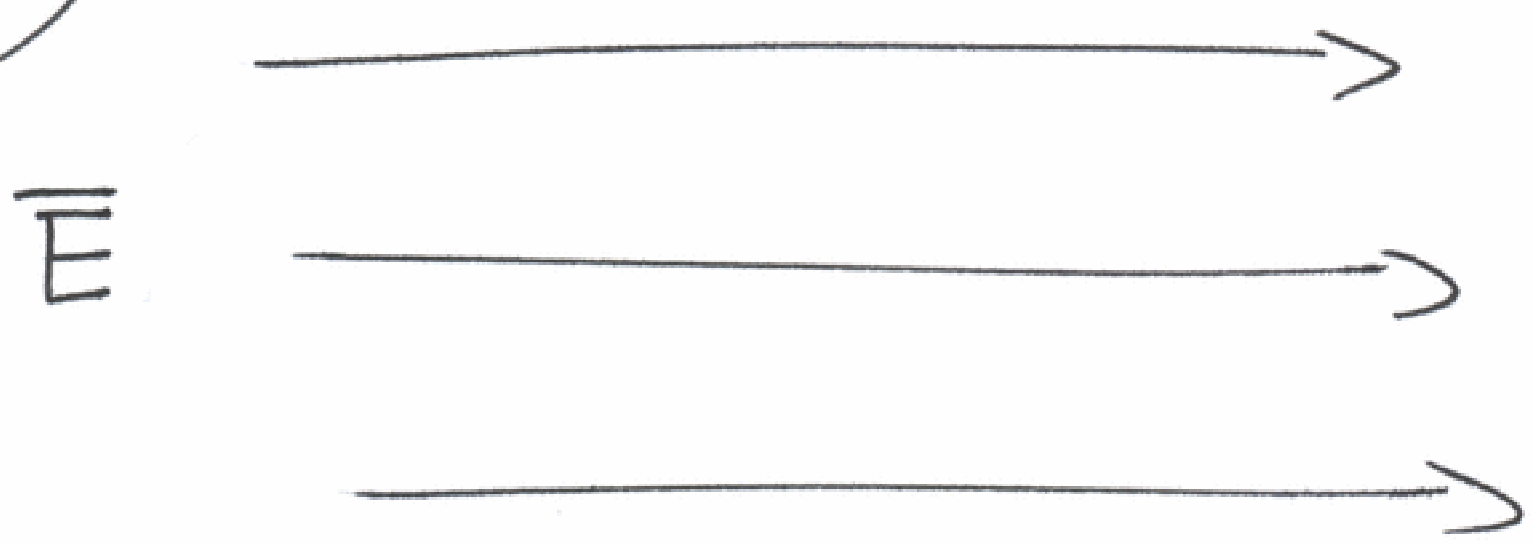
1. a)

$$\overline{\tau} = \overline{p} \times \overline{E}$$



tveir möguleikar

$\oplus \xleftarrow{p} \ominus$

$\ominus \xrightarrow{p} \oplus$

samsíða eða andsamsíða

$\rightarrow \overline{\tau} = 0$

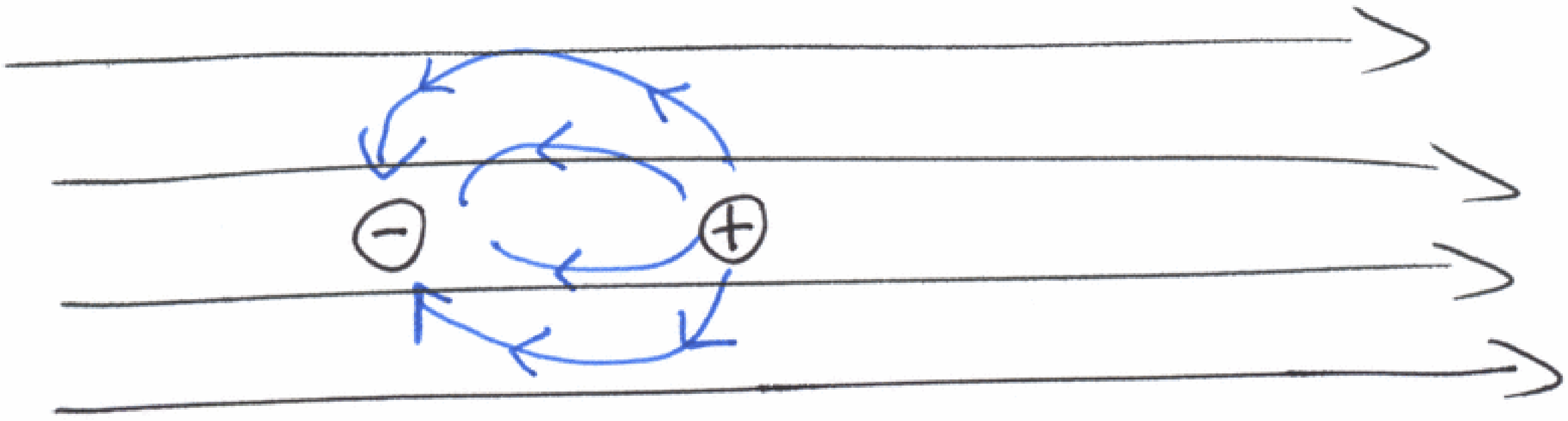
b) Stöðuorka rafturstauts í einsleitu ytra sviði

$$U = -\overline{p} \cdot \overline{E}$$

lægst þegar $\overline{p}$ er samsíða $\overline{E}$

hæst þ. $\overline{p}$ er andsamsíða $\overline{E}$

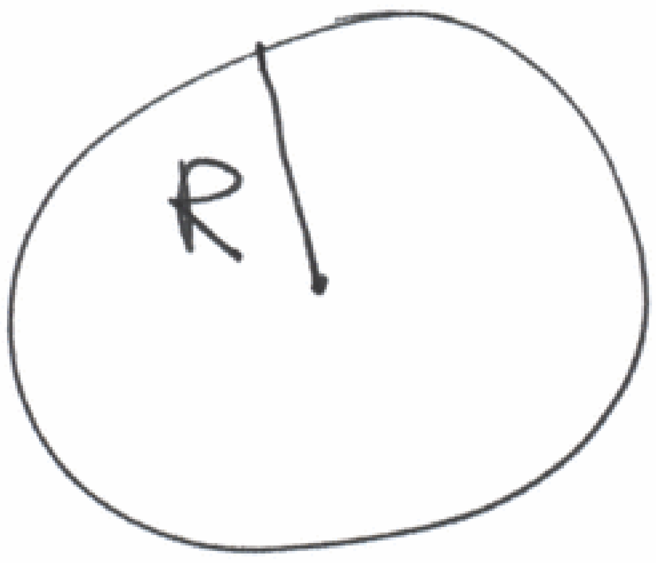
$\rightarrow$ samsíða er <u>stöðugt jafnvægi</u>



Rafsvið tvístautsins muntor pá heildar sviðið

②

Þunn kúluskel með jafndreifða hleðslu $-Q$, geisli R.



Reikna kraftinn á litla jákvæða hleðslu q

i) $r<R$

Ef rafsviðið $\bar{E}$ er þekkt gildir

$$\bar{F} = q\bar{E}$$

Reiknum $\bar{E}$

Gauß-lögmál $\oint \bar{E}\cdot d\bar{A} = \frac{Q'}{\epsilon_0}$

þar sem Q' var hér hleðslan innan sammiðja kúluyfirborðs með $r<R$

þar er $Q'=0$ $\rightarrow$ $\bar{E}=0$ vegna yfirborðshleðslunar innan skeljarinnar

$\rightarrow$ innan skeljar er enginn kraftur á q

ii) $r > R$

her

$$\oint \bar{E} \cdot d\bar{A} = -\frac{Q}{\epsilon_0}$$

sammedata kulsymt. ~~flate~~ med $r > R$

$$E \cdot 4\pi r^2 = -\frac{Q}{\epsilon_0}$$

$$\rightarrow \quad E = -\frac{Q}{4\pi\epsilon_0 r^2}$$

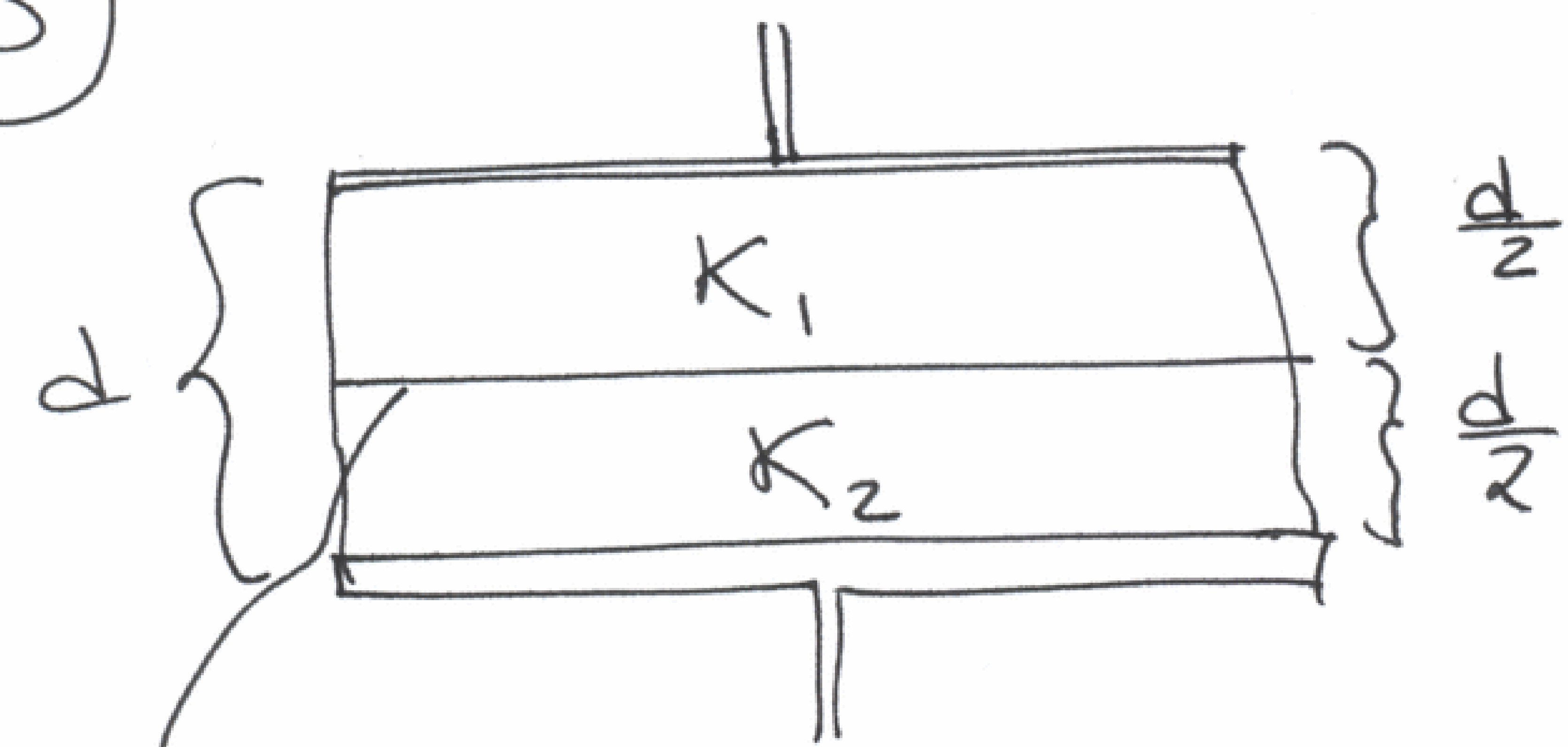
og $$\bar{E} = -\hat{r}\,\frac{Q}{4\pi\epsilon_0 r^2}$$

Kraftverkinn å q utan skaljar er då

$$\bar{F} = q\bar{E} = -\hat{r}\,\frac{qQ}{4\pi\epsilon_0 r^2}$$

Aedrätter krafter då $q > 0$

3



Hér má hugsa sér hleðslu (örþunna) +Q og −Q á sama stað (engin heildar hleðsla) þá sést að þetta er eins og tveir raðtengdir þéttar

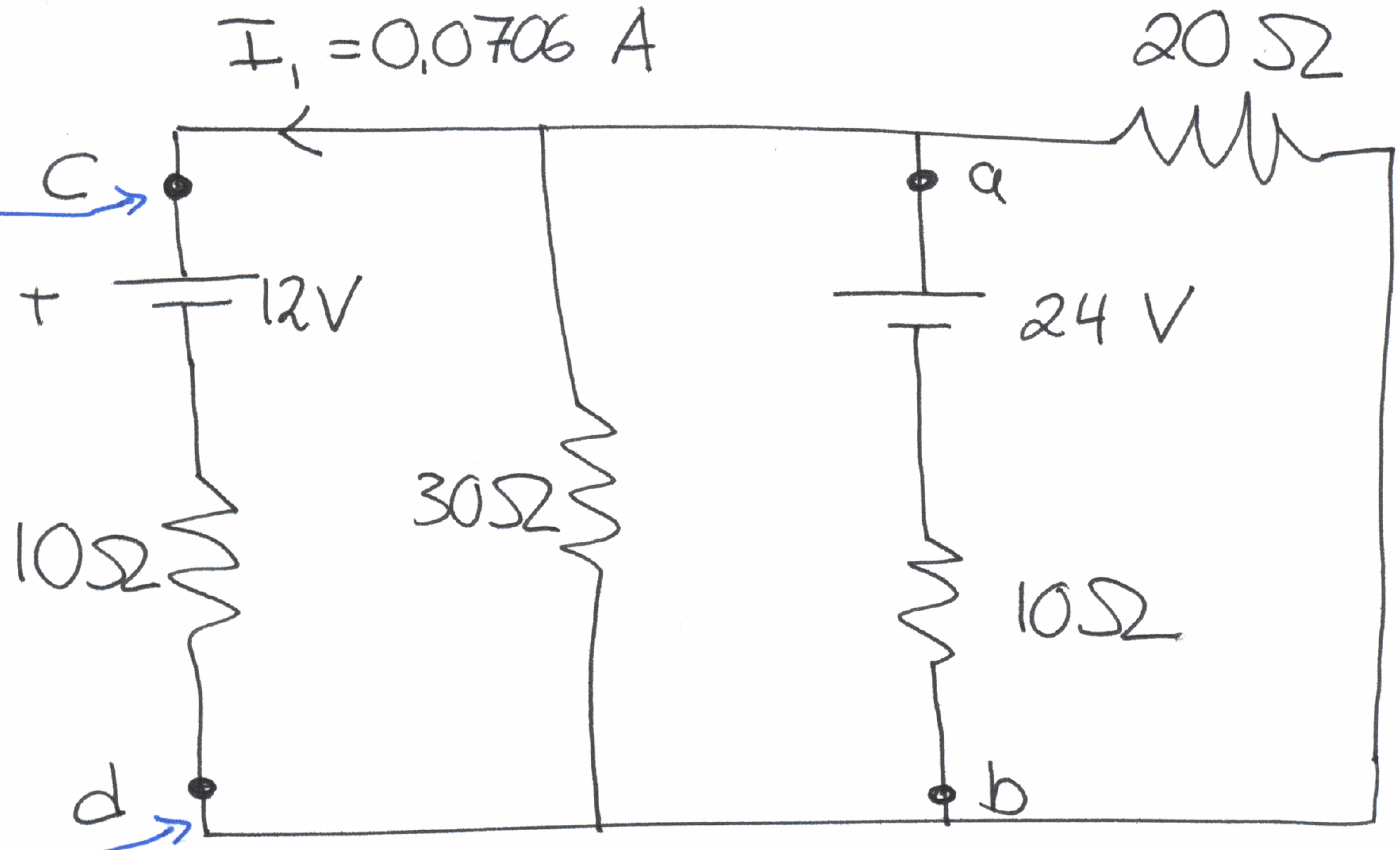
Heildar rýmdin er

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C_1 = \frac{\epsilon_0 K_1 A}{\frac{d}{2}} \qquad C_2 = \frac{\epsilon_0 K_2 A}{\frac{d}{2}}$$

$$C_{eq} = \frac{2\epsilon_0 A}{d}\left(\frac{K_1 K_2}{K_1 + K_2}\right)$$

4



$$V_d + I_1(10\Omega) + 12V = V_c$$

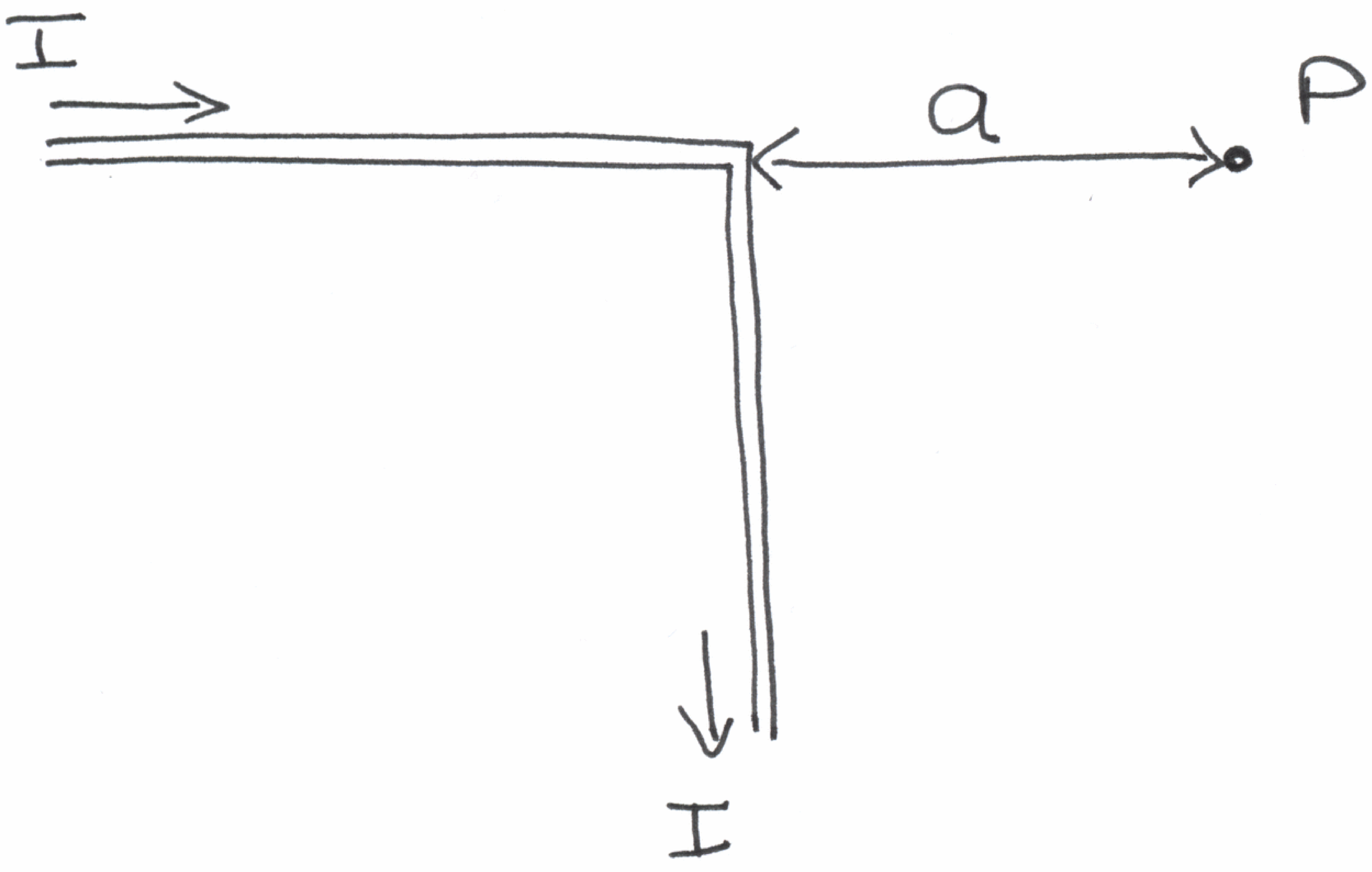
$$\rightarrow V_c - V_d = 12.706\ V$$

$$\text{Kirchhoff} \rightarrow V_a - V_b = V_c - V_d$$

$$\approx 12.7\ V$$

Sama skautspenna
hægri rafhlöðunnar

5



Láréttí hlutí vírsins leggur ekkert til segulsviðsins í P því

$$d\bar{B} = \frac{\mu_0}{4\pi}\frac{I\,d\bar{l}\times\hat{r}}{r^2}$$

og þar gildi $d\bar{l}\times\hat{r} = 0$ (samsíða)

Lóðrétti vírinn leggur til helming þess sem óendanlegur vír myndi gera

$$\Rightarrow \quad B = \frac{1}{2}\frac{\mu_0 I}{2\pi R}$$

og stefnir út úr blaðinu

(6)

Afl frá loftnetinu er

$$P = SA = \left(\frac{c B_{max}^2}{2\mu_0}\right)\left(4\pi r^2\right)$$

$$\rightarrow B_{max} = \sqrt{\frac{2\mu_0 P}{4\pi r^2 c}} \approx 2.42 \cdot 10^{-9}\ \mathrm{T}$$

Spennan í móttökuloftnetinu er

$$\mathcal{E} = -\frac{d\Phi}{dt} = -A_e \frac{dB}{dt}$$

$$\frac{dB}{dt} = \omega B_{max} \approx 1.44\ \mathrm{T/s}$$

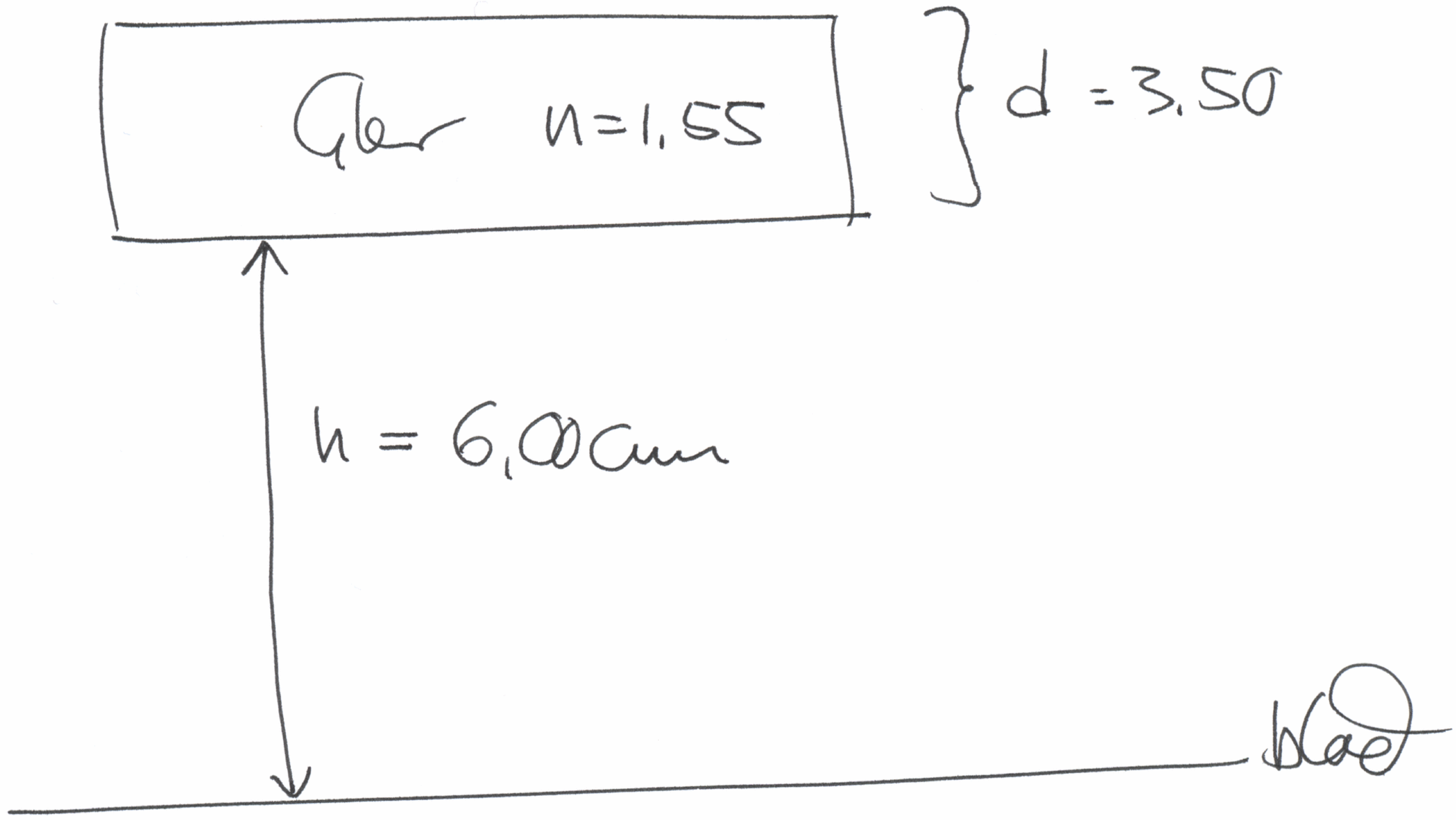
$$\mathcal{E} = -A_e \frac{dB}{dt} = \frac{\pi d^2}{4}\frac{dB}{dt}$$

$$= \frac{\pi d^2}{4}\omega B_{max} = 0{,}0366\ \mathrm{V}$$

$$S_{ave} = \frac{E_0 B_0}{2\mu_0}, \quad E_0 = c B_0$$

Hér stendur $_0$ fyrir max gildin

7



$$\frac{n_a}{s} + \frac{n_b}{s'} = 0 \;\Bigg\}\rightarrow\; \frac{1}{6{,}00\,\text{cm}} + \frac{1{,}55}{s_1'} = 0$$

$$\rightarrow s_1' = -9{,}30\ \text{cm}$$

$$\rightarrow s_2 = d - s_1' = 12.80\ \text{cm}$$

$$\frac{n}{d - s_1'} + \frac{1}{s_2'} = 0$$

$$\rightarrow s_2' = -8{,}26\ \text{cm}$$

målt frå øvre bladet → mynda er 1,24 cm frå ovan sida