RICE ADAMAS GROUP

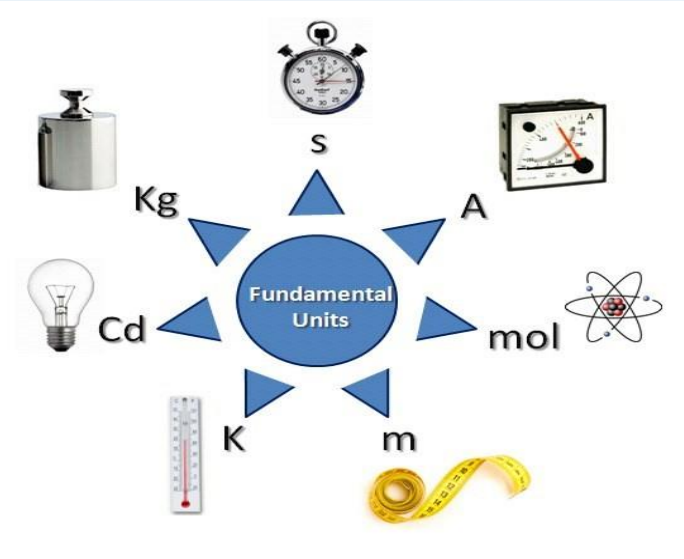
935426

RICE EDUCATION | ricesmart TOGETHER IN SUCCESS

MODULE- 1 CLASS- 1

SYSTEM OF MEASUREMENT, UNIT, DIMENSION

Presented By- Dept. of Physics



RICE ADAMAS GROUP

RICE EDUCATION | ricesmart TOGETHER IN SUCCESS

TODAY'S LESSON

- Physical quantities
- System of measurement.
- Dimension.

Measurable parameter of an object

Eg:- mass, length, Time, Volume, Weight, velocity -

Type

① Dependency

- Fundamental → Independent
  Eg:- mass, length, Time,
- Derived → Dependent
  Eg:- Area, velocity, Volume, Force - - - - - - -

② Directive

- Scaler
  only magnitude without direction
  Eg:- mass, Length, Time, work, Energy - - -
- Vector
  having both magnitude & direction
  Eg:- force, velocity, Momentum, Impulse - - - - -

SYSTEM OF MEASUREMENT

System	Length	Mass	Time
F.P.S	Foot	Pound	Second
C.G.S	Centimetre	Gram	Second
M.K.S	Metre	Kilogram	Second

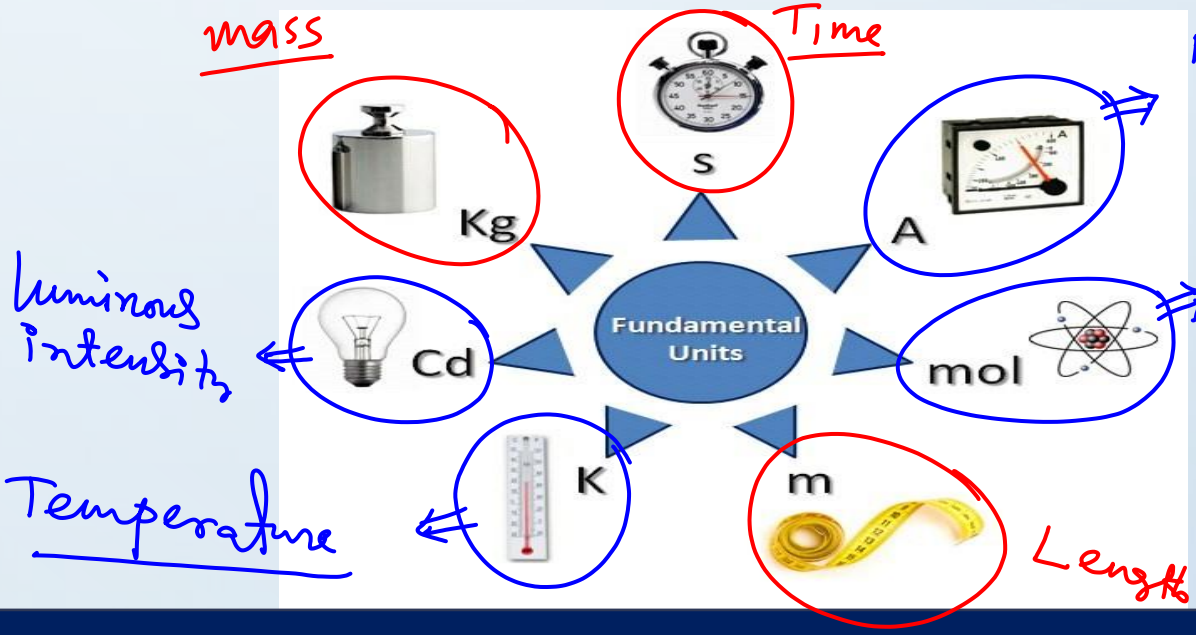
No. of fundamental quantity = 3

SI ← Extension of MKS System.

4 + 3 = 7 quantity.

FUNDAMENTAL QUANTITY

- Fundamental means independent of each other.
- These quantities are self dependent .
- If we spilt these unit, we cannot find other units
- In SI scale we have 7 fundamental units



mass

Time

Electric Current

Luminous intensity

Quantity of Substance.

Temperature

Length.

FUNDAMENTAL UNIT

There are 7 Fundamental(Base) SI Units.

Physical Quantity	Name of Unit	Abbreviation	Dimension
Mass	Kilogram	Kg	[M]
Length	Meter	M	[L]
Time	Second	S	[T]
Temperature	Kelvin	K	[K]
Amount of Substance	Mole	Mol	[N]
Electric Current	Ampere	A	[A]
Luminous Intensity	Candela	cd	[J]

DERIVED QUANTITY

Quantity	Symbol	Unit	Unit Abbv.	Derivation
Area	A	square meter	m^2	Length x width
Volume	V	cubic meter	m^3	Length x width x height
Density	D	kilograms/cubic meter	kg/m^3	mass/volume
Momentum	P	Kilogram. Meter/sec.	Kg. m/sec	Mass.velocity
velocity	v	meters/second	m/s	length/time
Acceleration	a	meters/second/second	m/s^2	speed/time
Force	F	newton	N	mass x acceleration
Energy	E	joule	J	force x length

DIMENSION ANALYSIS

Pressure = Thrust / Area = $MLT^{-2} / L^2 = [ML^{-1}T^{-2}]$

Stress, Elastic Constant, Energy per unit volume

↓

Same dimension -

- Mass [M]
- Length [L]
- Time [T]
- Temperature [K]
- Electric current [A]
- Luminous intensity [J]
- Quantity of substance [N]

Power = Work / time = ML^2T^{-2} / T

$= [ML^2T^{-3}]$

DIMENSION CALCULATION

AREA $[L^2]$

VOLUME $[L^3]$

DISTANCE OR DISPLACEMENT [L]

VELOCITY $[LT^{-1}]$

ACCELERATION $[LT^{-2}]$

FORCE $[MLT^{-2}]$

IMPORTANT POINTS

- Biggest unit of mass is Chandra Sekhar mass limit. (C.S.L) 1 CSL = 1.39 M_0 [M_0 = Solar mass] ≈ 1.4 M_0 → mass of Galaxy measure
- Biggest unit of length is parsec. Parallactic Second. 1 Parsec = 3.26 light year = 3.08×10^{16} m
- Smallest unit of length is Planck length. 1 Planck length = 1.616×10^{-35} m.
- Fermi is unit of length which is used to measure nuclear size. 1 Fm = 10^{-15} m
- light year :- Light travel a distance through vacuum in one year. 1 light year = 9.46 × 10^{15} metre. = 365 days × 24 hrs × 3600 sec × 3×10^8 m/sec
- Astronomical unit-It is defined as the mean distance of the earth from the sun. 1AU= 1.496 × 10^{11} metre.
- Atomic mass unit :- It is defined as (1/12) th of the mass of one C_6^{12} atom. 1 amu = 1u = 1.66 × 10^{-27} Kg.

Shake → Jiffy ⇒ Unit of time, 1 Shake = 10^{-8} sec.

1 Parsec > 1 L.Y > 1 A.U

SCALAR AND VECTORS

Scalars

1. scalars have only magnitude.

2. they changes if their magnitude changes

3. they can be added according to ordinary laws of algebra.

Eg: All fundamental quantity in SI system.

Electric Current,

↓

not obey vector addition rule

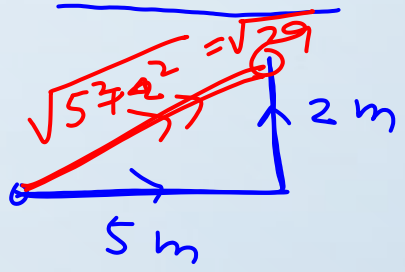
Vectors

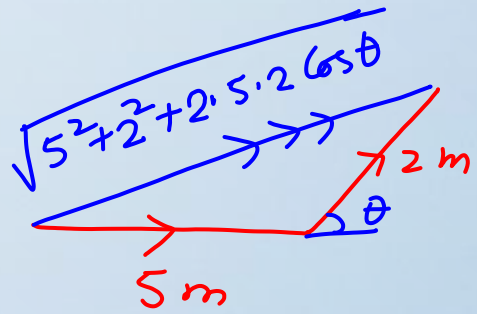
1. vectors have both magnitude and direction.

2. they change if either their magnitude, direction or both change.

Eg:- Electric Current density

3. they can be added only by using special laws of vector addition.





$R^2 = A^2 + B^2 + 2AB\cos\theta$

PYQ

Q1. Nuclear sizes are expressed in a unit name-

a) Fermi b) Angstrom c) Newton d) Tesla

Q2. Light year is—

a) light emitted by sun in one year. b) time taken by light to travel from Sun to Earth.

c) ***the distance travelled by light in free space in one year.*** d) the time taken by earth to go once around the Sun

Q3. 1 nm is equivalent to—

a) 10 Å b) 100 Å c) 10 micron d) 01 mm Å

Q4. Dimension of gravitational constant is—

a) cm sec-1 gm-2 b) cm sec-3 gm-2

c) $\boldsymbol{cm^3\ sec^{-2}\ gm^{-1}}$ d) gm cm-3 sec-2

Q5. Dyne-sec, stands for the unit of—

a) Force ***b) Momentum*** c) Energy d) Power

Q6. Which one of these is not a measuring instrument?

a) Barometer b) Thermometer ***c) Picometer*** d) Hygrometer

RICE ADAMAS GROUP

RICE EDUCATION | ricesmart TOGETHER IN SUCCESS

Physical quantity having unit without dimension

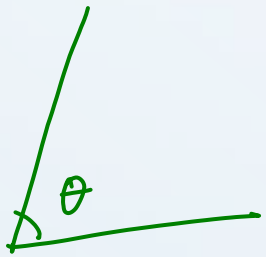
→ Supplementary quantity

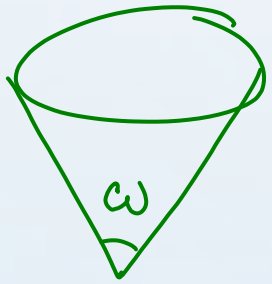
LIBRARY REFERENCE BOOK

Eg:- ① Angle ⇒ Radian

② Solid angle ⇒ ste-radian

Dimension $[M^0 L^0 T^0] = 1$





- CHAYA PHYSICS(11+12)
- GENERAL SCIENCE ENCYCLOPEDIA(ARIHANT)

$1\,\text{Å} = 10^{-10}\,m = 10^{-8}\,cm$

Angstrom