METHODS OF MEASURING TEMPERATURE

Temperature is the measure of the degree of hotness or coldness of the body and is related to the energy of movement. The unit for temperature is degree Celsius (^{o}C) or Kelvin (K).

Our sense of touch can give us a general impression of the degree of hotness or coldness of a body. This is however not a reliable method of estimating or measuring temperature, because the response of the human sense to touch to a temperature change tends to be influenced by its previous experience. Thus, warm water will feel cool if a hand initially dipped in hot water is dipped into it. Hence, in order to gauge accurately the exact degree of hotness an instrument, an instrument called thermometer is used. Thermometers are more reliable than hands.

Thermometers use any physical property of a substance which varies in a known way with temperature, and is easily measurable as a means of

gauging temperature. The substance of whose physical property is so used is known as a thermometric substance.

Some types of thermometers and their thermometric substances are given below:

Thermometer	Thermometric substance	Physical property
Liquid-in-glass	Mercury or alcohol	Change in volume of liquid with temperature
Gas thermometer	Gas	Change of gas pressure at constant volume with temperature
Resistance thermometer	Resistance wire	Change in the electrical resistance of wire with temperature
Thermocouple	Two dissimilar metals (e.g. copper and constantan)	Change in electric p.d. (or current) between two metal junctions at different temperatures

Bimetallic thermometer	Two dissimilar metals (e.g. iron and copper)	The differential expansion of the two metals of the bimetallic strip

Fixed Temperature and Temperature Scales of Thermometer

Each thermometer has two reference temperatures or fixed points called the upper fixed temperature point and the lower fixed temperature point.

The upper fixed point is the temperature of steam from pure water boiling at standard pressure of 760mmHg. The lower fixed point is the temperature of pure melting ice at the standard atmospheric pressure of 760mmHg.

The difference in temperature between the two temperature points is called the Fundamental Interval (or temperature interval) of a thermometer. The calibration of this interval depends on the temperature scale chosen.

There are three main scales in current use. They are the Celsius scale, Fahrenheit scale, and the Kelvin (or absolute or thermodynamic) scale.

The lower and upper fixed points are $0^{o}C$ and $100^{o}C$ for the Celsius scale, $32^{o}F$ and $212^{o}F$ for the Fahrenheit scale. The fundamental interval on the Celsius scale is divided into 100 equal parts; each part of which defines 1^{o} C on this scale. For the Fahrenheit scale, the fundamental interval is divided into 180 units or degrees (^{o}F).

The S.I. unit of temperature is the Kelvin (K) and its scale is called the Absolute or Thermodynamic temperature scale. The fundamental interval for the Kelvin scale goes from a lower fixed point of 273K to an upper fixed point of 373K, i.e. a difference of 100K. This interval is divided into 100 equal parts each of which is equal to 1K. Temperatures on this scale are not measure in degrees but in units called Kelvin (K). Hence, the unit symbol K is written without the degree sign.

Unlike Kelvin thermometers, lower fixed point of the Kelvin temperature is -273^{o}C which is 0K. This temperature is called the absolute zero.

A temperature of θ^{o}C in the Celsius scale is related to T of the Kelvin scale by: T= θ+273.

Note: Since on thermometers, Kelvin and degrees Celsius have the same temperature intervals, we say that they are equivalent to each other.