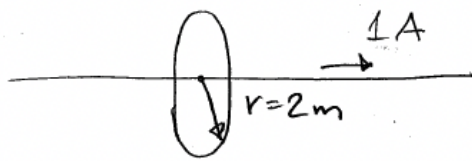


3.1



Ampères law:

$$H \cdot l = N \cdot I$$

$$\Rightarrow B = \mu H = \frac{I \cdot \mu}{2\pi r} \quad \left[\frac{\text{Wb}}{\text{m}^2} \right]$$

(N=1)

$$H = \frac{I}{l} = \frac{1}{2\pi \cdot 2} = \frac{1}{4\pi} \text{ A/m}$$

$$= 79,6 \text{ mA/m (effective)}$$

$$B = \mu H = 4\pi \cdot 10^{-7} \cdot H = \frac{4\pi \cdot 10^{-7}}{4\pi} = 1 \cdot 10^{-7} \text{ Wb/m}^2$$

$$= 0,1 \cdot 10^{-6} \text{ Wb/m}^2$$

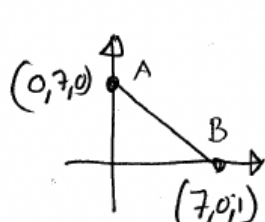
$$= 0,1 \text{ } \mu\text{Wb/m}^2 \text{ (effective)}$$

3.2

$$d\vec{F} = I d\vec{\ell} \times \vec{B}$$

$$\vec{F} = I \cdot (\vec{\ell} \times \vec{B})$$

$$\vec{B} = \begin{bmatrix} 15 \\ 15 \\ -10 \end{bmatrix} \frac{\text{mWb}}{\text{m}^2}$$



$$\vec{\ell} = B - A = \begin{bmatrix} 7 \\ 0 \\ 1 \end{bmatrix} - \begin{bmatrix} 0 \\ 7 \\ 0 \end{bmatrix} = \begin{bmatrix} 7 \\ -7 \\ 1 \end{bmatrix}$$

$$\vec{\ell} \times \vec{B} = \begin{bmatrix} \hat{x} & \hat{y} & \hat{z} \\ 7 & -7 & 1 \\ 15 & 15 & -10 \end{bmatrix} = \begin{bmatrix} 70-15 \\ 15+70 \\ 105+105 \end{bmatrix} = \begin{bmatrix} 55 \\ 85 \\ 210 \end{bmatrix} \text{ mN}$$

a)

$$\vec{F} = \begin{bmatrix} 55 \\ 85 \\ 210 \end{bmatrix} \text{ mN pr. A}$$

b) $\vec{\ell} \cdot \vec{B} = 15 \cdot 7 - 15 \cdot 7 - 10 \cdot 1 = -10$

Da prikprod. af ledning og felt ikke er 0, er de ikke orthogonale.

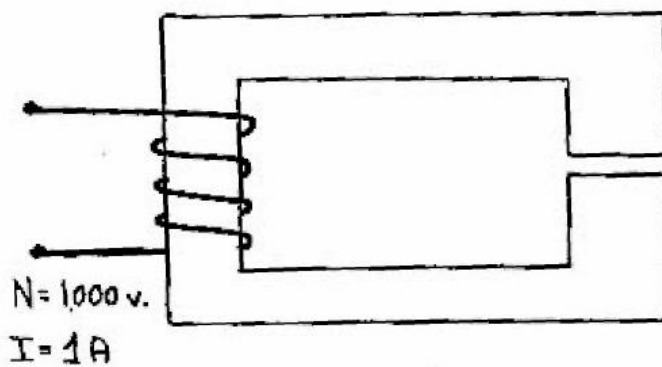
$$|\vec{B}| = 23,45 \quad |\vec{B}| \cdot |\vec{\ell}| = 223,34$$

$$|\vec{\ell}| = 9,94 \quad |\vec{F}| = |\vec{\ell} \times \vec{B}| = 233,13$$

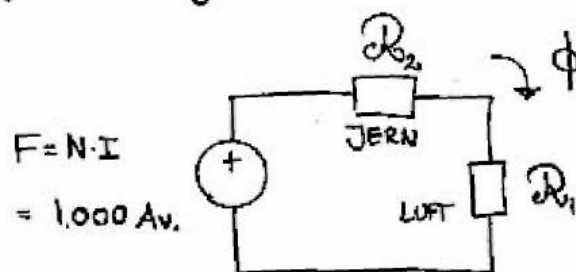
Vinklen mellem dem er

$$\varphi = \arcsin \frac{|\vec{F}|}{|\vec{B}| \cdot |\vec{\ell}|} = 87,5^\circ$$

3.3



Magnetisk diagram



a) Reluktansen for jernkernen:

$$R_2 = \frac{l}{\mu_0 \cdot \mu_r \cdot A} = \frac{0,24}{4\pi \cdot 10^{-7} \cdot 3000 \cdot 9 \cdot 10^{-4}} = 71 \cdot 10^3 \frac{\text{A}}{\text{wb}}$$

b) Reluktansen for luftspalten:

$$R_1 = \frac{l}{\mu_0 \cdot \mu_r \cdot A} = \frac{0,5 \cdot 10^{-3}}{4\pi \cdot 10^{-7} \cdot 1 \cdot 9 \cdot 10^{-4} \cdot 1,1} = 402 \cdot 10^3 \frac{\text{A}}{\text{wb}}$$

c) Den magnetiske flux:

$$\Phi = \frac{F}{\mathcal{R}_G + \mathcal{R}_{G_2}} = \frac{1000}{(402 + 71) \cdot 10^3}$$

$$= \frac{1000}{473} \cdot 10^{-3} = 2,12 \text{ mWb}$$

Fluxen er lige stor i jernkerne og luftspalte.