



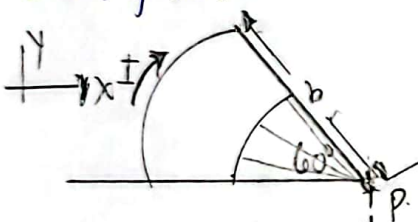
UNIVERSIDAD DE SAN CARLOS  
FACULTAD DE INGENIERIA  
DEPARTAMENTO DE FISICA  
CURSO DE VACACIONES JUNIO 2022

Firma:

*[Handwritten signature]*

Carné : 902100081 Curso: Física 2 Sección: C  
Nombre : Javier Andrés Monjes Solórzano

H1 -----Puede iniciar su examen a partir de aquí -----  
En la trayectoria de corriente  $I=5A$  que se muestra en la figura, produce un campo magnético en  $P$ , que es el centro del arco, con  $a=5cm$ ,  $b=12cm$ . Utilizando la ley de Biot y Savart.



Datos  
 $P=?$   
 $I=5A$   
 $a=5cm$   
 $b=12cm$

Ley de Biot-Savart  
$$d\vec{B} = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^2}$$

$\mu_0 = 4\pi \times 10^{-7} T \cdot m/A$

$d\vec{B} = d\vec{B}_1 + d\vec{B}_2 \rightarrow \text{arco} \rightarrow d\vec{l} \perp \vec{r} \rightarrow d\vec{l} \times \vec{r} \rightarrow d\vec{B}_1$   
 $d\vec{B}_1 = \frac{\mu_0 I}{4\pi} \frac{d\vec{l} \times \vec{r}}{r^2} \rightarrow \text{Sendo } dL = ds \rightarrow ds = b \text{ y } h = b$

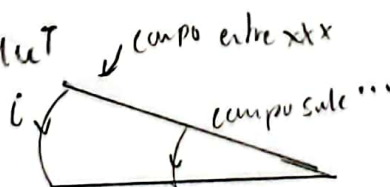
$B_1 = \frac{\mu_0 I}{4\pi} \frac{2\pi b}{b^2}$  (Integración circular)  $\rightarrow \vec{B} = \vec{B}_2 - \vec{B}_1$   
 $B_2 = \frac{\mu_0 I}{4\pi} \frac{2ab}{a^2}$  (Paralela-solo)  
 $B_1 = \frac{4\pi \times 10^{-7}}{4\pi} = \frac{5(0,12)(\pi)}{(0,12)^2} = 4,36 \times 10^{-6} T$   
 $B_2 = \frac{4\pi \times 10^{-7}}{4\pi} = \frac{(5)(0,05)(\pi)}{(0,05)^2} = 1,05 \times 10^{-4} T$   
 $\vec{B} = 6,12 \times 10^{-4} T$

a) Sumando de radios  $b=B_2 = 4,36 \times 10^{-6} + \frac{1,05}{10^{-4}} = 4,364 T$

b)  $6,12 \times 10^{-4} T$

c) total es  $6,12 \mu T = 6,109 \mu T$  campo entre xx

d) Dirección =  $\uparrow R$



Respuestas

a) 4.363

b) 0

c) 6.109

d) 4K

## Problema # 2

$$\Phi_B = [(3.00t + 1.00)(t - 2.00)] ; \Phi_B \text{ en mwb by } t(s)$$

B (Positiva) Sale del plano  $R = 2m$

a)  $t = 5.55$

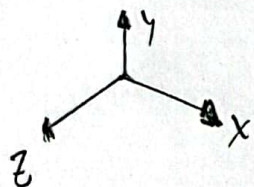
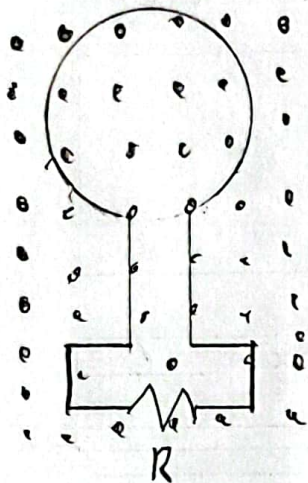
$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

$$\Phi_B = [3t^2 - 6t + t - 2] = [3t^2 - 5t - 2]$$

$$\frac{d\Phi}{dt} = (3t)' - (5t)' - (2)' = 6t - 5$$

$$t = 5.55 \rightarrow \frac{d\Phi_B}{dt} = (6)(5.55) - 5 = 23.3 \text{ mwb/s}$$

$$\mathcal{E} = 23.3 \text{ mwb/s} \rightarrow |\vec{\mathcal{E}}_{ind}| = 23.3 \text{ mwb/s}$$



b)  $L = 18m$

$$\rho = 1.70 \times 10^{-8} \Omega m$$

$$b = 6mm$$

$$i_{ind}$$

$$V_{ind} = \mathcal{E}_{ind} = i_{ind} \cdot R$$

$$R = \rho \cdot \frac{L}{A} ; A = \frac{\pi}{4} b^2 = \frac{\pi}{4} (0.006m)^2 = 2.8274 \times 10^{-5} m^2$$

$$L = 18m$$

$$R = \frac{(1.70 \times 10^{-8} \Omega m)(18m)}{2.8274 \times 10^{-5} m^2} = 0.01082 \Omega \quad i_{ind} = \frac{\mathcal{E}_{ind}}{R} = \frac{23.3 \text{ mwb/s}}{0.01082 \Omega} \cdot \frac{1 \text{ Wb}}{1000 \text{ mwb}} \rightarrow i_{ind} = 2.587A$$

c) -C

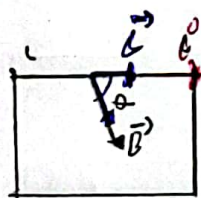
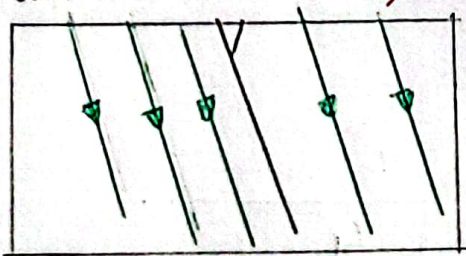
Respuesta

$$A = 23$$

$$B = 2.587$$

$$C = -C$$

## Problema # 3



$$L = 60.1m$$

$$I = 2.72kA = 2720A$$

$$\vec{B} = 58 \times 10^{-6} T$$

$$\theta = 63.2^\circ$$

$$\vec{F}_B = I \vec{L} \times \vec{B}$$

$$|\vec{F}_B| = I L B \sin \theta$$

$$|\vec{F}_B| = (2720A)(60.1)(58 \times 10^{-6}) \sin 63.2^\circ$$

$$|\vec{F}_B| = 8.463N$$

$$\text{Dirección} = (\vec{L} \times \vec{B}) ; \vec{L}(i) ; \vec{B}(-j) \rightarrow \vec{L} \times \vec{B} = -k$$

Respuesta

a) 8.463N

b) -k



# Problema #4

Actuador:

$$q = 3,3 \times 10^{-6} \text{ C}$$

$$m = 11.2 \text{ g} = 1,12 \times 10^{-2} \text{ kg}$$

$$V_0 = 0$$

$$V = (3,5\hat{i} + 7,97\hat{j}) \text{ m/s}$$

$$\vec{B} = (140\hat{i} + 218\hat{j}) \text{ T}$$

$$\sum \vec{F} = \vec{F}_B = m\vec{a};$$

$$\vec{F}_B = q \cdot (\vec{v} \times \vec{B})$$

$$\vec{v} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3,5 & 0 & 1,77 \\ 140 & 218 & 0 \end{vmatrix}$$

$$\hat{i}(0 - 1693,86) - \hat{j}(0 - 1087,8) + \hat{k}(763 - 0)$$

$$\vec{F}_B = (-1693,86\hat{i} + 1087,8\hat{j} + 763\hat{k})(3,3 \times 10^{-6} \text{ C})$$

$$\vec{F}_B (-5,5897 \times 10^{-3}\hat{i} + 3,589 \times 10^{-3}\hat{j} + 2,5179 \times 10^{-3}\hat{k}) = m\vec{a}$$

$$\vec{a} = (-486060,870\hat{i} + 312147,826\hat{j} + 218967,826\hat{k}) \text{ m/s}^2$$

Respuestas

$$a_x = -4861 \times 10^5 \text{ m/s}^2$$

$$a_y = 3.121 \times 10^5 \text{ m/s}^2$$

$$a_z = 2.189 \times 10^5 \text{ m/s}^2$$

$$|\vec{a}| = 6.17761.754 \text{ m/s}^2$$

$$= 6.178 \times 10^5 \text{ m/s}^2$$

Respuesta

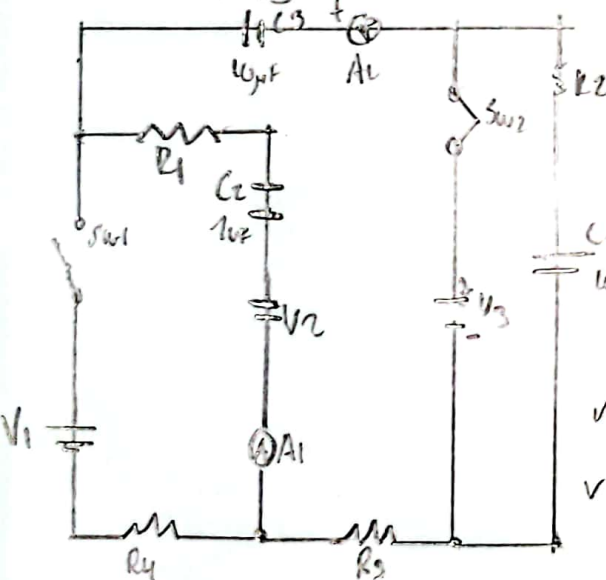
$$a) a_x = -4.861$$

$$b) a_y = 3.121$$

$$c) a_z = 2.189$$

$$d) a = 6.178$$

## Problema #5



$$R_1 = 1000 \Omega$$

$$R_2 = 1000 \Omega$$

$$R_3 = 1000 \Omega$$

$$R_4 = 1000 \Omega$$

$$V_1 = 24 \text{ V}$$

$$V_2 = 12 \text{ V}$$

$$V_3 = 12 \text{ V}$$

$$V_1 - i_3 R_1 - V_2 - i_4 R_4 = 0$$

$$i_2 = i_4 + i_5$$

$$-i_4 R_2 + V_3 = 0 \checkmark$$

$$-V_3 - i_6 R_3 - V_2 - i_3 R_1 = 0$$

$$i_5 + i_4 = i_6$$

$$C_6 = i_3 = i_1$$

$$i_1 = i_2 + i_3$$

$$\sqrt{24 - 1000 i_3 + 12 - 1000 i_1} = 0$$

$$\sqrt{12 - 1000 i_4} \rightarrow i_4 = \frac{12}{1000} \rightarrow i_4 = 0,012 \text{ A}$$

$$i_2 = i_4 + i_5 \rightarrow i_2 = 0,024 + i_5 \rightarrow i_5 = i_2 - 0,024$$

$$i_1 = i_2 + i_3 \rightarrow i_3 = i_1 - i_2 \rightarrow \text{switch open}$$

$$\sqrt{0,036 = i_1 + i_1 - i_2}$$

$$-1,004 = i_1 + i_2 = 0,024 - i_1 + i_2 = 0 \rightarrow i_2 = -i_1$$

$$0,036 = 2i_1 - i_2 \rightarrow 0,036 = 2i_1 - (-i_1) = 3i_1 \rightarrow i_1 = 0,012 \text{ A}; i_2 = -0,012 \text{ A}$$

$$i_3 = 0,024 \text{ A}$$

$$\sqrt{12 - 1000 i_6 - 12 - 1000 i_5} = 0$$

$$i_2 = i_4 + i_5$$

$$i_2 = i_1 - i_3$$

$$i_4 = i_5 - i_6$$

$$i_3 = i_4 + i_6$$

Respuesta

$$A_1 = 24$$

$$A_2 = 12$$

$$A_1 = 211 \text{ mA}$$

$$A_2 = 12 \text{ mA}$$

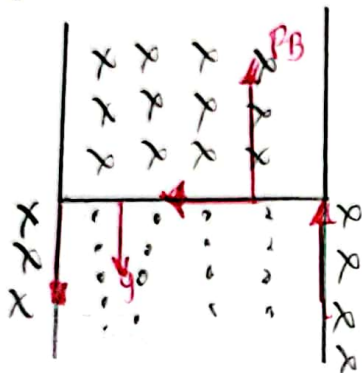
Problema 6.

$$L = 16,6 \text{ cm} = 0,166 \text{ m}$$

$$m = 19,3 \text{ g} = 0,0193 \text{ kg}$$

$$i = 7,96 \text{ A}$$

$$g = 9,81 \text{ m/s}^2$$



a)  $B = \frac{\mu_0 i}{2a}$  or targeted

$$B = \frac{(4\pi \times 10^{-7} \text{ Tm/A})(7,96 \text{ A})}{2\pi(0,156 \text{ m})}$$

$$B = 8,560 \times 10^{-6} \text{ T}$$

b) Direction  $+k$

c) Direction fuerza magnetica

$$F = (L \times B) = (L B \sin 90^\circ) = (L B)$$

$$(7,96 \text{ A})(0,166 \text{ m})(8,560 \times 10^{-6})$$

$$F = 1,26 \times 10^{-5} \text{ N} \ll 0,01 \text{ N}$$

Varilla hacia a unirse hacia abajo

Direction  $+j$

Respuestas

a)  $8,560 \times 10^{-6}$

b)  $+k$

c)  $+j$