SRISHTI education

4 B Patrika Marg, Civil Lines, Prayagraj – 211 001
www.srishtieducation.org
Ph: 9984521555, 9984556600

SRISHTI EDUCATION

Physics by: VAIBHAV PANDIYA

WORK BOOK
LECTURE 2 OF DIMENSIONS

LIST OF PHYSICAL QUANTITIES

List 1: Mechanics

Note!

The object of this list is to have the basic formula/relation so that you can have comfort when you encounter some new physical quantity while solving assignment problems or past years JEE/NEET Questions

S No	Physical Quantity	Formula	Dimensional Formula	S.I Unit
1.	Area (A)	Length x Breadth	$[M^0L^2T^0]$	m^2
2.	Volume (V)	Length x Breadth x Height	$[M^0L^3T^0]$	m^3
3.	Density (d)	Mass / Volume	$[ML^{-3}T^0]$	kgm^{-3}
4.	Speed	Distance / Time	$[M^0LT^{-1}]$	ms^{-1}
5.	Velocity (v)	Displacement / Time	$[M^0LT^{-1}]$	ms^{-1}
6.	Acceleration (a)	Change in velocity / Time	$[M^0LT^{-2}]$	ms^{-2}
7.	Acceleration due to gravity (g)	Change in velocity / Time	$[M^0LT^{-2}]$	ms^{-2}
8.	Specific gravity/Relative Density	Density of body/density of water at 4^oC	No dimensions $[M^0L^0T^0]$	No unit
9.	Plane angle	Dimensionless	$[M^0L^0T^{-0}]$	radian (rad)

10.	Solid angle	Dimensionless	$[M^0L^0T^{-0}]$	steradian (sr)
11.	Linear momentum (p)	Mass x Velocity	$[MLT^{-1}]$	$kgms^{-1}$
12.	Force (F)	Mass x Acceleration	$[MLT^{-2}]$	newton (N)
13.	Work (W)	Force x Distance	$[ML^2T^{-2}]$	joule (J)
14.	Kinetic Energy (K)	$\frac{1}{2}$ (mass) $(speed)^2$	$[ML^2T^{-2}]$	joule (J)
15.	Potential Energy (U)	U = mgh M= mass, g = acceleration due to gravity, h = height	$[ML^2T^{-2}]$	joule (J)
16.	Heat / Any kind of energy/ Radiation	Energy	$[ML^2T^{-2}]$	joule (J)
17.	Impulse (J)	Force x Time	$[MLT^{-1}]$	Ns
18.	Action	Energy x Time	$[ML^2T^{-1}]$	Js
19.	Pressure (P)	Force / Area	$[ML^{-1}T^{-2}]$	Nm^{-2} pascal (Pa)
20.	Power (P)	Work / Time	$[ML^2T^{-3}]$	W
21.	Intensity (I)	Power (P)/ Area (A)	$[ML^0T^{-3}]$	W/m^2
22.	Co-efficient of friction	$\frac{Force}{Force}$	$[M^0L^0T^{-0}]$	No unit
23.	Co-efficient of restitution	$\frac{final\ speed}{initial\ speed}$	$[M^0L^0T^0]$	No unit
24.	Co-efficient of viscosity (n)	$F = 6\pi nrv$ F = Force n = viscosity r = radius v = speed	$[ML^{-1}T^{-1}]$	pascal second (Pa-s)
25.	Universal gravitational constant (G)	$F = \frac{Gm_1m_2}{r^2}$ F = force m_1 and m_2 = mass	$[M^{-1}L^3T^{-2}]$	$Nm^2\ kg^{-2}$

		r = distance		
26.	Gravitational Potential	Work/Mass	$[M^oL^2T^{-2}]$	J/kg
27.	Gravitational field (g)	Force/mass	$[M^oLT^{-2}]$	m/s^2
28.	Moment of inertia (I)	Mass x $(distance)^2$	$[ML^2T^0]$	kgm^2
29.	Torque (τ)/Moment of force/ couple	Force x distance	$[ML^2T^{-2}]$	Nm
30.	Surface tension (T)	Force / Length	$[ML^0T^{-2}]$	Nm^{-1}
31.	Surface energy (E)	Energy / unit area	$[ML^0T^{-2}]$	Nm^{-1}
32.	Force constant (x)	Force / Displacement	$[M^1L^0T^{-2}]$	Nm^{-1}
33.	Thrust (F)	Force	$[MLT^{-2}]$	N
34.	Tension (T)	Force	$[MLT^{-2}]$	N
35.	Stress	Force / Area	$[ML^{-1}T^{-2}]$	Nm^{-2} or pascal (Pa)
36.	Strain	Change in dimension / Original dimension	No dimensions $[M^0L^0T^0]$	No unit
37.	Modulus of Elasticity (E) • Young's modulus (Y) • Bulk's modulus (B) • Rigidity Modulus (G)	Stress / strain	$[ML^{-1}T^{-2}]$	Nm^{-2}
38.	Radius of gyration (k)	Distance	$[M^0LT^0]$	m
39.	Angular impulse	Torque X time	$[ML^2T^{-1}]$	Js (joule second)

40.	Angular velocity(ω)	Angle / Time	$[M^0L^0T^{-1}]$	rad s^{-1}
41.	Angular acceleration(α)	Angular velocity / Time	$[M^0L^0T^{-2}]$	rad s^{-2}
42.	Angular momentum (J) or (l)	Moment of inertia x Angular velocity	$[ML^2T^{-1}]$	kgm^2s^{-1}
43.	Velocity gradient $\left(\frac{dv}{dx}\right)$	Velocity / Distance	$[M^0L^0T^{-1}]$	s^{-1}
44.	Rate flow	Volume / Time	$[M^0L^3T^{-1}]$	m^3s^{-1}
45.	Wavelength(**λ**)	Length of a wavelet	$[M^0LT^0]$	m
46.	Frequency(ν)	Number of vibrations/second or 1/time period	$[M^0L^0T^{-1}]$	Hz or s^{-1}
47.	Angular frequency (ω)	2π x frequency	$[M^0L^0T^{-1}]$	
48.	Planck's constant (h)	Energy / Frequency	$[ML^2T^{-1}]$	Js
49.	Buoyant force	Force	$[M^1L^1T^{-2}]$	N
50.	Pressure gradient	Pressure / Distance	$[M^1L^{-2}T^{-2}]$	Nm^{-3}
51.	Pressure energy	Pressure x Volume	$[ML^2T^{-2}]$	J

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LECTURE 2 OF DIMENSIONS

QUESTIONS

1. **Which of the following have the same dimensions?**
   (a) Pressure and stress
   (b) Work and torque
   (c) Angle and strain
   (d) Energy and surface energy?

2. **A dimensionless quantity is always unit less. (True/False)?**

3. **Name two quantities which are unit less as well as dimensionless.**

4. **Maximum number of dimensions a quantity can have is _____**

5. **If two physical quantities have the same dimensional formulae then they must be identical in physical nature. (True/False)**

6. **A base quantity can never have non-zero dimensions in other base quantities. (True/False)?**

7. **A physical quantity must have non-zero dimensions in at least one of the base quantities. (True/False).**

ANSWERS

1. (a), (b), (c)
2. False
3. Many are there, like angle and strain
4. 7 dimensions
5. False
6. True
7. False