AP#01: Noções de Electromagnetismo

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(Aulas preparadas para estudantes de Radiologia)

8 de Fevereiro de 2022

1

$$F_{12} = \frac{1}{4\pi\varepsilon_0\varepsilon_r}\frac{|q_1||q_2|}{r_{12}^2}$$

$$K = \frac{1}{4\pi\varepsilon_0} \sim 9\times10^9$$

$\rightsquigarrow \varepsilon_r \approx 1.0$ (no air)

$r = 0.5 \rightarrow F = 5.4\times10^{-6}\ N$

$r = 1.0 \rightarrow F = 1.35\times10^{-6}\ N$

$r = 2.0 \rightarrow F = 3.375\times10^{-7}\ N$

$r = 2.5 \rightarrow F = 2.16\times10^{-7}\ N$

$r = 3.0 \rightarrow F = 1.5\times10^{-7}\ N$

(2) $F = \frac{K}{\varepsilon_r} \frac{|q_1||q_2|}{r^2}$

$q_1 = q_{Na^+}$

$q_2 = q_{Cl^-}$

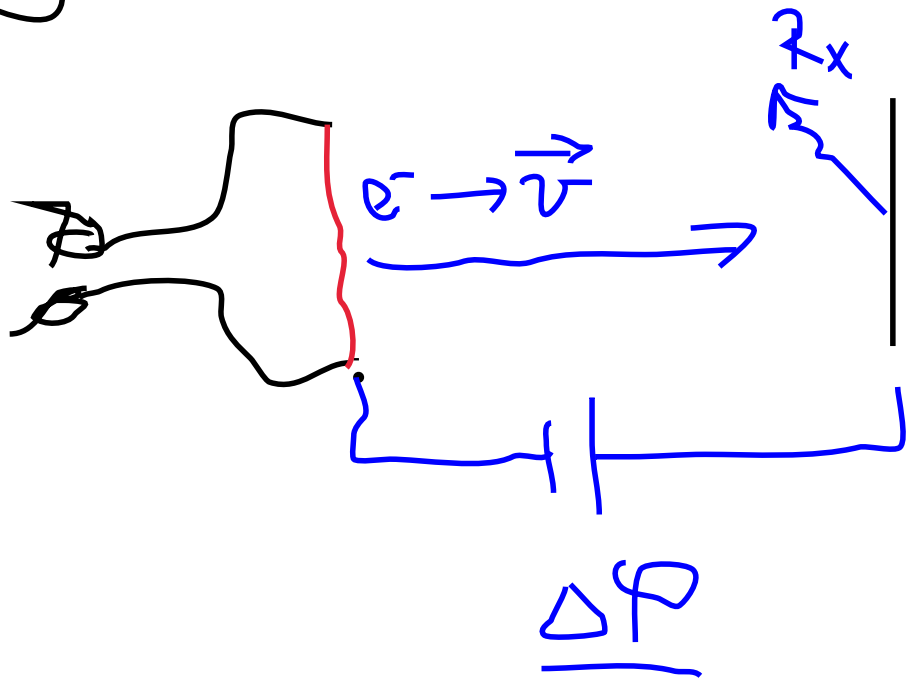
No ar: $\varepsilon_r = 1.0$

Na água: $\varepsilon_r = 80$

$$\frac{F_{ar}}{F_{H_2O}} = \frac{\frac{K}{1} \frac{q_1 q_2}{r^2}}{\frac{K}{80} \frac{q_1 q_2}{r^2}} \Rightarrow$$

$$\boxed{F_{ar} = 80\, F_{H_2O}}$$

3



$$E_c = E_{pe}$$

$$\frac{1}{2} m_e v^2 = q\Delta\varphi$$

$$v = \left(\frac{2 q_e \Delta\varphi}{m_e} \right)^{1/2}$$

$$v = 6.49 \times 10^7 \text{ m/s}$$

④ a) $R - ?$

$\sigma = \frac{1}{\rho}$

$\vec{J} = \sigma \vec{E}$ ← Lei de Ohm na forma diferencial

$\sigma = \frac{J}{E}$; $J = \rho v \Rightarrow \sigma = \rho \frac{v}{E}$ μ

$\sigma = \rho \mu_{total}$; $\rho = \frac{Q}{V}$; $Q = Ne$

$\rho = [\,]\, e$

$\Rightarrow \rho = \frac{N}{V} e$

$[\,]$ concentracao

$\sigma = [\,] e \mu_{total}$

$\sigma = z^+ [\,]^+ \mu^+ + z^- [\,]^- \mu^-$

$$\sigma = z[](\mu^+ + \mu^-)$$

ze

$$[] = \frac{N}{V} \; ; \; N = n N_A$$

$$[] = \frac{n N_A}{V} \; ; \; n = \frac{m}{M} \Rightarrow n = \frac{m}{M(Na) + M(Cl)}$$

$$[] = \frac{0.154 \times 6.022 \times 10^{23}}{10^{-3}\ m^3} \qquad n = \frac{9g}{22.99\ g/mol + 35.453\ g/mo}$$

$$[] = 9.27 \times 10^{25}\ m^{-3} \qquad n = 0.154\ mol$$

$$R = \frac{1}{6}\ \frac{l}{5}$$

$$\sigma = 9.27 \times 10^{25} \times 1.6 \times 10^{-19} \times (46 + 685) \times 10^{-8}$$

$$\sigma = 1698 \ \frac{1}{\Omega m}$$

$$R = \frac{1}{1.698} \times \frac{1.5}{10^{-3}}$$

$$\boxed{R = 883 \ \Omega}$$

$(1m)^2 = (10^2 cm)^2$

$1 m^2 = 10^4 cm^2$

$x = 10 cm^2$

$x = 10^{-3} m^2$

b) $V_{crit} = I_{crit} \times R \Rightarrow \underline{V_{crit} = 88.3 \ V}$

(7) $E_c = E_{p_e} \Rightarrow \frac{1}{2}mv^2 = qV$

$v^2 = \frac{2qV}{m}$ *

$F_c = F_m \Rightarrow \frac{mv^2}{R} = qvB$

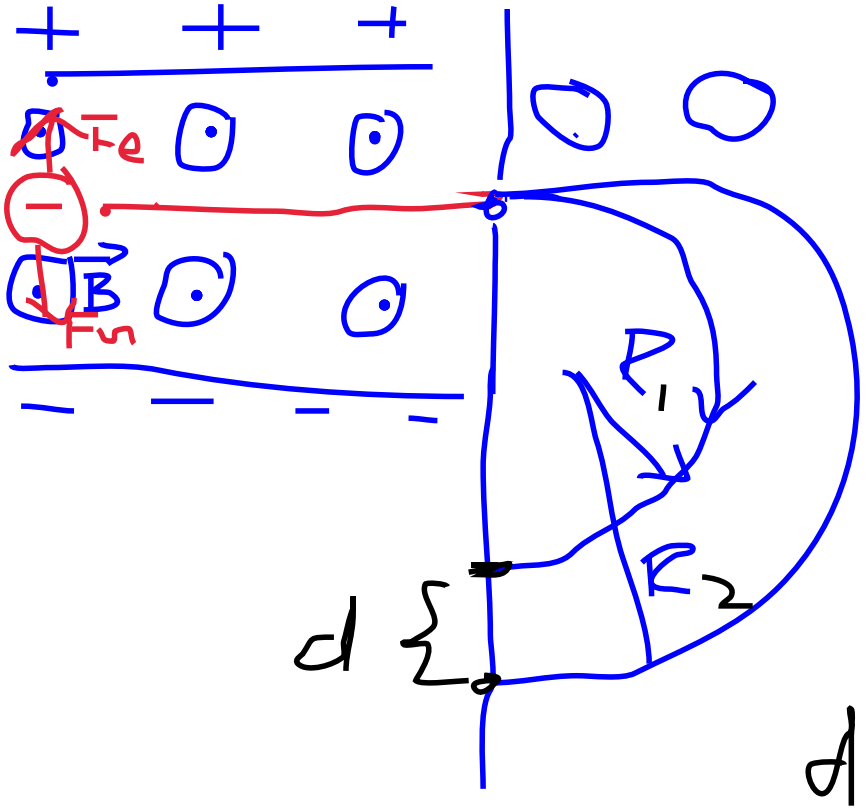
$v = \frac{qRB}{m} \Rightarrow v^2 = \frac{q^2R^2B^2}{m^2}$ *

$\Rightarrow \frac{2qV}{m} = \frac{q^2R^2B^2}{m^2} \Rightarrow m = \frac{qB^2R^2}{2V}$

$\frac{m_o}{m_c} = \frac{q_o R_o^2}{q_c R_c^2} \Rightarrow \frac{m_o}{m_c} = \frac{R_o^2}{R_c^2}$

$m_o = \frac{R_o^2}{R_c^2} m_c \Rightarrow m_o = 1.33\, m_c$ ≈ 16

$m_o = 1.33 \times 12\ \text{uma} = 15.96\ \text{u}$



$E_c = E_{pe}$

a) $v = \left(\frac{2qV}{m}\right)^{1/2}$

b) $d - ?$

$R = \frac{mv}{qB}$

$d = 2R_2 - 2R_1$

$d = \frac{2}{qB}\left|(m_1 v_1 - m_2 v_2)\right|$