CHAPTER

01

Units, Dimensions & Measurement

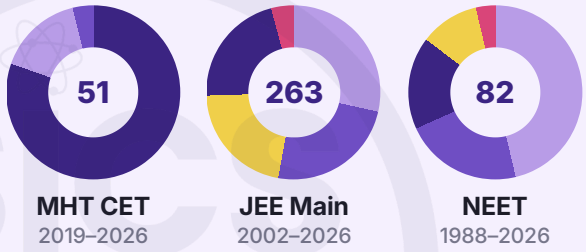
MHT CET · JEE · NEET Physics

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EXAM WEIGHTAGE



	CET	JEE	NEET
Units & Dimensions	8 16%	75 29%	38 46%
Errors in Measurement	41 80%	56 21%	14 17%
Applications of Dimensional Analysis	2 4%	64 24%	18 22%
Least Count, Vernier Callipers & Screw Gauge	0 0%	57 22%	9 11%
Significant Figures & Order of Magnitude	0 0%	11 4%	3 4%

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01 CONCEPT Units & Dimensions

IN ONE LINE

Every physical quantity is **number × unit**. Its dimensions tell how it is built from M, L, T, A, K, mol and cd.

1.1.1 Physical quantity

$$Q = n\,u$$

$$n_1u_1 = n_2u_2$$

- n = numerical value, u = unit. A bigger unit gives a smaller number: $n \propto \frac{1}{u}$.
- Fundamental quantities do not depend on others; derived quantities are built from them.
- Ratio quantities (relative density, refractive index, strain) have no unit.

1.1.2 SI base units

Quantity	Unit	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

- Supplementary: radian (plane angle) and steradian (solid angle). Angles have units but no dimensions.
- CGS: cm, g, s. MKS: m, kg, s. FPS: foot, pound, second.

1.1.3 Prefixes

Power	Prefix	Power	Prefix
10^{18}	exa (E)	10^{-1}	deci (d)
10^{15}	peta (P)	10^{-2}	centi (c)
10^{12}	tera (T)	10^{-3}	milli (m)
10^{9}	giga (G)	10^{-6}	micro (μ)
10^{6}	mega (M)	10^{-9}	nano (n)
10^{3}	kilo (k)	10^{-12}	pico (p)
10^{2}	hecto (h)	10^{-15}	femto (f)

1.1.4 Practical units

Unit	Value
1 fermi	10^{-15} m
1 Å	10^{-10} m
1 AU	1.5×10^{11} m
1 light year	9.46×10^{15} m
1 parsec	3.26 ly = 3.08×10^{16} m
1 amu	1.66×10^{-27} kg
1 eV	1.6×10^{-19} J
1 kWh	3.6×10^{6} J
1 atm	1.013×10^{5} N m^{-2}

- 1′ (minute of arc) = $\frac{\pi}{180 \times 60}$ rad ≈ 2.91×10^{-4} rad.
- Light year and parsec measure distance, not time.

1.1.5 Dimensions and dimensional formula

- Dimensions = the powers to which M, L, T (and A, K) are raised to build a quantity.
- Force = mass × acceleration ⇒ [F] = [MLT^{-2}].
- Pure numbers, angles, strain, refractive index: dimensionless [M^{0}L^{0}T^0].

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1.1.6 Dimensions of common quantities

Quantity	Dimensions
velocity	$[LT^{-1}]$
acceleration, g	$[LT^{-2}]$
force, weight	$[MLT^{-2}]$
momentum, impulse	$[MLT^{-1}]$
work, energy, torque	$[ML^2T^{-2}]$
power	$[ML^2T^{-3}]$
pressure, stress, Y	$[ML^{-1}T^{-2}]$
surface tension, spring constant	$[MT^{-2}]$
viscosity η	$[ML^{-1}T^{-1}]$
angular momentum, h	$[ML^2T^{-1}]$
moment of inertia	$[ML^2]$
G	$[M^{-1}L^3T^{-2}]$
latent heat	$[L^2T^{-2}]$
specific heat	$[L^2T^{-2}K^{-1}]$
gas constant R, k	$[ML^2T^{-2}K^{-1}]$
Stefan σ	$[MT^{-3}K^{-4}]$
Wien b	$[LK]$
frequency, ω, velocity gradient	$[T^{-1}]$

1.1.7 Quantities with the same dimensions

- Work, energy, torque: $[ML^2T^{-2}]$.
- Pressure, stress, Young's modulus, energy density: $[ML^{-1}T^{-2}]$.
- Planck's constant and angular momentum: $[ML^2T^{-1}]$.
- Impulse and momentum: $[MLT^{-1}]$.
- Frequency, angular velocity, velocity gradient, decay constant: $[T^{-1}]$. $\sqrt{\frac{l}{g}}, \sqrt{\frac{m}{k}}$: $[T]$.

JEE · NEET Corner

Electrical and magnetic quantities

Quantity	Dimensions
charge q	$[AT]$
potential V	$[ML^2T^{-3}A^{-1}]$
resistance R	$[ML^2T^{-3}A^{-2}]$
capacitance C	$[M^{-1}L^{-2}T^4A^2]$
inductance L	$[ML^2T^{-2}A^{-2}]$
magnetic field B	$[MT^{-2}A^{-1}]$
magnetic flux φ	$[ML^2T^{-2}A^{-1}]$
ε_0	$[M^{-1}L^{-3}T^4A^2]$
μ_0	$[MLT^{-2}A^{-2}]$

- Time: RC, $\frac{L}{R}$, $\sqrt{(LC)}$. Speed: $\frac{1}{\sqrt{\mu_0\varepsilon_0}} = c$.
- $\frac{E}{B}$ = velocity; $\frac{\mu_0}{\varepsilon_0} = R^2$; $\frac{B^2}{2\mu_0}$ and $\frac{1}{2}\varepsilon_0 E^2$ = energy density.

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Solved Examples 01 Units & Dimensions

SOLVED 1 MHT CET 2026 · 13 Apr · Shift 1

According to Boyle's law, the product PV remains constant. The SI unit of PV is the same as that of

(a) momentum (b) energy
(c) force (d) impulse

STEP 1 $P = N\,m^{-2}$, $V = m^3$
STEP 2 $PV = N\,m^{-2} \times m^3 = N\,m$
STEP 3 N m = joule ⇒ **energy**

Answer: **(b)**

SOLVED 2 MHT CET 2025 · 19 Apr · Shift 2

If L is the inductance and R is the resistance, then the SI unit of $\frac{L}{R}$ is

(a) second (b) volt
(c) ampere (d) per second

STEP 1 $\frac{L}{R}$ is the time constant of an L–R circuit
STEP 2 $[L] = [ML^2T^{-2}A^{-2}]$, $[R] = [ML^2T^{-3}A^{-2}]$
STEP 3 $\frac{L}{R} = [T]$ ⇒ **second**

Answer: **(a)**

SOLVED 3 NEET 2020 · Phase 2

The angle of 1′ (minute of arc) in radian is nearly equal to

(a) 1.75×10^{-2} rad (b) 2.91×10^{-4} rad
(c) 4.85×10^{-4} rad (d) 4.80×10^{-6} rad

STEP 1 $1° = \frac{\pi}{180}$ rad and $1' = \frac{1}{60}°$
STEP 2 $1' = \frac{3.1416}{180 \times 60}$ rad
STEP 3 = **2.91×10^{-4} rad**

Answer: **(b)**

SOLVED 4 NEET 2020 · Phase 1

The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly

(a) 0.6 (b) 0.06
(c) 0.006 (d) 6

STEP 1 1 eV = 1.6×10^{-19} J
STEP 2 $E = \frac{10^{-20}}{1.6 \times 10^{-19}}$ eV
STEP 3 = 0.0625 ≈ **0.06 eV**

Answer: **(b)**

SOLVED 5 JEE Main 2021 · 27 Aug · Shift 1

If E and H represent the intensity of electric field and magnetising field respectively, then the unit of $\frac{E}{H}$ will be

(a) ohm (b) mho
(c) joule (d) newton

STEP 1 Unit of E = V m^{-1}; unit of H = A m^{-1}
STEP 2 $\frac{E}{H} = \frac{V\,m^{-1}}{A\,m^{-1}} = \frac{V}{A}$
STEP 3 V ÷ A = **ohm**

Answer: **(a)**

SOLVED 6 MHT CET 2020 · 19 Oct · Shift 2

Let $x = \pi R\left(\frac{P^2 - Q^2}{2}\right)$, where P, Q and R are lengths. The physical quantity x is

(a) area (b) length
(c) volume (d) velocity

STEP 1 $P^2 - Q^2$ has dimension $[L^2]$
STEP 2 $x = R \times [L^2] = [L^3]$
STEP 3 $[L^3]$ ⇒ **volume**

Answer: **(c)**

SOLVED 7 MHT CET 2019 · 3 May · Shift 1

$[L^2M^1T^{-2}]$ are the dimensions of

(a) torque (b) force
(c) angular acceleration (d) angular momentum

STEP 1 Torque = force × distance
STEP 2 = $[MLT^{-2}] \times [L]$
STEP 3 = $[ML^2T^{-2}]$ ⇒ **torque**

Answer: **(a)**

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Solved Examples 01 Units & Dimensions (contd.)

SOLVED 8 MHT CET 2019 · 2 May · Shift 2

The dimensions of self or mutual inductance are given as

(a) $[L^{-2}M^{1}T^{-2}I^{-2}]$ (b) $[L^{2}M^{2}T^{-2}I^{-2}]$
(c) $[L^{2}M^{1}T^{-2}I^{-2}]$ (d) $[L^{2}M^{2}T^{-2}I^{-2}]$

STEP 1 Energy stored $U = \frac{1}{2}LI^2 \Rightarrow L = \frac{2U}{I^2}$
STEP 2 $[L] = \frac{[ML^2T^{-2}]}{[I^2]}$
STEP 3 $= \mathbf{[L^{2}M^{1}T^{-2}I^{-2}]}$

Answer: **(c)**

SOLVED 9 MHT CET 2019 · 2 May · Shift 2

The ratio of the dimensions of Planck's constant to that of moment of inertia is the dimensions of

(a) angular momentum (b) velocity
(c) frequency (d) time

STEP 1 $[h] = [ML^2T^{-1}]$, $[I] = [ML^2]$
STEP 2 $\frac{[h]}{[I]} = [T^{-1}]$
STEP 3 $[T^{-1}] \Rightarrow$ **frequency**

Answer: **(c)**

SOLVED 10 MHT CET 2019 · 2 May · Shift 1

Dimensions of gyromagnetic ratio are

(a) $[L^{1}M^{0}T^{1}I^{1}]$ (b) $[L^{0}M^{-1}T^{1}I^{1}]$
(c) $[L^{1}M^{0}T^{0}I^{-1}]$ (d) $[L^{-1}M^{0}T^{1}I^{1}]$

STEP 1 Gyromagnetic ratio $= \frac{\text{magnetic moment}}{\text{angular momentum}} = \frac{q}{2m}$
STEP 2 $= \frac{[IT]}{[M]}$
STEP 3 $= \mathbf{[L^{0}M^{-1}T^{1}I^{1}]}$

Answer: **(b)**

SOLVED 11 MHT CET 2020 · 19 Oct · Shift 2

Let σ and b be Stefan's constant and Wien's constant respectively. Then the dimensions of σb are

(a) $[L^{1}M^{-1}T^{-3}K^{-3}]$ (b) $[L^{1}M^{1}T^{3}K^{-3}]$
(c) $[L^{-1}M^{1}T^{-3}K^{-3}]$ (d) $[L^{1}M^{1}T^{-3}K^{-3}]$

STEP 1 $E = \sigma T^4$ (power per area) $\Rightarrow [\sigma] = [MT^{-3}K^{-4}]$
STEP 2 $\lambda_m T = b \Rightarrow [b] = [LK]$
STEP 3 $[\sigma b] = \mathbf{[L^{1}M^{1}T^{-3}K^{-3}]}$

Answer: **(d)**

SOLVED 12 NEET 2022 · Phase 1

Plane angle and solid angle have

(a) units but no dimensions
(b) dimensions but no units
(c) no units and no dimensions
(d) both units and dimensions

STEP 1 Angle = arc ÷ radius; solid angle = area ÷ r^2
STEP 2 Both are ratios of like quantities ⇒ dimensionless
STEP 3 They still carry units (rad, sr) ⇒ **units but no dimensions**

Answer: **(a)**

SOLVED 13 AIPMT 2004

The dimensions of the universal gravitational constant are

(a) $[M^{-1}L^{3}T^{-2}]$ (b) $[ML^{2}T^{-1}]$
(c) $[M^{-2}L^{3}T^{-2}]$ (d) $[M^{-2}L^{2}T^{-1}]$

STEP 1 $F = \frac{Gm_1m_2}{r^2} \Rightarrow G = \frac{Fr^2}{m_1m_2}$
STEP 2 $= \frac{[MLT^{-2}][L^2]}{[M^2]}$
STEP 3 $= \mathbf{[M^{-1}L^{3}T^{-2}]}$

Answer: **(a)**

SOLVED 14 JEE Main 2024 · 9 Apr · Shift 1

The dimensional formula of latent heat is

(a) $[M^{0}LT^{-2}]$ (b) $[MLT^{-2}]$
(c) $[M^{0}L^{2}T^{-2}]$ (d) $[ML^{2}T^{-2}]$

STEP 1 $L = \frac{Q}{m}$ (heat per unit mass)
STEP 2 $= \frac{[ML^2T^{-2}]}{[M]}$
STEP 3 $= \mathbf{[M^{0}L^{2}T^{-2}]}$

Answer: **(c)**

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02 CONCEPT Applications of Dimensional Analysis

IN ONE LINE
Every term of a correct equation has the **same dimensions**. Use it to find constants, convert units and guess formulas.

1.2.1 Principle of homogeneity

- Only like quantities can be added or subtracted.
- So every term on both sides of an equation has the same dimensions.
- A dimensionally correct equation may still be wrong (a missing ½ or 2π cannot be seen).

1.2.2 Dimensions of constants in an equation

- $v = at + \frac{b}{t + c}$: c adds to t ⇒ [c] = [T]; at is a velocity ⇒ [a] = [LT^{-2}]; [b] = [L].
- Van der Waals: $(P + \frac{a}{V^2})(V - b) = RT$ ⇒ [a] = [PV^2] = [ML^5T^{-2}], [b] = [L^3].
- The argument of sin, cos, log and e^x is dimensionless.

1.2.3 Conversion of units

$$n_2 = n_1 \left[\frac{M_1}{M_2}\right]^a \left[\frac{L_1}{L_2}\right]^b \left[\frac{T_1}{T_2}\right]^c$$

- For a quantity of dimensions [$M^aL^bT^c$]; system 1 is known, system 2 is new.
- 1 N = 10^5 dyne; 1 J = 10^7 erg.
- G = 6.67 × 10^{-8} CGS = 6.67 × 10^{-11} SI.

1.2.4 Deriving a relation

- Assume the quantity ∝ product of powers of the quantities it depends on.
- Put in dimensions and equate the powers of M, L and T.

$$T = k\, m^x l^y g^z \Rightarrow x = 0,\ y = \frac{1}{2},\ z = -\frac{1}{2}$$

$$T = 2\pi\sqrt{\frac{l}{g}}$$

- Stokes' law the same way: $F = k\,\eta^x r^y v^z \Rightarrow x = y = z = 1$, $F = 6\pi\eta r v$.

1.2.5 Other quantities as base

- If F, V, T (or any three) are chosen as base: write each of M, L, T in terms of them, then substitute.
- Mass = [$FV^{-1}T$], length = [VT] with F, V, T as base.

1.2.6 Limitations

- Cannot find dimensionless constants (½, 2π).
- Cannot derive sums, or formulas with sin, log or e^x.
- Fails if the quantity depends on more than three others.
- Same dimensions do not fix the quantity: [ML^2T^{-2}] may be work or torque.

JEE · NEET Corner

Constants in exponents and trig functions

- In $e^{-\alpha t}$, sin(kx − ωt), log(x) the argument must be dimensionless.
- So [α] = [T^{-1}], [k] = [L^{-1}], [ω] = [T^{-1}].
- In $F = a\,e^{-bx}$: [a] = [F] and [b] = [L^{-1}].

New base quantities

- Write the asked quantity as $F^aV^bT^c$ (or with the given base set).
- Equate the powers of M, L, T and solve.
- With F, V, T as base: mass = [$FV^{-1}T$], length = [VT].
- Planck length = $\sqrt{\frac{hG}{c^3}}$, Planck time = $\sqrt{\frac{hG}{c^5}}$.

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PHYSICS CIRCLE

UNITS, DIMENSIONS & MEASUREMENT

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

204	18	5
questions	concepts	topics

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01	Units & Dimensions	Q 1–91	91 Qs
02	Applications of Dimensional Analysis	Q 92–141	50 Qs
03	Significant Figures & Order of Magnitude	Q 142–151	10 Qs
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	Answer key		

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TOPIC 01

Units & Dimensions

91 PYQs · Easy 91 · Medium 0 · Difficult 0 | MHT CET 8 · NEET 36 · JEE 47

Concepts covered: Physical quantities & SI units (13) · Dimensional formula of a quantity (54) · Same dimensions & dimensionless (17) · Match-the-dimension lists (7)

LEVEL 1 · EASY 91 questions

◆ Physical quantities & SI units 13 Qs

1. According to Boyle's law, the product PV remains constant. The SI unit of PV is same as that of
MHT CET 2026 · 13 APR · SHIFT 1
(a) momentum (b) energy (c) force (d) impulse

2. If L is the inductance and R is the resistance then the SI unit of $\frac{L}{R}$ is
MHT CET 2025 · 19 APR · SHIFT 2
(a) second (b) volt
(c) ampere (d) per second

3. The angle of 1′ (minute of arc) in radian is nearly equal to
NEET 2020 · PHASE 2
(a) 1.75×10^{-2} rad (b) 2.91×10^{-4} rad
(c) 4.85×10^{-4} rad (d) 4.80×10^{-6} rad

4. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly:
NEET 2020 · PHASE 1
(a) 0.6 (b) 0.06 (c) 0.006 (d) 6

5. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are
AIPMT 2012 · PRELIMS
(a) kg m s^{-1} (b) kg m s^{-2}
(c) kg s^{-1} (d) kg s

6. The unit of permittivity of free space, ε_0, is
AIPMT 2004
(a) coulomb/newton-metre
(b) newton-metre^2/coulomb^2
(c) coulomb^2/newton-metre^2
(d) coulomb^2/(newton-metre)^2

7. If $x = at + bt^2$, where x is the distance travelled by the body in kilometers while t is the time in seconds, then the units of b is
AIPMT 1989
(a) km/s (b) km s (c) km/s^2 (d) km s^2

8. If ϵ, E and t represent the free space permittivity, electric field and time respectively, then the unit of $\frac{\epsilon E}{t}$ will be:
JEE MAIN 2026 · 22 JAN · SHIFT 2
(a) Am (b) A/m (c) A/m^2 (d) Am^2

9. Which one of the following is the correct dimensional formula for the capacitance in F? M, L, T and C stand for unit of mass, length, time and charge respectively.
JEE MAIN 2025 · 22 JAN · SHIFT 2
(a) $[F] = \left[CM^{-1}L^{-2}T^{2}\right]$
(b) $[F] = \left[C^{2}M^{-2}L^{2}T^{2}\right]$
(c) $[F] = \left[C^{2}M^{-1}L^{-2}T^{2}\right]$
(d) $[F] = \left[CM^{-2}L^{-2}T^{-2}\right]$

10. The SI unit of a physical quantity is pascal-second. The dimensional formula of this quantity will be:
JEE MAIN 2022 · 27 JUN · SHIFT 2
(a) $[ML^{-1}T^{-1}]$ (b) $[ML^{-1}T^{-2}]$
(c) $[ML^{2}T^{-1}]$ (d) $[M^{-1}L^{3}T^{0}]$

11. If E and H represents the intensity of electric field and magnetising field respectively, then the unit of E/H will be:
JEE MAIN 2021 · 27 AUG · SHIFT 1
(a) ohm (b) mho (c) joule (d) newton

12. In SI units, the dimensions of $\sqrt{\frac{\in_0}{\mu_0}}$ is:
JEE MAIN 2019 · 8 APR · SHIFT 1
(a) $A^{-1}TML^3$ (b) $A^2T^3M^{-1}L^{-2}$
(c) $AT^{-3}ML^{3/2}$ (d) $AT^2M^{-1}L^{-1}$

13. Let ℓ, r, C and V represent inductance, resistance, capacitance and voltage, respectively. The dimension of $\frac{\ell}{rCV}$ in SI units will be:
JEE MAIN 2019 · 12 JAN · SHIFT 2
(a) $[A^{-1}]$ (b) [LTA] (c) $[LA^{-2}]$ (d) $[LT^2]$

◆ Dimensional formula of a quantity 54 Qs

14. Let σ and b be Stefan's constant and Wien's constant respectively, then dimensions of σb are
MHT CET 2020 · 19 OCT · SHIFT 2
(a) $\left[L^1M^{-1}T^{-3}K^{-3}\right]$ (b) $\left[L^1M^1T^3K^{-3}\right]$
(c) $\left[L^{-1}M^1T^{-3}K^{-3}\right]$ (d) $\left[L^1M^1T^{-3}K^{-3}\right]$

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15. Let $x = \pi R\left(\frac{P^2-Q^2}{2}\right)$, where P, Q and R are lengths. The physical quantity x is
MHT CET 2020 · 19 OCT · SHIFT 2
(a) area (b) length (c) volume (d) velocity

16. $\left[\mathrm{L^2M^1\,T^{-2}}\right]$ are the dimensions of
MHT CET 2019 · 3 MAY · SHIFT 1
(a) torque (b) force
(c) angular acceleration (d) angular momentum

17. The dimensions of self or mutual inductance are given as
MHT CET 2019 · 2 MAY · SHIFT 2
(a) $\left[L^{-2}M^1T^{-2}I^{-2}\right]$ (b) $\left[L^2M^2T^{-2}I^{-2}\right]$
(c) $\left[L^2M^1T^{-2}I^{-2}\right]$ (d) $\left[L^2M^2T^{-2}I^{-2}\right]$

18. The ratio of the dimensions of Planck's constant to that of moment of inertia is the dimensions of
MHT CET 2019 · 2 MAY · SHIFT 2
(a) angular momentum (b) velocity
(c) frequency (d) time

19. Dimensions of Gyromagnetic ratio are
MHT CET 2019 · 2 MAY · SHIFT 1
(a) $\left[L^1M^0T^1I^1\right]$ (b) $\left[L^0M^{-1}T^1I^1\right]$
(c) $\left[L^1M^0T^0I^{-1}\right]$ (d) $\left[L^{-1}M^0T^1I^1\right]$

20. Consider that σ_s, k_B, b represents Stefan-Boltzmann constant, Boltzmann constant and Wien's displacement law constant, respectively. The dimension of $\sigma_s k_B^{-1} b$ is
RE-NEET 2026
(a) $\left[\mathrm{L^{-1}\,T^{-1}\,K^{-4}}\right]$ (b) $\left[\mathrm{L^{-1}\,T^{-1}\,K^{-2}}\right]$
(c) $\left[\mathrm{L^{-1}\,K^{-2}}\right]$ (d) $\left[\mathrm{L^{-1}\,T^{-1}\,K^{-3}}\right]$

21. The mechanical quantity, which has dimensions of reciprocal of mass $(\mathrm{M^{-1}})$ is:
NEET 2023
(a) angular momentum
(b) coefficient of thermal conductivity
(c) torque
(d) gravitational constant

22. The dimensions $[\mathrm{MLT^{-2}A^{-2}}]$ belong to the
NEET 2022 · PHASE 1
(a) Magnetic flux
(b) Self inductance
(c) Magnetic permeability
(d) Electric permittivity

23. Plane angle and solid angle have
NEET 2022 · PHASE 1
(a) Units but no dimensions
(b) Dimensions but no units
(c) No units and no dimensions
(d) Both units and dimensions

24. If E and G respectively denote energy and gravitational constant, then $\frac{E}{G}$ has the dimensions of:
NEET 2021
(a) $[\mathrm{M^2}]\,[\mathrm{L^{-2}}]\,[\mathrm{T^{-1}}]$ (b) $[\mathrm{M^2}]\,[\mathrm{L^{-1}}]\,[\mathrm{T^0}]$
(c) $[\mathrm{M}]\,[\mathrm{L^{-1}}]\,[\mathrm{T^{-1}}]$ (d) $[\mathrm{M}]\,[\mathrm{L^0}]\,[\mathrm{T^0}]$

25. Dimensions of stress are:
NEET 2020 · PHASE 1
(a) $\left[ML^2T^{-2}\right]$ (b) $\left[ML^0T^{-2}\right]$
(c) $\left[ML^{-1}T^{-2}\right]$ (d) $\left[MLT^{-2}\right]$

26. The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are
AIPMT 2012 · MAINS
(a) $\left[L^{1/2}T^{-1/2}\right]$ (b) $\left[L^{-1}T\right]$
(c) $\left[LT^{-1}\right]$ (d) $\left[L^{1/2}T^{1/2}\right]$

27. The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are
AIPMT 2011 · PRELIMS
(a) $\left[L^{1/2}T^{-1/2}\right]$ (b) $\left[L^{-1}T\right]$
(c) $\left[LT^{-1}\right]$ (d) $\left[L^{1/2}T^{1/2}\right]$

28. If the dimensions of a physical quantity are given by $\mathrm{M^aL^bT^c}$, then the physical quantity will be
AIPMT 2009
(a) velocity if a = 1, b = 0, c = –1
(b) acceleration if a = 1, b = 1, c = – 2
(c) force if a = 0, b = –1, c = –2
(d) pressure if a = 1, b = –1, c = –2

29. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be
AIPMT 2007
(a) $[\mathrm{ML^2T^{-2}}]$ (b) $[\mathrm{ML^2T^{-1}I^{-1}}]$
(c) $[\mathrm{ML^2T^{-3}I^{-2}}]$ (d) $[\mathrm{ML^2T^{-3}I^{-1}}]$

30. The ratio of the dimensions of Planck's constant and that of moment of inertia is the dimensions of
AIPMT 2005
(a) time (b) frequency
(c) angular momentum (d) velocity

31. The dimensions of universal gravitational constant are
AIPMT 2004
(a) $[\mathrm{M^{-1}L^3T^{-2}}]$ (b) $[\mathrm{ML^2T^{-1}}]$
(c) $[\mathrm{M^{-2}L^3T^{-2}}]$ (d) $[\mathrm{M^{-2}L^2T^{-1}}]$

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32. The dimensions of Planck's constant equals to that of
AIPMT 2001
(a) energy (b) momentum
(c) angular momentum (d) power

33. The dimensional formula for magnetic flux is
AIPMT 1999
(a) $[ML^2T^{-2}A^{-1}]$ (b) $[ML^3T^{-2}A^{-2}]$
(c) $[M^0L^{-2}T^2A^{-2}]$ (d) $[ML^2T^{-1}A^2]$

34. The dimensions of impulse are equal to that of
AIPMT 1996
(a) pressure (b) linear momentum
(c) force (d) angular momentum

35. Which of the following is a dimensional constant?
AIPMT 1995
(a) Relative density
(b) Gravitational constant
(c) Refractive index
(d) Poisson ratio

36. The dimensions of RC is
AIPMT 1995
(a) square of time
(b) square of inverse time
(c) time
(d) inverse time

37. The dimensions of universal gravitational constant are
AIPMT 1992
(a) $[M^{-1}L^3T^{-2}]$ (b) $[ML^2T^{-1}]$
(c) $[M^{-2}L^3T^{-2}]$ (d) $[M^{-2}L^2T^{-1}]$

38. The dimensional formula of permeability of free space μ_0 is
AIPMT 1991
(a) $[MLT^{-2}A^{-2}]$ (b) $[M^0L^1T]$
(c) $[M^0L^2T^{-1}A^2]$ (d) none of these

39. Dimensional formula of self inductance is
AIPMT 1989
(a) $[MLT^{-2}A^{-2}]$ (b) $[ML^2T^{-1}A^{-2}]$
(c) $[ML^2T^{-2}A^{-2}]$ (d) $[ML^2T^{-2}A^{-1}]$

40. The dimensional formula of torque is
AIPMT 1989
(a) $[ML^2T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[ML^{-1}T^{-2}]$ (d) $[ML^{-2}T^{-2}]$

41. If C and R denote capacitance and resistance, the dimensional formula of CR is
AIPMT 1988
(a) $[M^0L^0T^1]$
(b) $[M^0L^0T^0]$
(c) $[M^0L^0T^{-1}]$
(d) not expressible in terms of MLT

42. The dimensional formula of angular momentum is
AIPMT 1988
(a) $[ML^2T^{-2}]$ (b) $[ML^{-2}T^{-1}]$
(c) $[MLT^{-1}]$ (d) $[ML^2T^{-1}]$

43. The dimension of $\sqrt{\frac{\mu_0}{\epsilon_0}}$ is equal to that of:
(μ_0 = Vacuum permeability and ϵ_0 = Vacuum permittivity)
JEE MAIN 2025 · 7 APR · SHIFT 2
(a) Voltage (b) Inductance
(c) Resistance (d) Capacitance

44. In an electromagnetic system, a quantity defined as the ratio of electric dipole moment and magnetic dipole moment has dimension of $[M^PL^QT^RA^S]$. The value of P and Q are:
JEE MAIN 2025 · 4 APR · SHIFT 2
(a) $-1, 0$ (b) $0, -1$ (c) $-1, 1$ (d) $1, -1$

45. If μ_0 and ϵ_0 are the permeability and permittivity of free space, respectively, then the dimension of $\left(\frac{1}{\mu_0\epsilon_0}\right)$ is:
JEE MAIN 2025 · 2 APR · SHIFT 2
(a) T^2/L (b) L^2/T^2 (c) T^2/L^2 (d) L/T^2

46. If B is magnetic field and μ_0 is permeability of free space, then the dimensions of (B/μ_0) is
JEE MAIN 2025 · 22 JAN · SHIFT 1
(a) $MT^{-2}A^{-1}$ (b) $L^{-1}A$
(c) $ML^2T^{-2}A^{-1}$ (d) $LT^{-2}A^{-1}$

47. The dimensional formula of latent heat is:
JEE MAIN 2024 · 9 APR · SHIFT 1
(a) $[M^0LT^{-2}]$ (b) $[MLT^{-2}]$
(c) $[M^0L^2T^{-2}]$ (d) $[ML^2T^{-2}]$

48. If ϵ_o is the permittivity of free space and E is the electric field, then $\epsilon_o E^2$ has the dimensions:
JEE MAIN 2024 · 8 APR · SHIFT 2
(a) $[ML^{-1}T^{-2}]$ (b) $[ML^2T^{-2}]$
(c) $[M^0L^{-2}TA]$ (d) $[M^{-1}L^{-3}T^4A^2]$

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49. If G be the gravitational constant and u be the energy density then which of the following quantity have the dimensions as that of the $\sqrt{uG}$:

JEE MAIN 2024 · 5 APR · SHIFT 1

(a) Gravitational potential
(b) pressure gradient per unit mass
(c) Energy per unit mass
(d) Force per unit mass

50. The dimensional formula of angular impulse is:

JEE MAIN 2024 · 1 FEB · SHIFT 1

(a) $[ML^2T^{-2}]$ (b) $[ML^{-2}T^{-1}]$
(c) $[ML^2T^{-1}]$ (d) $[MLT^{-1}]$

51. Dimension of $\frac{1}{\mu_0\epsilon_0}$ should be equal to

JEE MAIN 2023 · 8 APR · SHIFT 1

(a) T^2/L^2 (b) T/L (c) L^2/T^2 (d) L/T

52. The dimensions of $\left(\frac{B^2}{\mu_0}\right)$ will be:

(if μ_0: permeability of free space and B: magnetic field)

JEE MAIN 2022 · 28 JUL · SHIFT 1

(a) $[ML^2T^{-2}]$ (b) $[MLT^{-2}]$
(c) $[ML^{-1}T^{-2}]$ (d) $[ML^2T^{-2}A^{-1}]$

53. The dimension of mutual inductance is:

JEE MAIN 2022 · 26 JUN · SHIFT 2

(a) $[ML^2T^{-2}A^{-1}]$ (b) $[ML^2T^{-3}A^{-1}]$
(c) $[ML^2T^{-2}A^{-2}]$ (d) $[ML^2T^{-3}A^{-2}]$

54. If 'C' and 'V' represent capacitance and voltage respectively then what are the dimensions of λ where C/V = λ?

JEE MAIN 2021 · 26 FEB · SHIFT 2

(a) $[M^{-3}L^{-4}I^3T^7]$ (b) $[M^{-2}L^{-3}I^2T^6]$
(c) $[M^{-2}L^{-4}I^3T^7]$ (d) $[M^{-1}L^{-3}I^{-2}T^{-7}]$

55. If e is the electronic charge, c is the speed of light in free space and h is Planck's constant, the quantity $\frac{1}{4\pi\varepsilon_0}\frac{|e|^2}{hc}$ has dimensions of:

JEE MAIN 2021 · 25 FEB · SHIFT 2

(a) $[MLT^{-1}]$ (b) $[MLT^0]$
(c) $[M^0L^0T^0]$ (d) $[LC^{-1}]$

56. Dimensional formula for thermal conductivity is (here K denotes the temperature):

JEE MAIN 2020 · 4 SEP · SHIFT 1

(a) $MLT^{-3}K^{-1}$ (b) $MLT^{-2}K^{-2}$
(c) $MLT^{-2}K$ (d) $MLT^{-3}K$

57. Amount of solar energy received on the earth's surface per unit area per unit time is defined as solar constant. Dimension of solar constant is:

JEE MAIN 2020 · 3 SEP · SHIFT 2

(a) MLT^{-2} (b) ML^0T^{-3}
(c) $M^2L^0T^{-1}$ (d) ML^2T^{-2}

58. The dimension of $\frac{B^2}{2\mu_0}$, where B is magnetic field and μ_0 is the magnetic permeability of vacuum, is:

JEE MAIN 2020 · 7 JAN · SHIFT 2

(a) ML^2T^{-2} (b) MLT^{-2}
(c) $ML^{-1}T^{-2}$ (d) ML^2T^{-1}

59. In the following 'I' refers to current and other symbols have their usual meaning. Choose the option that corresponds to the dimensions of electrical conductivity:

JEE MAIN 2016 · 9 APR · SHIFT 1

(a) $ML^{-3}T^{-3}I^2$ (b) $M^{-1}L^3T^3I$
(c) $M^{-1}L^{-3}T^3I^2$ (d) $M^{-1}L^{-3}T^3I$

60. In terms of resistance R and time T, the dimensions of ratio $\frac{\mu}{\in}$ of the permeability μ and permittivity $\in$ is:

JEE MAIN 2014 · 11 APR · SHIFT 1

(a) $[RT^{-2}]$ (b) $[R^2T^{-1}]$
(c) $[R^2]$ (d) $[R^2T^2]$

61. The dimensions of angular momentum, latent heat and capacitance are, respectively.

JEE MAIN 2013 · 22 APR · SHIFT 1

(a) $ML^2T^1A^2$, L^2T^{-2}, $M^{-1}L^{-2}T^2$
(b) ML^2T^{-2}, L^2T^2, $M^{-1}L^{-2}T^4A^2$
(c) ML^2T^{-1}, L^2T^{-2}, ML^2TA^2
(d) ML^2T^{-1}, L^2T^{-2}, $M^{-1}L^{-2}T^4A^2$

62. Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of vacuum. If M = mass, L = length, T = time and A = electric current, then:

JEE MAIN 2013

(a) $\varepsilon_0 = [M^{-1}L^{-3}T^2A]$ (b) $\varepsilon_0 = [M^{-1}L^{-3}T^4A^2]$
(c) $\varepsilon_0 = [M^1L^2T^1A^2]$ (d) $\varepsilon_0 = [M^1L^2T^1A]$

63. The dimension of magnetic field in M, L, T and C (coulomb) is given as

AIEEE 2008

(a) $MLT^{-1}C^{-1}$ (b) MT^2C^{-2}
(c) $MT^{-1}C^{-1}$ (d) $MT^{-2}C^{-1}$

64. Which of the following units denotes the dimension $\frac{ML^2}{Q^2}$, where Q denotes the electric charge?

AIEEE 2006

(a) Wb/m^2 (b) Henry (H)
(c) H/m^2 (d) Weber (Wb)

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65. Which one of the following represents the correct dimensions of the coefficient of viscosity?
AIEEE 2004
(a) $ML^{-1}T^{-1}$ (b) MLT^{-1}
(c) $ML^{-1}T^{-2}$ (d) $ML^{-2}T^{-2}$

66. Dimensions of $\frac{1}{\mu_0\varepsilon_0}$, where symbols have their usual meaning, are
AIEEE 2003
(a) $[L^{-1}T]$ (b) $[L^{-2}T^2]$
(c) $[L^2T^{-2}]$ (d) $[LT^{-1}]$

67. Identify the pair whose dimensions are equal
AIEEE 2002
(a) torque and work (b) stress and energy
(c) force and stress (d) force and work

◆ Same dimensions & dimensionless 17 Qs

68. The quantities which have the same dimensions as those of solid angle are:
NEET 2024
(a) strain and angle
(b) stress and angle
(c) strain and arc
(d) angular speed and stress

69. The physical quantity that has the same dimensional formula as pressure is
NEET 2022 · PHASE 2
(a) Coefficient of viscosity
(b) Force
(c) Momentum
(d) Young's modulus of elasticity

70. The pair of quantities having same dimensions is
NEET 2013
(a) Impulse and Surface Tension
(b) Angular momentum and Work
(c) Work and Torque
(d) Young's modulus and Energy

71. Which pair do not have equal dimensions?
AIPMT 2000
(a) Energy and torque
(b) Force and impulse
(c) Angular momentum and Planck constant
(d) Elastic modulus and pressure.

72. Which of the following dimensions will be the same as that of time?
AIPMT 1996
(a) $\frac{L}{R}$ (b) $\frac{C}{L}$ (c) LC (d) $\frac{R}{L}$

73. Which of the following has the dimensions of pressure?
AIPMT 1994
(a) $[MLT^{-2}]$ (b) $[ML^{-1}T^{-2}]$
(c) $[ML^{-2}T^{-2}]$ (d) $[M^{-1}L^{-1}]$

74. Which of the following has the dimensions of pressure?
AIPMT 1990
(a) $[MLT^{-2}]$ (b) $[ML^{-1}T^{-2}]$
(c) $[ML^{-2}T^{-2}]$ (d) $[M^{-1}L^{-1}]$

75. Of the following quantities, which one has dimensions different from the remaining three?
AIPMT 1989
(a) Energy per unit volume
(b) Force per unit area
(c) Product of voltage and charge per unit volume
(d) Angular momentum

76. Given a charge q, current I and permeability of vacuum μ_o. Which of the following quantity has the dimension of momentum?
JEE MAIN 2025 · 2 APR · SHIFT 2
(a) qI/μ_o (b) $q^2\mu_o I$ (c) $q\mu_0/I$ (d) $q\mu_o I$

77. The pair of physical quantities not having the same dimensions is:
JEE MAIN 2025 · 29 JAN · SHIFT 1
(a) Angular momentum and Planck's constant
(b) Torque and energy
(c) Surface tension and impulse
(d) Pressure and Young's modulus

78. Which of the following physical quantities have the same dimensions?
JEE MAIN 2022 · 25 JUL · SHIFT 1
(a) Electric displacement $(\vec{D})$ and surface charge density
(b) Displacement current and electric field
(c) Current density and surface charge density
(d) Electric potential and energy

79. Identify the pair of physical quantities that have same dimensions:
JEE MAIN 2022 · 24 JUN · SHIFT 2
(a) velocity gradient and decay constant
(b) Wien's constant and Stefan constant
(c) angular frequency and angular momentum
(d) wave number and Avogadro number

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80. Identify the pair of physical quantities which have different dimensions:

JEE MAIN 2022 · 24 JUN · SHIFT 1

(a) Wave number and Rydberg's constant
(b) Stress and Coefficient of elasticity
(c) Coercivity and Magnetisation
(d) Specific heat capacity and Latent heat

81. Which of the following is not a dimensionless quantity?

JEE MAIN 2021 · 27 AUG · SHIFT 1

(a) Relative magnetic permeability (μ_r)
(b) Power factor
(c) Permeability of free space (μ_0)
(d) Quality factor

82. Which of the following combinations has the dimension of electrical resistance ($\in_0$ is the permittivity of vacuum and μ_0 is the permeability of vacuum)?

JEE MAIN 2019 · 12 APR · SHIFT 1

(a) $\sqrt{\frac{\in_0}{\mu_0}}$ (b) $\frac{\in_0}{\mu_0}$ (c) $\sqrt{\frac{\mu_0}{\in_0}}$ (d) $\frac{\mu_0}{\in_0}$

83. Out of the following pair, which one does NOT have identical dimensions is

AIEEE 2005

(a) angular momentum and Planck's constant
(b) impulse and momentum
(c) moment of inertia and moment of a force
(d) work and torque

84. The physical quantities not having same dimensions are

AIEEE 2003

(a) torque and work
(b) momentum and Planck's constant
(c) stress and Young's modulus
(d) speed and $(\mu_0\varepsilon_0)^{-1/2}$

◆ Match-the-dimension lists 7 Qs

85. Match List - I with List - II.

List - I	List - II
(A) Mass density	(I) $[ML^2T^{-3}]$
(B) Impulse	(II) $[MLT^{-1}]$
(C) Power	(III) $[ML^2T^0]$
(D) Moment of inertia	(IV) $[ML^{-3}T^0]$

Choose the correct answer from the options given below:

JEE MAIN 2025 · 7 APR · SHIFT 2

(a) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(b) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(c) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(d) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

86. Match List I with List II.

List - I		List - II	
(A)	Coefficient of viscosity	(I)	$[ML^0T^{-3}]$
(B)	Intensity of wave	(II)	$[ML^{-2}T^{-2}]$
(C)	Pressure gradient	(III)	$[M^{-1}LT^2]$
(D)	Compressibility	(IV)	$[ML^{-1}T^{-1}]$

Choose the correct answer from the options given below:

JEE MAIN 2025 · 2 APR · SHIFT 1

(a) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(b) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
(c) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(d) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

87. Match List - I with List - II.

List - I	List - II
(A) Young's Modulus	(I) $M L^{-1} T^{-1}$
(B) Torque	(II) $M L^{-1} T^{-2}$
(C) Coefficient of Viscosity	(III) $M^{-1} L^3 T^{-2}$
(D) Gravitational Constant	(IV) $M L^2 T^{-2}$

Choose the correct answer from the options given below:

JEE MAIN 2025 · 29 JAN · SHIFT 2

(a) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(b) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(c) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(d) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

88. Match List - I with List - II.

List - I	List - II
(A) Angular Impulse	(I) $M^0 L^2 T^{-2}$
(B) Latent Heat	(II) $M L^2 T^{-3} A^{-1}$
(C) Electrical resistivity	(III) $M L^2 T^{-1}$
(D) Electromotive force	(IV) $M L^3 T^{-3} A^{-2}$

Choose the correct answer from the options given below:

JEE MAIN 2025 · 28 JAN · SHIFT 2

(a) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(b) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
(c) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(d) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)

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89. Match List - I with List - II

	List - I		List - II
(A)	Permeability of free space	(I)	$\left[ML^2\ T^{-2}\right]$
(B)	Magnetic field	(II)	$\left[MT^{-2}\ A^{-1}\right]$
(C)	Magnetic moment	(III)	$\left[MLT^{-2}\ A^{-2}\right]$
(D)	Torsional constant	(IV)	$\left[L^2\ A\right]$

Choose the correct answer from the options given below:

JEE MAIN 2025 · 23 JAN · SHIFT 2

(a) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)
(b) (A) – (I), (B) – (IV), (C) – (II), (D) – (III)
(c) (A) – (II), (B) – (I), (C) – (III), (D) – (IV)
(d) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

90. Match List I with List II.

	List I		List II
(A)	Coefficient of viscosity	(I)	$\left[ML^2\ T^{-2}\right]$
(B)	Surface tension	(II)	$\left[ML^2\ T^{-1}\right]$
(C)	Angular momentum	(III)	$\left[ML^{-1}\ T^{-1}\right]$
(D)	Rotational kinetic energy	(IV)	$\left[ML^0\ T^{-2}\right]$

Choose the correct answer from the options given below:

JEE MAIN 2024 · 30 JAN · SHIFT 1

(a) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(d) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

91. Match List - I with List - II

	List-I		List-II
(a)	Magnetic Induction	(i)	$ML^2T^{-2}A^{-1}$
(b)	Magnetic Flux	(ii)	$M^0L^{-1}A$
(c)	Magnetic Permeability	(iii)	$MT^{-2}A^{-1}$
(d)	Magnetization	(iv)	$MLT^{-2}A^{-2}$

Choose the most appropriate answer from the options given below:

JEE MAIN 2021 · 26 AUG · SHIFT 2

(a) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)
(b) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)
(c) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)
(d) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

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TOPIC 02

Applications of Dimensional Analysis

50 PYQs · Easy 50 · Medium 0 · Difficult 0 | MHT CET 2 · NEET 11 · JEE 37

Concepts covered: Dimensions of constants in an equation (31) · New base quantities (15) · Conversion of units (1) · Deriving relations by dimensions (3)

LEVEL 1 · EASY 50 questions

◆ Dimensions of constants in an equation 31 Qs

92. Let force $F = A\sin(Ct) + B\cos(Dx)$, where x and t are displacement and time, respectively. The dimensions of $\frac{C}{D}$ are same as dimensions of

MHT CET 2020 · 16 OCT · SHIFT 1

(a) angular velocity (b) velocity
(c) angular momentum (d) velocity gradient

93. The force 'F' acting on a body of density 'd' are related by the relation $F = \frac{y}{\sqrt{d}}$. The dimensions of 'y' are

MHT CET 2019 · 2 MAY · SHIFT 2

(a) $\left[\mathrm{L}^{-\frac{1}{2}}\mathrm{M}^{\frac{3}{2}}\,\mathrm{T}^{-2}\right]$ (b) $\left[L^{-1}M^{\frac{1}{2}}T^{-2}\right]$
(c) $\left[L^{-1}M^{\frac{3}{2}}T^{-2}\right]$ (d) $\left[\mathrm{L}^{-\frac{1}{2}}\mathrm{M}^{\frac{1}{2}}\,\mathrm{T}^{-2}\right]$

94. The potential energy of a particle moving along x-direction varies as $V = \frac{Ax^2}{\sqrt{x}+B}$. The dimensions of $\frac{A^2}{B}$ are:

NEET 2024

(a) $\left[\mathrm{M}^{3/2}\,\mathrm{L}^{1/2}\,\mathrm{T}^{-3}\right]$ (b) $\left[\mathrm{M}^{1/2}\mathrm{LT}^{-3}\right]$
(c) $\left[M^2L^{1/2}T^{-4}\right]$ (d) $\left[\mathrm{ML}^2\,\mathrm{T}^{-4}\right]$

95. A force defined by $F = \alpha t^2 + \beta t$ acts on a particle at a given time t. The factor which is dimensionless, if α and β are constants, is:

NEET 2024

(a) $\beta t/\alpha$ (b) $\alpha t/\beta$ (c) $\alpha\beta t$ (d) $\alpha\beta/t$

96. The dimension of $\frac{1}{2}\varepsilon_0 E^2$, where ε_0 is permittivity of free space and E is electric field, is

AIPMT 2010 · PRELIMS

(a) $\mathrm{ML}^2\mathrm{T}^{-2}$ (b) $\mathrm{ML}^{-1}\mathrm{T}^{-2}$
(c) $\mathrm{ML}^2\mathrm{T}^{-1}$ (d) MLT^{-1}

97. The velocity v of a particle at time t is given by v = at + $\frac{b}{t+c}$, where a, b and c are constants. The dimensions of a, b and c are

AIPMT 2006

(a) [L], [LT] and [LT^{-2}]
(b) [LT^{-2}], [L] and [T]
(c) [L^2], [T] and [LT^{-2}]
(d) [LT^{-2}], and [LT] and [L]

98. An equation is given here $\left(P + \frac{a}{V^2}\right) = b\frac{\theta}{V}$ where P = Pressure, V = Volume and θ = Absolute temperature. If a and b are constants, the dimensions of a will be

AIPMT 1996

(a) $[\mathrm{ML}^{-5}\mathrm{T}^{-1}]$ (b) $[\mathrm{ML}^5\mathrm{T}^1]$
(c) $[\mathrm{ML}^5\mathrm{T}^{-2}]$ (d) $[\mathrm{M}^{-1}\mathrm{L}^5\mathrm{T}^2]$

99. The time dependence of a physical quantity p is given by $p = p_0\exp(-at^2)$, where a is a constant and t is the time. The constant a

AIPMT 1993

(a) is dimensionless (b) has dimensions $[\mathrm{T}^{-2}]$
(c) has dimensions $[\mathrm{T}^2]$ (d) has dimensions of p

100. Consider the equation $H = \frac{x^p\epsilon^q E^r}{t^s}$

Where H = magnetic field intensity; E = electric field, ϵ = permittivity, x = distance, t = time The values of p, q, r and s respectively are:

JEE MAIN 2026 · 8 APR · SHIFT 2

(a) $1, 1, 1, 1$ (b) $-1, 1, 2, 1$
(c) $1, -1, -2, 1$ (d) $-1, -2, -2, 1$

101. The potential energy of a particle changes with distance x from a fixed origin as $V = \frac{A\sqrt{x}}{x+B}$, where A and B are constants with appropriate dimensions. The dimensions of AB are ____

JEE MAIN 2026 · 6 APR · SHIFT 1

(a) $\left[\mathrm{M}^1\,\mathrm{L}^{5/2}\,\mathrm{T}^{-2}\right]$ (b) $\left[\mathrm{M}^{3/2}\,\mathrm{L}^{5/2}\,\mathrm{T}^{-2}\right]$
(c) $\left[\mathrm{M}^1\,\mathrm{L}^2\,\mathrm{T}^{-2}\right]$ (d) $\left[\mathrm{M}^1\,\mathrm{L}^{7/2}\,\mathrm{T}^{-2}\right]$

102. L, C and R represents physical quantities inductance, capacitance and resistance respectively. The dimensional formula $\mathrm{ML}^2\,\mathrm{T}^{-4}\,\mathrm{A}^{-2}$ corresponds to ____.

JEE MAIN 2026 · 5 APR · SHIFT 1

(a) $\frac{R}{\sqrt{LC}}$ (b) $\frac{R}{LC}$ (c) $\frac{C}{\sqrt{LR}}$ (d) $\frac{1}{R}\sqrt{\frac{L}{C}}$

103. The dimensional formula of $\frac{1}{2}\epsilon_0 E^2$ (ϵ_0 = permittivity of vacuum and E = electric field) is $M^aL^bT^c$. The value of $2a - b + c =$ _____.

JEE MAIN 2026 · 2 APR · SHIFT 1

(a) 0 (b) 1 (c) -1 (d) 2

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104. Consider a modified Bernoulli equation.

$\left(\mathrm{P}+\frac{A}{Bt^2}\right)+\rho g(h+Bt)+\frac{1}{2}\rho V^2=$ constant

If t has the dimension of time then the dimensions of A and B are ____, ____ respectively.

JEE MAIN 2026 · 21 JAN · SHIFT 1

(a) $\left[\mathrm{ML^0\,T^{-1}}\right]$ and $\left[\mathrm{M^0LT}\right]$

(b) $\left[\mathrm{ML^0\,T^{-2}}\right]$ and $\left[\mathrm{M^0LT^{-1}}\right]$

(c) $\left[\mathrm{ML^0\,T^{-2}}\right]$ and $\left[\mathrm{M^0LT^{-2}}\right]$

(d) $\left[\mathrm{ML^0\,T^{-1}}\right]$ and $\left[\mathrm{M^0LT^{-1}}\right]$

105. In an electromagnetic system, the quantity representing the ratio of electric flux and magnetic flux has dimension of $M^PL^QT^RA^S$, where value of ' Q ' and ' R ' are

JEE MAIN 2025 · 4 APR · SHIFT 1

(a) $(3,-5)$ (b) $(-2,1)$ (c) $(-2,2)$ (d) $(1,-1)$

106. The equation for real gas is given by $\left(\mathrm{P}+\frac{\mathrm{a}}{\mathrm{V}^2}\right)(\mathrm{V}-\mathrm{b})=\mathrm{RT}$, where P, V, T and R are the pressure, volume, temperature and gas constant, respectively. The dimension of ab^{-2} is equivalent to that of:

JEE MAIN 2025 · 2 APR · SHIFT 1

(a) Compressibility (b) Planck's constant

(c) Energy density (d) Strain

107. The expression given below shows the variation of velocity (v) with time (t),

$v=\mathrm{At}^2+\frac{\mathrm{Bt}}{\mathrm{C}+\mathrm{t}}$.

The dimension of ABC is:

JEE MAIN 2025 · 29 JAN · SHIFT 1

(a) $[\mathrm{M^0L^1T^{-2}}]$ (b) $[\mathrm{M^0L^2T^{-3}}]$

(c) $[\mathrm{M^0L^2T^{-2}}]$ (d) $[\mathrm{M^0L^1T^{-3}}]$

108. The position of a particle moving on x-axis is given by $x(t)=A\sin t+B\cos^2 t+Ct^2+D$, where t is time. The dimension of $\frac{ABC}{D}$ is

JEE MAIN 2025 · 23 JAN · SHIFT 1

(a) L (b) $\mathrm{L^3\,T^{-2}}$ (c) $\mathrm{L^2\,T^{-2}}$ (d) $\mathrm{L^2}$

109. The de-Broglie wavelength associated with a particle of mass m and energy E is $h/\sqrt{2mE}$. The dimensional formula for Planck's constant is:

JEE MAIN 2024 · 9 APR · SHIFT 2

(a) $\left[\mathrm{M^2\,L^2\,T^{-2}}\right]$ (b) $\left[\mathrm{ML^{-1}\,T^{-2}}\right]$

(c) $\left[\mathrm{ML^2\,T^{-1}}\right]$ (d) $\left[\mathrm{MLT^{-2}}\right]$

110. What is the dimensional formula of ab^{-1} in the equation $\left(\mathrm{P}+\frac{\mathrm{a}}{\mathrm{V}^2}\right)(\mathrm{V}-\mathrm{b})=\mathrm{RT}$, where letters have their usual meaning.

JEE MAIN 2024 · 5 APR · SHIFT 2

(a) $[\mathrm{M^6\,L^7\,T^4}]$ (b) $[\mathrm{M^{-1}\,L^5\,T^3}]$

(c) $[\mathrm{M^0\,L^3\,T^{-2}}]$ (d) $[\mathrm{ML^2\,T^{-2}}]$

111. Applying the principle of homogeneity of dimensions, determine which one is correct, where T is time period, G is gravitational constant, M is mass, r is radius of orbit.

JEE MAIN 2024 · 4 APR · SHIFT 2

(a) $T^2=\frac{4\pi^2 r}{GM^2}$ (b) $T^2=4\pi^2 r^3$

(c) $T^2=\frac{4\pi^2 r^3}{GM}$ (d) $T^2=\frac{4\pi^2 r^2}{GM}$

112. The equation of stationary wave is:

$y=2\mathrm{a}\sin\left(\frac{2\pi \mathrm{nt}}{\lambda}\right)\cos\left(\frac{2\pi x}{\lambda}\right)$.

Which of the following is NOT correct:

JEE MAIN 2024 · 4 APR · SHIFT 1

(a) The dimensions of nt is [L]

(b) The dimensions of n is $[\mathrm{LT^{-1}}]$

(c) The dimensions of x is [L]

(d) The dimensions of n/λ is [T]

113. Consider two physical quantities A and B related to each other as $E=\frac{B-x^2}{At}$ where E, x and t have dimensions of energy, length and time respectively. The dimension of AB is

JEE MAIN 2024 · 31 JAN · SHIFT 2

(a) $L^{-2}M^1T^0$ (b) $L^2M^{-1}T^1$

(c) $L^0M^{-1}T^1$ (d) $L^{-2}M^{-1}T^1$

114. A force is represented by $F=ax^2+bt^{\frac{1}{2}}$ where $x=$ distance and $t=$ time. The dimensions of b^2/a are:

JEE MAIN 2024 · 31 JAN · SHIFT 1

(a) $\left[\mathrm{ML^2\,T^{-3}}\right]$ (b) $\left[\mathrm{ML^3\,T^{-3}}\right]$

(c) $\left[MLT^{-2}\right]$ (d) $\left[ML^{-1}T^{-1}\right]$

115. In the equation $\left[X+\frac{a}{Y^2}\right][Y-b]=\mathrm{R}T, X$ is pressure, Y is volume, R is universal gas constant and T is temperature. The physical quantity equivalent to the ratio $\frac{a}{b}$ is:

JEE MAIN 2023 · 13 APR · SHIFT 2

(a) Impulse

(b) Energy

(c) Pressure gradient

(d) Coefficient of viscosity

116. An expression of energy density is given by $u=\frac{\alpha}{\beta}\sin\left(\frac{\alpha x}{kt}\right)$, where α, β are constants, x is displacement, k is Boltzmann constant and t is the temperature. The dimensions of β will be:

JEE MAIN 2022 · 27 JUL · SHIFT 2

(a) $\left[\mathrm{ML^2\,T^{-2}}\theta^{-1}\right]$ (b) $\left[\mathrm{M^0\,L^2\,T^{-2}}\right]$

(c) $\left[\mathrm{M^0\,L^0\,T^0}\right]$ (d) $\left[\mathrm{M^0\,L^2\,T^0}\right]$

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117. In van der Waal equation $\left[P+\frac{a}{V^2}\right][V-b]=RT$; P is pressure, V is volume, R is universal gas constant and T is temperature. The ratio of constants $\frac{a}{b}$ is dimensionally equal to:

JEE MAIN 2022 · 29 JUN · SHIFT 1

(a) $\frac{P}{V}$ (b) $\frac{V}{P}$ (c) PV (d) PV^3

118. The force is given in terms of time t and displacement x by the equation

$F = A\cos Bx + C\sin Dt$

The dimensional formula of $\frac{AD}{B}$ is:

JEE MAIN 2021 · 25 JUL · SHIFT 2

(a) $[M^0LT^{-1}]$ (b) $[ML^2T^{-3}]$

(c) $[M^1L^1T^{-2}]$ (d) $[M^2L^2T^{-3}]$

119. If momentum (P), area (A) and time (T) are taken to be the fundamental quantities then the dimensional formula for energy is

JEE MAIN 2020 · 2 SEP · SHIFT 2

(a) $[P^2AT^{-2}]$ (b) $\left[P^{\frac{1}{2}}AT^{-1}\right]$

(c) $\left[PA^{\frac{1}{2}}T^{-1}\right]$ (d) $[PA^{-1}T^{-2}]$

120. The dimension of stopping potential V_0 in photoelectric effect in units of Planck's constant 'h', speed of light 'c' and Gravitational constant 'G' and ampere A is:

JEE MAIN 2020 · 8 JAN · SHIFT 1

(a) $h^{1/3}\,G^{2/3}\,c^{1/3}\,A^{-1}$ (b) $h^0\,c^5\,G^{-1}\,A^{-1}$

(c) $h^{2/3}\,c^{5/3}\,G^{1/3}\,A^{-1}$ (d) $h^2\,G^{3/2}\,c^{1/3}\,A^{-1}$

121. In the formula $X = 5YZ^2$, X and Z have dimensions of capacitance and magnetic field, respectively. What are the dimensions of Y in SI units?

JEE MAIN 2019 · 10 APR · SHIFT 2

(a) $[M^{-3}L^{-2}T^8A^4]$ (b) $[M^{-2}L^{-2}T^6A^3]$

(c) $[M^{-1}L^{-2}T^4A^2]$ (d) $[M^{-2}L^0\,T^{-4}A^{-2}]$

122. If speed (V), acceleration (A) and force (F) are considered as fundamental units, the dimension of Young's modulus will be:

JEE MAIN 2019 · 11 JAN · SHIFT 2

(a) $V^{-2}A^2F^2$ (b) $V^{-4}A^{-2}F$

(c) $V^{-4}A^2F$ (d) $V^{-2}A^2F^{-2}$

◆ New base quantities 15 Qs

123. If force [F], acceleration [A] and time [T] are chosen as the fundamental physical quantities. Find the dimensions of energy.

NEET 2021

(a) [F] [A $^{-1}$] [T] (b) [F] [A] [T]

(c) [F] [A] [T^2] (d) [F] [A] [T^{-1}]

124. If energy (E), velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be

AIPMT 2015 · CANCELLED PAPER

(a) $[EV^{-2}T^{-2}]$ (b) $[E^{-2}V^{-1}T^{-3}]$

(c) $[EV^{-2}T^{-1}]$ (d) $[EV^{-1}T^{-2}]$

125. If force (F), velocity (V) and time (T) are taken as fundamental units, then dimensions of mass are

AIPMT 2014

(a) $[FVT^{-1}]$ (b) $[FVT^{-2}]$

(c) $[FV^{-1}T^{-1}]$ (d) $[FV^{-1}T]$

126. Dimensions of universal gravitational constant (G) in terms of Planck's constant (h), distance (L), mass (M) and time (T) are _____.

JEE MAIN 2026 · 2 APR · SHIFT 2

(a) $[hTLM^{-2}]$ (b) $[hT^{-1}LM^{-2}]$

(c) $[hTL^2M^{-2}]$ (d) $[h^{-1}T^{-1}LM^{-2}]$

127. If force (F), velocity (V) and time (T) are considered as fundamental physical quantities, then dimensional formula of density will be:

JEE MAIN 2023 · 11 APR · SHIFT 2

(a) $FV^{-2}\,T^2$ (b) $FV^4\,T^{-6}$

(c) $F^2\,V^{-2}\,T^6$ (d) $FV^{-4}\,T^{-2}$

128. If the velocity of light c , universal gravitational constant G and Planck's constant h are chosen as fundamental quantities. The dimensions of mass in the new system is:

JEE MAIN 2023 · 1 FEB · SHIFT 2

(a) $[h^1c^1G^{-1}]$ (b) $[h^{-1/2}c^{1/2}G^{1/2}]$

(c) $[h^{1/2}c^{1/2}G^{-1/2}]$ (d) $[h^{1/2}c^{-1/2}G^1]$

129. If current (I), kinetic energy (K) and charge (Q) are taken as the fundamental quantities, The dimensional representation of power will be:

JEE MAIN 2022 · 30 JUL · SHIFT 2

(a) $[K^{-1}\,Q\,I^{-1}]$ (b) $[K\,I\,Q^{-1}]$

(c) $[K\,Q\,I^{-1}]$ (d) $[K^{-1}\,Q^{-1}\,I]$

130. If momentum [P], area [A] and time [T] are taken as fundamental quantities, then the dimensional formula for coefficient of viscosity is:

JEE MAIN 2022 · 25 JUL · SHIFT 1

(a) $\left[P\,A^{-1}\,T^0\right]$ (b) $\left[P\,A\,T^{-1}\right]$

(c) $\left[P\,A^{-1}\,T\right]$ (d) $\left[P\,A^{-1}\,T^{-1}\right]$

131. If velocity [V], time [T] and force [F] are chosen as the base quantities, the dimensions of the mass will be:

JEE MAIN 2021 · 31 AUG · SHIFT 2

(a) $[FT^{-1}\,V^{-1}]$ (b) $[FTV^{-1}]$

(c) $[FT^2\,V]$ (d) $[FVT^{-1}]$

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132. If force (F), length (L) and time (T) are taken as the fundamental quantities. Then what will be the dimension of density:

JEE MAIN 2021 · 27 AUG · SHIFT 2

(a) $[FL^{-4}T^2]$ (b) $[FL^{-3}T^2]$
(c) $[FL^{-5}T^2]$ (d) $[FL^{-3}T^3]$

133. If time (t), velocity (v), and angular momentum (l) are taken as the fundamental units. Then the dimension of mass (m) in terms of t, v and l is:

JEE MAIN 2021 · 20 JUL · SHIFT 2

(a) $[t^{-1}v^1l^{-2}]$ (b) $[t^1v^2l^{-1}]$
(c) $[t^{-2}v^{-1}l^1]$ (d) $[t^{-1}v^{-2}l^1]$

134. A quantity x is given by $\left(\frac{IFv^2}{WL^4}\right)$ in terms of moment of inertia I, force F, velocity v, work W and Length L. The dimensional formula for x is same as that of:

JEE MAIN 2020 · 4 SEP · SHIFT 2

(a) Coefficient of viscosity
(b) Force constant
(c) Energy density
(d) Planck's constant

135. If speed V, area A and force F are chosen as fundamental units, then the dimension of Young's modulus will be

JEE MAIN 2020 · 2 SEP · SHIFT 1

(a) $FA^{-1}V^0$ (b) FA^2V^{-1} (c) FA^2V^{-2} (d) FA^2V^{-3}

136. Expression for time in terms of G (universal gravitational constant), h (Planck constant) and c (speed of light) is proportional to:

JEE MAIN 2019 · 9 JAN · SHIFT 2

(a) $\sqrt{\frac{hc^5}{G}}$ (b) $\sqrt{\frac{c^3}{Gh}}$ (c) $\sqrt{\frac{Gh}{c^5}}$ (d) $\sqrt{\frac{Gh}{c^3}}$

137. Time (T), velocity (C) and angular momentum (h) are chosen as fundamentalquantities instead of mass, length and time. In terms of these, the dimensions of mass would be:

JEE MAIN 2017 · 8 APR · SHIFT 1

(a) $[M] = [T^{-1}\ C^{-2}\ h]$
(b) $[M] = [T^{-1}\ C^2\ h]$
(c) $[M] = [T^{-1}\ C^{-2}\ h^{-1}]$
(d) $[M] = [T\ C^{-2}\ h]$

◆ Conversion of units 1 Q

138. The speed of light in vacuum is taken as unity. If light takes 6 min 40 s to reach the Earth from the Sun, the distance between the Sun and the Earth in new unit is:

NEET 2026

(a) 3×10^8 (b) 500 (c) 3×10^{10} (d) 400

◆ Deriving relations by dimensions 3 Qs

139. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by a relation $f = am^x k^y$, where a is a dimensionless constant. The values of x and y are

AIPMT 1990

(a) $x = \frac{1}{2}, y = \frac{1}{2}$ (b) $x = -\frac{1}{2}, y = -\frac{1}{2}$
(c) $x = \frac{1}{2}, y = -\frac{1}{2}$ (d) $x = -\frac{1}{2}, y = \frac{1}{2}$

140. If mass is written as $m = kc^P G^{-1/2} h^{1/2}$ then the value of P will be: (Constants have their usual meaning with k a dimensionless constant)

JEE MAIN 2024 · 30 JAN · SHIFT 2

(a) 1/3 (b) − 1/3 (c) 1/2 (d) 2

141. A quantity f is given by $f = \sqrt{\frac{hc^5}{G}}$ where c is speed of light, G universal gravitational constant and h is the Planck's constant. Dimension of f is that of:

JEE MAIN 2020 · 9 JAN · SHIFT 1

(a) Energy (b) Momentum (c) Area
(d) Volume

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TOPIC 03

Significant Figures & Order of Magnitude

10 PYQs · Easy 10 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 2 · JEE 8

Concepts covered: Counting significant figures (2) · Significant figures in calculations (6) · Order of magnitude (2)

LEVEL 1 · EASY 10 questions

◆ Counting significant figures 2 Qs

142. Match List - I with List - II.

List I (Number)	List II (Significant figure)
(A) 1001	(I) 3
(B) 010.1	(II) 4
(C) 100.100	(III) 5
(D) 0.0010010	(IV) 6

Choose the correct answer from the options given below:

JEE MAIN 2024 · 1 FEB · SHIFT 2

(a) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(b) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(c) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(d) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

143. The respective number of significant figures for the numbers 23.023, 0.0003 and 2.1×10^{-3} are

AIEEE 2010

(a) 5, 1, 2 (b) 5, 1, 5 (c) 5, 5, 2 (d) 4, 4, 2

◆ Significant figures in calculations 6 Qs

144. The area of a rectangular field (in m^2) of length 55.3 m and breadth 25 m after rounding off the value for correct significant digits is

NEET 2022 · PHASE 1

(a) 138×10^1 (b) 1382
(c) 1382.5 (d) 14×10^2

145. Taking into account of the significant figures, what is the value of $9.99m - 0.0099m$?

NEET 2020 · PHASE 1

(a) 9.98 m (b) 9.980 m (c) 9.9 m (d) 9.9801 m

146. Keeping the significant figures in view, the sum of the physical quantities 52.01 m, 153.2 m and 0.123 m is:

JEE MAIN 2026 · 21 JAN · SHIFT 2

(a) 205.3 m (b) 205 m
(c) 205.333 m (d) 205.33 m

147. For an experimental expression $y = \frac{32.3 \times 1125}{27.4}$, where all the digits are significant. Then to report the value of y we should write

JEE MAIN 2025 · 24 JAN · SHIFT 1

(a) $y = 1326.186$ (b) $y = 1326.2$
(c) $y = 1326.19$ (d) $y = 1330$

148. The area of a square is 5.29 cm^2. The area of 7 such squares taking into account the significant figures is :-

JEE MAIN 2019 · 9 APR · SHIFT 2

(a) 37.0 cm^2 (b) 37 cm^2
(c) 37.030 cm^2 (d) 37.03 cm^2

149. A body of mass m = 3.513 kg is moving along the x-axis with a speed of 5.00 ms^{-1}. The magnitude of its momentum is recorded as

AIEEE 2008

(a) 17.6 kg ms^{-1} (b) 17.565 kg ms^{-1}
(c) 17.56 kg ms^{-1} (d) 17.57 kg ms^{-1}

◆ Order of magnitude 2 Qs

150. In an expression $a \times 10^b$:

JEE MAIN 2024 · 8 APR · SHIFT 1

(a) a is order of magnitude for $b \leq 5$
(b) b is order of magnitude for $a \leq 5$
(c) b is order of magnitude for $a \geq 5$
(d) b is order of magnitude for $5 < a \leq 10$

151. Match List - I (Event) with List - II (order of the time interval for happening of the event) and select the correct option from the options given below the lists.

JEE MAIN 2014 · 19 APR · SHIFT 1

List - I		List - II	
(a)	Rotation period of earth	(i)	10^5 s
(b)	Revolution period of earth	(ii)	10^7 s
(c)	Period of a light wave	(iii)	10^{-15} s
(d)	Period of a sound wave	(iv)	10^{-3} s

(a) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
(b) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)
(c) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)
(d) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

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TOPIC 04

Errors in Measurement

44 PYQs · Easy 44 · Medium 0 · Difficult 0 | MHT CET 22 · NEET 8 · JEE 14

Concepts covered: Types of errors (2) · Mean & relative error (3) · Error in sum & difference (3) · Error in product, quotient & power (36)

LEVEL 1 · EASY 44 questions

◆ Types of errors 2 Qs

152. Which of the following comes under the category of random errors?

MHT CET 2025 · 23 APR · SHIFT 1

(a) Improper calibration of thermometer
(b) Zero error of 1μ V in voltmeter
(c) Student measures 22°, where as the correct angle is 20°
(d) Errors resulting from the fluctuations in electric power supply

153. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are:

NEET 2023

(a) Personal errors (b) Least count errors
(c) Random errors (d) Instrumental errors

◆ Mean & relative error 3 Qs

154. The diameter of a spherical bob, when measured with vernier callipers yielded the following values: 3.33 cm, 3.32 cm, 3.34 cm, 3.33 cm and 3.32 cm. The mean diameter to appropriate significant figures is:

NEET 2023

(a) 3.328 cm (b) 3.3 cm
(c) 3.33 cm (d) 3.32 cm

155. Time intervals measured by a clock give the following readings:

1.25 s, 1.24 s, 1.27 s, 1.21 s and 1.28 s

What is the percentage relative error of the observations?

NEET 2020 · PHASE 2

(a) 1.6% (b) 2% (c) 4% (d) 16%

156. Four persons measure the length of a rod as 20.00 cm, 19.75 cm, 17.01 cm and 18.25 cm. The relative error in the measurement of average length of the rod is:

JEE MAIN 2026 · 23 JAN · SHIFT 1

(a) 0.18 (b) 0.24 (c) 0.06 (d) 0.08

◆ Error in sum & difference 3 Qs

157. If two resistors of resistances have values $R_1 = (350 \pm 3)\,\Omega$ and $R_2 = (140 \pm 4)\,\Omega$. The percentage error for the sum and difference of R_1 and R_2 are respectively

MHT CET 2026 · 18 APR · SHIFT 1

(a) 1.43%, 3.33% (b) 7%, 1%
(c) 1%, 7% (d) 3.33%, 1.43%

158. The initial and final temperatures of water as recorded by an observer are $(38.6 \pm 0.2)^\circ$C and $(82.3 \pm 0.3)^\circ$C. The rise in temperature with proper error limits is

MHT CET 2025 · 19 APR · SHIFT 2

(a) $(43.7 \pm 0.2)^\circ$C (b) $(43.7 \pm 0.3)^\circ$C
(c) $(43.7 \pm 0.1)^\circ$C (d) $(43.7 \pm 0.5)^\circ$C

159. Two resistances are given as $R_1 = (10 \pm 0.5)\Omega$ and $R_2 = (15 \pm 0.5)\Omega$. The percentage error in the measurement of equivalent resistance when they are connected in parallel is -

JEE MAIN 2023 · 6 APR · SHIFT 1

(a) 2.33 (b) 5.33 (c) 4.33 (d) 6.33

◆ Error in product, quotient & power 36 Qs

160. Mass and volume of a body are found to be (6.00 ± 0.03) kg and (2.00 ± 0.02) m^3 respectively. Then the density of the body is

MHT CET 2026 · 20 MAY · SHIFT 1

(a) 3 ± 0.010 kg/m^3 (b) 3 ± 0.015 kg/m^3
(c) 3 ± 0.020 kg/m^3 (d) 3 ± 0.045 kg/m^3

161. A wire has mass (0.4 ± 0.002) g, radius (0.6 ± 0.006) mm and length (8 ± 0.04) cm. The percentage error in the measurement of its density is

MHT CET 2026 · 19 MAY · SHIFT 2

(a) 2% (b) 2.55% (c) 3% (d) 3.55%

162. In a certain system, the quantities A and B are measured as 8 ± 0.08 and 6 ± 0.06 respectively. Let $x = AB$, $y = A + B$ and $z = A - B$. The correct order of % error in x, y and z is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) $x = y > z$ (b) $x < z < y$
(c) $z > x > y$ (d) $x > z > y$

163. If the error in the measurement of volume of the sphere is 6% then the error in the measurement of its surface area will be

MHT CET 2026 · 14 MAY · SHIFT 1

(a) 2% (b) 3% (c) 4% (d) 7.5%

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164. The resistance of a conductor is $R = V/I$ where voltage $V = 100 \pm 5$ V and current $I = 10 \pm 0.2$ A. The error in the calculation of R is

MHT CET 2026 · 13 MAY · SHIFT 2

(a) 5% (b) 7% (c) 5.2% (d) 2.5%

165. The percentage error in the measurement of mass and speed are 2% and 3% respectively. The maximum error in the estimation of kinetic energy is

MHT CET 2026 · 13 MAY · SHIFT 1

(a) 11 % (b) 8 % (c) 5 % (d) 1 %

166. A quantity Q is formulated $X^{-2}Y^{+\frac{3}{2}}Z^{-\frac{2}{5}}$. X, Y and Z are independent parameters which have fractional errors of 0.1, 0.2 and 0.5 respectively in measurement. The maximum fractional error of Q is

MHT CET 2026 · 12 MAY · SHIFT 2

(a) 0.6 (b) 0.7 (c) 0.8 (d) 0.1

167. A physical quantity x is related as $x = \sqrt{a}\, b^2 c^3 d^{-4}$. Relative errors in the quantities a, b, c and d are 2%, 1%, 3% and 4% respectively. Relative error in x will be

MHT CET 2026 · 20 APR · SHIFT 2

(a) 30% (b) 28% (c) 24% (d) 18%

168. The voltage across a lamp is (6.0 ± 0.3) volt and the current passing through it is (4.0 ± 0.1) ampere. The power consumed in watt will be (using percentage error)

MHT CET 2026 · 19 APR · SHIFT 1

(a) (24.0 ± 1.8) (b) (24.0 ± 0.75)
(c) (22.0 ± 0.4) (d) (18.0 ± 0.4)

169. Mass and volume of a body are found to be (6.00 ± 0.03) kg and (2.00 ± 0.02) m^3 respectively. Then the density of a body is

MHT CET 2026 · 17 APR · SHIFT 1

(a) (3.00 ± 0.010) kg/m^3 (b) (3.00 ± 0.015) kg/m^3
(c) (3.00 ± 0.020) kg/m^3 (d) (3.00 ± 0.045) kg/m^3

170. The error in the measurement of length and mass of a cube is 3% and 4% respectively. The error in the measurement of its density will be

MHT CET 2026 · 16 APR · SHIFT 2

(a) 13 % (b) 6 % (c) 9 % (d) 15 %

171. A wire has mass (0.3 ± 0.003) gram, radius (0.5 ± 0.005) cm and length (6 ± 0.06) cm. The maximum percentage error in the measurement of density is

MHT CET 2026 · 16 APR · SHIFT 1

(a) 2 % (b) 3 % (c) 4 % (d) 5 %

172. A wire has mass (0.3 ± 0.003) gram, radius (0.5 ± 0.005) mm and length (6 ± 0.06) cm. The maximum error in the measurement of density is

MHT CET 2026 · 15 APR · SHIFT 2

(a) 4% (b) 3% (c) 2% (d) 5%

173. A quantity P is related as $X^{-2}Y^{-3/2}Z^{2/5}$ where X,Y,Z are independent parameters which have fractional errors of 0.1, 0.2 and 0.5 respectively in measurement. The maximum fractional error in P is

MHT CET 2026 · 11 APR · SHIFT 2

(a) 0.7 (b) 0.1 (c) 0.8 (d) 0.6

174. In an experiment four quantities p, q, r and s are measured with percentage 3%, 2%, 3% and 1% respectively. Quantity ' A ' is calculated as follows $A = \frac{pq^2}{r^2 s^4}$, the percentage error in ' A ' is

MHT CET 2025 · 26 APR · SHIFT 2

(a) 17% (b) 12% (c) 18% (d) 19%

175. The error in the measurement of length and mass of a cube is 3% and 4% respectively. The error in the measurement of density will be

MHT CET 2025 · 26 APR · SHIFT 1

(a) 6% (b) 13% (c) 9% (d) 15%

176. A wire has a mass 0.3 ± 0.003 gram, radius 0.5 ± 0.005 mm and length 6 ± 0.06 cm . The maximum percentage error in the measurement of its density is

MHT CET 2025 · 25 APR · SHIFT 1

(a) 2% (b) 5% (c) 4% (d) 3%

177. The percentage error in the measurement of mass and speed of a particular body is 3% and 4% respectively. The percentage error in the measurement of kinetic energy is

MHT CET 2025 · 22 APR · SHIFT 2

(a) 9% (b) 10% (c) 11% (d) 12%

178. Error in the measurement of radius of the sphere is 2% . The error in the calculated value of its volume is

MHT CET 2025 · 21 APR · SHIFT 2

(a) 3% (b) 2% (c) 6% (d) 9%

179. In an electrical circuit, the voltage is measured as $V = (200 \pm 4)$ volt and the current is measured as $I = (20 \pm 0.2)$ A. The value of the resistance is:

NEET 2024

(a) $(10 \pm 4.2)\Omega$ (b) $(10 \pm 0.3)\Omega$
(c) $(10 \pm 0.1)\Omega$ (d) $(10 \pm 0.8)\Omega$

180. A metal wire has mass (0.4 ± 0.002) g , radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm . The maximum possible percentage error in the measurement of density will nearly be:

NEET 2023

(a) 1.3% (b) 1.6% (c) 1.4% (d) 1.2%

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181. The percentage error in the measurement of g is: (Given that $g = \frac{4\pi^2 L}{T^2}$, $L = (10 \pm 0.1)$ cm, $T = (100 \pm 1)$ s)
NEET 2022 · PHASE 2
(a) 7% (b) 2% (c) 5% (d) 3%

182. If an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively.
Quantity P is calculated as follows P = $\frac{a^3b^2}{cd}$ % error in P is
NEET 2013
(a) 7% (b) 4% (c) 14% (d) 10%

183. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be
AIPMT 2008
(a) 8% (b) 2% (c) 4% (d) 6%

184. The percentage error in the calculated volume of a sphere, if there is 2% error in its diameter measurement, is ____.
JEE MAIN 2026 · 6 APR · SHIFT 2
(a) 1 (b) 2 (c) 6 (d) 8

185. The maximum percentage error in the measurement of density of a wire is
[Given, mass of wire = (0.60 ± 0.003)g
radius of wire = (0.50 ± 0.01)cm
length of wire = (10.00 ± 0.05)cm]
JEE MAIN 2025 · 22 JAN · SHIFT 2
(a) 7 (b) 8 (c) 5 (d) 4

186. The radius (r), length (l) and resistance (R) of a metal wire was measured in the laboratory as
r = (0.35 ± 0.05) cm
R = (100 ± 10) ohm
$l = (15 \pm 0.2)$ cm
The percentage error in resistivity of the material of the wire is:
JEE MAIN 2024 · 1 FEB · SHIFT 1
(a) 37.3% (b) 25.6% (c) 35.6% (d) 39.9%

187. If the percentage errors in measuring the length and the diameter of a wire are 0.1% each. The percentage error in measuring its resistance will be:
JEE MAIN 2024 · 31 JAN · SHIFT 1
(a) 0.144% (b) 0.2% (c) 0.1% (d) 0.3%

188. A physical quantity Q is found to depend on quantities a, b, c by the relation $Q = \frac{a^4b^3}{c^2}$. The percentage error in a, b and c are 3%, 4% and 5% respectively. Then, the percentage error in Q is:
JEE MAIN 2024 · 29 JAN · SHIFT 2
(a) 43% (b) 34% (c) 66% (d) 14%

189. The resistance $R = \frac{V}{I}$ where V = (200 ± 5)V and $I = (20 \pm 0.2)$A , the percentage error in the measurement of R is:
JEE MAIN 2024 · 29 JAN · SHIFT 1
(a) 5.5% (b) 3% (c) 7% (d) 3.5%

190. A body of mass (5 ± 0.5) kg is moving with a velocity of (20 ± 0.4) m/s. Its kinetic energy will be
JEE MAIN 2023 · 13 APR · SHIFT 1
(a) (1000 ± 140) J (b) (500 ± 0.14) J
(c) (1000 ± 0.14) J (d) (500 ± 140) J

191. A cylindrical wire of mass (0.4 ± 0.01)g has length (8 ± 0.04)cm and radius (6 ± 0.03)mm . The maximum error in its density will be:
JEE MAIN 2023 · 8 APR · SHIFT 1
(a) 1% (b) 5% (c) 4% (d) 3.5%

192. A silver wire has a mass (0.6 ± 0.006) g, radius (0.5 ± 0.005) mm and length (4 ± 0.04) cm. The maximum percentage error in the measurement of its density will be:
JEE MAIN 2022 · 27 JUN · SHIFT 1
(a) 4% (b) 3% (c) 6% (d) 7%

193. If $Z = \frac{A^2B^3}{C^4}$, then the relative error in Z will be:
JEE MAIN 2022 · 25 JUN · SHIFT 1
(a) $\frac{\Delta A}{A} + \frac{\Delta B}{B} + \frac{\Delta C}{C}$ (b) $\frac{2\Delta A}{A} + \frac{3\Delta B}{B} - \frac{4\Delta C}{C}$
(c) $\frac{2\Delta A}{A} + \frac{3\Delta B}{B} + \frac{4\Delta C}{C}$ (d) $\frac{\Delta A}{A} + \frac{\Delta B}{B} - \frac{\Delta C}{C}$

194. If the length of the pendulum in pendulum clock increases by 0.1%, then the error in time per day is:
JEE MAIN 2021 · 26 AUG · SHIFT 2
(a) 86.4 s (b) 4.32 s (c) 43.2 s (d) 8.64 s

195. The relative error in the determination of the surface area of sphere is α. Then the relative error in the determination of its volume is:
JEE MAIN 2018 · 15 APR · SHIFT 1
(a) $\frac{3}{2}\alpha$ (b) $\frac{2}{3}\alpha$ (c) $\frac{5}{2}\alpha$ (d) α

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TOPIC 05

Least Count, Vernier Callipers & Screw Gauge

9 PYQs · Easy 9 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 3 · JEE 6

Concepts covered: Vernier callipers (3) · Screw gauge (4) · Travelling microscope & spectrometer (2)

LEVEL 1 · EASY 9 questions

◆ Vernier callipers 3 Qs

196. In a vernier calliper, 20 VSD coincide with 16 MSD (each division of length 1 mm). The least count of the vernier callipers is:
NEET 2026
(a) 0.2 cm (b) 0.01 cm (c) 0.02 cm (d) 0.1 cm

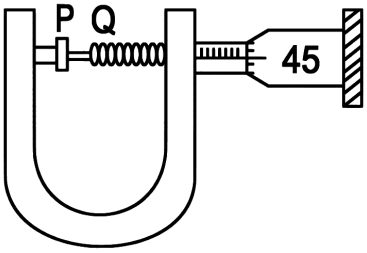
197. In a vernier callipers, $(N+1)$ divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is:
NEET 2024
(a) $\frac{1}{10\,N}$ (b) $\frac{1}{100(N+1)}$
(c) 100 N (d) $10(N+1)$

198. A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it?
JEE MAIN 2014
(a) A screw gauge having 100 divisions in the circular scale and pitch as 1 mm.
(b) A screw gauge having 50 divisions in the circular scale and pitch as 1 mm.
(c) A meter scale.
(d) A vernier calliper where the 10 divisions in vernier scale matches with 9 divisions in main scale and main scale has 10 divisions in 1 cm.

◆ Screw gauge 4 Qs

199. A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is:
NEET 2020 · PHASE 1
(a) 0.25 mm (b) 0.5 mm (c) 1.0 mm (d) 0.01 mm

200. In an experiment to find out the diameter of wire using screw gauge, the following observations were noted:



(A) Screw moves 0.5 mm on main scale in one complete rotation
(B) Total divisions on circular scale = 50
(C) Main scale reading is 2.5 mm
(D) 45^{th} division of circular scale is in the pitch line
(E) Instrument has 0.03 mm negative error
Then the diameter of wire is:
JEE MAIN 2022 · 29 JUL · SHIFT 1
(a) 2.92 mm (b) 2.54 mm (c) 2.98 mm (d) 3.45 mm

201. Using screw gauge of pitch 0.1 cm and 50 divisions on its circular scale, the thickness of an object is measured. It should correctly be recorded as
JEE MAIN 2020 · 3 SEP · SHIFT 1
(a) 2.123 cm (b) 2.124 cm (c) 2.125 cm (d) 2.121 cm

202. The least count of the main scale of a screw gauge is 1 mm. The minimum number of divisions on its circular scale required to measure 5 μm diameter of a wire is:
JEE MAIN 2019 · 12 JAN · SHIFT 1
(a) 500 (b) 100 (c) 200 (d) 50

◆ Travelling microscope & spectrometer 2 Qs

203. Identify the physical quantity that cannot be measured using spherometer:
JEE MAIN 2024 · 27 JAN · SHIFT 1
(a) Radius of curvature of concave surface
(b) Specific rotation of liquids
(c) Thickness of thin plates
(d) Radius of curvature of convex surface

204. An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distances are measured by
AIEEE 2008
(a) a vernier scale provided on the microscope
(b) a standard laboratory scale
(c) a meter scale provided on the microscope
(d) a screw gauge provided on the microscope

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ANSWER KEY

Shaded by level: **Easy**

01 Units & Dimensions

1. (b)	2. (a)	3. (b)	4. (b)	5. (c)	6. (c)	7. (c)	8. (c)	9. (c)	10. (a)
11. (a)	12. (b)	13. (a)	14. (d)	15. (c)	16. (a)	17. (c)	18. (c)	19. (b)	20. (b)
21. (d)	22. (c)	23. (a)	24. (b)	25. (c)	26. (c)	27. (c)	28. (d)	29. (c)	30. (b)
31. (a)	32. (c)	33. (a)	34. (b)	35. (b)	36. (c)	37. (a)	38. (a)	39. (c)	40. (a)
41. (a)	42. (d)	43. (c)	44. (b)	45. (b)	46. (b)	47. (c)	48. (a)	49. (d)	50. (c)
51. (c)	52. (c)	53. (c)	54. (c)	55. (c)	56. (a)	57. (b)	58. (c)	59. (c)	60. (c)
61. (d)	62. (b)	63. (c)	64. (b)	65. (a)	66. (c)	67. (a)	68. (a)	69. (d)	70. (c)
71. (b)	72. (a)	73. (b)	74. (b)	75. (d)	76. (d)	77. (c)	78. (a)	79. (a)	80. (d)
81. (c)	82. (c)	83. (c)	84. (b)	85. (d)	86. (c)	87. (d)	88. (c)	89. (a)	90. (d)
91. (d)									

02 Applications of Dimensional Analysis

92. (b)	93. (a)	94. (c)	95. (b)	96. (b)	97. (b)	98. (c)	99. (b)	100. (a)	101. (d)
102. (a)	103. (b)	104. (d)	105. (d)	106. (c)	107. (b)	108. (c)	109. (c)	110. (d)	111. (c)
112. (d)	113. (b)	114. (b)	115. (b)	116. (d)	117. (c)	118. (b)	119. (c)	120. (b)	121. (a)
122. (c)	123. (c)	124. (a)	125. (d)	126. (b)	127. (d)	128. (c)	129. (b)	130. (a)	131. (b)
132. (a)	133. (d)	134. (c)	135. (a)	136. (c)	137. (a)	138. (d)	139. (d)	140. (c)	141. (a)

03 Significant Figures & Order of Magnitude

142. (a)	143. (a)	144. (d)	145. (a)	146. (a)	147. (d)	148. (a)	149. (a)	150. (b)	151. (a)

04 Errors in Measurement

152. (d)	153. (c)	154. (c)	155. (a)	156. (c)	157. (a)	158. (d)	159. (c)	160. (d)	161. (c)
162. (c)	163. (c)	164. (b)	165. (b)	166. (b)	167. (b)	168. (a)	169. (d)	170. (a)	171. (c)
172. (a)	173. (a)	174. (a)	175. (b)	176. (c)	177. (c)	178. (c)	179. (b)	180. (b)	181. (d)
182. (c)	183. (d)	184. (c)	185. (c)	186. (d)	187. (d)	188. (b)	189. (d)	190. (a)	191. (c)
192. (a)	193. (c)	194. (c)	195. (a)						

05 Least Count, Vernier Callipers & Screw Gauge

196. (c)	197. (b)	198. (d)	199. (b)	200. (c)	201. (b)	202. (c)	203. (b)	204. (a)	

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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