# YAKEEN NEET 2.0

2026

## Units and Measurements

Physics | Lecture - 07

By- Manish Raj (MR Sir)

# Topics to be covered

1. # JEE Advance batti Banyenge
2. H/W
3. Significant digit
4.

Code (Pw store)

Toppu 15


Vector ka Maha-manthan

Join.

Sangha assign

Basic maths of vector

class question of unit & dimension

Sangharsh assignment (Maha Manthan Update)

Sangharsh assign vector → 5

## Question

The relation between $[E]$ and $[B]$ is [JEE Adv, 2018]

1. $[E] = [B][L][T]$
2. $[E] = [B][L]^{-1}[T]$
3. $[E] = [B][L][T]^{-1}$ 97% correct
4. $[E] = [B][L]^{-1}[T]^{-1}$

E

$F = qE = qvB$

$E = BL$

$E = B(LT^{-1})$

## Question

The relation between $[\varepsilon_0]$ and $[\mu_0]$ is

1. $[\mu_0] = [\varepsilon_0][L]^2[T]^{-2}$
2. $[\mu_0] = [\varepsilon_0][L]^{-2}[T]^2$
3. $[\mu_0] = [\varepsilon_0]^{-1}[L]^2[T]^{-2}$
4. $[\mu_0] = [\varepsilon_0]^{-1}[L]^{-2}[T]^2$

Ans. A

$$C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$ * easy

[JEE Adv, 2018]

method-1

$$C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$ ← EM wave, Ray optics

$$C^2 = \frac{1}{\mu_0 \varepsilon_0}$$

$$\mu_0 = \frac{1}{\varepsilon_0 C^2} = \varepsilon_0^{-1} C^{-2}$$

$$\{ \mu_0 = \varepsilon_0^{-1} L^{-2} T^2 \}$$

## Question

A physical quantity $\vec{S}$ is defined as $\vec{S} = (\vec{E} \times \vec{B})/\mu_0$, where $\vec{E}$ is electric field, $\vec{B}$ is magnetic field and $\mu_0$ is the permeability of free space. The dimensions of $\vec{S}$ are the same as the dimensions of which of the following quantity (ies)?

**(JEE Adv. 2021)**

1. $\dfrac{\text{Energy}}{\text{Charge} \times \text{Current}}$
2. $\dfrac{\text{Force}}{\text{Length} \times \text{Time}}$ (721.)
3. $\dfrac{\text{Energy}}{\text{Volume}}$
4. $\dfrac{\text{Power}}{\text{Area}}$

$\vec{S} = \dfrac{\vec{E} \times \vec{B}}{\mu_0}$

$S = \dfrac{EB}{\mu_0}$

$= \dfrac{F \times F}{q \times I \times L \times \frac{F}{I^2 \times I}}$

$= \dfrac{F}{L \times \left(\frac{q}{I}\right)}$

$S = \dfrac{F}{L \times t}\left(\dfrac{L}{L}\right)$

$= \dfrac{\text{Energy}}{L^2 \times t}$ (Power / Area)

$S = \dfrac{F}{L \times t}$

$F = qE$ $\quad F = BIL$

$E = F/q$ ← given

$B = \dfrac{F}{IL}$

$\mu_0 = \dfrac{F}{I^2}$

**Question**

Let us consider a system of units in which mass and angular momentum are dimensionless. If length has dimension of $L$, which of the following statement(s) is/are correct? **[JEE Adv, 2019]**

1. The dimension of force is $L^{-3}$.
2. The dimension of energy of $L^{-2}$.
3. The dimension of power is $L^{-5}$.
4. The dimension of linear momentum is $L^{-1}$.

$m^0L^0T^0$

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

$F = mLT^{-2} = LT^{-2}$

$= L(L^2)^{-2}$

$= L \times L^{-4}$

$= L^{-3}$

$E = mL^2T^{-2} = L^2(L^2)^{-2} = L^2 \times L^{-4}$

$= L^{-2}$

$P = mL^2T^{-3} = L^2(L^2)^{-3} = L^2T^{-6} = L^{-4}$

$L = mLT^{-1} = LT^{-1}$

$= L(L^2)^{-1} = L \times L^{-2} = L^{-1}$

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

$L = mL^2T^{-1} = 1$ [dimless $(m^0L^0T^0)$]

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

$L^2 = T$ ①

MR* Box

- Jab bhi 3-PQ ko fundamental assume kar ke 4th ka dimension inke Term me Nikalna ho →

(1) To directly in 4-PQ ka koi formula think karo.

(2) Sirf Mass ke Bare me socho 4th ka mass given 3-fundamental P.Q. ko arrange kar ke Nikalo.

(3) Mass ke Bad length socho

**QUESTION**

Expression for time in terms of $G$ (universal gravitational constant), $h$ (Planck constant) and $c$ (speed of light) is proportional to [JEE Adv, 2012]

A. $\sqrt{\frac{hc^5}{G}}$ ✗

B. $\sqrt{\frac{c^3}{Gh}}$ ✗

C. $\sqrt{\frac{Gh}{c^5}}$ ✓✓

D. $\sqrt{\frac{Gh}{c^3}}$ ✗

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

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

$C = LT^{-1}$

$t = G^x h^y C^z$

$M^0L^0T^1 = M^{x-y} L^{3x+2y+z} T^{-2x-y-z}$

$x - y = 0$

$3x + 2y + z = 0$

$-2x - y - z = -1$

$M^0L^0T^1 = (M^{-1}L^3T^{-2})^y (ML^2T^{-1})^y (LT^{-1})^z$

Mass Nahi hai

$= \sqrt{Gh/c^5}$

$= M^{-1}M^1\sqrt{L^3 \times L^2} = \sqrt{\frac{L^5}{c^5}}$

$= M^0$

**Question**

JEE-Advance

In a new system of units energy (E) density (d) and power (P) are taken as fundamental units, then the dimensional formula of universal gravitational constant G will be

1. $[E^{-1} d^{-2} P^2]$
2. $[E^{-2} d^{-1} P^2]$
3. $[E^2 d^{-1} P^{-1}]$
4. $[E^1 d^{-2} P^{-2}]$

$\frac{P^2}{E} = \frac{T^2}{T^6} = \frac{1}{T^4}$

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

$E = ML^2T^{-2} \propto \frac{1}{T^2}$

$d = ML^{-3}$

$P = ML^2T^{-3} \propto \frac{1}{T^3}$

$\frac{P^2}{E^2} = \frac{T^4}{T^6} = \frac{1}{T^2} = T^{-2}$

$G = E^x d^y P^z$

$G = (ML^2T^{-2})^x (ML^{-3})^y (ML^2T^{-3})^z$

$M^{-1}L^3T^{-2} = M^{x+y+z} L^{2x-3y+2z} T^{-2x-3z}$

$x+y+z = -1$

$2x-3y+2z = 3$

$-2x-3z = -2$

$\frac{E}{P^2} = \frac{T^6}{T^8} = \frac{1}{T^2}$

**Question**

JEE-Advance

In a new system of units energy (E) density (d) and power (P) are taken as fundamental units, then the dimensional formula of universal gravitational constant G will be

1. $[E^{-1} d^{-2} P^2]$ $= \frac{P^2}{E} = \frac{T^2}{T^6} = T^{-4}$

2. $[E^{-2} d^{-1} P^2]$ $= \frac{P^2}{E^2} \propto \frac{T^4}{T^6} = T^{-2}$ AB

3. $[E^2 d^{-1} P^{-1}]$

4. $[E^1 d^{-2} P^{-2}]$

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

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

$P = M L^2 T^{-3}$

$d = M L^{-3}$

$G \propto T^{-2}$

$E \propto \frac{1}{T^2}$

$P \propto \frac{1}{T^3}$

**Question**

In terms of potential difference $V$, electric current $I$, permittivity $\varepsilon_0$, permeability $\mu_0$ and speed of light $c$, the dimensionally correct equations is/are **[JEE Adv, 2015]**

1. $\mu_0 I^2 = \varepsilon_0 V^2$
2. $\varepsilon_0 I = \mu_d V$
3. $I = E_0 c V$
4. $\mu_0 c I = \varepsilon_0 V$

## Question

Young's modulus of elasticity $Y$ is expressed in terms of three derived quantities, namely, the gravitational constant $G$. Planck's constant $h$ and the speed of light $c$, as $Y = c^{\alpha} h^{\beta} G^{\gamma}$. Which of the following is the correct option? **[JEE Adv, 2023]**

1. $\alpha = 7, \beta = -1, \gamma = -2$
2. $\alpha = -7, \beta = -1, \gamma = -2$
3. $\alpha = 7, \beta = -1, \gamma = 2$
4. $\alpha = -7, \beta = 1, \gamma = -2$

**QUESTION**

H/W

A length-scale ($l$) depends on the permittivity ($\varepsilon$) of a dielectric material, Boltzmann constant ($k_B$) ,the absolute temperature ($T$), the number per unit volume ($n$) of certain charged particles, and the charge ($q$) carried by each of the particles. Which of the following expression(s) for $l$ is (are) dimensionally correct? [JEE Advanced 2016]

**A** $l = \sqrt{\left(\frac{nq^2}{\varepsilon k_B T}\right)}$

**B** $l = \sqrt{\left(\frac{\varepsilon k_B T}{nq^2}\right)}$

**C** $l = \sqrt{\left(\frac{q^2}{\varepsilon n^{2/3} k_B T}\right)}$

**D** $l = \sqrt{\left(\frac{q^2}{\varepsilon n^{1/3} k_B T}\right)}$

**Question**

H/w

Sometimes it is convenient to construct a system of units so that all quantities can be expressed in terms of only one physical quantity. In one such system, dimensions of different quantities are given in terms of a quantity $x$ as follows: [position] = $[x^{\alpha}]$; speed = $[x^{\beta}]$; [acceleration] = $[x^{p}]$; [linear momentum] = $[x^{q}]$; [force = $[x^{r}]$ . Then **[JEE Adv, 2020]**

1. $\alpha + p = 2\beta$
2. $p + q - r = \beta$
3. $p - q + r = \alpha$
4. $p + q - r = \beta$

**Question**

H/W

In a particular system of units, a physical quantity can be expressed in terms of the electric charge $e$, electron mass $m_e$, Planck's constant $h$, and coulomb's constant $k = \frac{1}{4\pi\varepsilon_0}$, where $\varepsilon_0$ is the permittivity of vacuum. In terms of these physical constants, the dimension of the magnetic field is $[B] = [e]^{\alpha}[m_e]^{\beta}[h]^{\gamma}[k]^{\delta}$. The value of $\alpha + \beta + \gamma + \delta$ is

**(JEE Adv. 2022)**

H/w

12 Questn JEE Advance
7 done → 5 (H/w)

**Question**

NEET-2014

If dimensions of critical velocity $v_c$ of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$ where $\eta$, $\rho$, $r$ are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of $x$, $y$ and $z$ are given by

1. 1, 1, 1 ✗
2. 1, -1, -1 ✓
3. -1, -1, 1 ✗
4. -1, -1, -1 ✗

$v = LT^{-1}$ — (*)

$v = \eta^x \rho^y r^z$

$M^0 LT^{-1} = (ML^{-1}T^{-1})^x (ML^{-3})^y (L)^z$

Mass Nahi hai

$\eta = \frac{f}{\gamma v} = \frac{MLT^{-2}}{L \times LT^{-1}}$

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

$\rho = \frac{m}{l^3} = ML^{-3}$

$r = L$.

$\lambda$ (charge per unit length) $= \frac{\theta}{l}$

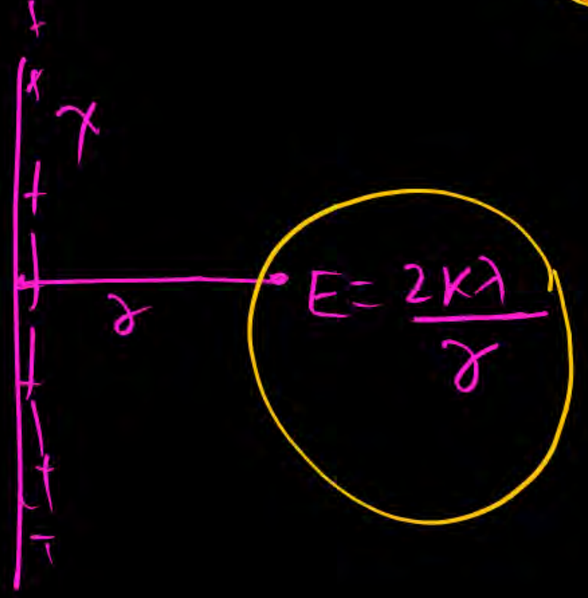
$\sigma$ (charge per unit Area) $= \frac{\theta}{A} = \frac{\theta}{l^2}$

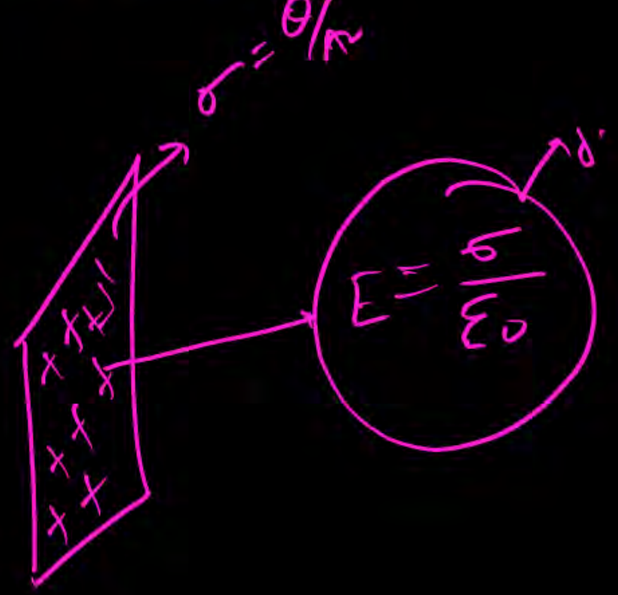
$\rho$ (charge per unit volume) $= \frac{\theta}{l^3}$

$P = 2l$ dipolem

$E_{dip} = \frac{2KP}{\gamma^3} = \frac{2K(2l)}{\gamma^3}$

Q —r→ $E = \frac{K\theta}{R^2}$ Dimensional formula of Electric fie




Inside solid sp


$E_{ins} = \frac{\rho r}{3\varepsilon_0}$ $\left(\rho = \frac{q}{l^3}\right)$

**Question**

do it by yourself

The speed of light C, gravitational constant G and plant constant h are taken as fundamental P.Q then the dimension of time in the new system of unit

1. $G^{+1/2} h^{1/2} c^{-5/2}$
2. $G^{-1/2} h^{1/2} c^{-1/2}$
3. $G^{-1/2} h^{1/2} c^{-3/2}$
4. $G^{-1/2} h^{1/2} c^{1/2}$

R/D

## Question

The frequency of vibrations $f$ of a mass $m$ suspended from a spring of spring constant K is given by a relation of type $f = cm^x K^y$, where $c$ is a dimensionless constant. The values of $x$ and $y$ are:

1. $x = \frac{1}{2}, y = \frac{1}{2}$ ✗
2. $x = \frac{-1}{2}, y = \frac{-1}{2}$ ✗
3. $x = \frac{1}{2}, y = \frac{-1}{2}$ ✗
4. $x = \frac{-1}{2}, y = \frac{1}{2}$ ✓

$f = m^x K^y$

$T^{-1} = M^x (m T^{-2})^y$

$M^0 L^0 T^{-1} = m^{x+y} T^{-2y}$

Compare Powers of time.

$-2y = +1$

$y = -\frac{1}{2}$

$x + y = 0$

$x = -y = -\frac{1}{2}$

$F = Kx$

$K = \frac{F}{x} = \frac{mLT^{-2}}{L}$

H/W

**Question**

**Which of the following is a dimensional constant? (1995)**

1. **Relative density** (dimn less) $\rho_r = \frac{\rho_{obj}}{\rho_w}$
2. **Gravitational constant** ✓✓
3. **Refractive index** dimn less
4. **Poisson's ratio.** ✓ dime.

Dimensionless const$^n$ → Ex $\pi$, Ef

Dimensional constant
↳ G/C

H/W

likhna hai

(1) ✓ If in Mechanics force, mass, energy, length. taken as fundamental then find dimension of Power.

↳ 3 equation 4 Variable → Not Possible to solve.

likhna

(2) If Force, Work & energy taken as fundament then find dimension of time.

↳ Ans → Not Possible (question wrong)

(3) If Work, length & strain taken as fundamental P.Q. then dim$^n$ of acc$^n$

Ans → Not Possible

↳ dimenless can't be fundamen P.Q. ✓

(4) Let consid $\sin\theta$, $e^x$, $\log x$ are fundamt. P.Q.

↳ Not Possile to derive dim$^n$ lon P.Q.

# LIMITATION OF DIMENSIONAL ANALYSIS

$T = 2\pi\sqrt{\frac{l}{g}}$ → can't derive.

(1) It is not use to derive dimensionless proportional constant.

(2) It can not derive dimensionless function, like sinθ, cosθ, tanθ $e^x$ etc.

(3) If physical quantity depends upon two P.Q. of same dimension

(4) It can not derive formula which have '+' and '–' term

Ex : $S = ut + \frac{1}{2}at^2$

(5) We equate the power of M, L and T. So, it only work when quantity depends only on three physical quantity.

Ex : If force depends upon energy, velocity, time work.

Bad me likh lena

## Question

Which of the following equation can be derived dimensionally

1. $s = vt - \frac{1}{2}at^2$ ✗
2. $v^2 = u^2 - 2as$ ✗
3. $h = \frac{\omega^2 r^2}{2g}$ ✗ → Not Possible
4. $v = \frac{d}{t}$ ✓

## Question

Which of the following equation can not be derived dimensionally (Best Possible)

1. $F = 6\pi r\eta$

2. $\theta = \omega t$ → $\theta = \omega^x t^y$

$M^0L^0T^0 = (T^{-1})^x (T)^y$

$M^0L^0T^0 = T^{-x} T^y$

$T^0 = T^{-x+y}$

$-x+y=0$

$x=y$

3. $\frac{d\theta}{dt} = \rho A v$ ($T^{-1} = \rho A v$ dimensionally possible)

4. $P = \rho gh$ (correct)

Best Possible → (1)

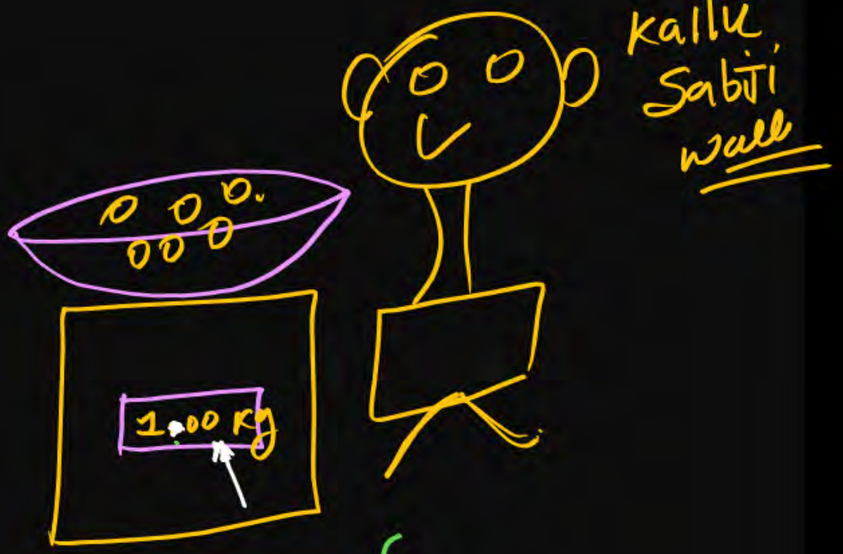
Wrong (1) & (2)

Dono hi galat hai

Significant digit = all certain + one uncertain.

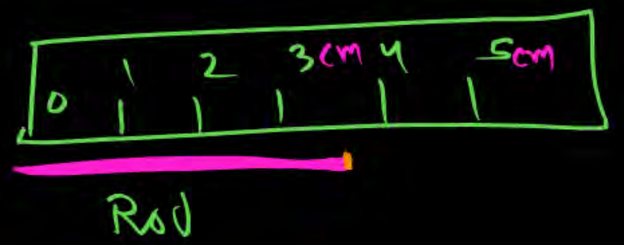

Mass = 1.00 kg ✗

= 1 kg ✓




m = 1.00 kg

Significant digit = 3




$l = 3\ cm$

↑ uncertain digit ✓

Significant = 1 ✓

- **Significant figure (digit) = (All certain + one uncertain)**

**Ex. :** **M = 256703 kg =** 6 signifi

***Significant digit indicate precision in the measurement.***

- **Choice of change in different unit does not affect the significant digit.**

$l = 1\,m = 100\,cm$

one signifi ✓ one signifi ✓

## Rule to find significant digit :

1. All non-zero are significant.
2. all zero between non-zero are significant.
3. Trailing zero without decimal point is not significant.
4. After decimal place all zero are significant
5. If number is less than one (1), all zero left of non-zero are not significant.
6. Exact number have infinite significant number. → Ex. 5 pen → Infinite significant digit
7. In power form power is not significant.

$2.48 \times 10^{8}$ ⇒ 3 significant digit.

significant digit

① 24435m → 5

② 24006m → 5

③ 246000m → 3

④ 24600 m
24.600 m
2460.0 m
→ 5

⑤ 0.003m → 1

0.0305m → 3

0.4630 m → 4

⑥ $2.430 \times 10^{4}$ m = ④ sign.

⑦ Pure number have infinite significant digit hoga.

# Counting of Significant Digit

| Counting of Significant Digit | |
|---|---|
| 1. 23.500 m | 5 |
| 2. 402 cm | 3 |
| 3. 5280 kg | 3 |
| 4. 6.780 | 4 |
| 5. 0.034 gram | 2 |
| 6. 3.070 gram | 4 |
| 7. $1.608 \times 10^{23}$ | 4 |

Note me likh le

## Question

Give the number of significant figures in each measurement.

1. 36.7 m
2. 0.006606 s
3. 2,002 kg
4. 306,490,000 people

## Question

Given P = 0.0030 m, Q = 2.40 m and R = 3000 m, the number of significant figures in P, Q, R are respectively:

1. 1, 2, 1
2. 2, 3, 1
3. 4, 2, 1
4. 4, 2, 4

# THANK YOU