

UNIT IN SCIENCE

MEASUREMENTS

Dear Students/ Parents,

After through learning of this chapter you will be able to:

1. Learn about the different systems of the unit.
2. Know about the measurement of –
 - Length
 - Area
 - Volume
 - Mass
 - Time

This is the link to the WEDA Video Lesson on Measurements:

Go through it and attempt the exercises

Video Link On Measurements: https://youtu.be/VvoXUEjA_js

- Physics is inherently a science of measurement.
- The act of measuring a quantity required is called measurement.

I. Physical Quantity

Any quantity that is measurable in physics is known as a Physical Quantity.

Examples: Length, Mass, Time

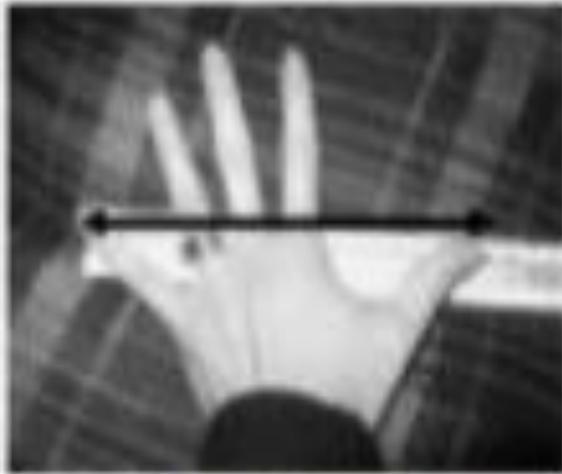
II. Unit

Measurement of a physical quantity means comparing it with known standard quantity. Each accepted standard quantity is the standard of measurement and commonly called unit.

III. Non-standard units

In early days, people used to measure length with the help of parts of body, such as outstretched palm, foot, arm or cubit.

Such units cannot serve as standard for measuring length because they are going to be different for different people.



Handspan



Footspan



Cubit

IV. Standard unit

The measured value which is same when measured by anybody at any place is known as standard unit.

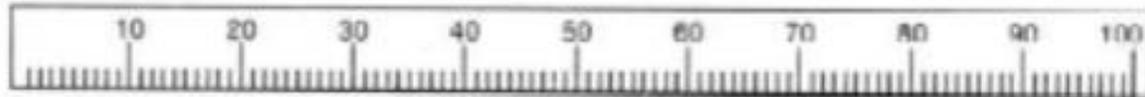
Fundamental Measurements

Measurement used to measure length, mass and time are called fundamental measurements

or basic measurements.

System Of Units

Measurement Of Length



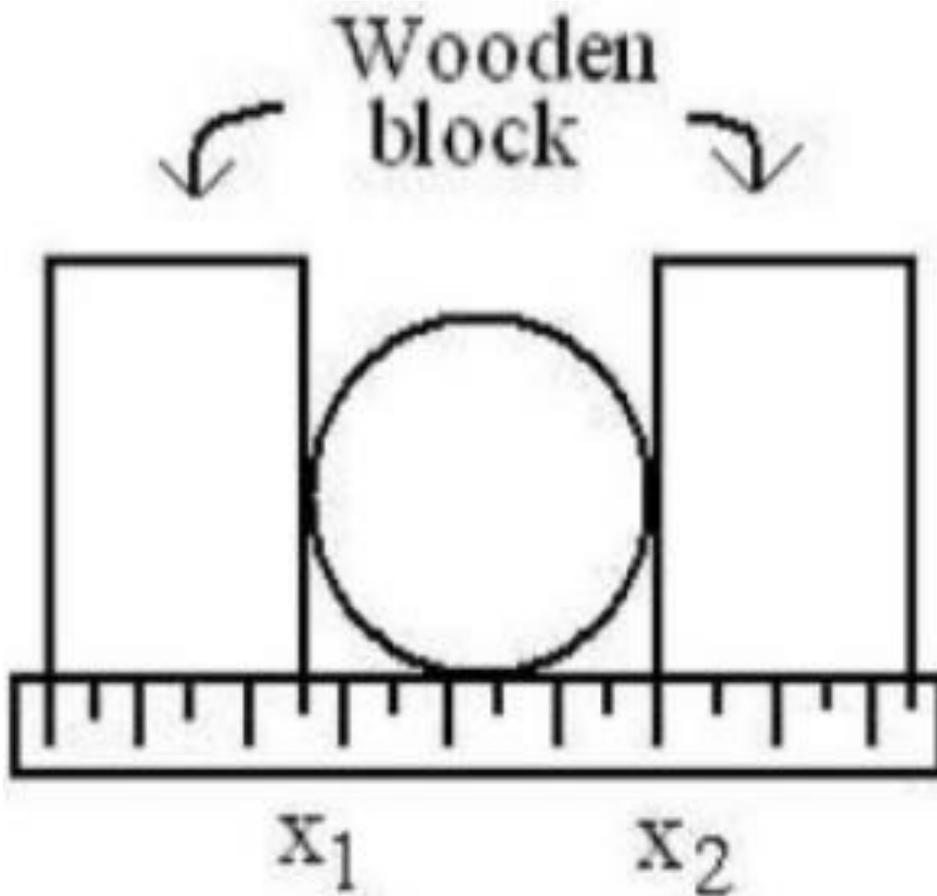
- Length is the distance between two fixed points.
- SI unit – meter(m)
C.G.S unit – centimetre(cm)
- The various units used to measure length are μm , mm, cm, km etc.
- The inter-relationship among these units with a standard unit:
 - 1 micro metre = $1 \mu\text{m} = 10^{-6} \text{ m}$
 - 1 millimeter = $1\text{mm} = 10^{-3} \text{ m}$
 - 1 centimeter $1\text{cm} = 10^{-2} \text{ m}$
 - 1 kilometer = $1 \text{ km} = 10^3 \text{ m}$

I. Least Count

- The smallest quantity that can be measured accurately using any instrument is known as least count of that instrument.
- Least count of regular scale (LC) = $1\text{mm} = 1/10 \text{ cm}$
- Measurement of curved lines can be done by using a piece of thread.
- Thickness of coin by a centimetre scale or millimetre scale is
- Thickness of one coin = Thickness (cm or mm) of 'n' of coins/Number of coins(n)

Diameter of a wire

- Diameter = Length of the coins/Number of turns in the coil
- The diameter of spherical object can be measured by placing the object between two wooden blocks as shown in the figure.
- The diameter of spherical object can be measured by placing the object between two wooden blocks as shown in the figure.
- The diameter of spherical object = $x_2 - x_1$



II. Measurement of very large distances

Distance between earth and moon, or earth and sun can't be done by using conventional units. Such large distances are expressed using following units.

III. Astronomical unit(A.U)

It is the average distance of the earth from the sun.

$$1 \text{ A.U} = 1.496 \times 10^{11} \text{ m}$$

Measurement Of Area

- Area is the amount of surface occupied by an object or a place. Area of a regular surface like a rectangle or a square can be calculated by using formula knowing its length and breadth (or) length of its side.
Area = length \times breadth
- The SI unit of area is m^2 or square metre. The other units of area are cm^2 , mm^2 , km^2 etc.

- Larger areas are measured in 'acre' and 'hectare'. (1acre = 100 m², 1hectare = 100acre).
- For measuring bigger areas, such as area of fields or towns hectare is used.
- Area of an irregular surface is measured by using a graph paper as there is no formula for finding area of irregular shapes.

Measurement Of Volume

- The space occupied by a substance (solid, liquid or gas) is called volume.
- Volume = length × breadth × height
- S.I unit of volume – m³(cubic meter)
C.G.S unit of volume – cm³(centimetre cube)
- Volume of regular shape like a cuboid = length × breadth × height
- Volume of irregular bodies cannot be measured by formula. They can be calculated by using measuring jar and overflow jar.

Measurement Of Volume Of Liquid

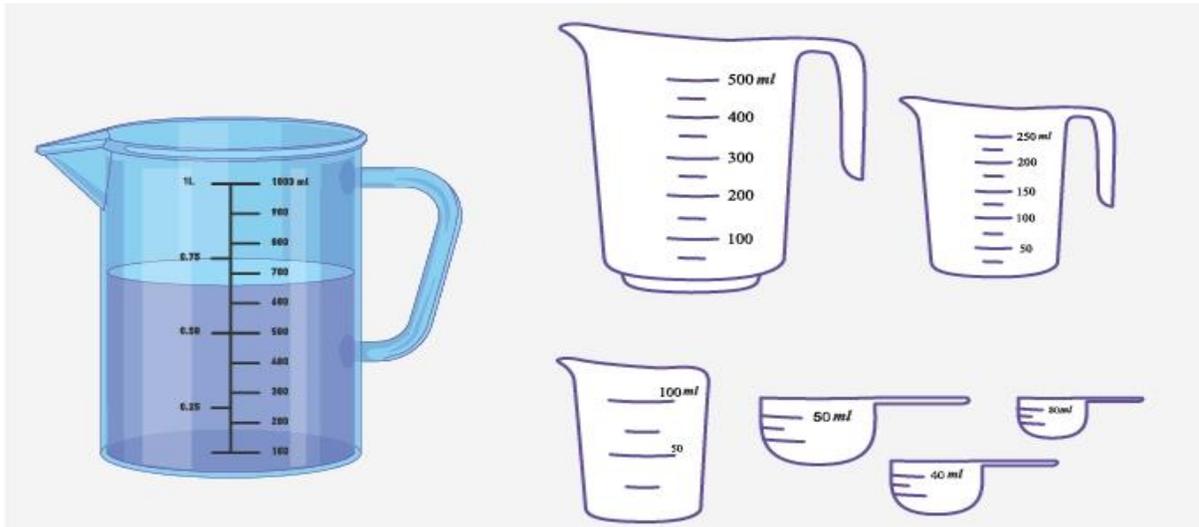
To measure the volume of liquids measuring jars can be used directly.

Different Measuring jars

- **Measuring jar:** It is used to measure the liquids of desired quantity.



- **Measuring Vessels:** They are used to measure volume of liquids like milk and oil.



- **Pipette:** It is used in laboratories to take specific volume of liquid.



- **Burette:** It is also used in laboratories to extract required volume of liquid for the experiment.



Measurement Of Mass

- Mass is the amount of matter contained in a body. Mass is measured using devices like common balance, physical balance etc.,
- SI unit of mass is kg.
- The other units of mass are milligram(mg), gram(g), tonne, quintal.
1mg = 10^{-3} g
1quintal = 100 kg
1tonne = 1000 kg

Measurement Of Time

Time is the interval between two events. The SI unit of time is second. The different units of time are given below.

1mean solar day = 24 hours
1 min = 60 seconds
1 hour = 60 minutes
1 year = 365 days
1 decade = 10 years
1 century = 100 years
1 millennium = 1000 years

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