4.1

a) $H = 200\ A/m$, $B = 1\ Wb/m^2$

$$\mu_r = \frac{B}{\mu_0 H} = \frac{1}{4\pi \cdot 1E\text{-}7 \cdot 200} = 3979$$

b) $H = 400\ A/m$, $B = 1{,}2\ Wb/m^2$

$$= \text{forrige} \cdot \frac{1{,}2}{2} = \text{forrige} \cdot 0{,}6 = 3979 \cdot 0{,}6 = 2387$$

c)

$150\ A/m$, $0{,}9\ Wb/m^2$

$300\ A/m$, $1{,}12\ Wb/m^2$

$\Delta H = 300 - 150 = 150\ A/m$

$\Delta B = 1{,}12 - 0{,}9 = 0{,}22\ Wb/m^2$

$$\mu_{incr,r} = \frac{\Delta B}{\mu_0 \Delta H} = \frac{0{,}22}{4\pi \cdot 1E\text{-}7 \cdot 150} = 1167$$

d) Linear op til

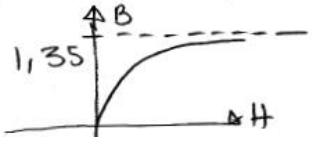
$H = 100\ A/m$

$B = 0{,}7\ Wb/m^2$

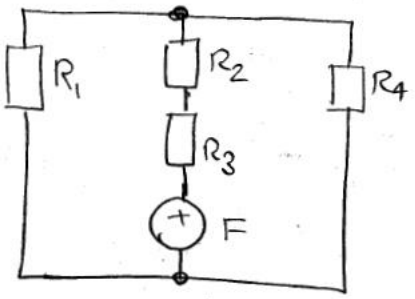
$$\mu_{INIT,r} = \frac{0{,}7}{4\pi \cdot 1E\text{-}7 \cdot 100} = 5570$$

e) Det ser ud til at være

$B_s = 1{,}35\ Wb/m^2$



4.2



$\mu_V = 2387$

$A = 1E\text{-}3\ m^2$

$f = \frac{2\ell}{\sqrt{A}} = \frac{2 \cdot 2E\text{-}3}{\sqrt{1E\text{-}3}} = 0{,}1265$

$F = N \cdot I = 200 \cdot 4{,}5$

$= 900\ A$

$R_1 = R_4$ (sideluftspalter):

$R_1 = R_4 = \frac{\ell}{\mu A}$

$= \frac{0{,}24 + 2 \cdot 0{,}20}{2387 \cdot \mu_0 \cdot 1E\text{-}3}$

$= 213{,}3\ k$

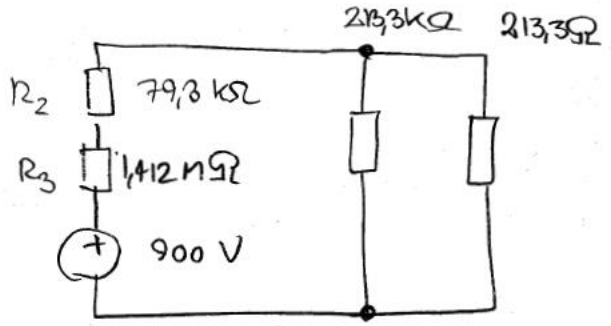
$R_2 =$ (midtluftspalt)

$\frac{0{,}24 - 2E\text{-}3}{2387 \cdot \mu_0 \cdot 1E\text{-}3} = 79{,}3\ k$

$R_3 =$ (luftspalten)

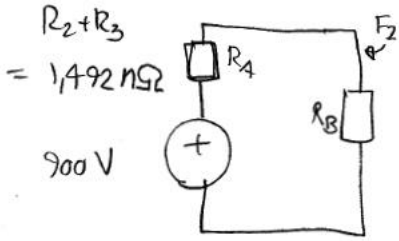
$\frac{2E\text{-}3}{\mu_0 \cdot A \cdot (1+f)}$

$= 1{,}412\ M$



$R_2 + R_3$

$= 1{,}492\ M\Omega$



$R_1 \parallel R_4$

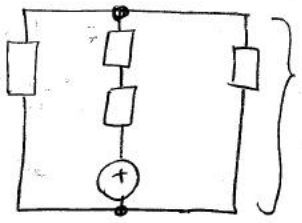
$= \frac{R_1}{2} = 106{,}67\ k\Omega$

Strømmen:

$$I = \frac{F}{R_A + R_B} = 0{,}563 \text{ mA} \;/_m \text{Wb}$$

$$F_2 = I \cdot R_B = 60{,}04 \text{ V} \;/\; \text{Av}$$

For ydersbenene



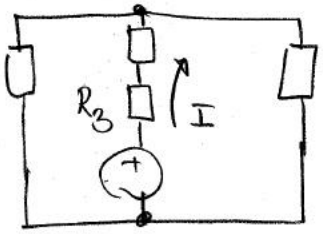
$F_2 = 60{,}04$ A.

$$H \cdot \ell = N \cdot I = F = 60{,}04 \text{ A}$$

$$\Rightarrow H = \frac{F}{\ell} = \frac{60{,}04}{0{,}24 + 2 \cdot 0{,}20} = 93{,}8 \text{ A/m}$$

$$B = \mu \cdot H = 0{,}28 \text{ Wb/m}^2$$

For luftspalten:

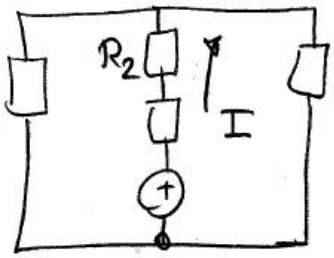


$$F_3 = I \cdot R_3 = 0{,}563 \text{ mA} \cdot 1{,}412 \text{ MΩ} = 795{,}3 \text{ A}$$

$$H = \frac{F_3}{\ell} = \frac{795{,}3}{} = 397{,}7 \text{ kA/m}$$

$$B = \mu_0 \cdot H = 0{,}999 \text{ Wb/m}^2$$

For midterbenet



$F_4 = I \cdot R_2 = 44,66 \ A$

$$H = \frac{F_4}{\ell} = \frac{44,66}{0,24} = 186,07 \ A/m$$

$$B = \mu H = 0,558 \ Wb/m^2$$

d)

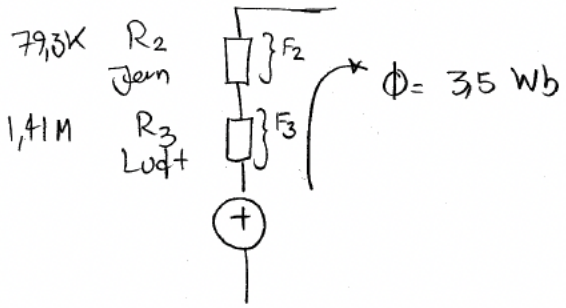
$\Phi_{midterben} = 0,563 \ mWb$

$\Phi_{yderben} = \frac{0,563}{2} = 0,281 \ mWb$

4.3

Nodvendig flux: $\phi = \frac{NI}{\omega N}$

$= \frac{220}{2\pi \cdot 50 \cdot 200} = 3{,}5$ mWb effektiv



For midterbenet:

$F_2 = \phi \cdot R_2 = 277{,}78$ A

$H_2 = \frac{F_2}{\ell} = \frac{277{,}78}{0{,}24 - 2E{-}3} = 1{,}157$ kA/m

$B_2 = \mu \cdot H_2 = 3{,}47$ Wb/m²

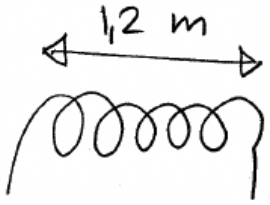
For luftspalten:

$F_3 = \phi \cdot R_3 = 4{,}947$ kA

$H_3 = \frac{F_3}{\ell} = \frac{4{,}947E3}{2E{-}3} = 2{,}47$ MA/m

$B_3 = \mu_0 \cdot H_3 = 3{,}11$ Wb/m²

4.4



N = 750

0,10 m diameter

I = 1,75 A

$$H \cdot \ell = N \cdot I$$

$$H = \frac{NI}{\ell} = \frac{750 \cdot 1,75}{1,2} = 1,09 \text{ kA/m}$$

$$L = \mu_0 \cdot N^2 \cdot \frac{A}{L} = 4\pi \cdot 1E\text{-}7 \cdot 750^2 \cdot \frac{\pi \cdot \left(\frac{0,1}{2}\right)^2}{1,2}$$

$$= 4,63 \text{ mH}$$