

FORMULÁRIO P1

$$\epsilon_0 = 8,85 \times 10^{-12} \text{ C}^2/\text{Nm}^2 \quad k = \frac{1}{4\pi\epsilon_0} = 8,89 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$$

Carga do elétron e próton $e = 1,6 \times 10^{-19} \text{ C}$

$$\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \hat{r} \quad \vec{E} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r} \quad d\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{dq}{r^2} \hat{r} \quad \vec{F} = q\vec{E}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{q_{\text{INT}}}{\epsilon_0}$$

$$U = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \quad U_B - U_A = W_{\text{EXT}} = -W_{\text{FE}} = -\int_A^B \vec{F}_E \cdot d\vec{s}$$

$$\Delta U = q\Delta V \quad V = \frac{1}{4\pi\epsilon_0} \frac{q}{r} \quad dV = \frac{1}{4\pi\epsilon_0} \frac{dq}{r} \quad V_B - V_A = -\int_A^B \vec{E} \cdot d\vec{s}$$

$$\vec{E} = -\left(\frac{\partial V}{\partial x} \hat{i} + \frac{\partial V}{\partial y} \hat{j} + \frac{\partial V}{\partial z} \hat{k} \right)$$

$$\int \frac{dy}{(y^2 + z^2)^{\frac{3}{2}}} = \frac{y}{z^2 \sqrt{y^2 + z^2}}$$

$$\int \frac{y dy}{(y^2 + z^2)^{\frac{3}{2}}} = \frac{-1}{\sqrt{y^2 + z^2}}$$

$$\int \frac{dy}{\sqrt{y^2 + z^2}} = \ln(y + \sqrt{y^2 + z^2})$$