Electrostatic equations for Test 1

PHYS 4392
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Deposit these guys in your brain box for safe keeping.

$|e| \simeq 1.60 \times 10^{-19}\,\mathrm{C}$ $\qquad \epsilon_0 \simeq 8.85 \times 10^{-12}\,\mathrm{F/m}$ $\qquad T_{1year} \simeq \pi \times 10^7\,\mathrm{sec}$

$(\mathbf{A} \times \mathbf{B})_i = \epsilon_{ijk} A_j B_k$ $\qquad (\nabla \times \mathbf{C})_i = \epsilon_{ijk} \frac{\partial}{\partial x_j} C_k$

$\mathbf{F} = \frac{1}{4\pi\epsilon_0} \frac{qQ}{s^2} \hat{\mathbf{s}}$ $\qquad \mathbf{F} = Q\mathbf{E}$ $\qquad \mathbf{E} = -\nabla V$

$\mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{dq}{s^2} \hat{\mathbf{s}}$ $\qquad \mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int_{\mathcal{V}} \frac{\rho(\mathbf{r}')}{s^2} \hat{\mathbf{s}}\, dV'$

Point, line and surface charges:

$\mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} (q/s^2) \hat{\mathbf{s}}$ $\qquad \mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\lambda(\mathbf{r}')\, dl'}{s^2} \hat{\mathbf{s}}$ $\qquad \mathbf{E}(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\sigma(\mathbf{r}')\, dS'}{s^2} \hat{\mathbf{s}}$

Gauss' law:

$\oint \mathbf{E} \cdot \mathbf{dS} = Q_{enc}/\epsilon_0$ $\qquad \nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$

Stokes' law:

$\oint \mathbf{E} \cdot \mathbf{dl} = 0$ $\qquad \nabla \times \mathbf{E} = 0$

$V(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\mathbf{r}')}{s}\, dV'$ $\qquad V(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\lambda(\mathbf{r}')}{s}\, dl'$ $\qquad V(\mathbf{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\sigma(\mathbf{r}')}{s}\, dS'$

$E^{\perp}_{\mathrm{above}} - E^{\perp}_{\mathrm{below}} = \frac{\sigma}{\epsilon_0}$ $\qquad E^{\parallel}_{\mathrm{above}} = E^{\parallel}_{\mathrm{below}}$ $\qquad \mathbf{E}_{\mathrm{above}} - \mathbf{E}_{\mathrm{below}} = \frac{\sigma}{\epsilon_0} \hat{\mathbf{n}}$

$V_{\mathrm{above}} = V_{\mathrm{below}}$ $\qquad \frac{\partial V_{\mathrm{above}}}{\partial n} - \frac{\partial V_{\mathrm{below}}}{\partial n} = -\frac{1}{\epsilon_0} \sigma$

conductor surface: $\sigma = -\epsilon_0 \frac{\partial V}{\partial n}$ $\qquad \mathbf{f} = \frac{1}{2\epsilon_0} \sigma^2 \hat{\mathbf{n}}$

$C = \frac{Q}{V}$ $\qquad$ parallel plates: $C = \frac{\epsilon_0 A}{d}$

$W = \frac{1}{2} \sum_{i=1}^{n} q_i V(\mathbf{r}_i)$ $\qquad W = \frac{1}{2} \int \rho V\, dV'$ $\qquad W = \frac{\epsilon_0}{2} \int_{all\ space} E^2\, dV'$

$dW = V\, dq$ $\qquad$ capacitor: $W = \frac{1}{2} C V^2$