NDA-CDS 1 2025

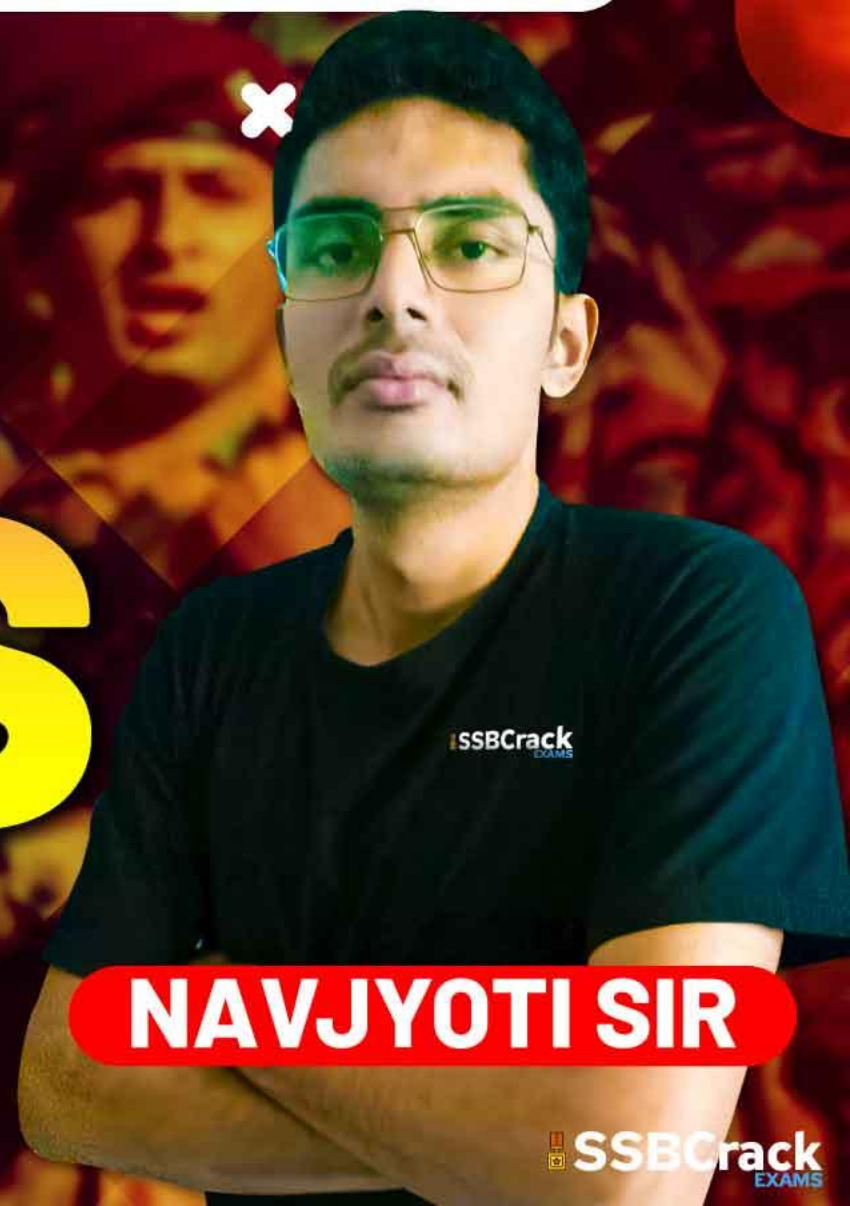
GS

LIVE

PHYSICS

UNITS & DIMENSIONS

CLASS 1



NAVJYOTI SIR

SSBCrack EXAMS

21 Nov 2024 Live Classes Schedule

8:00AM	21 NOVEMBER 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	21 NOVEMBER 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:30AM	MOCK PERSONAL INTERVIEWS	ANURADHA MA'AM

NDA 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 4	RUBY MA'AM
1:00PM	PHYSICS - UNITS & DIMENSIONS - CLASS 1	NAVJYOTI SIR
4:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - MATRICES & DETERMINANTS - CLASS 3	NAVJYOTI SIR

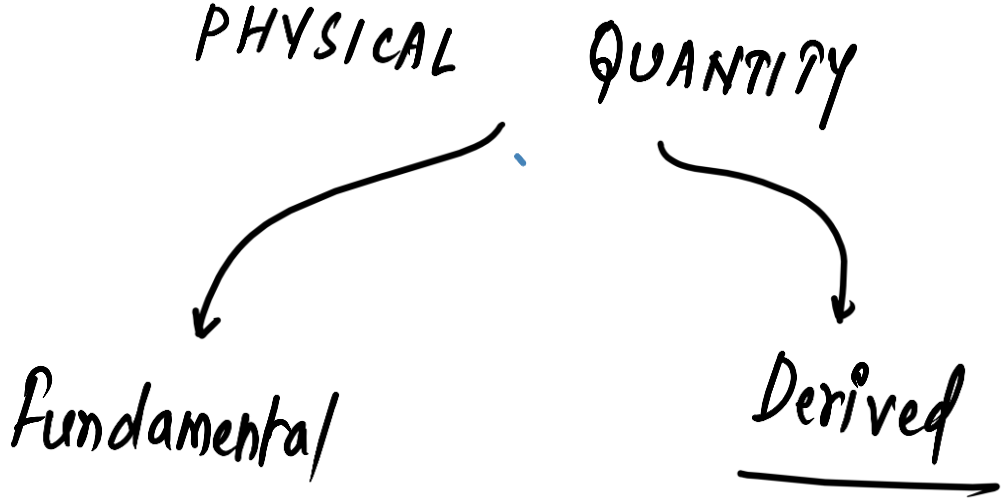
CDS 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 3	RUBY MA'AM
1:00PM	PHYSICS - UNITS & DIMENSIONS - CLASS 1	NAVJYOTI SIR
4:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM
7:00PM	MATHS - SPEED DISTANCE TIME - CLASS 3	NAVJYOTI SIR

Physical Quantities

→ A measurable quantity.

Example - length, volume, velocity, Force, Frequency, density etc.



Fundamental Quantities

- **Those physical quantities which do not depend on other quantities.**

1. Mass
2. Length
3. Time,
4. Temperature,
5. Electric current
6. Amount of substance.
7. Luminous Intensity

7 + 2 supplementary,

- **Plane angle and Solid angle are two supplementary Fundamental Quantities.**

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Derived Quantities

The physical quantities which depend on fundamental quantities.

Example – Speed , Force , Voltage , Density etc.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \rightarrow \frac{\text{Length}}{\text{Time}}$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \rightarrow \frac{\text{Mass}}{(\text{Length})^3}$$

$$\text{Force} = \text{mass} \times \text{acceleration}$$

(change in (length / time) / time

UNITS

- A Standard Amount of a Physical Quantity Chosen to Measure the Physical Quantity of The Same Kind.
- It Should Be Easily Reproducible, Internationally Accepted.

SYSTEM OF UNITS

	Mass	Length	Time
1. CGS	(gram)	(cm)	second ✓
2. FPS	Pound	foot	second
3. MKS	kilogram	metre	second
4. SI			

Metric system

(SI) → MKS

Fundamental Units

1. Mass ——— kilogram —(kg)
2. Length ——— metre — (m)
3. Time, ——— second —(s)
4. Temperature, ——— Kelvin — (K)
5. Electric current ——— Ampere (A)
6. Amount of substance. ——— mole (mol)
7. Luminous Intensity ——— Candela (cd)

plane angle - radian (rad)

solid angle - steradian (sr)

Derived Units

1. Speed

$$\frac{\text{Distance}}{\text{Time}} \longrightarrow \frac{\text{LENGTH}}{\text{TIME}} \longrightarrow \frac{m}{s} = m/s \text{ or } ms^{-1}$$

2. Momentum

mass x velocity

$kg \times m/s \longrightarrow kg\,ms^{-1}$

3. Voltage

$$\frac{\text{Work done}}{\text{charge}} = \frac{F \times \text{displacement}}{\text{current} \times \text{time}}$$

$$\frac{kg\,ms^{-2} \times m}{A \times s}$$

volts

4. Density , etc.

$$\frac{\text{Mass}}{\text{Volume}} \quad \frac{kg}{m^3} = kg/m^3 \text{ or } kgm^{-3}$$

PRACTICAL UNITS

Length :

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

(ii) 1 X-ray unit = 10^{-13} m] Smaller distances

(iii) 1 astronomical unit = 1.49×10^{11} m (average distance between sun and earth) (AU)

(iv) 1 light year = 9.46×10^{15} m (distance travelled by light in 1 year)

(v) 1 parsec = 3.08×10^{16} m = 3.26 light year] Large distances

Remember the names.

PRACTICAL UNITS

SSBCrack EXAMS

Mass / Weight

1 quintal = 10^2 kg = 100 kg
1 metric ton = 10^3 kg = 1000 kg
1 atomic mass unit (amu) or
dalton = 1.66×10^{-27} kg → very small mass
1 pound = 0.4537 kg

(lbs) ≈ 0.45 kg

PRACTICAL UNITS

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- **Time :**

1 solar day = 86400 sec.
1 year = 365¼ solar days
1 lunar month
= 27.3 solar days
Tropical year = It is the year in which total solar eclipse occurs.
Leap year = It is the year in which the month of February is of 29 days.

a normal day of 24 hours

24 x 60 x 60 → number of seconds

365 days + 6 hours

366 days

PREFIXES USED

Prefix	Symbol	Multiplier
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	m	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}

deca	da	10^{1}
hecto	h	10^{2}
kilo	k	10^{3}
mega	M	10^{6}

metre ⟶ $10^0 = 1$

Dimensional Analysis

Volume $\longrightarrow$ $(\text{Length})^3$

$\rightarrow [M^0 L^3 T^0] = [L^3]$

Frequency

$\frac{1}{\text{Time period}} \Rightarrow [M^0 L^0 T^{-1}]$

$= [T^{-1}]$

Dimensional formula, (for any derived quantity)

$[M^a L^b T^c]$

Mass Length Time

Density,

$$\frac{\text{Mass}}{\text{Volume}} = [M^1 L^{-3} T^0] = \underline{[ML^{-3}]}$$

kg m-3

g cm-3

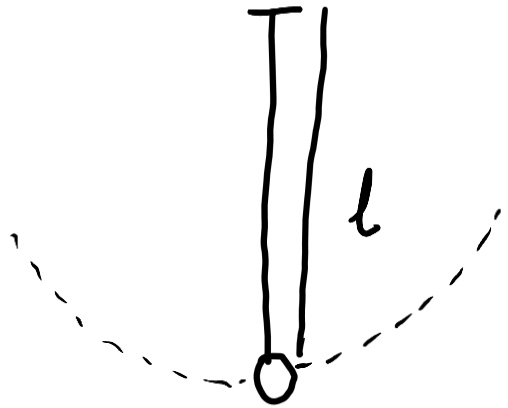
Velocity — $[M^0 L^1 T^{-1}] = \underline{[LT^{-1}]}$ ms-1

Acceleration — $[LT^{-2}]$

Force — $[MLT^{-2}]$

Work / Energy — $[ML^2T^{-2}]$

Time period of pendulum $= 2\pi\sqrt{\frac{l}{g}}$



LHS $= [T]$

RHS

$\frac{l}{g} = \frac{L}{LT^{-2}} = T^2$

$\sqrt{\frac{l}{g}} \longrightarrow (T^2)^{\frac{1}{2}} = [T]$

Same dimensional formula.

(only then eqn is valid)

CONVERSIONS BETWEEN UNITS

- **Measurement Of Physical Quantity = Numerical Value (Number) × Unit**
- **If u_1 And u_2 Are The Units Of A Physical Quantity In Two Different System Of Units And, n_1 And n_2 Are Their Numerical Values Then,**

$$n_1 \times u_1 = n_2 \times u_2$$

4 kg

$6\ kg\ m^{-3} = ?\ g\ cm^{-3}$

$6\ kg\ m^{-3} = x\ g\ cm^{-3}$

$$x = \frac{6\ kg\ m^{-3}}{g\ cm^{-3}}$$

$$= 6 \times \frac{1000\ g}{g} \times \frac{cm^3}{m^3}$$

$$6 \times 1000 \times \left(\frac{cm}{m}\right)^3$$

$$6 \times 1000 \left(\frac{1\ cm}{100\ cm}\right)^3$$

$$6 \times 1000 \times \left(\frac{1\ cm}{100\ cm}\right)^3$$

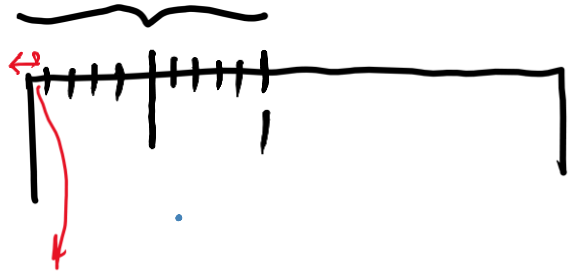
$$6000 \times \frac{1}{1000000} = \frac{6000}{1000000} = \frac{6}{1000} = \underline{6 \times 10^{-3}}$$

$$x = 6 \times 10^{-3} = \underline{0.006}$$

$$6\ kg\ m^{-3} = 6 \times 10^{-3}\ g\ cm^{-3} = 0.006\ g\ cm^{-3}$$

PRECISION AND ACCURACY

- The Accuracy Of A Measurement System Is The Degree Of Closeness Of Measurements Of A Quantity To That Quantity's True Value.
- The Precision Of A Measurement System, Is The Degree To Which Repeated Measurements Under Unchanged Conditions Show The Same Results .
  - Least Count of Instruments – Minimum length that can be measured.



$$\frac{1\ cm}{10} = 0.1\ cm = 1\ mm$$

Light year is a unit for measurement of

(a) age of universe

(b) very small time intervals

(c) very high temperature

(d) very large distance ✓

The unit of the ratio between thrust and impulse is same as that of

(a) frequency

(b) speed

(c) wavelength

(d) acceleration

Thrust → force in perpendicular direction

$$\frac{F}{F \times t} = \frac{1}{t} \rightarrow [T^{-1}] \Rightarrow \text{frequency}$$

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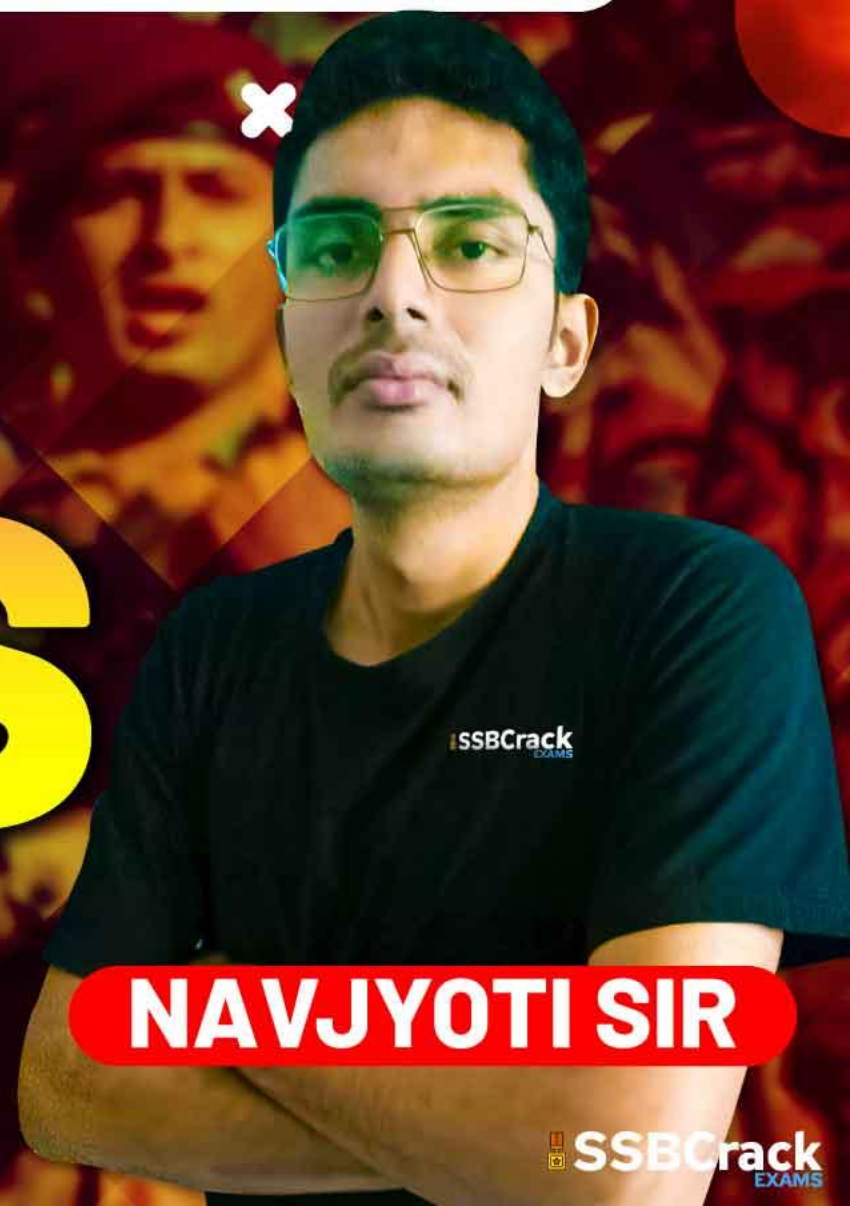
GS

LIVE

PHYSICS

UNITS & DIMENSIONS

CLASS 2



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