PHYS2002 Test 1 formula sheet

mass of proton	m_p = 1.67x10^{-27} kg
mass of electron	m_e = 9.11x10^{-31} kg
charge on proton	$q_p = +e$ = +1.602x10^{-19} C
charge on electron	$q_e = -e$ = -1.602x10^{-19} C
permittivity of free space	ε_0 = 8.85x10^{-12} C^2/(N·m^2)
Coulomb's Law constant	k = 8.99x10^9 N·m^2/C^2 = $\frac{1}{4\pi\varepsilon_0}$

Point charges

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

$$EPE = k\frac{q_1 q_2}{r} \qquad V = k\frac{q_1}{r}$$

Units

Joule = J = N·m

Watt = W = J/s

Amp = A = C/s

Volt = V = J/C

Ohm = Ω = V/A

$$\vec{F} = q\vec{E} \qquad \Delta V = E\cdot\Delta d \qquad \Delta EPE = -W = -q\Delta V$$

Kinematics (e.g. PHYS2001)

$$\sum\vec{F} = m\vec{a} \qquad \vec{p} = m\vec{v} \qquad W = Fd\cos\theta$$

$$x - x_0 = v_{0x}t + \frac{1}{2}a_x t^2 \qquad E_{total} = KE + EPE + GPE + \cdots$$

$$KE = \frac{1}{2}mv^2 \qquad GPE = mgy$$

$$v_x - v_{0x} = a_x t$$

$$v_x^{\,2} - v_{0x}^2 = 2a_x(x - x_0) \qquad F_c = \frac{mv^2}{r} = ma_c \qquad T = \frac{2\pi r}{v}$$

Resistance $R = \rho \frac{L}{A}$ Ohm's Law $V = IR$

$$R_{series} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{||}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$$

$$I_{series} = I_1 = I_2 = \ldots \qquad I_{||} = I_1 + I_2 + \ldots$$

$$V_{series} = V_1 + V_2 + \ldots \qquad V_{||} = V_1 = V_2 = \ldots$$

Power $P = IV = I^2R = \frac{V^2}{R}$

Capacitance

$$q = CV \qquad C = \frac{\kappa \varepsilon_0 A}{d} \qquad Energy = \frac{1}{2}CV^2$$

$$E_0 = \frac{\sigma}{\varepsilon_0} = \frac{q}{A\varepsilon_0} \qquad E = \frac{E_0}{\kappa}$$

$$\frac{1}{C_{series}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots \qquad C_{||} = C_1 + C_2 + \ldots$$

RC Circuits $\tau = RC$

RC discharging $q = q_0 e^{-t/\tau}$

RC charging $q = q_0\left(1 - e^{-t/\tau}\right)$