

Basic
0-4 - Foundation

Ready

कतई जदर

Strong

0-Hero

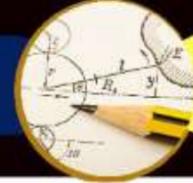
Class 03

Units and Dimensions

(इकाई और आयाम)

- Notes / e-Book
Extra Fact





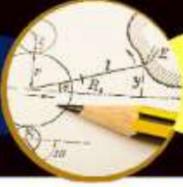
S. No	Physical quantity	Formula	SI unit	इकाई	Dimensional formula
1	Density	$\rho = M/V$	kilogram per cubic metre (kg/m^3)		$[L^{-3}M^1T^0]$
2	Acceleration	$a = v/t$	metre per second square (m/s^2)		$[L^1M^0T^{-2}]$
3	Momentum	$P = mv$	kilogram metre per second (kg m/s)		$[L^1M^1T^{-1}]$
4	Force	$F = ma$	kilogram metre per second square (kg m/s^2) or newton (N)		$[L^1M^1T^{-2}]$
5	Impulse	$J = F \cdot t$	newton second (Ns)		$[L^1M^1T^{-1}]$
6	Work	$W = F \cdot s$	joule (J)		$[L^2M^1T^{-2}]$
7	Kinetic Energy	$KE = 1/2 mv^2$	joule (J)		$[L^2M^1T^{-2}]$
8	Pressure	$P = F/A$	kilogram per metre second square (kg/ms^2)		$[L^{-1}M^1T^{-2}]$

(Use)





Dimensional formula



SSC / Railway

Dimensional Formula विमीय सूत्र

07 State / CDS

The Dimensional Formula Expresses A Physical Quantity In Terms Of Fundamental Quantities (Mass, Length, Time, Etc.) With Suitable Powers.

आयामी सूत्र किसी भौतिक राशि को मूल राशियों (द्रव्यमान, लंबाई, समय आदि) के घातों के रूप में व्यक्त करता है।

$$a^0 = 1$$

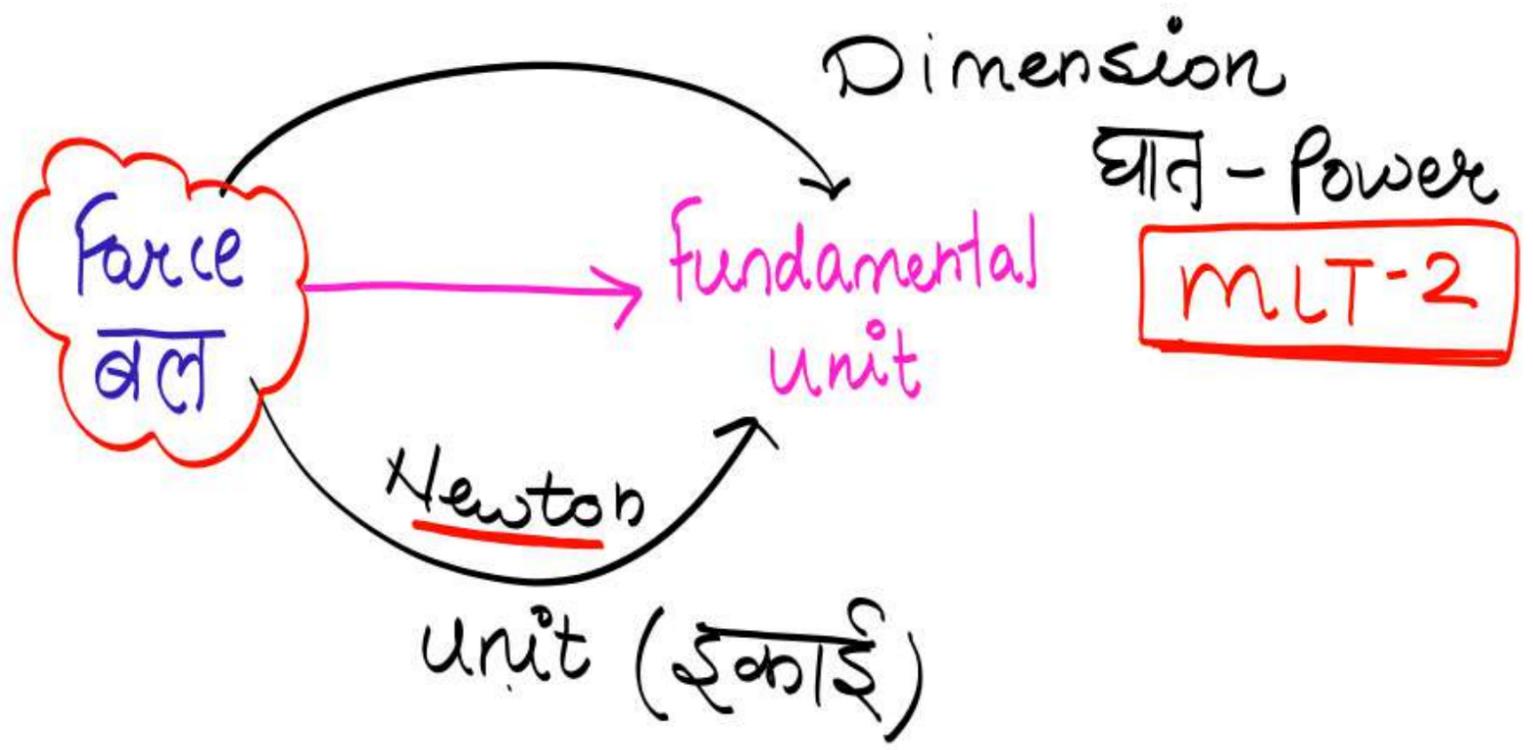
$$a^1 = a$$

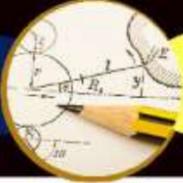
$$a^{-1} = \frac{1}{a}$$

$$a^{-2} = \frac{1}{a^2}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\underline{a^m} \times \underline{a^n} = \underline{a^{m+n}}$$





Dimensional Formula विमीय सूत्र

07 - Fundamental (मूल मात्रक)

Q. $[\underline{M} \underline{L}^2 \underline{T}^{-1} \underline{K}^{-1}]$

चमकी

3

Q. $[\underline{A}^1 \underline{T}^1]$

Current

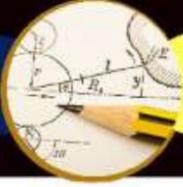
$m s^{-1}$
= $\frac{m}{s}$

$a = \frac{v}{t} = \frac{m}{s}$
 $\frac{m}{s^2} = \frac{m}{s} \cdot \frac{1}{s}$

$\vec{a} = \frac{v}{t}$ (वय)

$\vec{a} = \frac{ms^{-1}}{s}$
= ms^{-2}

Symbol (प्रतीक)	Represents / दर्शाता है
M	Mass (द्रव्यमान)
L	Length (लंबाई)
T	Time (समय)
K (or θ)	Thermodynamic Temperature (ऊष्मागतिक तापमान)
A	Electric Current (विद्युत धारा)
N	Amount of Substance (पदार्थ की मात्रा / मोल)
J	Luminous Intensity (प्रकाशीय तीव्रता)



$m^0 = 1$ $\frac{m}{s} = m s^{-1}$

Dimensional Formula विमीय सूत्र SI-Unit

चमक

dimension

• Area (क्षेत्रफल)



formula

$A = L \times B$

$A = \underline{m}^2$

$[L^2] / M^0 L^2 T^0$

• Volume (आयतन)



$V = A \times h$

$V = m^3$

$L^3 / M^0 L^3 T^0$

• Speed / Velocity (वेग / चाल)



$S = \frac{d}{t} \quad | \quad S = \vec{v}$

$S = \frac{m}{s} = \underline{m} \underline{s}^{-1}$

$L T^{-1} / M^0 L^1 T^{-1}$

• Acceleration (त्वरण)



$\vec{a} = \frac{v}{t}$

$\vec{a} = \frac{ms^{-1}}{s} = m s^{-2}$

$L T^{-2} / M^0 L^1 T^{-2}$

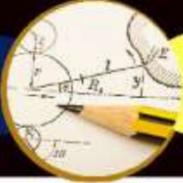
Force (बल)



$\vec{F} = \underline{m} \times \underline{\vec{a}}$

$F = kgms^{-2}$
= Newton

MLT^{-2}



• संवेग - momentum (\vec{p}) = $m \times \vec{v} = \text{kgms}^{-1} = \underline{MLT^{-1}}$ ↖ Same ↗

समान - Question

• Impulse (आवेग)

Impulse/ $J = F \cdot t = \text{kgms}^{-2} \times s \Rightarrow \underline{\text{kgms}^{-1}}$

MLT^{-1}

• Work (कार्य)

कार्य = ऊर्जा

$\underline{W} = \underline{F} \cdot \overset{\text{distance}}{\underline{s}} = \underline{N \cdot m} (\text{kgms}^{-2}) \times \underline{m} = \underline{\text{kgm}^2\text{s}^{-2}}$

• Kinetic Energy (गतिज ऊर्जा)

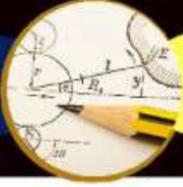
$KE = \frac{1}{2}mv^2$

ML^2T^{-2}

• dimension → संख्या (use) Number

$KE = \cancel{\frac{1}{2}}mv^2 \Rightarrow \text{kg}(\text{ms}^{-1})^2 = \text{kgm}^2\text{s}^{-2} \Rightarrow \underline{ML^2T^{-2}}$

same

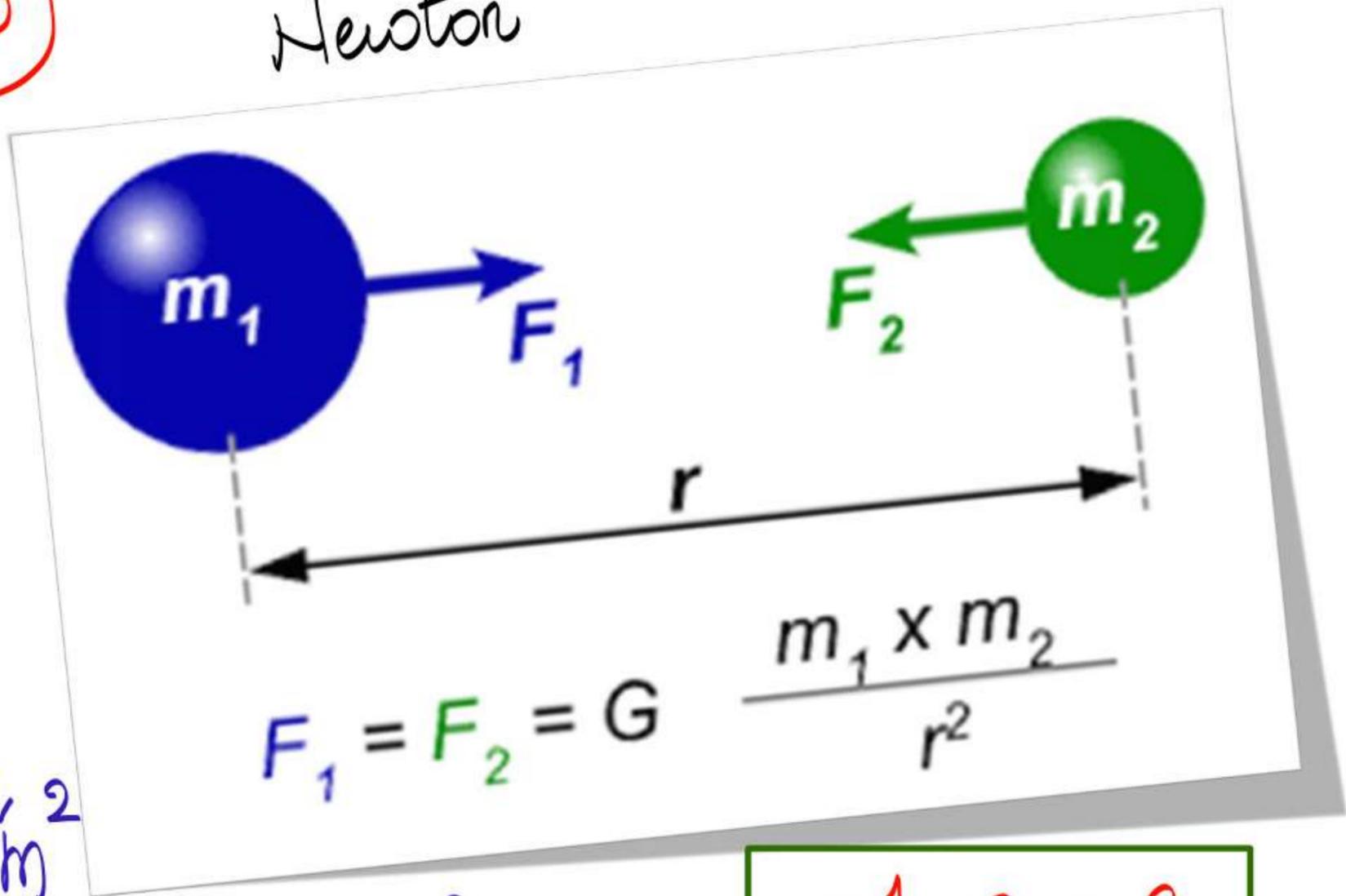


Gravitational Constant
(गुरुत्वाकर्षण स्थिरांक, G)

चमक

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

दूव्यमान

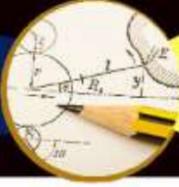


$$F \cdot r^2 = G m^2$$

$$G = \frac{F \cdot r^2}{m^2} \Rightarrow \frac{\text{kgms}^{-2} \times \text{m}^2}{\text{kg}^2}$$

$$\Rightarrow \frac{\text{kg}^{-1} \text{m}^3 \text{s}^{-2}}{\text{SI. for.}}$$

$$\Rightarrow M^{-1} L^3 T^{-2}$$



If E And G Respectively Denote Energy And Gravitational Constant, Then E/G Has The

Dimensions

↳ पूरा - physics (Foundation - Base)

यदि E और G क्रमशः ऊर्जा और गुरुत्वाकर्षण स्थिरांक को दर्शाते हैं, तो E/G के आयाम हैं

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

$$E = M \cancel{L^2} \cancel{T^{-2}}$$

$$G = M^{-1} \cancel{L^3} \cancel{T^{-2}}$$

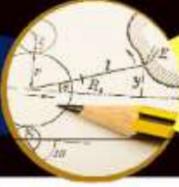


$$M^2 L^{-1} T^0$$

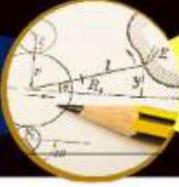
2. $[M^2] [L^{-1}] [T^0]$

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

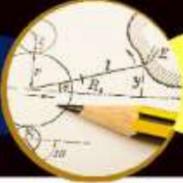
4. $[M] [L^0] [T^0]$



<i>top 30</i> S. No.	Physical Quantity (भौतिक राशि)	Formula (सूत्र)	SI Unit (एस.आई. इकाई)	Dimensional Formula (आयामी सूत्र)
1	Area (क्षेत्रफल)	$A = l \times b$	m^2	$[M^0 L^2 T^0]$
2	Volume (आयतन)	$V = l \times b \times h$	m^3	$[M^0 L^3 T^0]$
3	Speed/Velocity (वेग/चाल)	$v = d/t$	m/s	$[M^0 L^1 T^{-1}]$
4	Acceleration (त्वरण)	$a = v/t$	m/s^2	$[M^0 L^1 T^{-2}]$
5	Force (बल)	$F = ma$	$N (kg \cdot m/s^2)$	$[M^1 L^1 T^{-2}]$
6	Momentum (संवेग)	$p = mv$	$kg \cdot m/s$ <i>Same</i>	$[M^1 L^1 T^{-1}]$
7	Impulse (आवेग)	$J = Ft$	Ns	$[M^1 L^1 T^{-1}]$
8	Work (कार्य)	$W = F \cdot d$	$joule (J)$ <i>Same</i>	$[M^1 L^2 T^{-2}]$
9	Energy (ऊर्जा)	$E = W$	$joule (J)$	$[M^1 L^2 T^{-2}]$
10	Power (शक्ति)	$P = W/t$	$watt (W)$	$[M^1 L^2 T^{-3}]$



11	Pressure (दाब)	$P = F/A$	pascal (Pa)	$[M^1 L^{-1} T^{-2}]$
12	Density (घनत्व)	$\rho = M/V$	kg/m ³	$[M^1 L^{-3} T^0]$
13	Gravitational Constant (गुरुत्वाकर्षण स्थिरांक)	$F = G \frac{m_1 m_2}{r^2}$	N·m ² /kg ²	$[M^{-1} L^3 T^{-2}]$
14	✓ Universal Gas Constant (R)	$PV = nRT$	J/mol·K	$[M^1 L^2 T^{-2} K^{-1}]$
15	Boltzmann Constant (k)	$E = kT$	J/K	$[M^1 L^2 T^{-2} K^{-1}]$
16	Stefan's Constant (σ)	$E = \sigma T^4$	W/m ² ·K ⁴	$[M^1 T^{-3} K^{-4}]$
17	Surface Tension (पृष्ठ तनाव)	$T = F/L$	N/m	$[M^1 T^{-2}]$
18	Angular Velocity (कोणीय वेग)	$\omega = \theta/t$	rad/s	$[M^0 L^0 T^{-1}]$
19	Angular Acceleration (कोणीय त्वरण)	$\alpha = \omega/t$	rad/s ²	$[M^0 L^0 T^{-2}]$
20	Torque (आघूर्ण)	$\tau = F \cdot r$	N·m	$[M^1 L^2 T^{-2}]$



$$\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{MLT^{-2}}{L^2} = \boxed{ML^{-1}T^{-2}}$$

दाब

$$\left(P + \frac{an^2}{V^2}\right) (V - nb) = nRT$$

Gas Const.

$$\boxed{PV = nRT}$$

P → Pressure

V → Volume

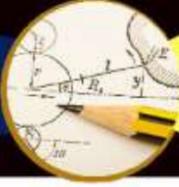
R → ?

T = Temp

$$R = \frac{PV}{nT} \Rightarrow \frac{ML^{-1}T^{-2} \times L^3}{[n] \cdot K}$$

↓
①

$$\Rightarrow \boxed{ML^2T^{-2} N^{-1}K^{-1}}$$



Q- Find the Dimensions of Latent Heat and Specific Heat

Question

गुप्त ऊष्मा और विशिष्ट ऊष्मा के आयाम ज्ञात करें।

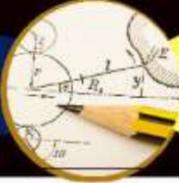
Latent Heat (L) = $\frac{Q}{m}$ Heat = ऊर्जा

$$= \frac{ML^2T^{-2}}{m} = L^2T^{-2}$$

Specific Heat = C विशिष्ट ऊष्मा

$$Q = mc\Delta T \quad C = \frac{Q}{m\Delta T} = \frac{ML^2T^{-2}}{m \cdot K}$$

$$\Rightarrow L^2T^{-2}K^{-1}$$



21	Stress (तनाव)	$\sigma = F/A$	N/m ²	[M ¹ L ⁻¹ T ⁻²]
22	अपूर्वनाक Strain (विकृति)	$\Delta l/l$	No unit	[M ⁰ L ⁰ T ⁰]
23	Elastic Modulus (लोचांक)	$E = \text{Stress/Strain}$	N/m ²	[M ¹ L ⁻¹ T ⁻²]
24	Viscosity (साँद्रता)	$\eta = \text{stress/strain rate}$	Pa·s	[M ¹ L ⁻¹ T ⁻¹]
25	Heat (ऊष्मा)	$Q = mc\Delta T$	joule (J)	[M ¹ L ² T ⁻²]
26	Specific Heat (विशिष्ट ऊष्मा)	$c = Q/m\Delta T$	J/kg·K	[M ⁰ L ² T ⁻² K ⁻¹]
27	Entropy (एंट्रॉपी)	$S = Q/T$	J/K	[M ¹ L ² T ⁻² K ⁻¹]
28	Latent Heat (गुप्त ऊष्मा)	$L = Q/m$	J/kg	[M ⁰ L ² T ⁻²]
29	Electric Charge (विद्युत आवेश)	$q = I \cdot t$	coulomb (C)	[A ¹ T ¹]
30	Electric Potential (विद्युत विभव)	$V = W/q$	volt (V)	[M ¹ L ² T ⁻³ A ⁻¹]

THANKS FOR WATCHING