7th – Temperature & Heat I

Heat is the transfer of energy from a hot body. The sense of touch can be used to understand the degree of hotness or coldness of something. But the sense of touch is not reliable and cannot be always used to say how much hot anything is. Moreover, using the sense of touch can be risky in case of something very hot. Thus, hotness of anything is measured in terms of TEMPERATURE in reliable way. To measure temperature a device called THERMOMETER is used.

Difference between Heat and Temperature

Heat	Temperature
It is a form of energy	It is the degree of hotness or coldness of a body
Heat causes a change in the temperature of a body	It is the effect of heat.
It is measured in joules or calories	It is measured in degree Celsius or degree Fahrenheit.

Temperature: temperature is defined as the degree of hotness or coldness of a given body or an environment.

Thermometer: a device used for measuring temperature of any object/body.

Unit of heat:

There are three units which are used to measure the temperature: Degree Celsius, Fahrenheit and Kelvin.

Degree Celsius: Degree Celsius is written as °C and read as degree Celsius

Fahrenheit: Fahrenheit is written as °F and read as degree Fahrenheit.

Kelvin: Kelvin is written as K. For example 100K; it is read as hundred Kelvin.

Conversion from one scale to another:

K= C + 273

C= 5/9(F-32)

Effects of heat:

1. Heat can change the state from Solid to liquid and From Liquid to gas.
2. Heat can burn things which is a chemical change.
3. Excessive Heat kills the organisms.

Heat Causes Expansion: When we heat a substance the energy of the molecules increases, they move away a bit more hence they occupy more space. In liquids molecules move more freely than in solids, when they are heated their movements increases more than in solids. A liquid expands more than solid. Similarly, gases expand more than liquids.

Expansion in everyday life:

1. The floor is laid out in rectangular pieces, sometime glass is placed between them to allow expansion.
2. Gaps are left between lengths of railway tracks to allow expansion in summers.
3. Gaps are left in the steel structure of bridges to allow expansion. Sometimes they are made to rest on rollers, so that they do not bend on expansion
4. Electric wire between poles sag during summer and become tight in winter because of expansion due to heat.

Temperature Rises With Heat: As an object is heated it gains energy. The kinetic energy of the molecules increases. This increase in energy of the molecules increases the temperature of the object.

Thermometer: Thermometer is a device which is used to measure temperature. Thermometer is made of a long narrow glass tube; with a bulb at one end. The narrow tube appears as a continuous silver line; because it is filled with mercury. Mercury is a metal which is in liquid state at room temperature and it readily expands or contracts at the slightest change in temperature. Hence, mercury is used in thermometer.

Types of thermometer:

A. Laboratory Thermometer: Laboratory thermometer is used to measure the temperature. The scale of temperature is graduated generally from –10°C to 110°C over the glass tube. Each division of temperature scale is further divided into 10 parts to read fraction of temperature.

B. Clinical Thermometer: Clinical thermometer is used to measure the body temperature. The scale of temperature is graduated from 35°C to 42°C and or from 94°F to 108°F. The temperature of human body always remains within this range and this is the range on the clinical thermometer. There is a kink make near the bulb of clinical thermometer which prevents the automatic fall of mercury level.

C. Digital Thermometer: In digital thermometer, reading of temperature is displayed digitally as in digital watches. This is safer because no mercury is used in this. It is important to note that mercury is a highly toxic substance.

D. Maximum-Minimum Thermometer: Maximum – minimum thermometer is used to measure the daily temperature to prepare weather reports.

Clinical Thermometer	Laboratory Thermometer
Clinical thermometer is scaled from 35°C to 42°C or from 94°F to 108°F	Laboratory thermometer is generally scaled from –10°C to 110°C.
Mercury level does not fall on its own, as there is a kink near the bulb to prevent the fall of mercury level.	Mercury level falls on its own as no kink is present.
Temperature can be read after removing the thermometer from armpit or mouth.	Temperature is read while keeping the thermometer in the source, such as liquid or anything.
To lower the mercury level jerks are given.	No need to give jerk to down the mercury level. automatically.
Clinical thermometer is used to take the body temperature.	Laboratory thermometer is used to take the temperature in laboratory.

Difference between clinical and laboratory thermometer

Reading of thermometer and measuring of temperature:

- Take a clinical thermometer and hold it horizontally with reading scale towards your eye.
- Do not hold the thermometer from the bulb.
- Rotate the thermometer slightly clockwise and anticlockwise. By doing this you will see a shiny thin silvery thread.
- The end of the silvery thread shows the reading of temperature. If mercury lining ends at 37, the reading is 37°C.
- Wash the bulb end of thermometer with an antiseptic solution.

• Give two or three jerks slightly. By doing this the mercury level would fall. When it falls to 35°C or below, put it below the tongue and wait for one minute.
• Take out the thermometer and read the temperature. Temperature would be near 37°C.
• The normal body temperature is 37°C. This can differ from person to person.

Use of Laboratory Thermometer:

• Take some water in a beaker.
• Take a laboratory thermometer and immerse its bulb end in water; holding it vertically. Ensure to dip whole portion of bulb end. The bulb end should not touch the bottom or side of the beaker.
• Observe the movement of rise of mercury. When it becomes stable, take the reading of the thermometer.
• Repeat this with hot water and take the reading.

Specific Heat: The amount of heat required to raise a particular mass of a substance through a certain temperature depends on its specific heat capacity.
The specific heat capacity or specific heat of a substance is defined as the amount of heat required to raise the temperature of 1 kg of the substance through 1 °C.

Heat capacity is defined as the quantity of heat required to raise its temperature by 1°C.

Heat Capacity = Specific Heat X Mass

The calorie (cal) is the amount of heat required to raise the temperature of 1 g of water through 1°**C**

1 cal= 4.18 J

Quantity of heat (Q)= specific heat(s) X mass (m) X change in temperature (t).

Q= s x m x t

Where mass is in kg , s is in J/kg °**C and t is in** °**C, The quantity of heat Q is in Joules (J)**

Thermal Equilibrium: When two bodies at different temperature are brought into contact with each other, heat flows from hotter body to colder body until they are both at same temperature, this is the state of Thermal Equilibrium.

The amount of heat lost by the hotter body= the amount of heat gained by the colder body.

Latent Heat Of Vaporisation: The latent heat of vaporisation of a substance is defined as the quantity of heat gained by 1 kg of the substance in changing from liquid to vapour state or from vapour to liquid state at constant temperature.

Latent Heat Of Fusion: The latent heat of fusion is defined as the quantity of heat gained by 1kg of substance in changing from the solid to liquid at same temperature.