YAKEEN NEET 2.0

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Units and Measurements

Physics

Assignment Solution 02

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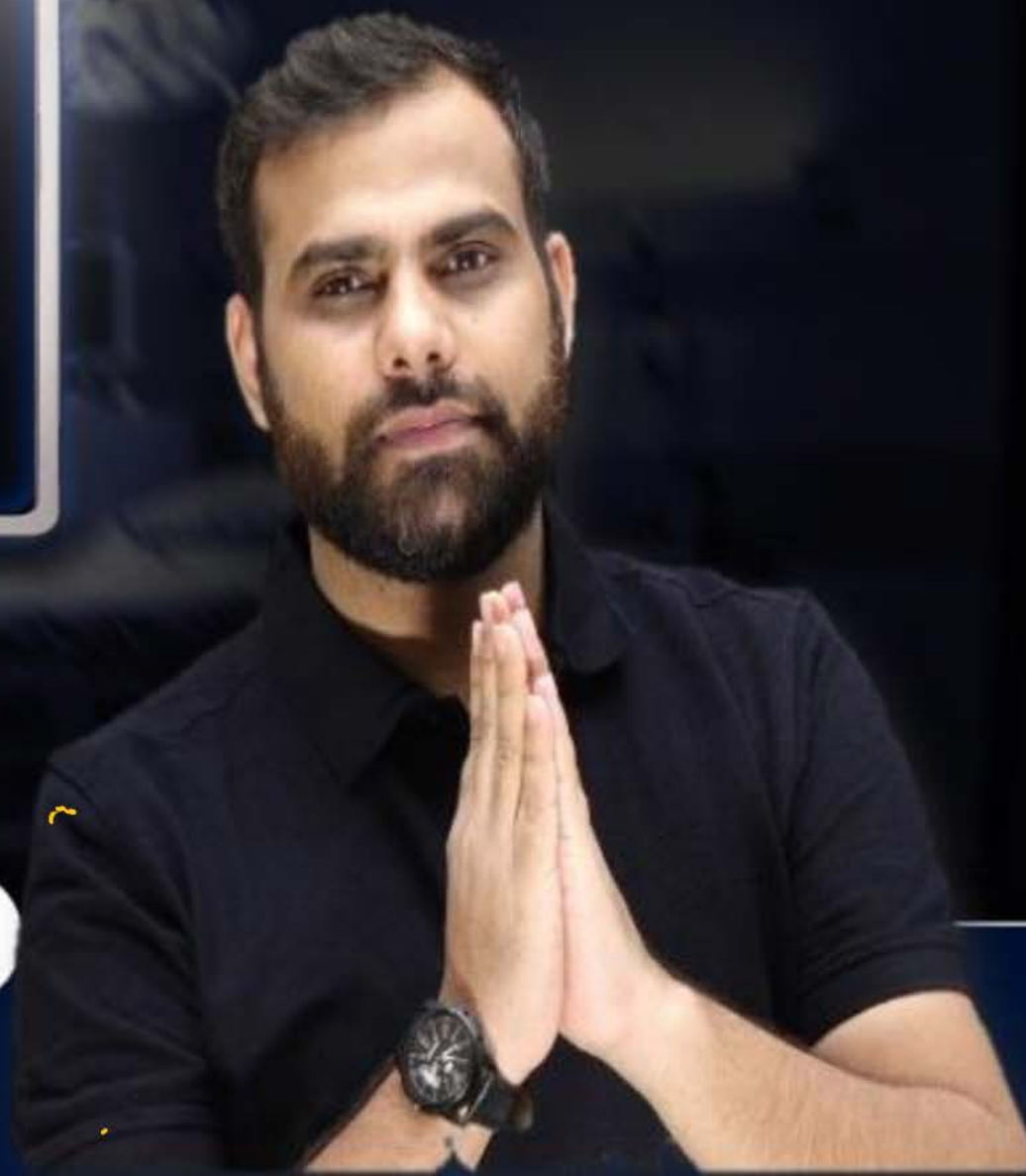

Question

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]

1. $FA^{-1}V^{0}$
2. $FA^{2}V^{-1}$
3. $FA^{2}V^{-2}$
4. $FA^{2}V^{-3}$

MR^{x}

speed / Area & force

Pressure $= \frac{F}{A}$

$= F^{1}A^{-1}V^{0}$

Question

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]

1. $[P^{1/2} AT^{-1}]$
2. $[P^2 AT^{-2}]$
3. $[PA^{1/2} T^{-1}]$
4. $[P^{-1} AT^{-2}]$

$P = mLT^{-1}$

$A = L^2$

$t = T^1$

MP*

$$\text{Energy} = F \times d = \frac{P}{T}\sqrt{A} = P^1 A^{1/2} T^{-2}$$

The MP*

Energy $\rightarrow$ mL^2T^{-2} $\rightarrow$ P^1

$$\frac{mLT^{-1} \times L}{T} \quad mL^2T^{-2}$$

Question

The dimensions 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]

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

$\frac{E}{V} = \frac{[ML^2T^{-2}]}{[L^3]}$

2. ML^2L^{-2}

3. $ML^{-1}T^2$

4. $ML^{-2}T^{-1}$

Question

Stopping potential depends on Planck's constant (h), current (I), Universal gravitational constant (G) and speed of light (C). Choose the correct option for the dimension of stopping potential (V)

[JEE Main 2020]

1. $hI^{-1}G^{-1}C^{5} = \frac{h}{q} = \frac{m}{m^{-1}} = m^2$
2. $h^{-1}I^{1}G^{-1}C^{6}$
3. $h^{0}I^{-1}G^{-1}C^{6}$
4. $h^{0}I^{-1}G^{-1}C^{5} = \frac{C^5}{q} = \frac{L^5 L^2}{L^3}$

$V \propto h^{\alpha} I^{\gamma} G^{z} C^{p}$

$m^{0} \quad x \quad m^{-1} \quad x$

$\frac{E}{q} =$

$\frac{ML^2T^{-2}}{AT} =$

$ML^2T^{-3}A^{-1} =$

Question

If 'C' and 'V' represent capacity and voltage respectively then what are the dimensions of λ where $C/V = \lambda$?

[JEE Main 2021]

1. $[M^{-2} L^{-4} I^{3} T^{7}]$
2. $[M^{-2} L^{-3} I^{2} T^{6}]$
3. $[M^{-1} L^{-3} I^{-2} T^{7}]$
4. $[M^{-3} L^{-4} I^{3} T^{7}]$

$E = \frac{Q^2}{2C}$

$C = \frac{Q^2}{E}$

$V = \frac{E}{Q}$

$\lambda = \frac{C}{V} = \frac{Q^2}{E\frac{E}{Q}} = \frac{Q^3}{E^2} = \frac{Q^3}{(ML^2T^{-2})^2}$

$= M^{-1}$

Question

Identify the pair of physical quantities which have different dimensions:

[JEE Main 2022]

1. Wave number and Rydberg's constant

   $\frac{1}{\lambda}$ $1/\lambda$

2. Stress and Coefficient of elasticity

3. Coercivity and Magnetization

4. Specific heat capacity and Latent heat

   $Q = mL$

   $Q = ms\Delta T$

Question

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]

1. $[P\ A^{-1}\ T^{0}]$
2. $[P\ A\ T^{-1}]$
3. $[P\ A^{-1}\ T]$
4. $[P\ A^{-1}\ T^{-1}]$

$F = 6\pi\eta r v_T$

$\eta = \frac{F}{r v_T}$

$= \frac{ML T^{-2}}{L \times L T^{-1}}$

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

P A T

$= P/A$

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

Question

Share is a unit of time

1 AU = 1.49×10^{11} m

1 ly ≈ 10^{15} m

1 Pc = 10^{16} m

Given below are two statements:

Statements-I: Astronomical unit (Au), Parsec (Pc) and Light year (ly) are units for measuring astronomical distances.

Statements-II: Au < Parsec (pc) < ly

In the light of the above statements, choose the most appropriate answer from the options given below:

[JEE Main 2023]

1. Both Statement I and Statement II are incorrect
2. Statement I is correct but Statement II is incorrect
3. Both Statement I and Statement II are correct
4. Statement I is incorrect but Statement II is correct

Question

If force (F), velocity (V) and time (T) are considered as fundamental physical quantity, then dimensional formula of density will be: [JEE Main 2023]

1. $FV^4 T^{-6}$
2. $FV^{-4} T^{-2}$
3. $F^2 V^{-2} T^6$
4. $FV^{-2} T^2$

$$d\left(\frac{m}{L^3}\right) = F^x V^y T^z$$

$$= \frac{F^1}{V^y} = FV^{-y}$$

$$= \frac{MLT^{-2}}{L^y T^{-y}}$$

Question

The speed of a wave produced in water is given by $v = \lambda^a g^b \rho^c$. Where λ, g and ρ are wavelength of wave, acceleration due to gravity and density of water respectively. The values of a, b and c respectively, are

[JEE Main 2023]

1. $1, -1, 0$ ✗
2. $\frac{1}{2}, 0, \frac{1}{2}$ ✗
3. $1, 1, 0$ ✗
4. $\frac{1}{2}, \frac{1}{2}, 0$ ✓

$$V = \lambda^a g^b \rho^c$$

$$LT^{-1} = L^a (LT^{-2})^b \left(\frac{M}{L^3}\right)^c$$

Question

The frequency (ν) of an oscillating liquid drop may depend upon radius (r) of the drop, density (ρ) of liquid and the surface tension (s) of the liquid as: $\nu = r^a \rho^b s^c$. The values of a, b and c respectively are

[JEE Main 2023]

1. $\left(-\frac{3}{2}, -\frac{1}{2}, \frac{1}{2}\right)$
2. $\left(\frac{3}{2}, -\frac{1}{2}, \frac{1}{2}\right)$
3. $\left(\frac{3}{2}, \frac{1}{2}, -\frac{1}{2}\right)$
4. $\left(-\frac{3}{2}, \frac{1}{2}, \frac{1}{2}\right)$

$$\nu = \gamma^a \rho^b s^c$$

$$M^0 L^0 T^{-1} = L^a \left(\frac{M}{L^3}\right)^b \left(MT^{-2}\right)^c$$

$$= \frac{1}{L^{3/2}} \times \frac{1}{(L^3)^{1/2}} = L^{-3}$$

Question

The equation of a circle is given by $x^2 + y^2 = a^2$, where a is the radius. If the equation is modified to change the origin other than (0, 0), then find out the correct dimensions of A and B in a new equation:

$$(x - At)^2 + \left(y - \frac{t}{B}\right)^2 = a^2.$$

The dimensions of t is given as $[T^{-1}]$. **[JEE Main 2023]**

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

$$(x - At)^2 + \left(y - \frac{t}{B}\right)^2 = a^2$$

$$x = At$$

$$A = \frac{x}{T} = \frac{L}{T} = LT$$

Question

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]

NEET-2016

1. $[h^{\frac{1}{2}}c^{-\frac{1}{2}}G^{1}]$

2. $[h^{1}c^{1}G^{-1}]$

3. $[h^{-\frac{1}{2}}c^{\frac{1}{2}}G^{\frac{1}{2}}]$

4. $[h^{\frac{1}{2}}c^{\frac{1}{2}}G^{-\frac{1}{2}}]$

$M = c^{x} G^{y} h^{z}$

$M^{2}L^{0}T^{0} = (LT^{-1})^{x} (M^{-1}L^{3}T^{-2})^{y} (M^{2}L^{2}T^{-1})^{\frac{1}{2}}$

$M^{-1} \times M^{\frac{1}{2}}$

$\frac{h}{G} = \frac{M}{M^{-1}} M$

$\frac{G^{\frac{1}{2}}}{h^{\frac{1}{2}}}$.

Ans

Question

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]

1. $T^2 = \frac{4\pi^2 r^2}{GM}$ $= \frac{L^2}{M^1 L^3 T^{-2} M}$

2. $T^2 = \frac{4\pi^2 r}{GM^2}$

3. $T^2 = \frac{4\pi^2 r^3}{GM}$

4. $T^2 = 4\pi^2 r^3$

Question

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]**

1. Pressure gradient per unit mass
2. Gravitational potential $\left(\frac{U}{m} = \frac{m L^2 T^{-2}}{m}\right)$
3. Energy per unit mass
4. Force per unit mass

$$\sqrt{uG} = \sqrt{[ML^{-1}T^{-2}] \times [M^{-1}L^3T^{-2}]}$$

$$\sqrt{L^2T^{-4}}$$

$$= LT^{-2}$$

Question

Statement (I): Dimension of specific heat is $[L^2T^{-2}K^{-1}]$

Statement (II): Dimension of gas constant is $[ML^2T^{-1}K^{-1}]$

[JEE Main 2024]

1. Both Statement (I) and Statement (II) are correct
2. Statement (I) is correct but Statement (II) is incorrect
3. Both Statement (I) and Statement (II) are incorrect Statement (I) is incorrect but statement (II) is correct
4. Statement (I) is incorrect but Statement (II) is correct

Question

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]**

1. $[ML^2 T^{-1}]$
2. $[ML^{-1} T^{-2}]$
3. $[MLT^{-2}]$
4. $[M^2 L^2 T^{-2}]$

Question

Statement-I: Planck's constant and angular momentum have same dimensions.

Statement-II: Linear momentum and moment of force have same dimensions.

Choose the correct answer from the options given below: **[JEE Main 2024]**

1. Statement I is true but Statement II is false
2. Both Statement I and Statement II are false
3. Both Statement I and Statement II are true
4. Statement I is false but Statement II is true

$E = hf$

$\lambda = \frac{h}{p}$

Question

If mass is written as $m = k\, c^P\, G^{-1/2}\, h^{1/2}$ then the value of P will be: (Constants have their usual meaning with k a dimensionless constant) **[JEE Main 2024]**

1. 1/2
2. 1/3
3. 2
4. -1/3

$$T^0 L^0 M = K\, c^P\, G^{-1/2}\, h^{1/2}$$

$$= (LT^{-1})^P \frac{M^{1/2} L^{\frac{1}{2}} T^{-1/2}}{M^{-1/2} L^{3/2} T^{-3/2}}$$

$$M^2 L^0 T^0 = L^{P+1-3/2}$$

$$P + 1 - \frac{3}{2} = 0$$

$$P = 1/2$$

Question

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]

1. $L^{-2}M^{1}T^{0}$
2. $L^{2}M^{-1}T^{1}$
3. $L^{-2}M^{-1}T^{1}$
4. $L^{0}M^{-1}T^{1}$

$$E = \frac{B}{At} = \frac{x^2}{At}$$

$$E = \frac{B - x^2}{At}$$

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

$$B = x^2 \quad (1)$$

$$AB = \frac{x^2}{Et} \times x^2 = \frac{x^4}{Et}$$

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

Question

In a measurement, it is asked to find modulus of elasticity per unit torque applied on the system. The measured quantity has dimension of $[M^aL^bT^c]$. If $b = 3$, the value of c is ____.

[JEE Main 2025]

$$\frac{\eta}{Tor} = \frac{ML^{-1}T^{-2}}{ML^2T^{-2}}$$

$$= L^{-3}T^{1}$$

$$= M^aL^bT^c$$

$a = 0$ $\quad b = -3$ $\quad c = 1$

$c = 0$ Ans.

Question

Match List-I with List-II

Choose the correct answer from the options given below: **[JEE Main 2025]**

	List-I		List-II
(A)	Gravitational constant	I	$[LT^{-2}]$
(B)	Gravitational potential energy	II	$[L^2T^{-2}]$
(C)	Gravitational potential	III	$[ML^2T^{-2}]$
(D)	Acceleration due to gravity	IV	$[M^{-1}L^3T^{-2}]$

1. A-IV, B-III, C-II, D-I
2. A-III, B-II, C-I, D-IV
3. A-II, B-IV, C-III, D-I
4. A-I, B-III, C-IV, D-II

Question

$m = IA$

In an electromagnetic system, a quantity defined as the ratio of electric dipole moment and magnetic dipole moment has dimension of $[M^P L^Q T^R A^S]$. The value of P and Q are:

[JEE Main 2020]

1. $-1, 0$
2. $-1, 1$
3. $1, -1$
4. $0, -1$ ✓

$\frac{P}{m} = \frac{2l}{IA}$

$= \frac{I + l^2}{I \; L^2}$

$\therefore t^1 L^{-1} = M^P L^Q T^R A^S$

$P = 0 \quad -1$

THANK YOU