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introduction

Concept of physics: physics is a fundamental science concerned with understanding the natural phenomena that occurs in our universe .

Physical quantities (in mechanics)

Fundamental quantities

- Length , mass , time

Derived quantities

- All other physical quantities (velocity , force , pressure , volume ….)

Units

	System international (SI)	Gaussian system	British system
mass	Kilogram (kg)	Gram (gr)	Pound (lb)
length	Meter (m)	Centimetre (cm)	Foot (ft)
time	Second (s)	Second (s)	Second (s)

1 FT = 30.48 cm
1 Mile = 1609 m
1 slug = 452 gr
1 inch = 2.54 cm

Some prefixes for powers of ten

power	prefix	abbreviation
10^{-18}	Atto	a
10^{-15}	Femto	f
10^{-12}	pico	p
10^{-9}	Nano	n
10^{-6}	Micro	μ
10^{-3}	Milli	m
10^{-2}	Centi	c
10^{-1}	deci	d

power	prefix	abbreviation
10^{3}	Kilo	K
10^{6}	Mega	M
10^{9}	Giga	G
10^{12}	Tera	T
10^{15}	Peta	P
10^{18}	exa	E

- **Examples :**
- Wavelength: $\lambda = 580\ nm = 580 * 10^{-9}\ m$
- Frequency: $f = 200\ MHz = 200 * 10^{6}\ Hz$
- Capacity: $c = 30\ pf = 30 * 10^{-12}\ f$
- Charse: $q = 3\mu c = 3 * 10^{-6}\ c$
- Mass: $m = 15\ kg = 15*10^{3}\ g$

Dimensional analysis

- The dimension of a physical quantity x is denoted as [x]

quantity	dimension
[length]	L
[mass]	M
[time]	T

Example :

- What is the dimension of :

[velocity]	Length/time = L/T
[acceleration]	Velocity/time = L/T*T = L/T^2
[force]	mass*acceleration = $M*L/T^2$
[volume]	$Length^3 = L^3$
[Density]	Mass/volume = M/L^3

quantity	Unit (SI)	dimension
Length	M	L
Mass	Kg	M
Time	S	T
Velocity	m/s	L/T
Force	$Kg*m/s^2$	ML/T^2
density	Kg/m^3	M/L^3

Consistency of units

- Its useful to determine whether the physical equations are correct or not
- **Example** :
- Show whether the following equations are dimensionally correct or not ?
- X = vt , X= at
- Where [x] is distance , [v] is velocity , [t] is the time , [a] is acceleration
- **To be continued** …..

- **Solution :**
- $[x] \stackrel{?}{=} vt$
- $L \stackrel{?}{=} L*T/T = L$
- So that [x] =vt is correct in dimensions
- $[x] \stackrel{?}{=} at$
- $L \stackrel{?}{=} L*T/T^2 = L/T$
- $L \neq L/T$
- So that [x] = at is not correct in dimension

- **Example :**
- For what values of N and M in the equation $[x] = a^n t^m$ to be correct in dimensions ?
- $X = a^n t^m$
- $L = (L/T^2)^N * T^M = L^N * T^{M-2N}$
- Or $\longrightarrow$ $L * T^0 = L^N * T^{M-2N}$
- $N = 1$, $M-2N = 0$ $\longrightarrow$ $M = 2N = 2$
- $N = 1$, $M = 2$

Conversion of units

- **Example :** *convert v = 100 km/hr into m/s*
- *V = 100 km/hr * 10^3m/km * hr/3600s = 27.7 m/s*
- **Example :** convert 20 ft to meter
- 20 ft = 20ft * 30.48 cm/ft * m/100 cm = 6.1 m
- **Example :** what is the density of a solid cube of mass 25 gr and length 5 cm in SI unit ??
- Density = mass/volume = 25 gr/125 cm^3 * kg/1000 gr * 10^6 cm^3 m^3 = 200 kg/m^3