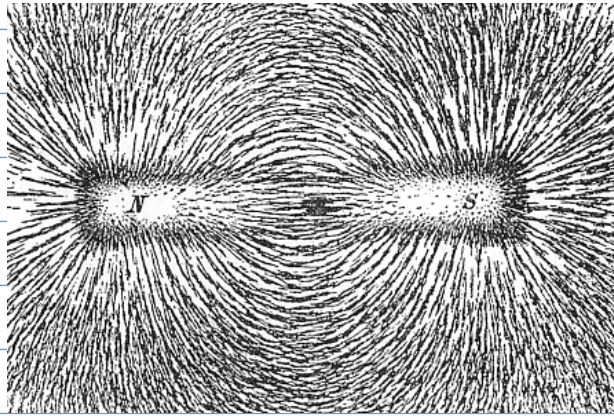
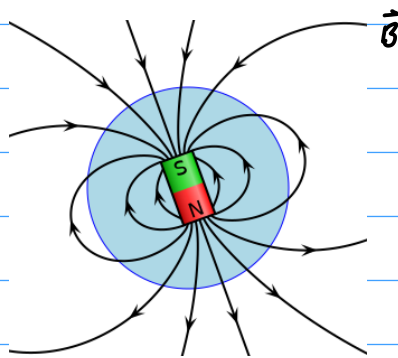


# Magnetisk felt

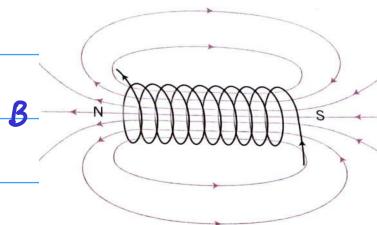
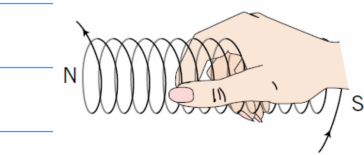
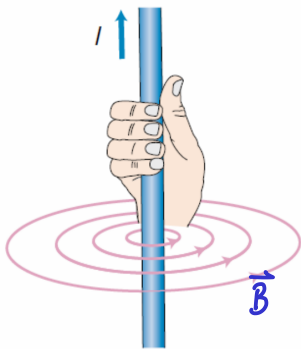


Feltlinjer:

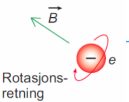
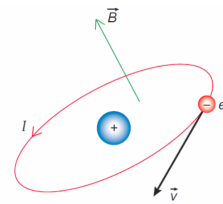


Wikipedia: magnetic field

Hva gir magnetfelt? Svar: Strøm!

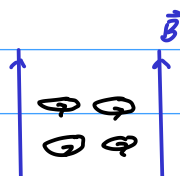
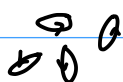


Grimenes, Jestad, Sletbak: Grunnleggende fysikk for universitet og høyskole



Rotasjonsretning

Ferromagnetisme:

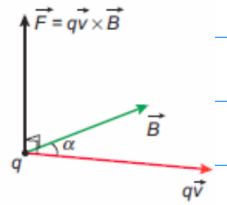
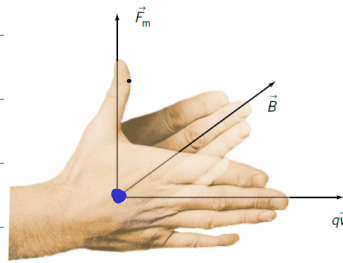


# Magnetfelt gir krefter på ladninger i bevegelse

Magnetisk kraft:  $F_m = qvB$

Enhet B:  $N = C \frac{m}{s} [B]$

$$[B] = \frac{Ns}{Cm} = T = \text{tesla}$$

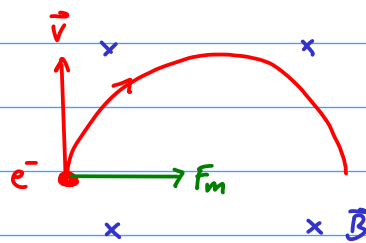


Magnetfelt jorda:  $50 \mu T$

Typisk permanentmagnet:  $10 mT$

Stor elektromagnet / MR-maskin:  $1 - 3 T$

Eks: Elektron i bevegelse i homogent  $\vec{B}$ -felt. Retning til  $\vec{B}$ ?



$$F_m = qvB$$



Radius bane?  $qvB = m \frac{v^2}{r} \Rightarrow qB = \frac{mv}{r} \Rightarrow \underline{r = \frac{mv}{qB}}$

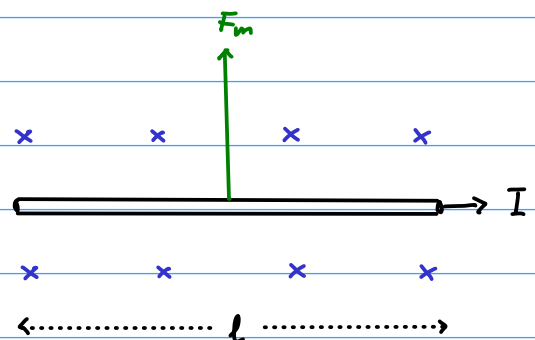
## Kraft på strømførende leder

$$F_m = qvB$$

$$I = \frac{q}{t} \Rightarrow q = It$$

$$F_m = ItvB = \underline{IlB}$$

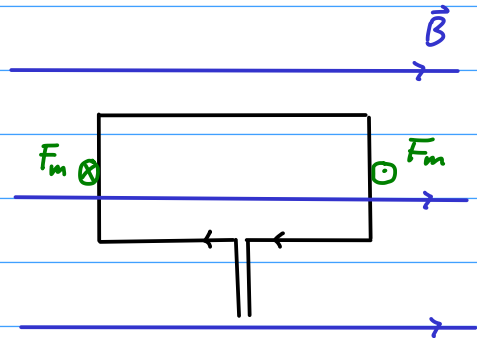
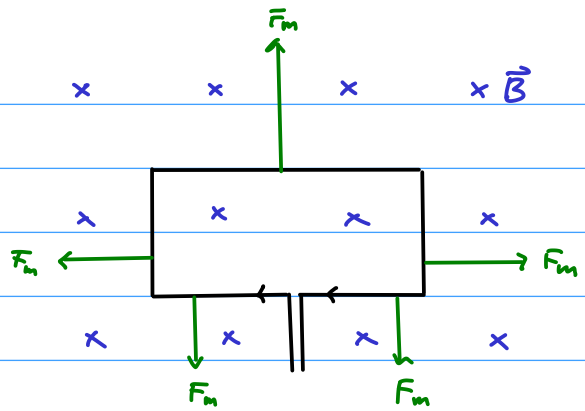
for homogent felt  $\perp$  strømmen.



Strømsløyfe i magnetfelt :

$$F_m = qvB$$

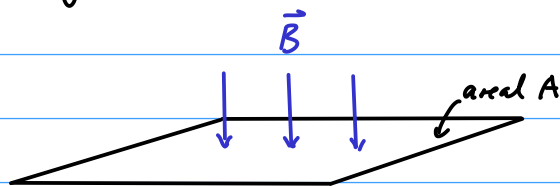
$$F_m = IlB$$



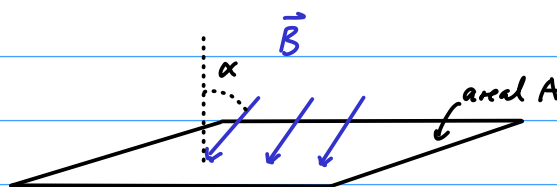
El-motor!

Magnetisk fluks og induksjon

Fluks :  $\Phi = BA$



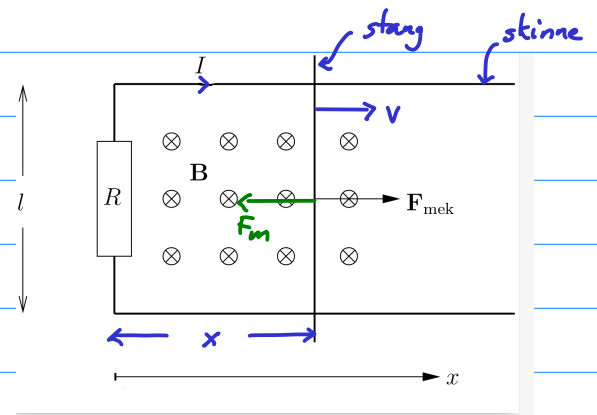
$$\Phi = BA \cos \alpha$$



Faradays lov:  $\mathcal{E} = - \frac{\Delta \Phi}{\Delta t}$  ← fluksending, areal omsluttet av løyfe

↑  
ems  
elektromotorisk spenning  
kildespenning

Eks: En stang dras bortover to skinner, konst. fart  $v$ .  $B$  er konstant.



a) Finn emsen.

$$\mathcal{E} = - \frac{\Delta \Phi}{\Delta t}, \quad \Phi = BA = Blx$$

$$\mathcal{E} = - Bl \frac{\Delta x}{\Delta t} = - Blv$$

$\leftarrow$  farten til stangen

b) Finn strømmen  $I$ .

$$I = \frac{\mathcal{E}}{R} = \frac{-Blv}{R}$$

c) Finn  $F_{mek}$ . Magn. kraft stang:  $F_m = |I|lB$

$$\Sigma F = 0 \Rightarrow F_{mek} = |F_m| = \frac{Blv}{R} lB = \frac{B^2 l^2 v}{R}$$

d) Finn effekten som varmer opp  $R$ .  $P = RI^2 = \frac{B^2 l^2 v^2}{R^2} R = \frac{B^2 l^2 v^2}{R}$

e) Hvor kommer denne energien fra? Fra vedkommende som drar stanga.

Arbeid iltiden  $\Delta t$ :  $\Delta W = \text{kraft} \cdot \text{forflytn.} = F_{mek} \Delta x$

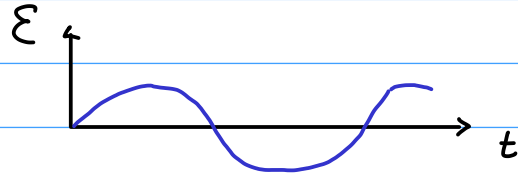
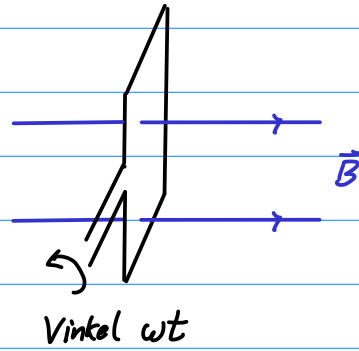
$$\text{Effekt: } P = \frac{\Delta W}{\Delta t} = F_{mek} \frac{\Delta x}{\Delta t} = F_{mek} v = \frac{B^2 l^2 v^2}{R}$$

# Vekselstrømgenerator

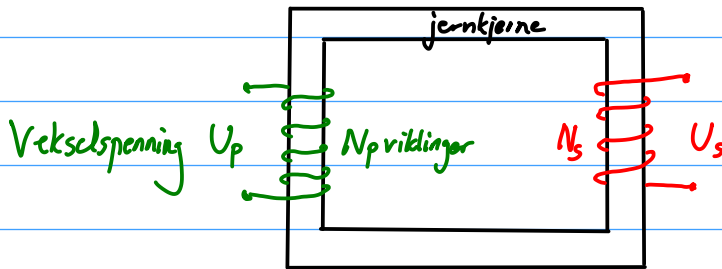
$$\Phi = BA \cos(\omega t)$$

$$\mathcal{E} = - \frac{\Delta \Phi}{\Delta t} = - \Phi'(t)$$

$$= BA \sin(\omega t) \omega$$



# Transformator



$$\frac{U_s}{U_p} = \frac{N_s}{N_p}$$

Ekspirimeter :

