Physics 132 Midterm I Equation Sheet

Relationships between the electric force, field, potential energy and potential.

$$F = qE$$

$$F \leftrightarrow E$$

$$\updownarrow \qquad \updownarrow \qquad E_x = -\frac{\partial V}{\partial x} \quad \text{and} \quad \Delta V = -\int \vec{E} \bullet d\vec{s}$$

$$\Delta U \leftrightarrow \Delta V$$

$$\Delta U = q\Delta V$$

$$U = qV$$

Point charges.

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

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

Uniform Fields.

$$\Delta V = -\vec{E} \bullet \vec{d} \qquad E_x = -\frac{\Delta V}{\Delta x}$$

Gauss's law and charge densities.

$$\Phi = \frac{1}{\varepsilon_o} q_{enc} \qquad \Phi = \oint \vec{E} \bullet d\vec{A} \qquad \Phi = \vec{E} \bullet \vec{A}$$

$q_{enc} = \rho\, V_{enc}$ $\qquad \rho$ = volume charge density

$q_{enc} = \sigma\, A_{enc}$ $\qquad \sigma$ = surface charge density

$q_{enc} = \lambda\, L_{enc}$ $\qquad \lambda$ = linear charge density

Electric field magnitudes for some symmetric charge distributions.

$E = 0$ inside a spherical shell of charge.

$E = k\frac{q}{r^2}$ outside a spherically symmetric charge distribution with total charge q.

$E = \frac{\lambda}{2\pi\varepsilon_o r}$ outside a cylindrically symmetric charge distribution with linear charge density λ.

$E = \frac{\sigma}{2\varepsilon_o}$ outside a sheet of charge with surface charge density σ.

$E = \frac{\sigma}{\varepsilon_o}$ outside a charged conducting sheet or very near the surface of any conductor

Constants.

$$k = \frac{1}{4\pi\varepsilon_o} = 8.99 \times 10^9 \frac{Nm^2}{C^2} \qquad \varepsilon_o = 8.85 \times 10^{-12} \frac{C^2}{Nm^2}$$

$e = 1.60 \times 10^{-19}$ C $\qquad q_{electron} = -e \qquad q_{proton} = e$

$g = 9.8\ m/s^2$

Constant Acceleration Kinematics.

$v = v_o + at \qquad x = x_o + v_o t + ½ at^2 \qquad v^2 = v_o^2 + 2\, a\, \Delta x$