* Temperature measurement :-

Temperature of a body shows degree of hotness with respect to reference body.

There are a number of temperature measurement systems like thermocouples, resistive temperature devices (RTDs & thermistors), infrared radiators, bimetallic devices, liquid expansion devices, change of state devices etc.

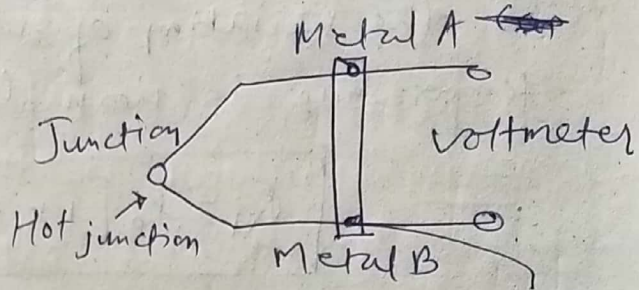
(1) Thermocouple :-

When two conductors made from dissimilar metals are connected forming two common junctions and the two junctions are exposed to two different temperatures, a net thermal emf (electromagnetic force) is produced, the actual

value being dependent on the materials used and the temperature difference between hot and cold junctions.

The thermoelectric emf generated, in fact is due to the combination of two effects i.e. Peltier effect & Thomson effect.

As temperature goes up, this output emf of the thermocouple rises.



> It is based on seebeck effect which is the conversion of thermal energy / temperature difference directly into electrical energy or electricity.

> The change in the voltage is proportional to the temperature difference between junction.

* Resistance temperature devices:- (RTD)

Resistive temperature devices work on the principle that the electrical resistance of a material changes with its temperature.

There are two types of devices RTD and thermistors. Electrical resistance of metallic conductors increases with temperature while that of semiconductors decreases with temperature.

Where metallic conductors are employed, devices called as Resistance temperature detector (RTD).

and those employing semiconductors are termed as thermistors.

RTDs rely on resistance change in metal, with the resistance rising more or less linearly with temperature.

Thermistors are based on resistance change in ceramic semiconductors, where resistance drops non-linearly with temperature rise.

The variation of resistance of metals with temperature is normally modelled in the form-

$$R_1 = R_0 [1 + \alpha (t - t_0)]$$

where R_1 & R_0 are resistances at temperatures t_1 & t_0.

α - Temp. coeff. of resistance for conductor material.

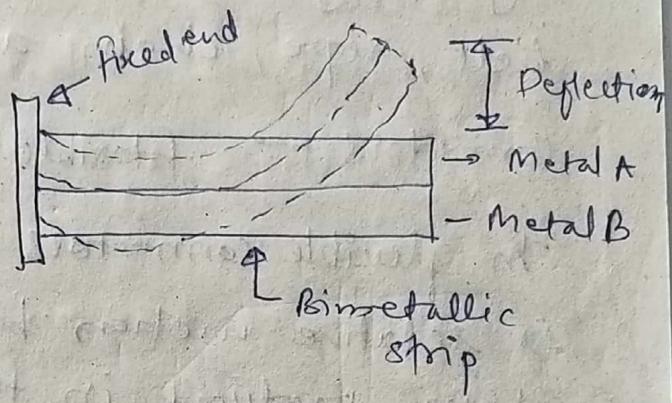
* Infrared temperature measurement devices:-

Infrared sensors are non-contacting devices. They infer temperature by measuring the thermal radiation emitted by a material.

* Bimetallic temperature measurement devices:-

> Bimetallic devices work on the principle that different materials have different rates of thermal expansion. Strips of two metals are bonded together. When heated, one side will expand more than the other, and the resulting bending is translated into a temperature

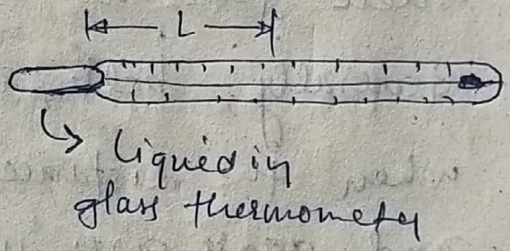
reading by mechanical linkage to the pointer. These devices are portable & they do not require a power supply, but they are usually not as accurate as thermocouples or RTDs and they do not readily lend themselves to temperature recording.



~~Fluid-expansion~~

* Fluid-expansion temperature measurement devices:-

Fluid expansion devices can be divided into two main classes:- the mercury type and the organic-liquid type.



Glass thermometer

~~Versions em~~

Mercury is considered an environmental hazard, so there are regulations governing the shipment of devices.

Fluid-expansion sensors do not require electric power, do not ~~impose~~ creat explosion hazards, and are stable even after repeated cycling.