RESOLUÇÃO – LISTA 06

EXERCÍCIO 02:

$$F_e = \frac{k\,q_1 q_2}{R^2} \qquad F_g = G\,\frac{m_1 m_2}{R^2}$$

$m_e = 9{,}11 \times 10^{-31}\ kg \qquad m_p = 1{,}675 \times 10^{-27}\ kg$

$$k = 9 \times 10^9\ \frac{N.m^2}{C^2} \qquad G = 6{,}67 \times 10^{-11}\ \frac{m^3}{kg.s^2}$$

VAMOS SUPOR $R = 1\,m$

a) 2 ELÉTRONS $\qquad q_e = -1{,}6 \times 10^{-19}\ C$

$$F_e = (9 \times 10^9)(1{,}6 \times 10^{-19})^2 = 2{,}304 \times 10^{-28}\ N$$

$$F_g = (6{,}67 \times 10^{-11})(9{,}11 \times 10^{-31})^2 = 5{,}536 \times 10^{-71}\ N$$

$$\frac{F_e}{F_g} \cong 4{,}2 \times 10^{42}$$

b) 2 PRÓTONS $\longrightarrow$ A F_e SERÁ A MESMA

$$F_g = (6{,}67 \times 10^{-11})(1{,}675 \times 10^{-27})^2 \cong 1{,}9 \times 10^{-64}$$

$$\frac{F_e}{F_g} \cong 1{,}2 \times 10^{36}$$

EXERCÍCIO 03:

$$|\vec{E}| = \frac{kq}{R^2}$$

$q = 2 \times 10^{-10}\ C \qquad R = 0{,}2\,m$

$$E = \frac{(9 \times 10^9).(2 \times 10^{-10})}{(0{,}2)^2} = \frac{1{,}8}{0{,}04} = 45\ N/C$$

$q = 2 \times 10^{-10} \qquad R = 0{,}5\,m$

$$E = \frac{1{,}8}{(0{,}5)^2} = 7{,}2\ N/C$$

$q = 2 \times 10^{-10} \qquad R = 0{,}8\,m$

$$E = \frac{1{,}8}{(0{,}8)^2} \cong 2{,}8\ N/C$$

EXERCÍCIO 04: $V = \frac{kQ}{R}$ $U = qV \Rightarrow U = \frac{kqQ}{R}$

a) ENERGIA POTENCIAL $e^- = -1,6 \times 10^{-19}\,C$ $R = 0,2\,m$

$Q = 6 \times 10^{-8}\,C$

$$U = \frac{(9 \times 10^9)(-1,6 \times 10^{-19})(6 \times 10^{-8})}{0,2} = -4,32 \times 10^{-16}\,J$$

b) $W = \Delta U = U(\infty) - U(0,2) = 4,32 \times 10^{-16}\,J$

EXERCÍCIO 05:

$$U = \frac{kqQ}{R} \quad U = qV \Rightarrow V = \frac{U}{q}$$

$U = 3 \times 10^{-18}\,J$ $q_p = 1,6 \times 10^{-19}\,C$

$$\therefore V = \frac{3 \times 10^{-18}\,J}{1,6 \times 10^{-19}\,C} = 18,75\,V$$

EXERCÍCIO 06: $8 \times 10^{-9}\,m$ de ESPESSURA $K^+ \rightarrow q = 1,6 \times 10^{-19}\,C$

$E = 7,5 \times 10^6\,N/C$

FORÇA ELÉTRICA $F_e = qE = (1,6 \times 10^{-19})(7,5 \times 10^6)$

$F_e = 1,2 \times 10^{-12}\,N$

MASSA ATÔMICA DO POTÁSSIO $\rightarrow 39,0983\,u$ $u \cong 1,66 \times 10^{-27}\,kg$

$P_{K^+} \cong (39,0983) \times (1,66 \times 10^{-27})(9,8)$

$P_{K^+} \cong 6,4 \times 10^{-25}\,N$

RAZÃO $\frac{F_e}{P_{K^+}} = \frac{1,2 \times 10^{-12}}{6,4 \times 10^{-25}}$

$$\therefore \frac{F_e^{K^+}}{P_{K^+}} \cong 1,9 \times 10^{12}$$

EXERCÍCIO 07: $d = 8 \times 10^{-9}\,m$

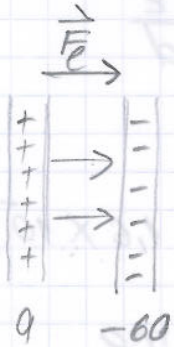
$E = 7{,}5 \times 10^{6}\ \frac{N}{C}$

a) POTENCIAL DE REPOUSO

$V_0 = d \cdot E = (8 \times 10^{-9})(7{,}5 \times 10^{6})$

$V_0 = 60 \times 10^{-3}\,V = 60\,mV$

b)



$U = qV$

K^+ ENTRANDO $(-60\,mV)(1{,}6 \times 10^{-19}) = -9{,}6 \times 10^{-18}\,J$

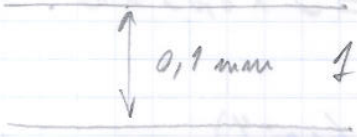
SAINDO $= 9{,}6 \times 10^{-18}\,J$

c)

Cl^- ENTRANDO $(-60\,mV)(-1{,}6 \times 10^{-19}\,C) = 9{,}6 \times 10^{-18}\,J$

SAINDO $= -9{,}6 \times 10^{-18}\,J$

EXERCÍOIO 08:



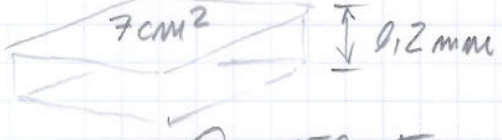
$C = \varepsilon \frac{A}{d}$ (PLACAS PARELELAS)

$\varepsilon = 8{,}85 \times 10^{-12}\ \frac{C^2}{N \cdot m^2}$ $\quad C = 1\,F$

$d = 0{,}1 \times 10^{-3}\,m$

$\therefore A = \frac{(1)(0{,}1 \times 10^{-3})}{8{,}85 \times 10^{-12}} \Rightarrow A \cong 11{,}3 \times 10^{6}\,m^2 = 11{,}3\,km^2$

EXERCÍCIO 09:



$C = 150\,pF$

$C = \varepsilon \frac{A}{d}$

$\varepsilon = \frac{C \cdot d}{A} = \frac{(150 \times 10^{-12})(2 \times 10^{-4})}{7 \times 10^{-4}}$

$\varepsilon \cong 42{,}86 \times 10^{-12}\ \frac{C^2}{N \cdot m^2}$

$\varepsilon \cong 4{,}8\,\varepsilon_0$

EXERCÍCIO 10:

OS FLUIDOS INTRA/EXTRA SÃO CONDUTORES

A MEMBRANA É O ISOLANTE — FUNCIONA COMO UM CAPACITOR

EXERCÍCIO 11:

$V_0 = -80\,mV \qquad \frac{C}{A} = 2\times10^{-2}\,\frac{F}{m^2} = \frac{\varepsilon}{d}$

$C = \varepsilon\frac{A}{d} = \frac{Q}{V_0} \qquad \sigma = \frac{Q}{A} = V_0\cdot\frac{\varepsilon}{d}$

a) ASSIM, $\sigma = (2\times10^{-2})(80\times10^{-3}) = 1{,}6\times10^{-3}\,\frac{C}{m^2}$

b) O POTENCIAL É 80mV DE FORA PARA DENTRO

FORA $V=0$ (REFERENCIAL), SE $V_0 = -80mV$

ISTO OCORRE PORQUE ESTAMOS INDO DO MAIOR (+) PARA O MENOR (−); PORTANTO, DENTRO (NA CAMADA INTERNA) DEVEMOS TER CARGAS NEGATIVAS

EXERCÍCIO 12

$\frac{C}{A} = \frac{1\,\mu F}{cm^2} = \frac{\varepsilon}{d} \qquad \varepsilon = 3\varepsilon_0 = 3\times8{,}85\times10^{-12}$

$\therefore\ d = \frac{\varepsilon}{\frac{C}{A}} = \frac{(3\times8{,}85\times10^{-12})(10^{-4})}{1\times10^{-6}}$

$d \cong 26{,}6\times10^{-10}\,m = 26{,}6\,Å$ OU $\cong 2{,}7\,mm$

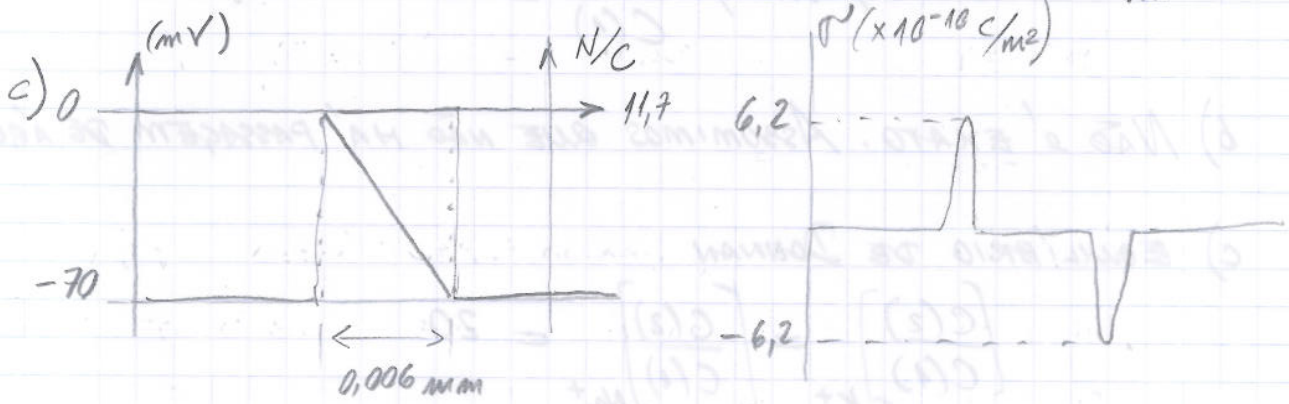
EXERCÍCIO 13: $V_0 = -70\,mV$ $d = 6\,mm = 0{,}006\,m$ $\varepsilon = 6\varepsilon_0$

a) $V_0 = E.d \Longrightarrow E = \frac{V_0}{d} = \frac{70 \times 10^{-3}}{0{,}006} \simeq 11{,}7\ \frac{N}{C}$

b) DENSIDADE DE CARGAS $E = \frac{\sigma}{\varepsilon} \Longrightarrow \sigma = E.\varepsilon$

ASSIM, $\sigma = (11{,}7)(6)(8{,}85 \times 10^{-12}) \simeq 6{,}2 \times 10^{-10}\ \frac{C}{m^2}$

c)



EXERCÍCIO 14: $V^N_{Cl^-} = -72\,mV$ $C_{Cl^-}(2) = 0{,}025\ M/l$

POTENCIAL DE NERNST PARA O ÍON $P+$

$$V^N_p = -\frac{KT}{q_p} \ln\left[\frac{C_p(2)}{C_p(1)}\right]$$

$K = 1{,}38 \times 10^{-23}\ J/K$

$T = 293\,K$

$q_p = 1{,}6 \times 10^{-19}\,C$

NO CASO, PARA ÍONS NEGATIVOS

$$-72 \times 10^{-3}\,V = \frac{(1{,}38 \times 10^{-23})(293)}{1{,}6 \times 10^{-19}} \ln\left[\frac{0{,}025}{C(1)}\right]$$

$$\ln\left[\frac{0{,}025}{C(1)}\right] = -2{,}85$$

$$\frac{0{,}025}{C(1)} \simeq 0{,}058 \Longrightarrow C(1) \simeq 0{,}43\ \frac{M}{l}$$

EXERCÍCIO 15: K^+

$T = 17°C = 290\ K \qquad V_0 = -75\ mV \qquad C = 2\times10^{-2}\ \frac{F}{m^2}$

a)

$$V_0 = -\frac{KT}{q}\ln\left[\frac{C(2)}{C(1)}\right] \Rightarrow -75\times10^{-3} = -\frac{(1{,}38\times10^{-23})290}{1{,}6\times10^{-19}}\ln\left[\frac{C(2)}{C(1)}\right]$$

$$\therefore \quad \ln\left[\frac{C(2)}{C(1)}\right] \cong 3$$

Assim, $\frac{C(2)}{C(1)} \cong 20$

b) NÃO É EXATO. ASSUMIMOS QUE NÃO HÁ PASSAGEM DE ÁGUA.

c) EQUILÍBRIO DE DONNAN

$$\left[\frac{C(2)}{C(1)}\right]_{K^+} = \left[\frac{C(2)}{C(1)}\right]_{Na^+} = 20$$