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NAME : .... STD. : .... SEC. : .... ROLL NO. : ....

10^{+1}	deka	da
10^{+2}	hecto	h
10^{+3}	kilo	K
10^{+6}	mega	M
10^{+9}	Giga	G
10^{+12}	tera	T
10^{+15}	Peta	P
10^{+18}	Exa	E

eg:s

$10^{-6} m = 1 \mu m$

$1 \mu s = 10^{-6} s$

$10^{-9} m = 1 nm$

~~$10^{3} kg = 1 t$~~

Units and Dimension

Physical Quantity :-

By means of which we can describe the law of Physics.

Physical quantities can be classified into three catogries —

i) Fundamental quantities
ii) Derived quantities
iii) Suplementary quantities.

i) Fundamental quantities ⇒

↳ which are Independent of each other.

i) Length
ii) mass
iii) Time
iv) Electric current
v) Thermodynamic temprature
vi) Luminious Intensity
vii) Amount of substance

2.) Derived quantities

↳ which can be derived by fundamental quantities.

Ex! ⇒

velocity = $\frac{length}{time}$

Force = mass × acc^n

3) Suplementary quantities ! ⇒

↳

a) Plane angle

b) Solid angle.

2.) Derived quantities

↳ which can be derived by fundamental quantities.

Ex! ⇒

velocity = length / time

Force = mass × acc^n

3) Suplementary quantities : ⇒

↳

a) Plane angle

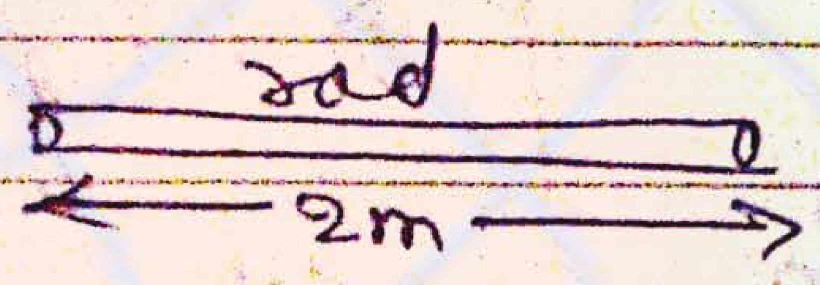
b) Solid angle.

⇒ Units: →

All physical quantities are measured w.r.t standard magnitude of same physical quantities. and these standard are called units.

Eg: –

quantity		unit		symbol
Length	→	metre	→	m



⇒ 2 m

2 ↓ Numerical value

m → Unit of length

⇒ 200 cm

Note: ⇒ magnitude of physical quantity (Q)

$$Q = nu$$

where

$n \rightarrow$ Numerical value

$u \rightarrow$ Unit

$$Q = n_1 u_1 = n_2 u_2 = \ldots \text{ constant}$$

fundamental quantities	units	symbol
1) length	metre	m
2) mass	kilogram	kg
3) Time	second	s
4) Electric current	Ampear	A
5.) Thermodynamic Temperature	kelvin	K
6.) luminious Intensity	Candela	cd
7.) Amount of Substance	mole	mol

characterstick of fundamental units ⇒

- (i) Are Invariable
- (ii) Are easily Available
- (iii) Are accessible.
- (iv) Are of suitable size and well defined

Derived Units :→

- Acceleration = $\frac{\text{velocity}}{\text{time}}$

  unit of acc^n = $\frac{\text{length}}{(\text{time})^2}$ = $\frac{m}{s^2}$

- Force = mass × acc^n

  = $\frac{kg\,m}{s^2}$ ~~⇒ Newton~~ ⟹ N

  = newton = N

  newton → small होगा; N → capital ही होगा

- Linear momentum

$$P = \text{mass} \times \text{velocity}$$
$$= kg \cdot \frac{m}{s}$$

Suplementary quantities	Units	Symbol
1) Plane angle	radian	rad
2) Solid angle	steradian	sr

Dimensions

Definition:⇒

Dimensions of physical quantities are the power to which fundamental quantities ~~are~~ must be raised to represent the physical quantities.

Eg:⇒

$$\text{velocity} = \frac{\text{length}}{\text{time}} = \frac{[M]}{[T]} = \frac{[L]}{[T]}$$

$$\Rightarrow [MT^{-1}] = [LT^{-1}]$$

Dimensional formula ⟶ $= [M^0 L^1 T^{-1}]$

Dimension of velocity are
zero(0) in mass.
1 in length.
−1 in time.

Eg:) Dimensional formula of accⁿ :⇒

$$\text{Acc}^n = \frac{\text{velocity}}{\text{time}} = \frac{[LT^{-1}]}{[T]}$$

$$= [LT^{-2}]$$

Eg:) Force = mass × accⁿ

$$= [MLT^{-2}]$$

Imp Eq) Work = Force × displacement

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

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

Eq) Energy (All type of Energy, K.E, P.E, Thermal energy, Heat

किसी भी constant का कोई Dimension नहीं होता

$K.E = \frac{1}{2} mv^2$

$= \frac{1}{2} [M^1 L^2 T^{-2}]$

Eq) Heat energy (Q) = mL

$= [M] [L^2 T^{-2}]$

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

, L → latent heat

$L_P = \frac{Q}{m}$ → Energy, → mass

$L_P = \frac{[ML^2 T^{-2}]}{[M]}$

$L_P = [M^0 L^2 T^{-2}]$

Eq) $E = h \nu$ → Planks constant

Energy of Photon

Frequency $= \frac{1}{\text{time period}}$

$\nu = [T^{-1}]$

$h = ?$

$h = \frac{E}{\nu} = \frac{[ML^2 T^{-2}]}{[T^{-1}]}$

$= [ML^2 T^{-1}]$

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(ix) $F = G \frac{m_1 m_2}{r^2}$ — G → Gravitational Constant

$G = ?$

$G = \frac{F r^2}{m_1 m_2}$

$= \frac{[MLT^{-2}][L^2]}{[M^2]}$

$= [M^{-1}L^3T^{-2}]$

(x) Power (P) = ?

$P = \frac{work}{time} = \frac{[ML^2T^{-2}]}{[T]}$

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

(xi) change (Q) = ?

$Q = current \times time$

$= I \cdot t$

$= [A \cdot T]$

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Unit

Physical quantity :->

$$Q = nu$$

n = numerical value
u = unit

$$l = 5m$$

Unit :-

Def :-> ~~Unit of a~~ physical quantity is defined as the reference standard we use to measure it.

or

measurement of any physical quantity involves comparison with a basic certain reference standard.

~~Base unit and derived unit~~

Type of unit :-

1) Base unit or Fundamental

Unit ~~for~~ of fundamental quantity is called

unit of derived quantity or unit derived from the base unit.

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[Ex] Stress = $\frac{\text{Force}}{\text{Area}}$

$$= \frac{[MLT^{-2}]}{[L^2]}$$

$$= [ML^{-1}T^{-2}]$$

[Ex] Strain = $\frac{\Delta l \text{ (change in length)}}{l \text{ (original length)}}$

↓ Dimensionless Quantity

$$= \frac{[L]}{[L]} = [M^0L^0T^0]$$

[Ex] Y (Young's modulus) = $\frac{\text{Stress}}{\text{Strain}}$

$$= \frac{[MLT^{-2}]}{[L^2]}$$

$$= [ML^{-1}T^{-2}]$$

[Ex] Pressure = $\frac{\text{Force}}{\text{Area}} = [ML^{-1}T^{-2}]$

[Ex 1] Find –

[Ex 2] Fin

(Q1) Find the dimensions of electrical Permitivity "ϵ_0".

$$F = \frac{1}{4\pi\epsilon_0} \cdot \frac{q_1 q_2}{r^2}$$

$$\epsilon_0 = \frac{q_1 q_2}{4\pi F r^2}$$

$$= \frac{[A^2 T^2]}{[MLT^{-2}][L^2]}$$

$$\epsilon_0 = [M^{-1} L^{-3} T^4 A^2]$$

$$K = \frac{1}{4\pi\epsilon_0}$$

$q = I \times time$
$= [AT]$

$F = [MLT^{-2}]$

(Q2) Find the dimension's of $\frac{1}{2}\epsilon_0 E^2$ (Given
$\epsilon_0 \Rightarrow$ Electrical Permitivity
$E \Rightarrow$ Electric field Intensity

Energy density

$$\text{Energy density} = \frac{\text{Energy}}{\text{volume}}$$

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

$$= [ML^{-1}T^{-2}]$$

c) System of unit.
A complete set of base unit and derived unit is called system of unit

i) CGS system
Centimete gram second

ii) FPS system
Foot, Pond, second unit

iii) MKS system
meter, ~~kg~~ kg(mass), second.

iv) SI units: or International system of u

Quantity	unit	symbol
1) Length	metre	m
2) mass	Kilogram	kg
3) Time	second	s
4) Thermodynamic Temperature	→ kelvin	K
5) Amount of substance	→ mole	mol

6) Electric current

7) luminious Intensity

Supplem

1) rad

ii) ~~ste~~

1) ~~....~~

ii) S

6) Electric current	Ampear	A
7) luminious Intensity	Candela	cd

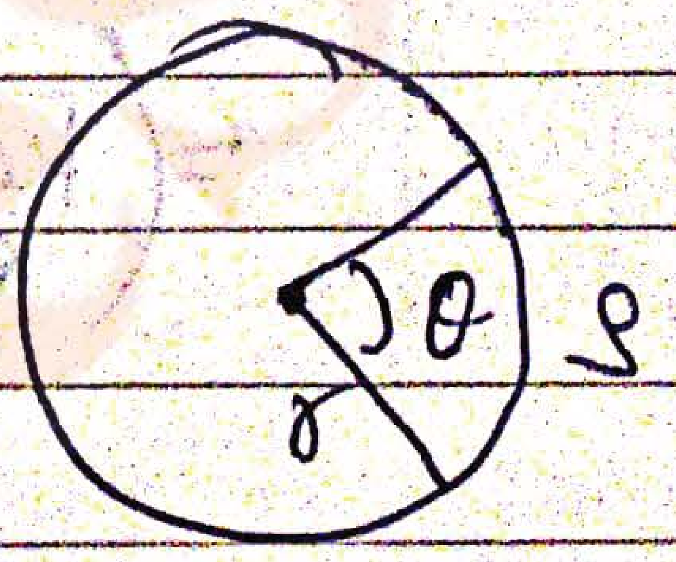
Supplementary Unit :⇒

1) radion (rad.) for Plane angle

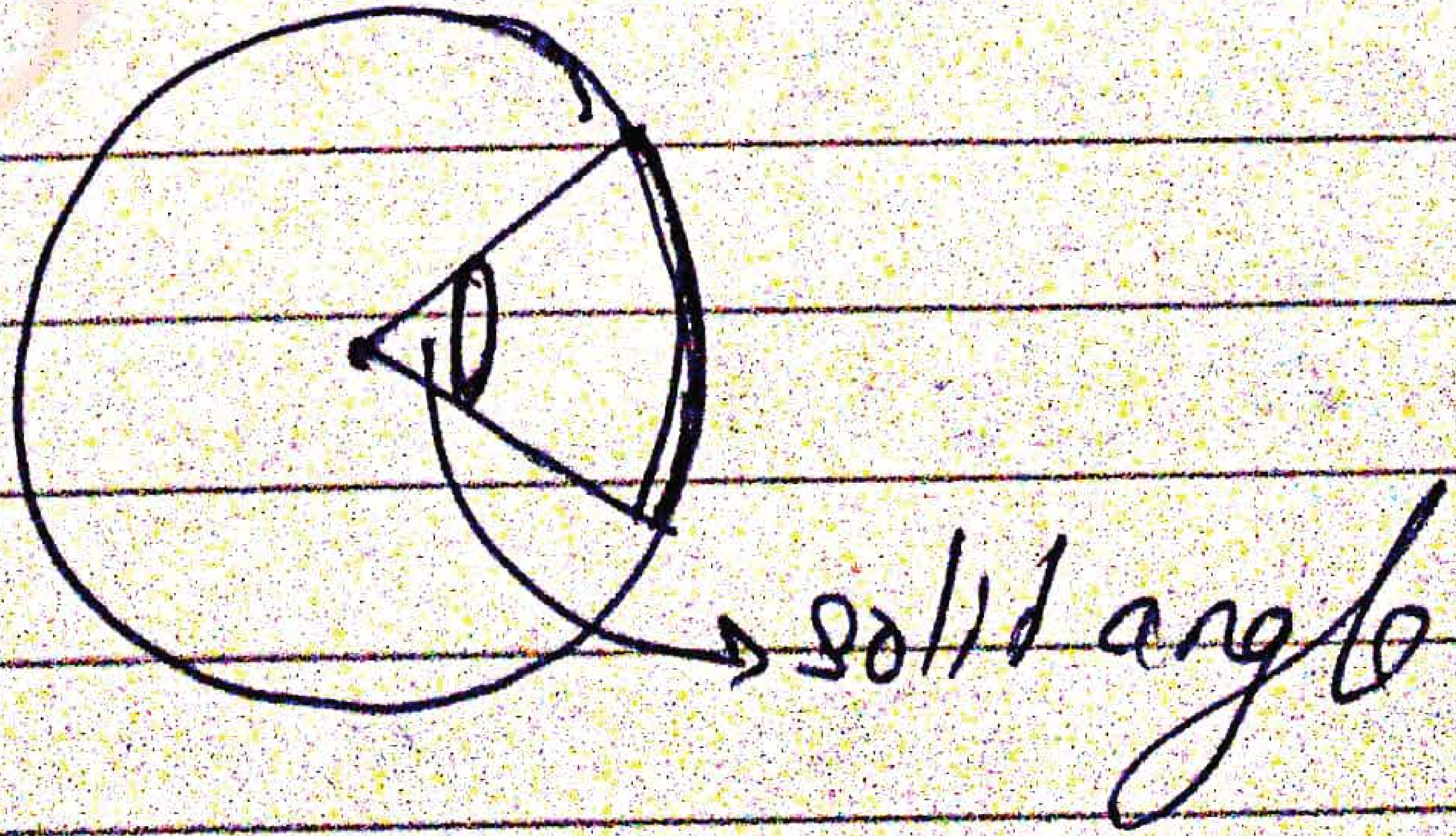
II) steradion (sr) for solid angle.

1) radion (rad) for plane angle :-

$$\theta = \frac{S}{r}$$



II) Steradion (sr) for solid angle :-



1) Derived unit

1) Speed → $\frac{\text{Distance}}{\text{time}}$

$$= \left(\frac{m}{s}\right)$$

2) Acceleration → ~~change~~ $\frac{\text{change in velocity}}{\text{time}}$

$$= \left(\frac{m}{s^2}\right)$$

3) Force = mass × acceleration

$$= \left(kg\ \frac{m}{s^2}\right)$$

4.)

8 SI de…

Press…
Quantity…

1) Force

2) Pres…

3) Gra…
wo…

4) Pre…

4) Ele…
C…

5) R…

6)

7)

SI derived unit for special name:→

~~Pressure~~ Quantity	Name	Symbol	Expression in terms of Base unit
1) Force	Newton	N	$kg\ m\ s^{2}$
2) Pressure	Pascle	Pa	$kg\ m^{-1}\ s^{-2}$
3) Energy, workdone	Joule	J	$kg\ m^{2}\ s^{-2}$
4) Frequency	Hertz	Hz	s^{-1}
4) Electric charge	Columb	C	
5) Resistance	own		
6) Potential differene	volte		
7) Inductance	Henry		

Practical units

→ Length

i) 1 fermi $= 10^{-15}$ m

(Nuclear

ii) Astronomical unit (AU)

$= 1.496 \times 10^{11}$ m

$\approx 1.5 \times 10^{11}$ m

iii) light year — (ly)

1 light year = Distance travelled by the light in one year in vaccum.

1 light year $= 9.46 \times 10^{15}$ m

iv) $1 A^{0} = 10^{-10}$ m

⟹ mass.

1) 1 metric tonne $= 10^{3}$ kg

2) 1 quintal $= 10^{2}$ kg

3) chandra shekhar limit $= 1.4 \times$ mass of sun (2×10^{30} kg)

4) unified atomic mass unit $= 1.67 \times 10^{-27}$ kg

→ Time

1) 1 sha

facto

10^{-1}

10^{-2}

10^{-3}

10^{-6}

10^{-9}

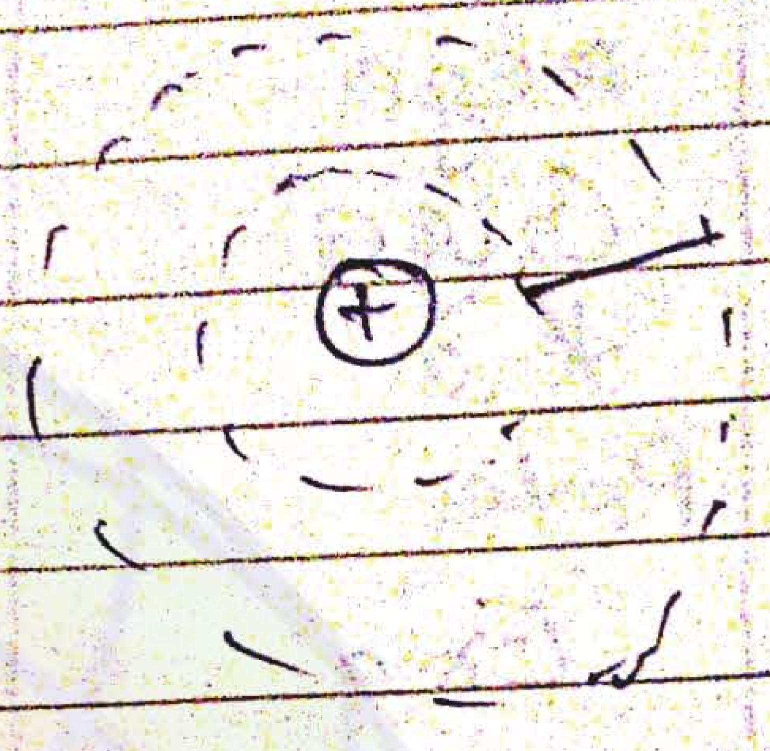
10^{-12}

10^{-15}

10^{-18}

Time

1) 1 shake = 10^{-8} s



S.I Prefix

factor	Prefix	Symbol
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	Pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Time

1) 1 shake = 10^{-8} s

S.I Prefixe

factor	Prefix	Symbol
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	Pico	p
10^{-15}	femto	f
10^{-18}	atto	a