YAKEEN NEET 2.0

2026

Units and Measurements

Physics | Lecture - 04

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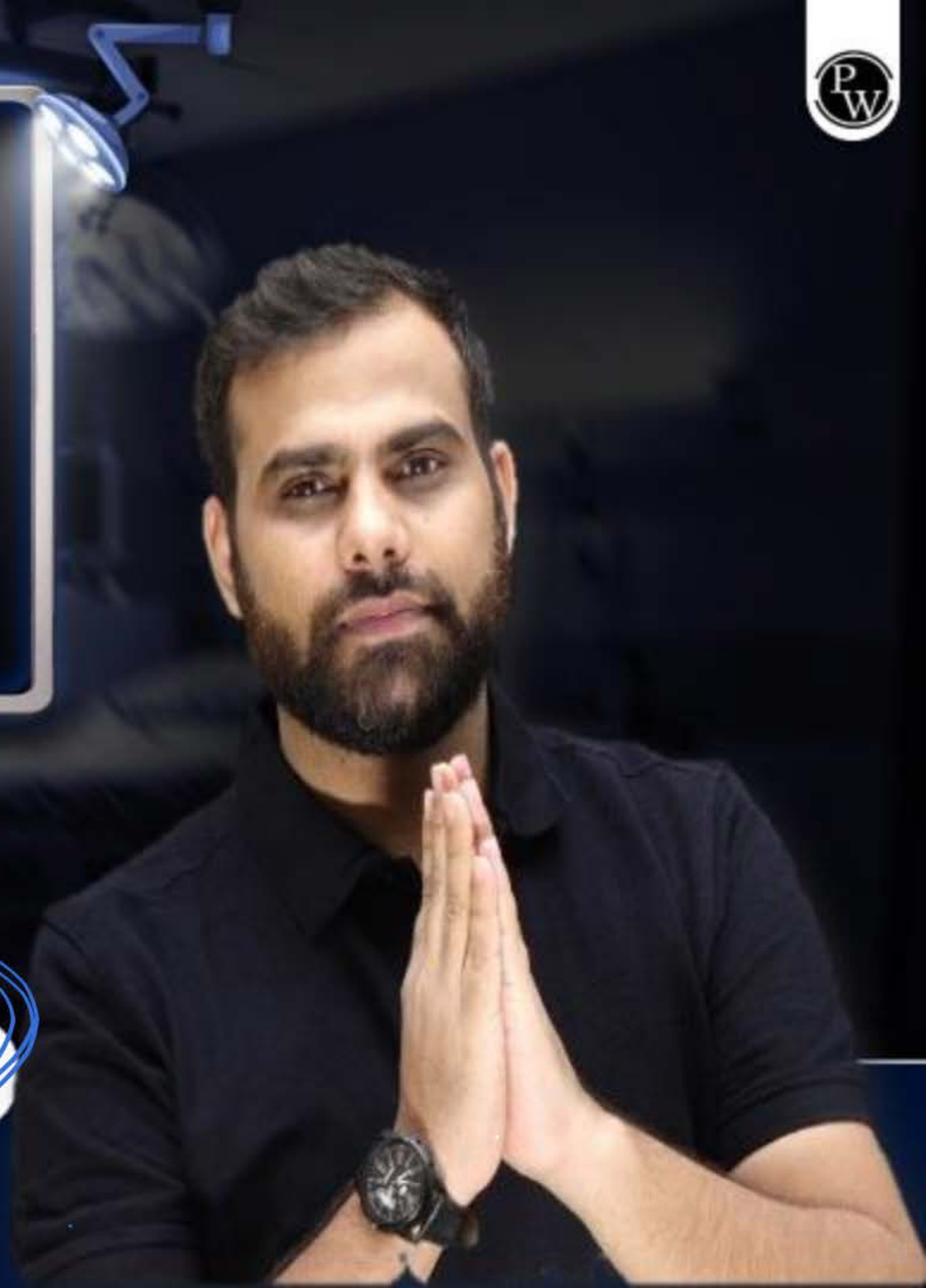

Topics to be covered

1. #
2.
3.
4.

~~JEE PYQ~~, NEET PYQ based on dimension ✓

Principle of Homogenity

12th → 2016 Pass → Padhai 2016-2023 तक पढ़ी की

NEET 2025
↳ Physics → 145.
Rank → 1K

Question

True/ false

A unitless physical quantity may have dimension → false

A dimensionless physical quantity may be unitless → True

Angle, refractive index

A physical quantity have unit must have dimension → false

A physical quantity have dimension may have unit → false

2nd fly

1st fly

NEET – PYQ

Based dimⁿ

Question

The pair of quantities having same dimensions is (Kar. NEET 2013)

1. Impulse and Surface Tension
2. Angular momentum and Work
3. Work and Torque
4. Young's modulus and Energy

- **Dimension of electric resistance** (2007)

$H = I^2 R t$

$R = \frac{H}{I^2 t} = \frac{m L^2 T^{-2}}{A^2 T} = m L^2 A^{-2} T^{-3}$ ✓

- **Self-Induction** (1989)

$E = \left(\frac{1}{2}\right) L I^2$

$L = \frac{E}{I^2} = m L^2 T^{-2} A^{-2}$

- **Permeability** (1991)

$F = \frac{\mu_0 I_1 I_2}{(2\pi)\, d}$

$\mu_0 = \frac{F}{I^2} = \frac{M L T^{-2}}{A^2} = M L T^{-2} A^{-2}$ ✓

[NEET- 2020] ✓

Stress → force / area

=

- **Magnetic field/Magnetic flux** **(1999)**

$F = IBl$

$B = \frac{F}{Il}$

$\phi = B \cdot A$

- **Coefficient of viscosity**

$F = 6\pi \eta r v$

$\eta = \frac{F}{6\pi r v}$

Question

If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be (2009)

$[V = LT^{-1}, \; a = LT^{-2}]$

1. velocity if $a = 1, b = 0, c = -1$ ✗
2. acceleration if $a = 1, b = 0, c = -2$ ✗
3. force if $a = 0, b = -1, c = -2$ ✗ MLT^{-2}
4. pressure if $a = 1, b = -1, c = -2$ ✓

$M^a L^b T^c = M^1 L^0 T^{-2}$

Pressure $= M^1 L^{-1} T^{-2}$

$= \frac{F}{A} = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$

Question

Which two of the following five physical parameters have the same dimensions ?

1. energy density
2. refractive index
3. dielectric constant
4. Youngs modulus
5. magnetic field

(2008)

$[\varepsilon_0] = \frac{Em}{\epsilon_0}$ → dim^n less

$\frac{F}{A} = Y\frac{\Delta l}{l}$ → dim^n less

energy density $= \frac{E}{\text{Volume}} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$

1. 1 and 4
2. 1 and 5
3. 2 and 4
4. 3 and 5

Question

Which pair do not have equal dimensions ? (2000)

1. Energy and torque
2. Force and impulse
3. Angular momentum and Planck's constant
4. Elastic modulus and pressure.

$L = \gamma P = L(MLT^{-1})$

$= ML^2T^{-1}$

$E = hf$

$h = E/f = \frac{ML^2T^{-2}}{T^{-1}}$

$= ML^2T1$

2000K rupes →

2000K ₹

99.99999999% MR* GST cut kar ke मिलेगा ||

Question

If L, C and R are the self inductance, capacitance and resistance respectively, which of the following does not have the dimension of time? [JEE Main 2022]

1. RC ✓
2. L/R ✓
3. $\sqrt{LC}$ ✓
4. L/C

Ans (4)

$R = \omega L = \frac{1}{\omega C}$

$\frac{R}{L} = 2\pi f$

$T = \frac{L}{R}$

$R = \frac{1}{\omega C}$

$RC = \frac{1}{\omega} = T$

$\omega L = \frac{1}{\omega C}$

$\omega^2 = \frac{1}{LC}$

$\omega = \frac{1}{\sqrt{LC}} = 2\pi f$

Question

H/W → Unit Conversion

The density of a material in CGS system of units is 4 g cm^{-3}. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be [Mains 2011]

$n_1 u_1 = n_2 u_2$

1. 0.04
2. 0.4
3. 40
4. 400

Likna hai

① $2m + 4Kg =$ Not Possible ✓

② $2m \times 4Kg = 8\ Kg \cdot m$ ⟶ Example → $P = mv$, $F = ma$

③ $4\,sec - 8Kg =$ Not Possible

④ $10Kg > 8m$ ⟶ wrong (Not Possible)

⑤ $\frac{12\,kg}{4\,sec} = 3\,\frac{kg}{sec}$ Possible

⑥ $4Kg - 1Kg = 3Kg$ Possible

⑦ $3Kg \times 3Kg = 9Kg^2$

⑧ $7Kg + 8 =$ ✗

Principle of Homogenity

we can only add (+), sub (−), compair (≥) a physical quantity which have same dimension.

* we can multiply or divide Two physical quantity which have same or diff^{n} dimn.

If a equation $A = B + C - D$

* Kisi equation me +, −, < hai to sabko hata ke equal kar do dimensionally

Kisi equation में +, −, > तो सबको हटा के equal kar दो. (dimensionally)

$A = B = C = D$

- $A = B$
- $A = C$
- $C = D$
- $B = C$

(a) Is A & B are same ??

Ans → NO

(a) Is A & B are dimensionally same ??

Ex - 8m - 3m = 5m

Ans → Yes

Ex

$A = B + C \cdot D - E$

MR* → $A = B = CD = E$

* feel hai

→ $A = CD$ ✓

→ $B = CD$ ✓

→ $B = E$ ✓

$A = \frac{B}{C - D}$

MR* → $A = \frac{B}{C = D}$

→ $C = D$ → dim^n same

$A = \frac{B}{C}$ or $A = \frac{B}{D}$

(1) · $F = \alpha t + \beta x$ find dim^n of α & β if F = force, t = time, x = distance.

↳ MR*

Sol^n

$$F = \alpha t = \beta x$$

$F = \alpha t$

$$\alpha = \frac{F}{T} = \frac{MLT^{-2}}{T^1}$$

$$\boxed{\alpha = MLT^{-3}}$$

$F = \beta x$

$$\beta = \frac{F}{x} = \frac{MLT^{-2}}{L}$$

$$\beta = MT^{-2}$$

→ Torque and work can not be add physically ✓

→ Torque and work can add dimensionally ✓

(#) Two physical quantity have same dimension. (non-zero dimension) then must have same unit → true
(Not gricultural Angle)

(#) Angular velocity and frequency can be add dimensionally?
Yes → (ω + f)

(#) Angular velocity ω → dimⁿ (T^{-1})
unit → rad/sec

(#) frequency → dim (T^{-1})
unit (sec^{-1})

ω (Angular velocity) + f (frequency) $\longrightarrow$ follow Principle of Homogenity

↳ yes

⑧ $V = \frac{At}{C-x}$

find dimⁿ of A & C where V is velocity, t = time, x = distance.

Soln

Soln $V = \frac{At}{C-x}$

$C = x = M^0 L^1 T^0$ ✓

$V = \frac{At}{x}$

$A = \frac{Vx}{t} = \frac{LT^{-1} \times L}{T} = L^2 T^{-2}$

Angle (θ) $\longrightarrow$ $M^0L^0T^0=1$

$\sin\theta = \frac{P}{H}$ $\longrightarrow$ $M^0L^0T^0=1$

$M^0L^0T^0=1$

(Q) $F = A\sin(Bt)$ find dim^n of A & B

Angle(θ) = Bt

Sol

$F = A\sin(Bt)$

Angle (θ) = Bt

$F = A \times$ dim^{n}less(sinθ)

$F = A$

$A = F = MLT^{-2}$

$Bt = 1$

$B = \frac{1}{T} = T^{-1}$

Exponential function ($e = 2.71$)

$= m^0 L^0 T^0 = 1$

e^x = dimless ($m^0 L^0 T^0 = 1$)

$e^{(xy)} = m^0 L^0 T^0$ # xy = dimnless $= m^0 L^0 T^0$

x & y may be dimnless or may have dimn.

Force $= (10)^{4m}$ ✗

$e^y = m^0 L^0 T^0$

$y = m^0 L^0 T^0$

MR*

Thara Bhai MR, Angle(θ) ko

$\sin\theta$, e^x, x, $\log e^x$, sako

equation 1 likh dega

Sol:

$$V = \alpha \cos(\beta x)$$

$V = \alpha \times 1$

$\alpha = V = LT^{-1}$

$\beta x = 1$

$\beta = \frac{1}{x} = L^{-1}$

$$y = \log e^{x}$$

$y = M^0 L^0 T^0$

$$\log e^{x} = M^0 L^0 T^0 = 1$$

x = dimn less

(21)

$$E = \alpha \log e^{\beta t}$$

E
T
energy

dimn of α & β

Soln

$E = \alpha$

$\alpha = ML^2T^{-2}$

$\beta t = 1$

$\beta = \frac{1}{t} = T^{-1}$

Question

$F = 2E$

$E = \frac{F}{q} = N/C$

Electric field in a certain region is given by $\vec{E} = \left(\frac{A}{x^2}\hat{i} + \frac{B}{y^3}\hat{j}\right)$. The SI unit of A and B are:

[JEE Main 2023]

1. $Nm^3\,C^{-1}; Nm^2\,C^{-1}$
2. $Nm^2\,C^{-1}; Nm^3\,C^{-1}$ (A; B)
3. $Nm^3\,C; Nm^2\,C$
4. $Nm^2\,C; Nm^3\,C$

$\vec{E} = \frac{A}{x^2}\,i + \frac{B}{y^3}\,\hat{j}$

Soln

$E = \frac{A}{x^2}$

$A = Ex^2$

$= \frac{Nm^2}{C}$

$= Nm^2C^{-1}$

$E = \frac{B}{y^3}$

$B = Ey^3$

$B = \frac{Nm^3}{C}$

$= Nm^3C^{-1}$

Question

Assertion: Work = Torque is dimensionally correct but not physically.

Reason: Dimensional correctness of an equation ensures its physical correctness.

1. If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
2. If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
3. If Assertion is True but the Reason is False.
4. If both Assertion & Reason are false.

Question

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 (2006)

1. $[L]$, $[LT]$ and $[LT^{-2}]$
2. $[LT^{-2}]$, $[L]$ and $[T]$
3. $[L^2]$, $[T]$ and $[LT^{-2}]$
4. $[LT^{-2}]$, $[LT]$ and $[L]$

Question

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

(1996)

1. $[MT^{-5}\ T^{-1}]$
2. $[MT^{5}\ T^{1}]$
3. $[MT^{5}\ T^{-2}]$
4. $[M^{-1}\ L^{5}\ T^{2}]$

Question

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 (1993)

1. is dimensionless
2. has dimensions $[T^{-2}]$
3. has dimensions $[T^2]$
4. has dimensions of p

Question

Assertion: The unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$ have units of distance and dimensions $[M^0 L^1 T^0]$

Reason: The product of a scalar and a vector is a new scalar.

1. If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
2. If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
3. If Assertion is True but the Reason is False.
4. If both Assertion & Reason are false.

Question

Assertion: Force is not added with pressure.

Reason: Quantities having different dimension are not added or subtracted.

1. If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
2. If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
3. If Assertion is True but the Reason is False.
4. If both Assertion & Reason are false.

Question

$Y = A \sin(\omega t - kx + \phi)$, find dimension of A, ω, k and ϕ where y and x is position.

Question

Velocity $V = \frac{\alpha}{\beta} e^{-\alpha t}$ then find dimension of α and β.

Question

If velocity $v = \alpha t + \beta x - \gamma x t$, then find dimension of α, β and γ.

do all HOME WORK.

THANK YOU