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Chapter 21:

$e = 1.60\times10^{-19}C$ $\quad k = 8.99\times10^{9}\,N\bullet m^2/C^2$ $\quad \vec{F}_{12} = \frac{kq_1q_2}{r_{12}^2}\hat{r}_{12}$

$\vec{E} = \frac{\vec{F}}{q_0}$ or $\vec{F} = q_0\vec{E}$ $\quad \vec{E}_{iP} = \frac{kq_i}{r_{iP}^2}\hat{r}_{iP}$ $\quad \vec{E}_P = \sum_i \vec{E}_{iP}$

$\vec{p} = q\vec{L}$ $\quad E = \frac{2kp}{|x|^3}$ $\quad \vec{a} = \frac{\sum\vec{F}}{m} = \frac{q}{m}\vec{E}$ $\quad \vec{\tau} = \vec{p}\times\vec{E}$ $\quad U = -\vec{p}\bullet\vec{E}$

Chapter 22:

$d\vec{E} = dE_r\hat{r} = \frac{kdq}{r^2}\hat{r}$ $\quad \vec{E} = \int d\vec{E} = \int\frac{k\hat{r}}{r^2}dq$ $\quad dq = \rho dV = \sigma dA = \lambda d\ell$

$\phi = \lim_{\Delta A_i\to 0}\sum_i \vec{E}_i\bullet\hat{n}\Delta A_i = \int_S \vec{E}\bullet\hat{n}\,dA$ $\quad$ Gauss: $\phi_{net} = \oint_S \vec{E}\bullet\hat{n}\,dA = \oint_S E_n\,dA = \frac{Q_{inside}}{\varepsilon_0}$

$k = \frac{1}{4\pi\varepsilon_0} = 8.99\times10^{9}\,N\bullet m^2/C^2$ $\quad \varepsilon_0 = \frac{1}{4\pi k} = 8.85\times10^{-12}\;C^2/(N\bullet m^2)$

$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$ $\quad \phi_{net} = \oint_S E_n\,dA = \frac{Q_{inside}}{\varepsilon_0}$ $\quad E_{n+} - E_{n-} = \frac{\sigma}{\varepsilon_0}$ $\quad E_n = \frac{\sigma}{\varepsilon_0}$

infinite line charge: $E_R = 2k\frac{\lambda}{R} = \frac{1}{2\pi\varepsilon_0}\frac{\lambda}{R}$

on axis of ring charge: $E_z = \frac{kQz}{\left(z^2+a^2\right)^{3/2}}$

infinite charged plane: $E_z = sign(z)\bullet\frac{\sigma}{2\varepsilon_0}$

thin charged spherical shell: $E_r = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ $\quad r > R$

$E_r = 0$ $\quad r < R$

Volume elements:

Rectangular: $dV = dx\,dy\,dz$

Cylindrical: $dV = r\,dr\,d\theta\,dz$

Spherical: $dV = r^2\sin\theta\,dr\,d\theta\,d\varphi$

Const thickness t: $dV = t\,dA$

Const Cross Sect A: $dV = A\,d\ell$

Table of integrals:

$\int kr^n dx = k\frac{r^{n+1}}{n+1}$ for $n \neq -1$ $\quad \int kr^{-1}dx = k\ln|r|$ $\quad \int e^{ax}dx = \frac{1}{a}e^{ax}$

$\int \sin(k\theta)\,d\theta = -\frac{1}{k}\cos(k\theta)$ $\quad \int \cos(k\theta)\,d\theta = \frac{1}{k}\sin(k\theta)$