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"What one man calls God, another calls the laws of physics."

-Nikola Tesla

# TOPIC 10: TEMPERATURE

THE ABOUT

# CHAPTER ANALYSIS

MASTERY

- Straight forward topic

EXAM

- Tested in MCQ mainly

WEIGHTAGE

- Light overall weightage
- Constitute to around **1.5%** of marks for past 5 year papers

KEY CONCEPT

# TEMPERATURE & THERMAL ENERGY
# THERMOMETRY & CALIBRATION
# THERMOMETRIC PROPERTIES

# TEMPERATURE & THERMAL ENERGY

Which has more thermal energy, an iceberg or a cup of hot coffee?


The hot coffee has a **higher temperature**, but **not more internal energy**.

Although **the iceberg is at a lower temperature**, it's enormously **greater mass** means that its **total kinetic energy** is still much greater than that of the coffee.



## TEMPERATURE

Temperature is a measure of the **degree of hotness of a body**. It is also a measure of the **average kinetic energy** of molecules in a body.

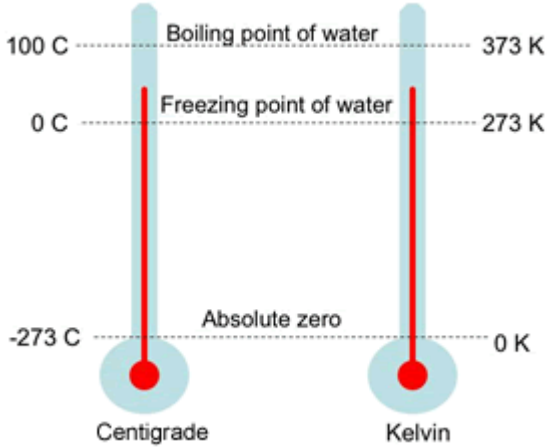
## THERMAL ENERGY

**Thermal energy** is the measure of the **total kinetic energy** of all molecules in a body.

## KELVIN & DEGREE CELSIUS

273 Kelvin = 0 Degree Celsius

373 K = 100 °C
0 K = - 273 °C



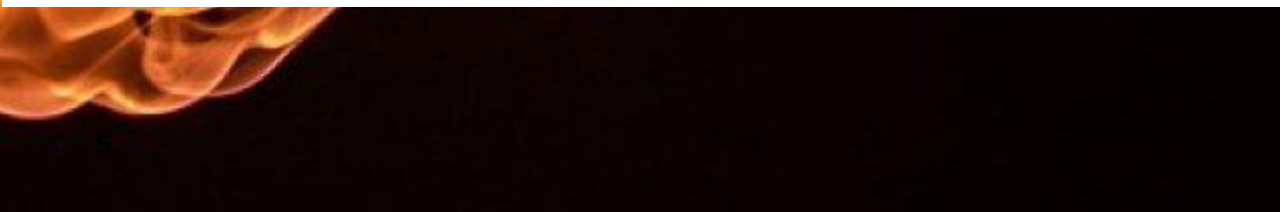
# PRINCIPLE OF THERMOMETRY

## PRINCIPLE OF THERMOMETRY

Thermal properties are **physical properties that vary with temperature**.

A good thermometric property should:

1) **Sensitive** to temperature changes (ability to reflect small change)
2) **Respond quickly** to temperature changes (time taken to respond to change)
3) **Vary at a constant and unique rate** accordingly to temperature (for calibration)
4) Accommodate **wide range of temperature** (usability)



## CALIBRATION OF THERMOMETERS

Makes use of a physical property that varies with temperature, known as the thermometric property.

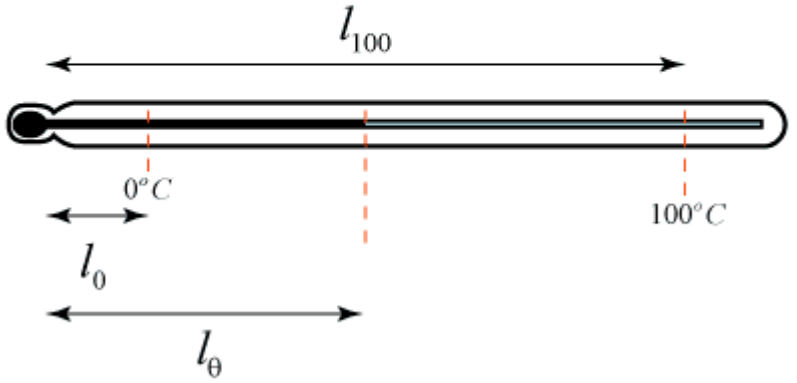
Steps to construct a thermometer:

1) Select a **thermometric property** that changes continuously and linearly with temperature

2) Select **2 fixed points** (usually ice point & steam point)

3) Select **appropriate divisions**

$$T = \frac{l_\theta - l_0}{l_{100} - l_0} \times 100^o C$$



# THERMOMETRIC PROPERTIES

| Thermometric Property | Thermometer |
|---|---|
| **Volume of fixed mass of liquid** | Mercury-in-glass thermometer<br><br>Alcohol-in-glass thermometer |
| **Resistance of wire** | Resistance thermometer |
| **Electromotive force** | Thermocouple |



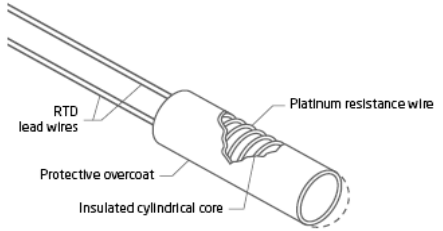
## Liquid-in-glass thermometer

As temperature increases, liquid expands and the thread of liquid in the capillary tube increases in length.

(Limited range of temperature that it can measure)

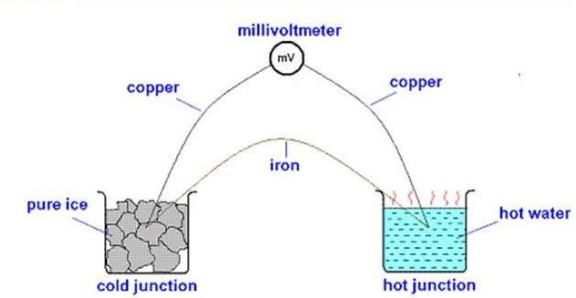
## Resistance thermometer

Usually made of platinum due to its linear resistance-temperature relationship and chemical inertness.
(Accurate & can measure wide range of temperature)




## Thermocouple

Consists of 2 wires of different metals joined together at the ends to form 2 junctions. (Hot & cold)
(Can measure temperature at a point, quick response)



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