Play with

PHYSICS

in MR Style

Lecture-05

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Topics To Be Covered

Based on Unit & Dimension

Solid

Gravitation

electrostatic

S.H.M

PYQ

Laws of motion

PYQ

Kinematics

PYQ

Modern Phy

PYQ

JEE

Question $g = LT^{-2}$ $R = L^{1}$

Question it-self from units dimn

A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is: **(2016-I)**

(NEET)

(1) $\sqrt{gR^2\left(\frac{\mu_s + \tan\theta}{1-\mu_s \tan\theta}\right)}$ $= \sqrt{gR^2}$ $= \sqrt{LT^{-2} \times L^2}$

(2) $\sqrt{gR\left(\frac{\mu_s + \tan\theta}{1-\mu_s \tan\theta}\right)}$ $= \sqrt{gR}$ $= \sqrt{LT^{-2} \times L}$ $= \sqrt{L^2T^{-2}}$ $= LT^{-1}$

(3) $\sqrt{\frac{g}{R}\left(\frac{\mu_s + \tan\theta}{1-\mu_s \tan\theta}\right)}$ $= \sqrt{\frac{LT^{-2}}{L}} = T^{-1}$

(4) $\sqrt{\frac{g}{R^2}\frac{\mu_s + \tan\theta}{1-\mu_s \tan\theta}}$

$\sqrt{g/R^2} = \sqrt{\frac{LT^{-2}}{L \cdot L}}$

Chapter → circul Dynamics

NLM

Velocity = ?? LT^{-1}

Concept

Question

Modern physics

The energy E and momentum p of a moving body of mass m are related by some equation. Given that c represents the speed of light, identify the correct equation

(JEE Main 2024) /2025

Energy / momentum / mass / c

MR*

⟹ Physically correct

Dimensionally correct

1. $E^2 = pc^2 + m^2c^2$

$E^2 = pc^2 = m^2c^2$ $E^2 = pc^2 = m^2c^2$

2. $E^2 = p^2c^2 + m^2c^2$

$E^2 = p^2c^2 = m^2c^2$

3. $E^2 = pc^2 + m^2c^4$

$E^2 = pc^2 = m^2c^4$

4. $E^2 = p^2c^2 + m^2c^4$

Check dim

concept

$E = pc$

$E = mc^2$

Question

moDern physics

An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglie wavelength λ_d, then: **(NEET 2020)**

Chme

(1) $\lambda_d^2 = \left(\frac{2mc}{h}\right)\lambda^2$ $= \lambda^2 = \lambda$

(2) $\lambda = \left(\frac{2mc}{h}\right)\lambda_d^2$ $= \lambda$

(3) $\lambda = \left(\frac{2h}{mc}\right)\lambda_d^2$

(4) $\lambda = \left(\frac{2m}{hc}\right)\lambda_d^2$

$E = \frac{hc}{\lambda} = mc^2$

$\lambda = \lambda \times \lambda_d^2$

$\lambda = \lambda^3$

$\boxed{\frac{h}{mc} = \lambda}$

Question

MODERN Physics

A photon and an electron (mass m) have the same energy $\boxed{E}$. The ratio $(\lambda_{photon}/\lambda_{electron})$ of their de Broglie wavelengths is (c is the speed of light)

(NEET 2016)

JEE-2021 / JEE-2024

(1) $\sqrt{E/2m} = \sqrt{\frac{\cancel{m}L^2T^{-2}}{\cancel{m}}}$ photon

(2) $c\sqrt{2mE} = LT^{-1}\sqrt{m(ML^2T^{-2})}$

(3) $c\sqrt{2m/E} = c\sqrt{\frac{2m}{E}} = LT^{-1}\sqrt{\frac{\cancel{m}}{\cancel{m}L^2T^{-2}}}$

$= \frac{\cancel{LT^{-1}}}{\cancel{LT^{-1}}} = M^0L^0T^0$

(4) $c\sqrt{\frac{E}{2m}} = LT^{-1}\sqrt{\frac{\cancel{m}L^2T^{-2}}{2\cancel{m}}}$

$$\boxed{\frac{(\lambda_{photon})}{(\lambda_{electron})} = ?? \quad \frac{L}{L} = M^0L^0T^0 =}$$

Question

When light propagates through a material medium of relative permittivity $\in_r$ and relative permeability μ_r, the velocity of light, v is given by: (c – velocity of light in vacuum)

(NEET 2022)

(1) $\underset{LT^{-1}}{v} = \dfrac{c}{\sqrt{\underbrace{\in_r \quad \mu_r}_{\text{dim}^n\text{less}}}}$

(2) $\boxed{v = c}$ ×

(3) $\underset{LT^{-1}}{v} = \sqrt{\dfrac{\mu_r}{\in_r}}$ dim^n less

(4) $v = \sqrt{\dfrac{\in_r}{\mu_r}}$ ×

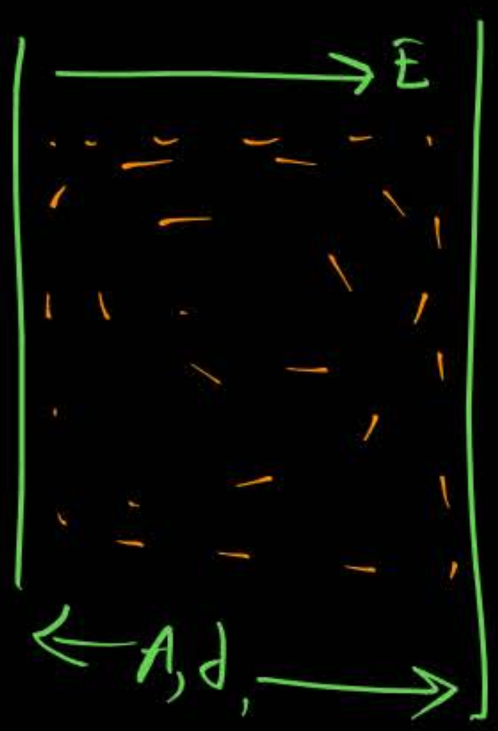
$\left.\begin{matrix}\mu_r \\ \varepsilon_r\end{matrix}\right\} \rightarrow$ dim^{n}less

Question

A parallel plate capacitor has a uniform electric field '$\vec{E}$' in the space between the plates. If the distance between the plates is 'd' and the area of each plate is 'A', the energy stored in the capacitor is: (ε_0 = permittivity of free space) (NEET 2021)

1. $\varepsilon_0 EAd$
2. $\frac{1}{2}\varepsilon_0 E^2 Ad$
3. $\frac{E^2 Ad}{\varepsilon_0}$
4. $\frac{1}{2}\varepsilon_0 E^2$

(energy density)



energy density $= \frac{1}{2}\varepsilon_0 E^2 = \frac{U}{\text{Volume}}$.

$U = \frac{1}{2}\varepsilon_0 E^2 (AL)$

The relation between time t and displacement x is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is (LT^{-2})

(Subtle) JEE Advance

(Kinematics)

A $2\alpha v^3 = \frac{t}{x^2}\left(\frac{x}{T}\right)^3 = \frac{t}{\cancel{x^2}} \times \frac{\cancel{x^3}}{t^3} = \frac{x}{t^2} = LT^{-2}$ (Ans)

B $2\beta v^3 = \frac{t}{x}\left(\frac{x}{T}\right)^3$
$= \frac{t}{\cancel{x}}\left(\frac{\cancel{x^3}}{t^3}\right) x^2$

$t = \alpha x^2 = \beta x$ (dim^n less)

$\boxed{\alpha = \frac{t}{x^2}}$ $\beta = t/x$

C $2\alpha\beta v^3$
$= \frac{t}{x^2} \times \frac{t}{x}\left(\frac{x}{T}\right)^3$

D $2b^2v^3$

Question

A car of mass m is moving on a level circular track of radius R. If μ_s represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by: **(2012 Mains)**

(1) $\sqrt{\mu_s mRg}$

(2) $\sqrt{\frac{Rg}{\mu_s}}$

(3) $\sqrt{mRg/s}$

(4) $\sqrt{\mu_s Rg}$

Question

A liquid drop of radius R oscillates due to surface tension forces, with gravity and density of the liquid also playing a role. The frequency f is expected to depend on R, the liquid density ρ, and surface tension S. Which expression could represent f?

(NEET 2024)

(1) $f = \sqrt{\dfrac{S}{\rho R^3}}$

(2) $f = \sqrt{\dfrac{S}{\rho R^2}}$

(3) $f = \dfrac{S}{\rho R^2}$

(4) $f = \sqrt{\dfrac{S}{\rho^2 R^3}}$

$f(T^{-1})$, $R(L^1)$, $\rho\left(\frac{M}{L^3}\right)$, $S(MT^{-2})$

$= \sqrt{\dfrac{\cancel{M}T^{-2}}{\left(\frac{\cancel{M}}{\cancel{L^3}}\right)\times \cancel{L^3}}} = T^{-1}$

Question

If R is the radius of the earth and g is the acceleration due to gravity on the earth surface. Then the mean density of the earth will be (2023-Manipur)

NEET

1. $\frac{\pi RG}{12g} = M^{-1}$
2. $\frac{3\pi R}{4gG}$
3. $\frac{3g}{4\pi RG} = \frac{LT^{-2}}{4(M^{-1}L^{3}T^{-2})}$
4. $\frac{4\pi G}{3gR}$

$* \; R \rightarrow (L^{2})$

$* \; g \rightarrow (LT^{-2})$

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

$d = \frac{M}{L^{3}}$

feel → physics dekho aap chhaa hua

Question

A particle of mass M starting from rest undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is: (2010 Mains)

H/W

(1) $\frac{1}{2}\frac{MV^2}{T}$

(2) $\frac{2}{1}\frac{MV^2}{T^2}$

(3) $\frac{MV^2}{T^2}$

(4) $\frac{1}{2}\frac{MV^2}{T}$

Question

A particle of mass m moves on a straight line with its velocity increasing with distance according to the equation $v = \alpha\sqrt{x}$, where α is a constant. The total work done by all the forces applied on the particle during its displacement from $x = 0$ to $x = d$, will be: (JEE Main 2024)

H/w

(1) $\frac{m}{2\alpha^2 d}$

(2) $\frac{md}{2\alpha^2}$

(3) $2m\alpha^2 d$

(4) $\frac{m\alpha^2 d}{2}$

Question

A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be: (2015 RE)

S.H.M

(1) $\frac{2\pi\beta}{\alpha}$

(2) $\frac{\beta^2}{\alpha^2}$

(3) $\frac{\alpha}{\beta}$

(4) $\frac{\beta^2}{\alpha}$

H/W

Question

What will be the formula of mass of the earth in terms of g, R and G? (1996)

1. $G\frac{R}{g}$

2. $g\frac{R^2}{G}$

3. $g^2\frac{R}{G}$

4. $G\frac{g}{R}$

H/W

Question

A particle of mass m is thrown upwards from the surface of the earth, with a velocity u. The mass and the radius of the earth are, respectively, M and R. G is gravitational constant and g is acceleration due to gravity on the surface of the earth. The minimum value of u so that the particle does not return back to earth is [MR*] (2011 Mains)

1. $\sqrt{\dfrac{2GM}{R}}$
2. $\sqrt{\dfrac{2gM}{R^2}}$
3. $\sqrt{2gR^2}$
4. $\sqrt{\dfrac{2GM}{R^2}}$

H/W

Thank You