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Heat & Temperature

Heat: Heat is a form of energy which always transfers from hotter body to colder body ~~then~~ if there is temperature difference. Its SI unit is Joule & CGS unit is calorie

1 calorie = 4.2 J

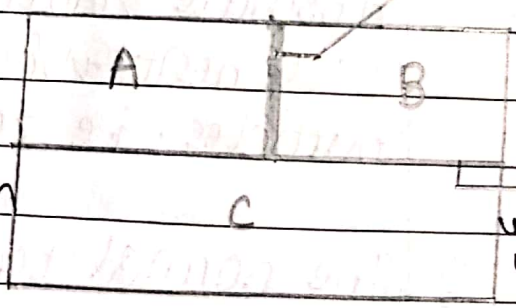
→ Measured by calorimeter.
→ It is cause.

Temperature: The degree of hotness or coldness of a body is called temperature. Its SI unit is Kelvin.
→ Measured by thermometer.
→ It is effect.

Thermal Equilibrium: Two systems (substances) are said to be at thermal equilibrium if they have same temperature

Zero law of Thermodynamics: Zero law of thermodynamics states that "If two systems are at thermal equilibrium with third system seperately, then these two system must be at thermal equilibrium with each other."

Here, systems A & B are at thermal equilibrium with system C seperately. Then system A & B are also in thermal equilibrium.



Thermometer

Thermometric scale

Centigrade (system) scale.

Upper fixed point = 100°C [boiling point of water]

Lower fixed point = 0°C [freezing point of water]

∴ 100 equal divisions between U.F.P & L.F.P.

Fahrenheit scale

U.F.P = 212 F

LFP = 32 F

→ 180 equal divisions.

Kelvin scale:

UFP = 373 K

LFP = 273 K

→ 100 equal division.

Reaumer scale.

UFP = 80 R

LFP = 0 R

→ 80 equal division.

Absolute zero (0K): Theoritically lowest possible value of heat where is no molecular motion of the particles. i.e zero Kelvin or −273°C.

Q.) The normal temperature of human body is 98.6°F. Convert it into centigrade scale.

Given, $F = 98.6\,^{\circ}F$

$$\text{or, } \frac{C}{100} = \frac{F-32}{180}$$

$$\text{or, } \frac{C}{100} = \frac{98.6-32}{180}$$

$$\text{or, } C = \frac{100(98.6-32)}{180}$$

$$\therefore C = 37^{\circ}$$

2) At what temperature do the fahrenheit scale & celsius scale coincide each other?

Let, $C = F = x$

$$\frac{C}{100} = \frac{F-32}{180}$$

$$\frac{x}{100} = \frac{x-32}{180}$$

$$180x = 100(x-32) \quad x = \frac{100x-3200}{180}$$

$$180x - 100x = -3200$$

$$80x = -3200$$

$$\therefore x = -40^{\circ}$$

$\therefore$ At -40° celsius scale & fahrenheit scale coinci each other.

3) At what temperature ~~scale~~ does Kelvin scale lead coincide with Fahrenheit scale?

Let, $K = F = x$

$$\frac{K-273}{100} = \frac{F-32}{180}$$

$$\frac{x-273}{100} = \frac{x-32}{180}$$

$$180x - 49140 = 100x - 3200$$

$$180x - 100x = -3200 + 4$$

$$80x = 45940$$

$$\therefore x = 574.25^{\circ}$$

$\therefore$ At 574.25°, Kelvin scal leading coincide wit Fahrenheit scale.

4. A faulty thermometer measures the temperature of a object as 28.2°C. A upper & lower fixed points of the thermometer are 98.4°C & -1.2°C respectively. What is the correct temperature of the object?

Given,
$C_{in} = 28.2°C$
$UF_{in} = 98.4°C$
$LF_{in} = -1.2°C$
$(C_{correct}) = ?$ Let C be the correct temp,

$$\text{or, } \frac{C-0}{100} = \frac{C_{in}-(-1.2)}{98.4-(-1.2)}$$

$$\text{or, } \frac{C-0}{100} = \frac{28.2+1.2}{98.4+1.2}$$

$$\text{or, } C = \frac{100 \times 29.4}{99.6}$$

$$\therefore C = 29.52°$$

5. A faulty thermometer has its fixed points marked 2°C & 98°C. Temperature of a body as measured by the faulty thermometer is 64°C. Find the correct temperature of the body?

Given,
$C_{in} = 64°C$
$UF_{in} = 98°C$
$LF_{in} = 2°C$
Let C be the correct temp,

$$\text{or, } \frac{C-0}{100} = \frac{C_{in}-2}{98-2}$$

$$\text{or, } \frac{C}{100} = \frac{64-2}{98-2}$$

$$\text{or, } C = \frac{100 \times 62}{96}$$

$$\therefore C = 64.58°$$