

Measurement of mass



Measurement of volume

# Measurement in everyday life



Measurement of length



Measurement of temperature

## Need for measurement in physics

- To understand any phenomenon in physics we have to perform experiments.
- Experiments require measurements, and we measure several physical properties like length, mass, time, temperature, pressure etc.
- Experimental verification of laws & theories also needs measurement of physical properties.



# Physical Quantity

A physical property that can be measured and described by a number is called physical quantity.

## Examples:

- **Mass** of a person is 65 kg.
- **Length** of a table is 3 m.
- **Area** of a hall is 100 m<sup>2</sup>.
- **Temperature** of a room is 300 K

## Types of physical quantities

### 1. Fundamental quantities:

The physical quantities which do not depend on any other physical quantities for their measurements are known as fundamental quantities.

### Examples:

- Mass
- Length
- Time
- Temperature

# Types of physical quantities

## 2. Derived quantities:

The physical quantities which depend on one or more fundamental quantities for their measurements are known as derived quantities.

### Examples:

- Area
- Volume
- Speed
- Force

## Units for measurement

The standard used for the measurement of a physical quantity is called a unit.

### Examples:

- metre, foot, inch for length
- kilogram, pound for mass
- second, minute, hour for time
- fahrenheit, kelvin for temperature

## Characteristics of units

Well - defined

Suitable size

Reproducible

Invariable

Indestructible

Internationally acceptable

## CGS system of units

- This system was first introduced in France.
- It is also known as *Gaussian system of units*.
- It is based on centimeter, gram and second as the fundamental units of length, mass and time.



## MKS system of units

- This system was also introduced in France.
- It is also known as French system of units.
- It is based on meter, kilogram and second as the fundamental units of length, mass and time.

## FPS system of units

- This system was introduced in Britain.
- It is also known as British system of units.
- It is based on foot, pound and second as the fundamental units of length, mass and time.

# International System of units (SI)

- In 1971, General Conference on Weight and Measures held its meeting and decided a system of units for international usage.
- This system is called international system of units and abbreviated as SI from its French name.
- The SI unit consists of seven fundamental units and two supplementary units.

## Seven fundamental units

FUNDAMENTAL QUANTITY	SI UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Electric current	ampere	A
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Definition of metre

The metre is the length of the path travelled by light in a vacuum during a time interval of  $1/29,979,245,8$  of a second.

## Definition of kilogram

The kilogram is the mass of prototype cylinder of platinum-iridium alloy preserved at the International Bureau of Weights and Measures, at Sevres, near Paris.





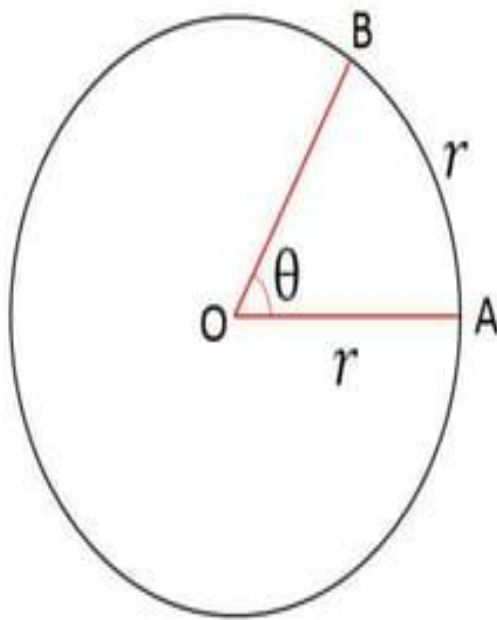
Prototype cylinder of platinum-iridium alloy

## Definition of second

One second is the time taken by 9,19,26,31,770 oscillations of the light emitted by a cesium-133 atom.

## Two supplementary units

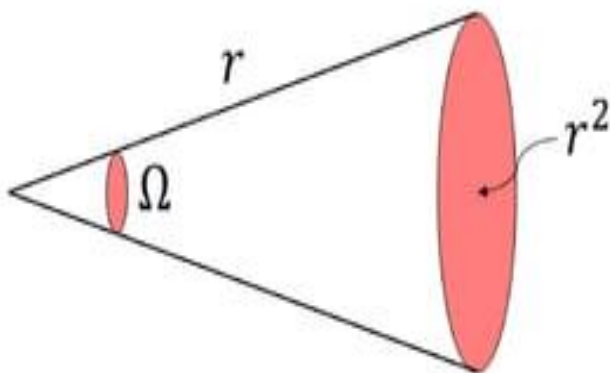
1. Radian: It is used to measure plane angle



$$\theta = 1 \text{ radian}$$

## Two supplementary units

2. Steradian: It is used to measure solid angle



$$\Omega = 1 \text{ steradian}$$