Equations you must KNOW **A2 physics**

NOTE: A number of these equations are easily derived from equations on the formula booklet, but you may find this helpful.

Chapter 10 Creating models

$A = A_0 e^{-\lambda t}$ (A = activity, A_0 = activity at time = 0, λ = decay constant, t = time)

Fraction of nuclei remaining after time $t = \frac{1}{2^x}$; where $x = t/t_{½}$ (t =time, $t_{½}$ = half life)

$E = \frac{Q^2}{2C}$ (E = energy stored in capacitor, Q = charge, C = capacitance)

$T = 2\pi\sqrt{\frac{l}{g}}$ (T = period of pendulum, l = length, g = acceleration due to gravity

Chapter 11 Out into space

$v = \frac{2\pi r}{T}$ (v = tangential velocity for object moving in circle, r = radius, T = period)

$F = mr\omega^2$ (F = centripetal force, m = mass, r = radius, ω = angular velocity)

$GPE = \frac{-GMm}{r}$ (GPE = gravitational potential energy, M = mass of planet, m = mass of object in planet's gravitational field, r = distance between centre of M and m)

Chapter 12 Our place in the Universe

$v = H_0 d$ (v = recession velocity of a galaxy, d = distance to galaxy, H_0 = Hubble constant)

$T = 1/H_0$ (T = estimate of age of Universe, H_0 = Hubble constant)

$t = t_0\,\gamma$ (t = time in frame of observer, t_0 = time in frame of moving particle, γ = time dilation relation)

Chapter 13 Matter: very simple and Chapter 14 Matter: very hot and cold

$PV = NkT$ (P = pressure, V = volume, N = number of molecules, k = Boltzmann constant, T = absolute temperature)

$N = \frac{\text{mass}}{\text{molar mass}} \times N_A$ (N = number of molecules, N_A = Avogadro's number)

$P = \frac{1}{3}\rho c_{rms}^2$ (P = pressure, ρ = density, c_{rms} = root mean square speed)

$\rho = \frac{PM}{RT}$ (ρ = density, P = pressure, M = molar mass, R = gas constant,

T = absolute temperature)

$\Delta U = Q + W$ (ΔU = change in internal energy, Q = thermal energy transferred,

W = work done)

Chapter 15 Electromagnetic machines

$\Lambda = \frac{\varphi}{NI}$ (Λ = permeance, φ = flux, NI = current turns driving flux)

$\Lambda = \frac{\mu A}{L}$ (Λ = permeance, μ = permeability, A = cross sectional area, L = length)

$B = \frac{\varphi}{A}$ (B = flux density, φ = flux, A = cross sectional area)

Chapter 16 Charge and field

$E = -\frac{V}{d}$ (E = field strength of uniform field, V = p.d. across plates, d = plate spacing)

$EPE = \frac{kQq}{r}$ (EPE = electrostatic potential energy, Q = charge producing radial field, q = test charge in field due to Q, r = distance between Q and q, k = electric force constant)

$r = \frac{mv}{qB}$ (r = radius of orbit in magnetic field, m = mass, v = velocity, q = charge, B = field strength, for charged particle travelling at right angles to magnetic field)

Chapter 17 Probing deep into matter

$\Delta E = hf = \frac{hc}{\lambda}$ (ΔE = energy difference between 2 energy levels in an atom or molecule, h = Planck's constant, c = speed of light, f = frequency, hf is the energy of the photon emitted or absorbed)

$KE = \frac{h^2}{2m\lambda^2}$ (KE = kinetic energy of a quantum particle, h = Planck's constant, m = mass,

λ = de Broglie wavelength)

$r = r_0 A^{1/3}$ (r = nuclear radius, r_0 = proton radius, A = number of nucleons)

Chapter 18 Ionising radiation and risk

$A = A_0 e^{-\lambda t}$ (A = activity, A_0 = activity at time = 0, λ = decay constant, t = time)

Fraction of nuclei remaining after time $t = \frac{1}{2^x}$; where $x = t/t_{½}$ (t =time, $t_{½}$ = half life)

$N = \frac{\text{mass}}{\text{molar mass}} \times N_A$ (N = number of molecules, N_A = Avogadro's number)