

### Formulae:

$$F_{net} = ma, \quad w = mg, \quad a_c = \frac{v^2}{r}, \quad K = \frac{1}{2}mv^2, \quad p = mv, \quad P = \frac{E}{t}, \quad E_0 = m_0c^2$$

$$F_e = k \frac{q_1q_2}{r^2}, \quad \vec{E} = \frac{\vec{F}}{q}, \quad E = k \frac{q}{r^2}, \quad E = -\frac{\Delta V}{\Delta s}, \quad \Delta U = q\Delta V, \quad V = \frac{kq}{r}$$

$$C = \frac{Q}{V}, \quad C = \frac{\epsilon_0 A}{d}, \quad U = \frac{1}{2}QV$$

$$V = IR, \quad P = IV, \quad R_{eq} = R_1 + R_2 + R_3 + \dots, \quad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots, \quad V=IR, \quad P=IV$$

$$F = qvB \sin \theta, \quad F = I\ell B \sin \theta, \quad B = \frac{\mu_0 I}{2\pi r}, \quad B = \frac{N\mu_0 I}{2R}, \quad B = \mu_0 \frac{N}{L} I$$

$$\Phi = BA \cos \phi, \quad \mathcal{E} = -N \frac{\Delta \Phi}{\Delta t}, \quad \mathcal{E} = NAB\omega \sin \omega t, \quad \frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}$$

$$f = \frac{1}{2\pi} \sqrt{\frac{1}{LC}}, \quad c = f\lambda, \quad E = cB, \quad I = I_0 \cos^2 \theta$$

$$\begin{aligned} n_1 \sin \theta_1 &= n_2 \sin \theta_2 & W \sin \theta &= m\lambda & \Delta t &= \frac{\Delta t_0}{\sqrt{1 - \frac{v^2}{c^2}}} & p &= \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}} \\ m &= -\frac{d_i}{d_o} & d \sin \theta &= m\lambda & & & E_0 &= m_0 c^2 \\ & & d \sin \theta &= (m - \frac{1}{2})\lambda & \sin \theta &= 1.22 \frac{\lambda}{D} & L &= L_0 \sqrt{1 - \frac{v^2}{c^2}} & E &= \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} \\ \frac{1}{f} &= \frac{1}{d_i} + \frac{1}{d_o} & & & & & & & & \end{aligned}$$

$$E_n = nhf, \quad E = hf, \quad c = \lambda f, \quad K_{max} = hf - W_0, \quad p = \frac{h}{\lambda}, \quad \lambda = \frac{h}{p}$$

$$\Delta p_y \Delta y \geq \frac{h}{2\pi}, \quad \Delta E \Delta t \geq \frac{h}{2\pi}, \quad \frac{1}{\lambda} = R \left( \frac{1}{n'^2} - \frac{1}{n^2} \right), \quad E_n = -(13.6eV) \frac{Z^2}{n^2}$$

$$N = N_0 e^{-\lambda t}, \quad R = \frac{\Delta N}{\Delta t} = \Delta \lambda = R_0 e^{-\lambda t}, \quad T_{1/2} = \frac{\ln 2}{\lambda}$$

### Constants and conversions:

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}, \quad \mu_0 = 4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}, \quad k = 8.99 \times 10^9 \text{ N m}^2 / \text{C}^2, \quad |e| = 1.60 \times 10^{-19} \text{ C}$$

$$h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}, \quad 1eV = 1.60 \times 10^{-19} \text{ J}, \quad c = 3.00 \times 10^8 \text{ m/s}$$

$$1 \text{ Ci} = 3.70 \times 10^{10} \text{ decays/second}$$

$$m_{\text{electron}} = 9.11 \times 10^{-31} \text{ kg} = 5.486 \times 10^{-4} \text{ u} = .511 \text{ MeV}/c^2$$

$$m_{\text{proton}} = 1.007 276 \text{ u}, \quad m_{\text{neutron}} = 1.008 665 \text{ u}$$

$$1 \text{ u} = 1.660 540 \times 10^{-27} \text{ kg} = 931.5 \text{ MeV}/c^2$$