PHYSICS 4C QUIZ 2 FALL QUARTER 2019
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Formulas:

$F = k\frac{q_1 q_2}{r^2}$ Coulomb's law ; $k = \frac{1}{4\pi\varepsilon_0} = 8.99\times10^9 \mathrm{N\cdot m^2/C^2}$; $\varepsilon_0 = 8.85\times10^{-12} C^2/Nm^2$

Electric field: $\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r} = \frac{kq}{r^2}\hat{r}$; $\vec{E}(\vec{r}) = k\int \rho(\vec{r}\,')\frac{\vec{r}-\vec{r}\,'}{|\vec{r}-\vec{r}\,'|^3}d^3r'$; $\vec{F} = q_0\vec{E}$

Linear, surface, volume charge density: $dq = \lambda\, d\ell$, $dq = \sigma\, da$, $dq = \rho\, dv$

Electric field of infinite: line of charge: $E = \frac{\lambda}{2\pi\varepsilon_0 r}$; sheet of charge: $E = \frac{\sigma}{2\varepsilon_0}$

Gauss law: $\Phi = \oint \vec{E}\cdot d\vec{a} = \frac{q_{enc}}{\varepsilon_0} = \frac{1}{\varepsilon_0}\int d^3r\, \rho(\vec{r})$; Φ=electric flux

Energy: $U = k\frac{q_1 q_2}{r_{12}}$ $U = \frac{\varepsilon_0}{2}\int E(\vec{r})^2 d^3r$ Work: $W = \int \vec{F}\cdot d\vec{s}$

Electric potential: $\phi(P_2) - \phi(P_1) = -\int_{P_1}^{P_2}\vec{E}\cdot d\vec{s}$ $\phi(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\int d^3r'\frac{\rho(\vec{r}\,')}{|\vec{r}-\vec{r}\,'|}$

Point charge: $\phi(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$ Dipole: $\phi(r,\theta) = \frac{p\cos\theta}{4\pi\varepsilon_0 r^2}$

$U = \frac{1}{2}\int \rho\, \phi\, d^3r$ $\vec{E} = -\vec{\nabla}\phi$; $\vec{\nabla}\cdot\vec{E} = \frac{\rho}{\varepsilon_0}$; $\vec{\nabla}\times\vec{E} = 0$

Capacitors: $Q = C\phi$, $U = \frac{Q^2}{2C}$; Planar: $C = \frac{\varepsilon_0 A}{s}$ Spherical: $C = 4\pi\varepsilon_0 R$