2.UNITS & MEASUREMENTS

IMP DEFINITIONS & FORMULAS

1.1 **a) Fundamental quantities:** The base physical quantities which are independent of other physical quantities are called fundamental quantities. **Ex:** Length, Mass, Time.

1.2 **a) Fundamental units:** The units of fundamental quantities are called fundamental units. **Ex:** m, kg, s,...

2.1 **b) Derived quantities:** The physical quantities which can be derived from other physical quantities are called derived quantities. **Ex:** Velocity, Acceleration, Force.

2.2 **b) Derived units:** The units of derived quantities are called derived units. **Ex:** ms^{-1}, ms^{-2}, N,....

3.1 **Systems of units:** 1) C.G.S. system (Metric system) 2) M.K.S system 3) F.P.S system 4) SI.

Quantity / System	Length	Mass	Time
C.G .S	centimetre (cm)	gram (g)	second (s)
M.K.S	metre (m)	kilogram (kg)	second (s)
F.P.S	foot (ft)	pound (*l* b)	second (s)

3.2(a) International System of units (SI system):

	Fundamental Quantity	Unit	Symbol
1.	Length	metre	m
2.	Mass	kilogram	kg
3.	Time	second	s
4.	Electric current	ampere	A
5.	Temperature	kelvin	K
6.	Amount of substance	mole	mol
7.	Luminous intensity	candela	cd

3.2(b) Supplementary Quantities in SI:

1.	Plane angle	radian	rad
2.	Solid angle	steradian	sr

BULLET MASTER'S PHYSI BEATS!

UNITS & MEASUREMENTS [1 VSAQ]

కొంతమంది విద్యార్థులు Physical Quantities కి Units వ్రాసేటప్పుడు వారికి నచ్చినట్లు వ్రాస్తారు తప్పితే ఈ Units అనే Chapter లో సూచించినట్లు రాయరు.

ఉదాహరణకు meter కు m అని రాయాలి కానీ mt అని రాస్తుంటారు.

gram కు g అని రాయాలి కానీ gm లేదా gr అని రాస్తుంటారు.

second కు s అని రాయాలి, కానీ sec అని రాస్తుంటారు.

మరి మీరు మీకు అలవాటైనట్లే వ్రాస్తారా? లేక Standard Notation ను follow అవుతారా?

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4.0 Dimensions : The dimensions of a physical quantity are the powers ,to which the fundamental quantities are to be raised ,to represent that physical quantity.

4.1 Dimensional Formula(D.F) : The expression ,showing the powers to which the fundamental quantities are to be raised, to represent a physical quantity , is called dimensional formula.

Ex : D.F of velocity = $[M^0L^1T^{-1}]$ (or) $M^0L^1T^{-1}$ (or) L^1T^{-1}

Here the powers 0,1,–1 of M,L,T are called the dimensions of velocity.

4.2 Dimensional equation : An equation, containing the symbol of a physical quantity on L.H.S and its dimensional formula on R.H.S, is called dimensional equation of that quantity.

Ex : Velocity (v) = $M^0L^1T^{-1}$, Acceleration (a) =$M^0L^1T^{-2}$

4.3 Principle of Homogeneity of Dimensions: The physical quantities having the same dimensions may be either added or subtracted or equated.

Ex : Consider the equation, v = u+at. The term on L.H.S is velocity.

Hence each term on R.H.S, 'u' and 'at' should possess the dimensions of velocity.

4.4 Uses of Dimensional Analysis : Dimensional analysis is used,

1) To convert one system of units into other system.

   Here, we use the relation such as $\mathbf{n_1u_1 = n_2u_2}$

2) To verify the correctness of equations related to physical quantities.

   Here, we use the **principle of Homogeneity**.

3) To derive relations between different physical quantities.

   Ex: If power (P) is assumed to depend on force (F) and velocity (V) then we write $P \propto F^aV^b$

4.5 Limitations of Dimensional Analysis :

1) The values of proportionality constants cannot be found by dimensional methods.
2) The equations containing trigonometric, exponential and logarithmic functions can't be analyzed
3) Dimensional methods are not applicable to derive an equation ,which is a sum of 'some quantities' . **Ex:** $v = u + at$; $s = ut + \frac{1}{2}at^2$ ....etc
4) It is difficult to apply dimensional methods on the physical quantities which are involved with more than 3 fundamental quantities .

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4.6 Dimensional Constants: The quantities having a fixed value and possessing dimensional formula are called dimensional constants.

Ex : Planck's constant, Universal gravitational constant, Universal gas constant, speed of light.

4.7 Dimensionless Quantities: There are certain physical quantities, which do not possess any dimensions.Such quantities are called dimensionless quantities. 'Ratio' of same quantities, angles,certain proportionality constants are dimensionless.

Ex : Strain, refractive index, trigonometrical ratios,specific gravity (relative density)...etc.

Same D.F but Different Quantities

$[ML^2T^{-2}]$: Work, P.E, K.E, Moment of force, Moment of couple, Torque, Heat

$[MLT^{-2}]$: Force,Weight, Tension, Thrust, Frictional force, Viscous force

$[ML^0T^{-2}]$: Surface tension, Force constant, Spring constant

$[ML^{-1}T^{-2}]$: Stress, Pressure, Modulus of Elasticity

☞ **MEMORY TIP: L^2, L, L^0, L^{-1} ల వరుసలో గుర్తుంచుకోండి. $[M,T^{-2}]$ are common]**

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