Physics-JEE-Mains-Formulas

October 20, 2025

Class	Lesson	Concept	Formula / Key Point	Variable Explanation
11	Physical World & Measurement	SI Units	[Base units: m, kg, s, A, K, mol, cd]	m: metre, kg: kilogram, s: second, A: ampere, K: kelvin, mol: mole, cd: candela
		Measurement Errors	[Percentage error = $\frac{\text{Error}}{\text{Measured value}} \times 100$]	Error: Difference from true value, Measured value: Obtained value
		Significant Figures	[Rules for significant digits]	-
11	Kinematics	Equations of Motion	[$v = u + at$], [$s = ut + \frac{1}{2}at^2$], [$v^2 = u^2 + 2as$]	v: Final velocity, u: Initial velocity, a: Acceleration, t: Time, s: Displacement
		Projectile Motion	[$R = \frac{u^2 \sin 2\theta}{g}$], [$T = \frac{2u \sin \theta}{g}$]	u: Initial velocity, : Angle, g: Gravity, R: Range, T: Time of flight
		Relative Velocity	[$\vec{v}_{A/B} = \vec{v}_A - \vec{v}_B$]	$v_{A/B}$: Velocity of A relative to B
11	Laws of Motion	Newton's Second Law	[$\vec{F} = m\vec{a}$]	F: Force, m: Mass, a: Acceleration
		Friction	[$f_{\max} = \mu N$]	$f_{\max}$: Max static friction, μ: Coefficient of friction, N: Normal force
		Impulse & Momentum	[$\vec{J} = \vec{F}\Delta t$], [$\vec{p} = m\vec{v}$]	J: Impulse, p: Momentum, F: Force, Δt: Time interval, m: Mass, v: Velocity
11	Work, Energy & Power	Work Done	[$W = \vec{F} \cdot \vec{d} = Fd \cos\theta$]	W: Work, F: Force, d: Displacement, : Angle between force and displacement
		Kinetic Energy	[$K.E. = \frac{1}{2}mv^2$]	m: Mass, v: Velocity
		Power	[$P = \frac{W}{t}$], [$P = Fv$]	P: Power, W: Work, t: Time, F: Force, v: Velocity

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11	Gravitation	Newton's Law of Gravitation	$[F = G\frac{m_1 m_2}{r^2}]$	F: Force, G: Gravitational constant, m_1, m_2: Masses, r: Distance between centers
		Acceleration due to Gravity	$[g = G\frac{M}{R^2}]$	g: Gravity, G: Gravitational constant, M: Planet mass, R: Radius of planet
		Escape Velocity	$[v_e = \sqrt{\frac{2GM}{R}}]$	v_e: Escape velocity, G: Gravitational constant, M: Mass of planet, R: Radius
11	Properties of Matter	Stress and Strain	[Stress = $\frac{F}{A}$], [Strain = $\frac{\Delta L}{L}$]	F: Force, A: Area, ΔL: Change in length, L: Original length
		Young's Modulus	$[Y = \frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta L/L}]$	Y: Young's modulus, F: Force, A: Area, L: Length, ΔL: Change in length
		Bulk Modulus	$[B = -V\frac{\Delta P}{\Delta V}]$	B: Bulk modulus, V: Volume, ΔP: Pressure change, ΔV: Volume change
11	Thermodynamics	First Law	$[\Delta U = Q - W]$	ΔU: Change in internal energy, Q: Heat, W: Work
		Work in Expansion	$[W = P\Delta V]$	W: Work, P: Pressure, ΔV: Volume change
		Specific Heat Capacity	$[Q = mc\Delta T]$	Q: Heat, m: Mass, c: Specific heat, ΔT: Temp change
11	Oscillations	Simple Harmonic Motion	$[x = A\sin(\omega t + \phi)]$, $[\omega = 2\pi f = \sqrt{\frac{k}{m}}]$, $[T = \frac{2\pi}{\omega}]$	x: Displacement, A: Amplitude, : Angular frequency, : Phase, t: Time, k: Spring const.
		Time Period of Pendulum	$[T = 2\pi\sqrt{\frac{l}{g}}]$	T: Time period, l: Length of pendulum, g: Gravity
		Energy in SHM	$[E = \frac{1}{2}kA^2]$	E: Energy, k: Spring constant, A: Amplitude
11	Waves	Wave Velocity	$[v = f\lambda]$	v: Velocity, f: Frequency, : Wavelength
		Intensity	[Intensity $\propto$ Amplitude^2]	Intensity Square of Amplitude
		Superposition Principle	[Constructive and destructive interference]	Depends on phase difference of overlapping waves

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12	Electrostatics	Coulomb's Law	$[F = k\frac{q_1 q_2}{r^2}]$	F: Force, k: Coulomb constant, q_1, q_2: Charges, r: Distance between charges
		Electric Field	$[E = \frac{F}{q} = k\frac{Q}{r^2}]$	E: Electric field, F: Force, q: Test charge, Q: Source charge, r: Distance
		Electric Potential	$[V = k\frac{Q}{r}]$	V: Electric potential, Q: Charge, r: Distance, k: Coulomb constant
12	Current Electricity	Ohm's Law	$[V = IR]$	V: Voltage, I: Current, R: Resistance
		Power in Electric Circuit	$[P = VI]$, $[P = I^2R]$, $[P = \frac{V^2}{R}]$	P: Power, V: Voltage, I: Current, R: Resistance
		Resistance (Series/Parallel)	[Series: $R = R_1 + R_2 + ...$], [Parallel: $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + ...$]	R: Net resistance, R_1, R_2: Individual resistances
12	Magnetic Effects	Biot–Savart Law	$[d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\hat{r}}{r^2}]$	μ_0: Permeability, I: Current, $d\vec{l}$: Element length, $\hat{r}$: Unit vector
		Magnetic Field on Coil Axis	$[B = \frac{\mu_0 NIR^2}{2(R^2+x^2)^{3/2}}]$	B: Magnetic field, N: Turns, I: Current, R: Radius, x: Axis dist.
		Force on Current-Carrying Wire	$[\vec{F} = I\vec{L} \times \vec{B}]$	F: Force, I: Current, L: Length vector, B: Magnetic field
12	Electromagnetic Induction	Faraday's Law	$[\mathcal{E} = -\frac{d\Phi_B}{dt}]$	$\mathcal{E}$: EMF, Φ_B: Magnetic flux, t: Time
		Lenz's Law	[Induced emf opposes the change causing it]	Direction opposes cause
		Self-Inductance	$[L = \frac{N\Phi_B}{I}]$	L: Inductance, N: Turns, Φ_B: Magnetic flux, I: Current
12	Alternating Currents	RMS Values	$[I_{\text{rms}} = \frac{I_0}{\sqrt{2}}]$, $[V_{\text{rms}} = \frac{V_0}{\sqrt{2}}]$	I_0: Peak current, V_0: Peak voltage
		Reactance	[Inductive: $X_L = \omega L$], [Capacitive: $X_C = \frac{1}{\omega C}$]	ω: Angular freq, L: Inductance, C: Capacitance
		Impedance	$[Z = \sqrt{R^2 + (X_L - X_C)^2}]$	Z: Impedance, R: Resistance, X_L, X_C: Reactances
12	Optics	Lens Formula	$[\frac{1}{f} = \frac{1}{v} - \frac{1}{u}]$	f: Focal length, v: Image distance, u: Object distance

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		Magnification	$[m = \frac{v}{u} = \frac{h_i}{h_o}]$	h_i: Image height, h_o: Object height
		Snell's Law	$[n_1 \sin\theta_1 = n_2 \sin\theta_2]$	n: Refractive index, θ: Angle
12	Dual Nature & Radiation	Photoelectric Equation	$[hf = \phi + \frac{1}{2}mv^2]$	h: Planck's const, f: Frequency, : Work function, m: Mass, v: Velocity
		de Broglie Wavelength	$[\lambda = \frac{h}{p} = \frac{h}{mv}]$	: Wavelength, h: Planck's constant, p: Momentum, m: Mass, v: Velocity
		Radioactive Decay	$[N = N_0 e^{-\lambda t}]$	N_0: Initial nuclei, : Decay const, t: Time
12	Atoms and Nuclei	Bohr Radius	$[r_n = n^2 \frac{h^2}{4\pi^2 m e^2}]$	r_n: Orbit radius, n: Level, h: Planck's const, m: Electron mass, e: Charge
		Energy Levels	$[E_n = -\frac{13.6\,\text{eV}}{n^2}]$	E_n: Energy of nth level, n: Orbit number