Formula Sheet (2nd Midterm)

$V = \dfrac{EPE}{q_0}$; $\Delta(EPE) = -W_{AB}$; $V = \dfrac{kq}{r}$ but [k =8.99×10^{9}N·m^2/C^2]; $E = -\dfrac{\Delta V}{\Delta s}$;

$q = CV$ (Capacitor); $\frac{1}{2}mv_i^2 + EPE_i = \frac{1}{2}mv_f^2 + EPE_f$ (Energy conservation);

$C = \dfrac{\kappa\varepsilon_0 A}{d}$ (Parallel plate capacitor filled with a dielectric)

$E = \frac{1}{2}CV^2$ (Energy storage in a capacitor);

$I = \dfrac{\Delta q}{\Delta t}$ (Definition of current); $V = IR$ (Ohm's law);

$R = \rho\dfrac{L}{A}$ (Resistance and resistivity); $\dfrac{R_1}{R_2} = \dfrac{I_2}{I_1}$ (In a parallel circuit)

$\rho = \rho_0\left[1 + \alpha(T - T_0)\right]$; and $R = R_0\left[1 + \alpha(T - T_0)\right]$ (Temperature dependence of resistance)

$P = IV$ (Electric power); $V = V_0 \sin 2\pi ft$ and $I = I_0 \sin 2\pi ft$ (Alternating current);

$V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ (Root mean square); $R_{eq} = R_1 + R_2 + \cdots$ (Series)

$\dfrac{1}{R_{eq}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \cdots$ (Parallel); $V_T = Emf - Ir$ and $I = \dfrac{Emf}{R_{total} + r}$ (Internal resistance)

$C_{eq} = C_1 + C_2 + \cdots$ (Parallel); $\dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \cdots$ (Series);

$q = q_0\left[1 - \exp\left(-t/(RC)\right)\right]$ (Capacitor charging);

$q = q_0 \exp\left(-t/(RC)\right)$ (Capacitor discharging);

$F = q_0 vB\sin\theta$ (Lorentz force); $F = IB\ell\sin\theta$ (Ampere's force);

$\tau = NIAB\sin\phi$ (Torque on the current-carrying coil)

$B = \dfrac{\mu_0 I}{2\pi r}$ (Long, straight wire); $B = N\dfrac{\mu_0 I}{2R}$ (Center of a circular loop);

$B = \mu_0 nI$ (Interior of a long solenoid);

Constants

$\varepsilon_0 = 8.85\times10^{-12} C^2/(N\cdot m^2)$ (Permittivity of free space);

$\mu_0 = 4\pi\times10^{-7}$ T·m/A (Permeability of free space);

Appendix

M (mega)	$\times 10^6$
k (kilo)	$\times 10^3$
m (milli)	$\times 10^{-3}$
μ (micro)	$\times 10^{-6}$

Right- and Left-Hand Laws