

PHYS212 EXAM 1 Equation Sheet

Electric Field and Coulomb's Law

$$\vec{F} = \frac{kq_1q_2}{r^2}\hat{r}, \quad \vec{E} = \frac{kQ}{r^2}\hat{r}, \quad \vec{F} = q\vec{E}, \quad \vec{E} = \int \frac{k dQ}{r^2}\hat{r}$$

Gauss's Law

$$\Phi = \int \vec{E} \cdot d\vec{A} = \frac{q_{in}}{\epsilon_0}$$

Energy and Electric Potential

$$V = \frac{kQ}{r}, \quad V = k \int \frac{dQ}{r}, \quad \vec{E} = -\hat{r} \frac{dV}{dr},$$

$$\Delta U = q\Delta V, \quad \Delta V = V_b - V_a = \int_a^b \vec{E} \cdot d\vec{S},$$

$$Work = \Delta E = \Delta U + \Delta K \quad (K = \frac{1}{2}mv^2),$$

Some constants

$$k = \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 Nm^2/(C^2), \quad \epsilon_0 = 8.85 \times 10^{-12} C^2/(Nm^2)$$

$$q_e \text{ (electron charge)} = -1.6 \times 10^{-19} C$$

$$p \text{ (pico)} = 10^{-12}, \quad n \text{ (nano)} = 10^{-9}, \quad \mu \text{ (micro)} = 10^{-6}$$

Some trig stuff

$$\sin(\theta) = \text{opposite/hypotenuse}, \quad \cos(\theta) = \text{adjacent/hypotenuse}, \quad \tan(\theta) = \text{opposite/adjacent}$$

Volume of a sphere = $\frac{4}{3}\pi r^3$. Area of a sphere = $4\pi r^2$. Circumference of a circle = $2\pi r$. Volume of a cylinder = $\pi r^2 L$. Area of a cylinder (ignoring the ends) = $2\pi r L$.