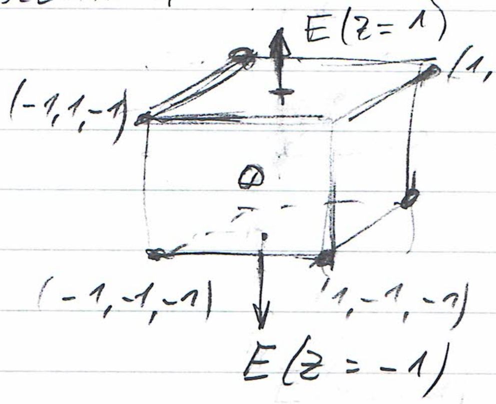
EXAMEN F2 - FEBRERO 2020

PROBLEMA 1



l = 2m

$E(z) = 2z\hat{k}$

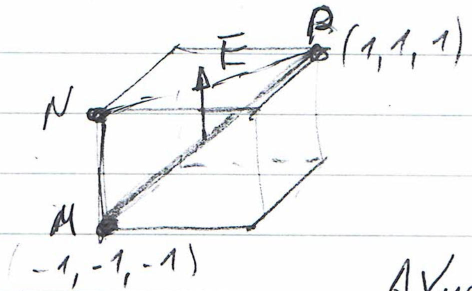
a) Gauss: flujo = $\frac{Q_{encerrada}}{\varepsilon_0}$

$$\underbrace{E(z=1)}_{2} \underset{\downarrow}{S} - \underbrace{E(z-1)}_{-2} S = \frac{Q_{enc}}{\varepsilon_0}$$

2×2

$$2\times4 + 2\times4 = \frac{Q_{enc}}{\varepsilon_0} \Rightarrow \boxed{Q_{enc} = 16\,\varepsilon_0 = 1{,}416\times10^{-10}\,C}$$

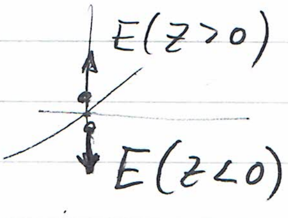
b)



$$\Delta V_{MP} = \Delta V_{MN} + \underbrace{\Delta V_{NP}}_{0} \; (\vec{E} \perp \vec{NP})$$

$$\Delta V_{MP} = -\int_{N}^{N} E_z\,dz = -\int_{-1}^{1} 2z\,dz = 0$$

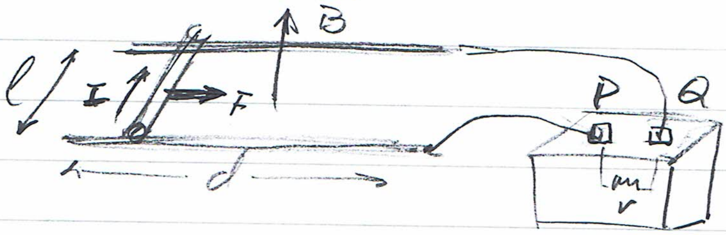
c)



El origen es un punto de equilibrio estable para cargas negativas ⇒

la carga queda en reposo

PROBLEMA 2



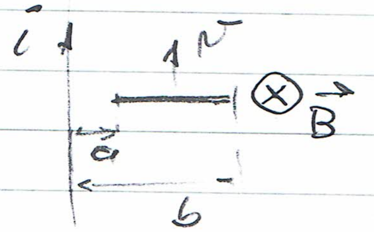
a) P es +

b) $F = BIl \qquad W = F.d = \frac{mv_f^2}{2} - \underbrace{\frac{mv_i^2}{2}}_{0}$

$$BIld = \frac{mv_f^2}{2} \Rightarrow \boxed{I = \frac{mv_f^2}{2Bld}}$$

c) $\varepsilon = IR + Ir = I(R+r) = \boxed{\frac{mv_f^2}{2Bld}(R+r)}$

PROBLEMA 3

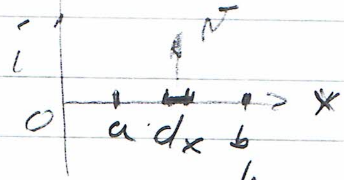


a) $\vec{F} = q\vec{v} \times \vec{B}$ hacia la derecha $(q<0)$

$B = \frac{\mu_0 i}{2\pi r} \Rightarrow B_{máx} = \frac{4\pi \times 10^{-7} \times 100}{2\pi \times 0.01}$

$B_{máx} = 2 \times 10^{-3}\,T \Rightarrow F_{máx} = 1,6 \times 10^{-19} \times 4 \times 2 \times 10^{-3} \cong \boxed{1,3 \times 10^{-15}\,N}$

b)



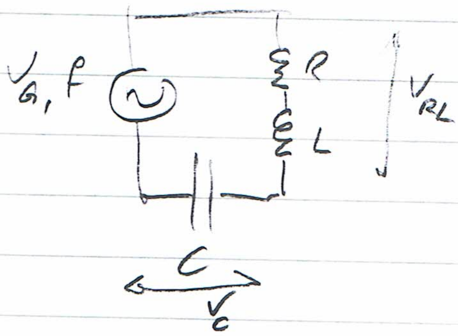
b) $\varepsilon = Blv$ (B uniforme)

$d\varepsilon = B(x)\,dx\,v$

$$\varepsilon = v\int_a^b B(x)\,dx = v\int_a^b \frac{\mu_0 i}{2\pi x}\,dx = \frac{v\mu_0 i}{2\pi}\int_a^b \frac{dx}{x}$$

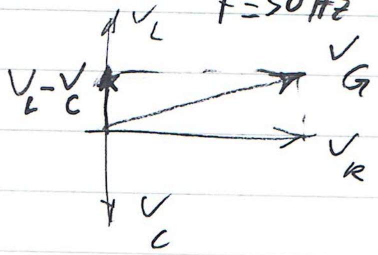
$$\boxed{\varepsilon = \frac{\mu_0 i v}{2\pi}\ln\left(\frac{b}{a}\right)} = 8 \times 10^{-5} \ln(20) \simeq \boxed{2,4 \times 10^{-4}\,V}$$

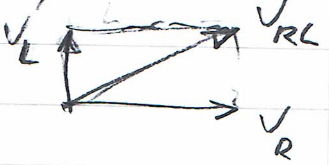
PROBLEMA 4



$V_G = 110\ V$ $V_{RL} = 50\ V$ $V_C = 132{,}5\ V$

$f = 50 Hz$ $C = 10 \mu F$





a) $V_G^2 = V_R^2 + (V_L - V_C)^2 = \underbrace{V_R^2 + V_L^2}_{V_{RL}^2} + V_C^2 - 2V_L V_C \Rightarrow$

$V_L = \frac{V_{RL}^2 + V_C^2 - V_G^2}{2V_C} = 30\ V$ $V_{RL}^2 = V_R^2 + V_L^2 \Rightarrow$

$V_R = \sqrt{V_{RL}^2 - V_L^2} = 40\ V$

b) $I = \frac{V_C}{X_C} = V_C \omega C = V_C 2\pi f C \cong \boxed{0.42\ A}$

c) $R = \frac{V_R}{I} = \frac{40}{0{,}42} = \boxed{95.2\ \Omega}$

$X_L = \frac{V_L}{I} = \frac{30}{0.42} = 71.4\ \Omega = \omega L \Rightarrow$

$L = \frac{X_L}{\omega} = \frac{71.4}{2\pi f} \cong \boxed{0.23\ H}$