Electric Flux (H.1)

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$$D = \frac{Q}{4\pi r^2} a_r$$

$$E = \frac{Q}{4\pi \varepsilon_0 r^2} a_r$$

$$D = \varepsilon_0 E$$

$$E = \int_{vol} \frac{\rho_v \, dv}{4\pi \varepsilon_0 R^2} a_r$$

$$E = \int_{vol} \frac{\rho_v \, dv}{4\pi \quad R^2} a_r$$

$$E_\rho = \frac{\rho_L}{2\pi \varepsilon_0 \rho}$$

$$E = \frac{\rho_L}{2\pi \varepsilon_0 \rho} a_\rho$$

$$E = \frac{\rho_s}{2 \varepsilon_0} a_N$$

$$\Psi = \oint_S \mathbf{D}_S \cdot d\mathbf{S} = Q$$

$$\oint_S \mathbf{D}_S \cdot d\mathbf{S} = \int_{vol} \rho_v \, dv$$

$$Q = \oint_S \mathbf{D}_S \cdot d\mathbf{S}$$

$$\mathbf{D} = \frac{Q}{4\pi r^2} \mathbf{a}_r$$

$$\mathbf{E} = \frac{Q}{4\pi \varepsilon_0 r^2} \mathbf{a}_r$$

$$\mathbf{D} = \frac{\rho_L}{2\pi \rho} \mathbf{a}_\rho$$

$$Q = \oint_S D_s \cdot dS$$

Change enclosed in volume Δv $= \frac{\partial D_x}{\partial x} + \frac{\partial D_y}{\partial y} + \frac{\partial D_z}{\partial z}$

Divergence of A $=$ div A $= \lim_{\Delta v \to 0} \frac{\oint A \cdot dS}{\Delta v}$

$$\text{div } D = \left(\frac{\partial D_x}{\partial x} + \frac{\partial D_y}{\partial y} + \frac{\partial D_z}{\partial z} \right)$$

$$= \frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho D_\rho) + \frac{1}{\rho} \frac{\partial}{\partial \phi} D_\varphi + \frac{\partial}{\partial z} D_z$$

$$= \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 D_r) + \frac{1}{r \sin\theta} \frac{\partial}{\partial \theta} (\sin\theta \, D_\theta) + \frac{1}{r \sin\theta} \frac{\partial}{\partial \phi} D_\varphi$$

$$\text{div } D = \rho_v$$

$$\nabla = \frac{\partial}{\partial x} a_x + \frac{\partial}{\partial y} a_y + \frac{\partial}{\partial z} a_z$$

$$\text{div } D = \nabla \cdot D = \frac{\partial D_x}{\partial x} + \frac{\partial D_y}{\partial y} + \frac{\partial D_z}{\partial z}$$

$$\oint_S D \cdot dS = \int_{vol} \nabla \cdot D \, dv$$