

Name _____ Rec. Instructor _____

P112 Midterm Equations

Coulomb's Law

$$F = k \frac{|q_1||q_2|}{r^2}, \quad k = 8.99 \times 10^9 \frac{N m^2}{C^2}$$

like charges repel, unlike attract

$$\vec{F} = q \vec{E}$$

\vec{F} is parallel to \vec{E} for + charges, anti-parallel for - charges

$$|\vec{E}| = k \frac{|q|}{r^2}$$

\vec{E} points away from + charges, points toward - charges

$$EPE = qV$$

$$EPE_B - EPE_A = q(V_B - V_A)$$

$$V = k \frac{q}{r}$$

for a point charge assuming that $V = 0$ at infinite distance

Capacitors:

$$q = CV$$

$$\text{stored energy} = \frac{1}{2} \frac{q^2}{C} = \frac{1}{2} CV^2 = \frac{1}{2} qV$$

For a parallel-plate capacitor

$$C = \kappa \frac{\epsilon_0 A}{d}, \quad \epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N m^2}$$

Electric current

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

[Equations continued on next page]

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Ohm's Law

$$V = I R$$

resistivity

$$R = \rho \frac{L}{A}$$

dissipated power

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

resistors in series

$$R_S = R_1 + R_2 + R_3 + \dots$$

resistors in parallel

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

Magnetic force on a moving charge

$$|F| = q v B \sin \theta$$

on a wire with current

$$|F| = I L B \sin \theta$$

use RHR #1 to find direction

circular motion of a charge in uniform magnetic field

$$r = \frac{m v}{|q| B}$$

torque on a coil of wire

$$\tau = N I A B \sin \phi$$

other useful constants

$$m_e = 9.11 \times 10^{-31} \text{ kg}, \quad e = 1.6 \times 10^{-19} \text{ C}, \quad m_p = 1.67 \times 10^{-27} \text{ kg}$$