Useful Formulae in Advanced Level Physics

A1.	$a = \frac{v^2}{r} = \omega^2 r$	centripetal acceleration
A2.	$a = \omega^2 \chi$	simple harmonic motion
A3.	$L = I\omega$	angular momentum of a rigid body
A4.	$T = \frac{dL}{dt}$	torque on a rotating body
A5.	$E = \frac{1}{2}\mathrm{I}\omega^2$	energy stored in a rotating body
B1.	$v = \sqrt{\frac{T}{m}}$	velocity of transverse wave motion in a stretched string
B2.	$v = \sqrt{\frac{E}{\rho}}$	velocity of longitudinal wave motion in a solid
B3.	$n = \tan\theta_p$	refractive index and polarizing angle
B4.	$d = \frac{\lambda D}{a}$	fringe width in double-slit interference
B5.	$d\sin\theta = n\lambda$	diffraction grating equation
B6.	$f' = f(\frac{\upsilon - u_0}{\upsilon - u_s})$	Doppler frequency
B7.	$10\log_{10}(\frac{\mathrm{I}_2}{\mathrm{I}_1})$	definition of the decibel
C1.	$F = \frac{Gm_1m_2}{r^2}$	Newton's law of gravitation
C2.	$V = \frac{GM}{r}$	gravitational potential
C3.	$r^3 / T^2 = constant$	Kepler's third law
C4.	$E = \frac{Q}{4\pi\varepsilon_0 r^2}$	electric field due to a point charge
C5.	$V = \frac{Q}{4\pi\varepsilon_0 r}$	electric potential due a point charge

C6.	$E = \frac{V}{d}$	electric field between parallel plates (numerically)
C7.	$C = \frac{Q}{V} = \frac{\varepsilon_0 A}{d}$	capacitance of a parallel-plate capacitor
C8.	$Q = Q_o e^{-t/RC}$	decay of charge with time when a capacitor discharges
C9.	$Q = Q_o (1 - e^{-t/RC})$	rise of charge with time when charging a capacitor
C10.	$E = \frac{1}{2} CV^2$	energy stored in a capacitor
C11.	$I = nA\upsilon Q$	general current flow equation
C12.	$R = \frac{\rho l}{A}$	resistance and resistivity
C13.	$F = BQ\upsilon \sin\theta$	force on a moving charge in a magnetic field
C14.	$F = BIl \sin\theta$	force on a current carrying a conductor in a magnetic field
C15.	$V = \frac{BI}{nQt}$	Hall voltage
C16.	$B = \frac{\mu_0 I}{2\pi r}$	magnetic field inside a long straight wire
C17.	$B = \frac{\mu_0 NI}{l}$	magnetic field inside long solenoid
C18.	$F = \frac{\mu_0 I_1 I_2}{2\pi r}$	force per unit length between long parallel straight current carrying conductors
C19.	$T = BAN \sin\phi$	torque on a rectangular current carrying coil in a uniform magnetic field
C20.	$E = BAN\omega \sin\omega t$	simple generator e.m.f.
C21.	$\frac{V_s}{V_\rho} \approx \frac{N_s}{N_\rho}$	ratio of secondary voltage to primary voltage in a transformer
C22.	$E = -LdI/dt$	e.m.f. induced in an inductor
C23.	$E = \frac{1}{2} LI^2$	energy stored in an inductor
C24.	$X_L = \omega L$	reactance of an inductor

C25. $X_C = \frac{1}{\omega C}$ reactance of a capacitor

C26. $P = IV_{COS}\theta$ power in an a.c. circuit

C27. $\Delta V_{out} / \Delta V_{in} = -\beta \frac{R_L}{R_B}$ voltage gain of transistor amplifier in the common emitter configuration

C28. $V_o = A_o(V_+ - V_-)$ output voltage of op amp (open-loop)

C29. $A = -\frac{R_f}{R_i}$ gain of inverting amplifier

C30. $A = 1 + \frac{R_f}{R_i}$ gain of non-inverting amplifier

D1. $pV = nRT = NkT$ equation of state for an ideal gas

D2. $pV = \frac{1}{3} Nm\overline{c^2}$ kinetic theory equation

D3. $E_k = \frac{3RT}{2N_A} = \frac{3}{2}kT$ molecular kinetic energy

D4. $E = \frac{F}{A} / \frac{x}{L}$ macroscopic definition of Young modulus

D5. $E = \frac{1}{2} Fx$ energy stored in stretching

D6. $F = -\frac{dU}{dr}$ relationship between force and potential energy

D7. $E = k / r$ microscopic interpretation of Young modulus

D8. $P + \frac{1}{2}\rho v^2 + \rho gh$ = constant Bernoulli's equation

D9. $\Delta U = Q + W$ first law of thermodynamics

D10. $E_n = -\frac{13.6}{n^2} eV$ energy level equation for hydrogen atom

D11. $N = N_o e^{-kt}$ law of radioactive decay

D12. $t_{\frac{1}{2}} = \frac{\ln 2}{k}$ half-life and decay constant

D13. $\frac{1}{2}m\upsilon_m^2 = hv - \phi$ Einstein's photoelectric equation

D14. $E = mc^2$ mass-energy relationship