Formulae

Circumference = $2\pi r$, circle area = πr^2, sphere surface area = $4\pi r^2$

V(cylinder) = $\pi r^2 h$, V(sphere) = $\frac{4}{3}\pi r^3$

$$v_x = v_{0x} + a_x t\,, \quad x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2\,, \quad v_x^2 = v_{0x}^2 + 2a_x(x - x_0)\,, \quad K = \frac{1}{2}mv^2$$

$$F = k\frac{|q_1||q_2|}{r^2}$$

$$k = \frac{1}{4\pi\varepsilon_0} = 8.99\times10^9\left[\frac{\text{N}\cdot\text{m}^2}{\text{C}^2}\right],\ \varepsilon_o = 8.85\times10^{-12}\left[\frac{\text{C}^2}{\text{N}\cdot\text{m}^2}\right],\ e = |e| = 1.60\times10^{-19}\,\text{C}$$

$$\vec{E} = \frac{\vec{F}}{q_0}\,,\quad E_{\text{point-charge}} = k\frac{|q|}{r^2}\,,\ E_{\text{sheet}} = \frac{\sigma}{2\varepsilon_o}\,,\ E_{\text{parallel plates}} = \frac{\sigma}{\varepsilon_o}\,,\ \sigma = \frac{Q}{A}$$

$$\Phi = EA\cos\theta\,,\quad \Phi = \frac{Q_{\text{enclosed}}}{\varepsilon_o}$$

$$\Delta U = -W_{\text{by E field}} = +W_{\text{by external body}}\,,\ \Delta V = \frac{\Delta U}{q_0}\,,\ E = -\frac{\Delta V}{\Delta s}$$

$$\frac{1}{2}mv_A^2 + U_A = \frac{1}{2}mv_B^2 + U_B$$

$$V_{\text{point charge}} = k\frac{q}{r}\,,\ U_{\text{point charge}} = k\frac{q_0 q}{r}$$

$$C = \frac{Q}{V}\,,\ C_{\text{parallel-plates}} = \varepsilon_0\frac{A}{d}\,,\quad C_{\text{dielectric}} = \kappa C_0$$

$$U = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{Q^2}{2C}\,,\quad u_E = \frac{1}{2}\varepsilon_o E^2$$

$$I = \frac{\Delta Q}{\Delta t}$$

Ohm's Law: $V = IR$, $\quad R = \rho\left(\frac{L}{A}\right)$, $\quad P_{\text{circuit}} = IV$, $\quad P_{\text{into a resistor}} = I^2R = \frac{V^2}{R}$

$R_{\text{eq}} = \sum_n R_n$ (in series), $\quad \frac{1}{R_{\text{eq}}} = \sum_n \frac{1}{R_n}$ (in parallel)

$C_{\text{eq}} = \sum_n C_n$ (in parallel), $\quad \frac{1}{C_{\text{eq}}} = \sum_n \frac{1}{C_n}$ (in series)

Kirchhoff: $\sum I = 0$ (junction rule), $\sum V = 0$ (loop rule)

RC circuit: $\tau = RC$, $\quad q(t) = C\mathcal{E}(1 - e^{-t/\tau})$, $I(t) = (\mathcal{E}/R)e^{-t/\tau}$ charging, $\quad q(t) = Q_o e^{-t/\tau}$ discharging

$$F = |q| vB\sin\theta \qquad \mu_0 = 4\pi \times 10^{-7}\left[\frac{\mathrm{T\cdot m}}{\mathrm{A}}\right] \qquad r = \frac{mv}{|q|B}$$

$$F = ILB\sin\theta \qquad \tau = NIAB\sin\theta \qquad F = \frac{\mu_0 I_1 I_2}{2\pi d} L$$