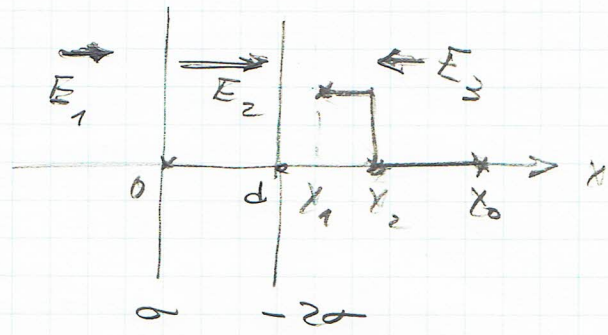
Problema 1.



a) $E_1 = \frac{2\sigma}{2\varepsilon_0} - \frac{\sigma}{2\varepsilon_0}$

$E_1 = \frac{\sigma}{2\varepsilon_0} \quad (x<0)$

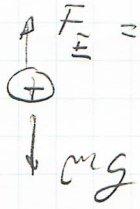
$E_2 = \frac{2\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0} = \frac{3}{2}\frac{\sigma}{\varepsilon_0} \quad (0<x<d)$

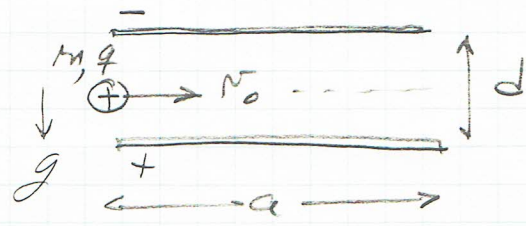
$E_3 = -\frac{2\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0} = -\frac{\sigma}{2\varepsilon_0} \quad (d<x)$

b) $V_f - V_i = -E(x_f - x_i) \Rightarrow V(x_1) - V(x_0) = \frac{\sigma}{2\varepsilon_0}(x_1 - x_0)$

$V(x_0) = 0 \Rightarrow \boxed{V(x_1) = \frac{\sigma}{2\varepsilon_0}(x_1 - x_0)}$

Problema 2





$q = 1\,\mu C$
$m = 10\,g$
$v_0 = 5\,m/s$
$a = 1\,m$
$d = 2\,mm$

$$qE = mg \Rightarrow E = \frac{mg}{q} = \frac{\Delta V}{d} \Rightarrow$$

a) $$\boxed{\Delta V = \frac{mgd}{q} = 196\ V}$$

$$E = \frac{\sigma}{\varepsilon_0} = \frac{\Delta V}{d} \Rightarrow \sigma = \frac{\Delta V}{d}\varepsilon_0 = \frac{Q}{S} \Rightarrow Q = \varepsilon_0 \frac{\Delta V S}{d}$$

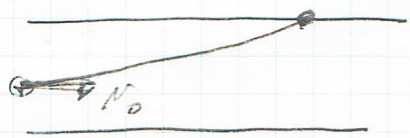
b) $$\boxed{Q = \frac{\varepsilon_0 \Delta V a^2}{d} = 0.87\,\mu C}$$

Si $\Delta V' = 2\Delta V \Rightarrow E' = 2E \Rightarrow F_E' = qE' = 2F_E = 2mg$

$$F_N = F_E' - mg = 2mg - mg = mg$$

c) $$\boxed{F_N = 0.098\ N \text{ hacia arriba}}$$

d)

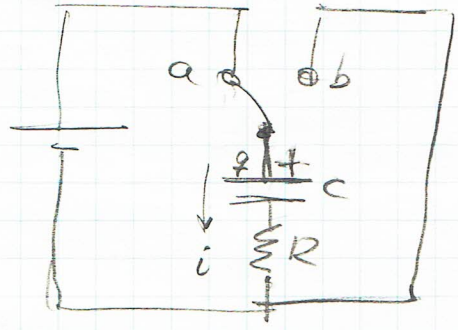


es una parábola

Problema 3

$\mathcal{E} = 12\ V \qquad C = 1.5\ \mu F$

$R = 2.0\ M\Omega$



$$\mathcal{E} = V_C(t) + V_R(t)$$

$$\mathcal{E} = \frac{q(t)}{C} + R\,i(t)$$

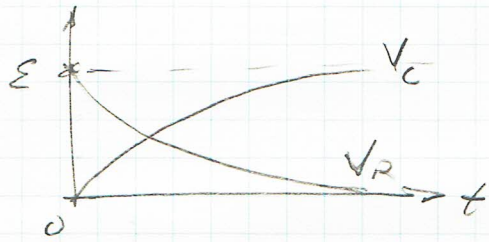
$$\mathcal{E} = \frac{q(t)}{C} + R\frac{dq}{dt} \Rightarrow \frac{dq}{dt} + \frac{q(t)}{RC} = \frac{\mathcal{E}}{R},\ q(0) = 0 \Rightarrow$$

$$q(t) = \mathcal{E}C\left(1 - e^{-t/RC}\right)$$

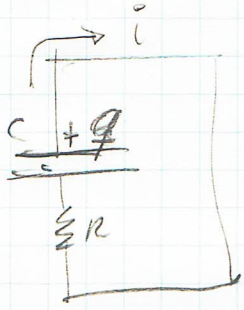
a) $$V_C(t) = \frac{q(t)}{C} = \mathcal{E}\left(1 - e^{-t/RC}\right)$$

$$V_R(t) = \mathcal{E} - V_C(t) = \mathcal{E}\,e^{-t/RC}$$

b)



c)



$$\frac{q(t)}{C} = R\,i(t) = -R\frac{dq}{dt} \Rightarrow$$

$$\frac{dq}{dt} + \frac{q(t)}{RC} = 0,\quad q(0) = \mathcal{E}C$$

$$q(t) = \mathcal{E}C\,e^{-t/RC} \Rightarrow$$

$$V_C(t) = \frac{q(t)}{C} = \mathcal{E}e^{-t/RC} \qquad V_R(t) = R\,i(t) = -R\frac{dq}{dt}$$

$$V_R(t) = \mathcal{E}e^{-t/RC} = V_C(t)$$

d) $$\frac{dE_C}{dt} = P_C = V_C\,i,\quad i = -\frac{dq}{dt} = \frac{\mathcal{E}}{R}e^{-t/RC}$$

$$P_C = \mathcal{E}e^{-t/RC}\left(\frac{\mathcal{E}}{R}e^{-t/RC}\right) = \frac{\mathcal{E}^2}{R}e^{-2t/RC} = \frac{12^2}{2\times10^6}e^{-1}$$

$$\boxed{P_C = 2.65\times10^{-5}\ \text{watts}}$$