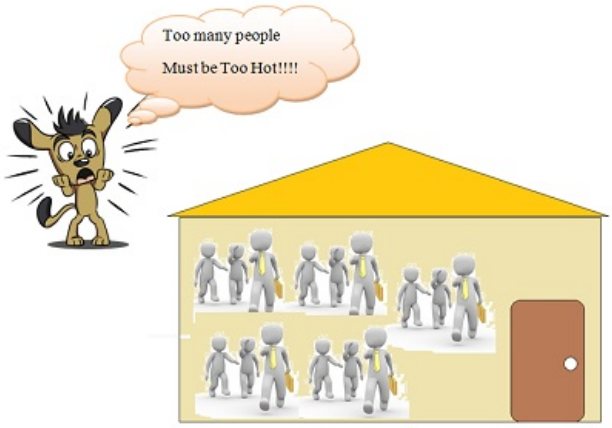
- The heat given off from the sun cannot reach us by the process of conduction or convection because both the processes requires a medium to transfer the heat but due to absence of a medium such as air in maximum layers of space between the earth and the sun these processes cannot transfer the heat to the earth.



- At this moment another process called radiation comes into act to transfer the heat radiated by the sun to the earth.
- This heat transferring process doesn't require any medium.
- These are the form of electromagnetic waves. Their characteristic is that they can travel through vacuum and travel with speed of light ($3X10^8$ m/s). This propagation of heat from sun to earth involves both electric field represented by E and magnetic field represented by B.



- Not only sun but all hot bodies radiate heat. That can propagate through medium or even in vacuum. Heating of room by a room heater, heating up of utensils kept over flame and then cooling down when kept away from heat are all due to radiation.
- Human body releases heat to the surroundings and receives heat from it by the process of radiation. This can be proved using a simple example. You feel quite comfortable in a room with one person but if the same room has many people you feel hot due to the radiation of heat from the human body.



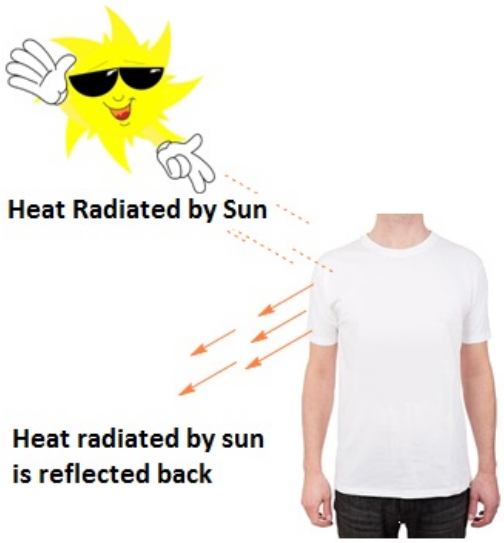
- All hot bodies radiate heat which falls on the nearby objects.
- The objects absorb some part of heat, reflect some part of heat and transmit some part of the heat falling on them. The temperature of the object increases due to the absorbed part of the heat.

Class 7 Chemistry Heat

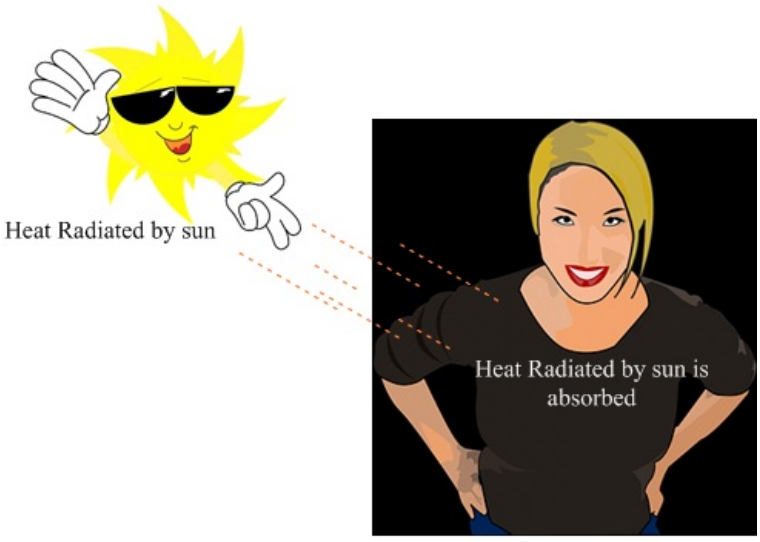
Reasons to wear light colored clothes in Summer

Reasons to wear white or light-coloured clothes in summer and dark-coloured and woollen clothes in winter

Light colours are the best reflectors of heat falling and as a result light coloured clothes reflect maximum amount of heat they receive and makes us feel cool to some extent and hence we feel more comfortable wearing them in the summer.



But on the other hand dark colours are good absorbers of heat falling on them and as a result the dark coloured clothes absorb maximum amount of heat they receive and makes us feel warm and comfortable during winter.



Winters seasons are also accompanied with woollen clothes. This is due to the reason that wool being a poor conductor of heat traps the air in between the woollen fibres. The trapped air prevents the flow of heat from our body to the cold surroundings and vice versa thereby making us feel warm.