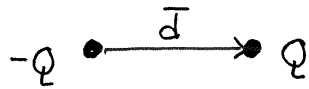


Raftuístaut

(1)

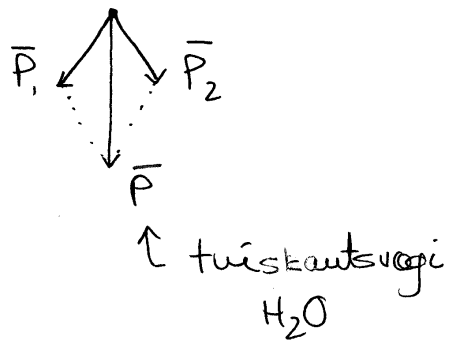
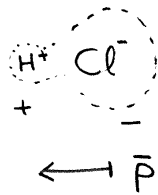
Tvar hléslur m. Síttvort formverkíð,
 $|Q_1| = |Q_2| = Q$, með bíl d mynda
tuístaut



Skilgreinum tuístautsvægi

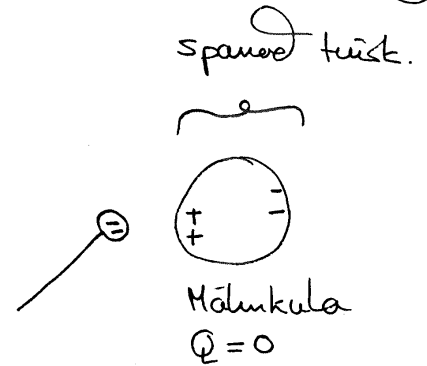
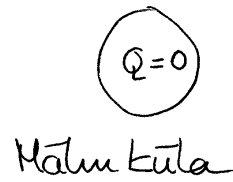
$$\bar{P} = Qd$$

Föst tuístaut: t.d. HCl, H₂O.....



Spönuð tuístaut

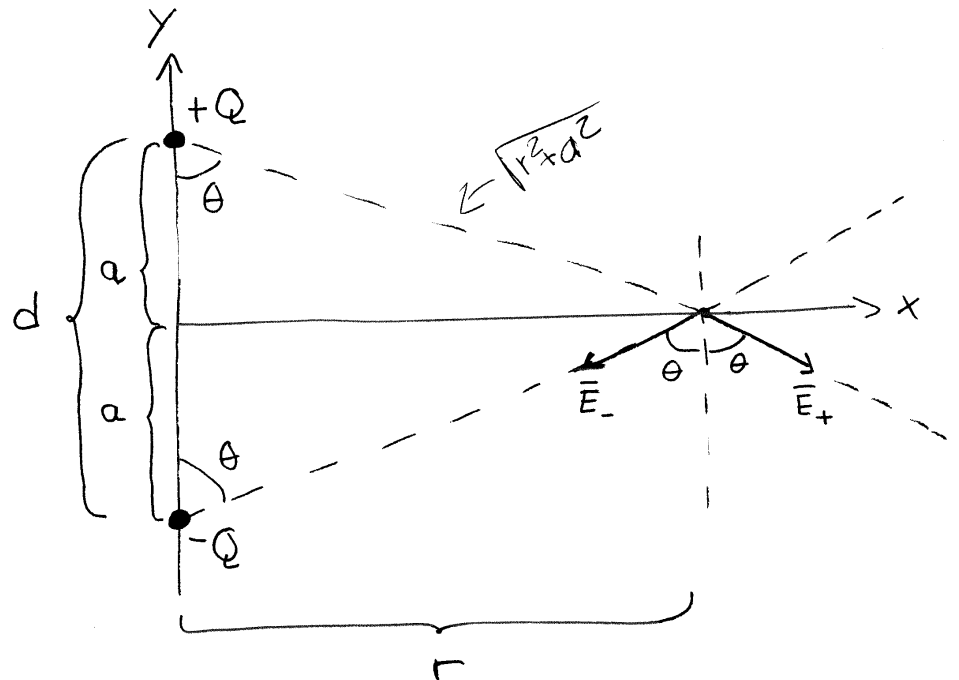
(2)



Samskonar fyrir atóm í rafsviði

Rafsvið tuístauts

á langás og þverás



Þverás

A x-osum gildir

$$\underbrace{|\bar{E}_+| = |\bar{E}_-|}_{\text{sambærta}} = \frac{kQ}{r^2 + a^2}$$

x-póttir styttast út (sjá mynd)

$$E_y = -(E_+ + E_-) \cos \theta \\ = -\frac{2kQ}{r^2 + a^2} \cos \theta$$

$$\text{en } \cos \theta = \frac{a}{\sqrt{r^2 + a^2}}$$

$$\rightarrow E_y = -\frac{2kaQ}{(r^2 + a^2)^{3/2}} = -\frac{kP}{(r^2 + a^2)^{3/2}}$$

athugum næstgildið þegar $r \gg a$

$$\frac{1}{(r^2 + a^2)^{3/2}} = \frac{1}{r^3 \left(1 + \frac{a^2}{r^2}\right)^{3/2}}$$

(3)

Nú gildir

$$\left(1 + \left(\frac{a}{r}\right)^2\right)^{-3/2} \sim 1 - \frac{3}{2}\left(\frac{a}{r}\right)^2 + \frac{15}{8}\left(\frac{a}{r}\right)^4 + O\left(\left(\frac{a}{r}\right)^6\right)$$

$$\rightarrow E_y \approx -\frac{kP}{r^3} \left\{1 - \frac{3}{2}\left(\frac{a}{r}\right)^2 + \frac{15}{8}\left(\frac{a}{r}\right)^4 + \dots\right\}$$

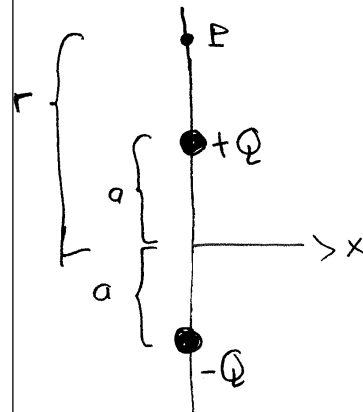
Átfelldu formið fyrir E_y þegar $r \rightarrow \infty$

er

$$E_y = -\frac{kP}{r^3}$$

↑ fellur hveitt m. v. eina hliðina

Langás



\bar{E}_+ og \bar{E}_- eru samsíða og andsamsíða y-ás í P

$$E_y = \frac{kQ}{(r-a)^2} - \frac{kQ}{(r+a)^2} \\ = kQ \left\{ \frac{(r+a)^2 - (r-a)^2}{((r-a)(r+a))^2} \right\}$$

(4)

5

$$E_y = kQ \left\{ \frac{4ra}{(r^2 - a^2)^2} \right\}$$

$$= 2kP \left\{ \frac{r}{(r^2 - a^2)^2} \right\}$$

athugum markgildið þegar $r \gg a$

$$E_y = \frac{2kPr}{r^4} \left\{ \frac{1}{(1 - (\frac{a}{r})^2)^2} \right\}$$

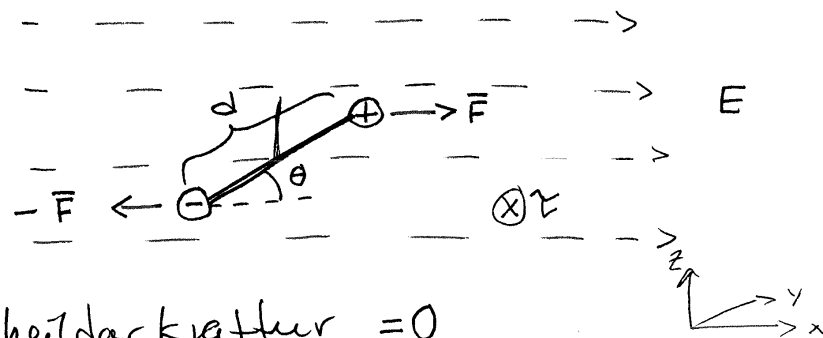
$$= \frac{2kPr}{r^3} \left\{ 1 + 2\left(\frac{a}{r}\right) + 3\left(\frac{a}{r}\right)^2 + \dots \right\}$$

af fellaformið fyrir E_y þegar $r \rightarrow \infty$

$$E_y = \frac{2kP}{r^3}$$

6

Kraftvogi í jöfnu sviði



heildar kraftur = 0

en vogi hvar?

Reknum vogi um miðpunkt

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$\vec{\tau} = (qE \cdot \frac{d}{2} \sin\theta + qE \cdot \frac{d}{2} \sin\theta) \hat{y}$$

Þessi vogi leitast við að snúa tvískautinu í sömu átt

$$\boxed{\vec{\tau} = \vec{p} \times \vec{E}}$$

$$(\vec{p} = q\vec{d})$$

$$\left\{ |\vec{\tau}| = qd \cdot E \cdot \sin\theta \right\}$$

Møllisorka tvi-skauts í einsbættu rafsviði (7)

Snúningur tvi-póls frá $\theta_1 \rightarrow \theta_2$ með ytri krafti kostar vinnu (\pm).

$$W_{\text{ext}} = - \int_{\theta_1}^{\theta_2} \tau d\theta \quad \left\{ \begin{array}{l} \text{kraft} \\ \text{gegn'vogi sviðs} \end{array} \right.$$

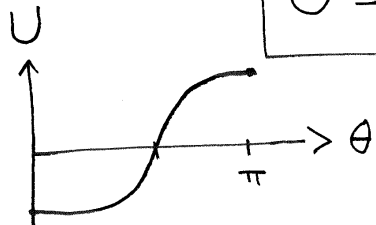
$$= - \int_{\theta_1}^{\theta_2} p E \sin\theta d\theta = pE(-\cos\theta_2 + \cos\theta_1)$$

$$= \Delta U = U_2 - U_1 \quad : \text{Gegnumkraftur}$$

Veljum $U_1 = 0$ fyrir $\theta_1 = \pi/2$

\rightarrow møllisorka tvi-skauts

$$U = -pE \cos\theta = -\bar{p} \cdot \bar{E}$$



Lögmark í stöðuorku (8)

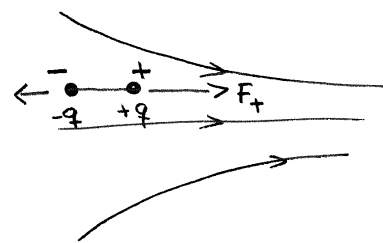
\hookrightarrow örvarir leida til sveifna um jáfnvægistöðu

$$\left\{ \begin{array}{l} \text{Hitun í örbylgjuotni} \\ 2.45 \text{ GHz} \end{array} \right.$$

deyting, (viðnám gegn sveiflum),
 \rightarrow hiti út í umhverfið.

skautið ephi leysast vel upp í skautverum vökvum.

Tvi-skaut í misbættu rafsviði



heildarkraftur

$$F = q(E_+ - E_-) = \underline{q\Delta E \neq 0}$$

tvi-skaut í x-stefnu

$$\rightarrow F_x = p \frac{dE}{dx}$$

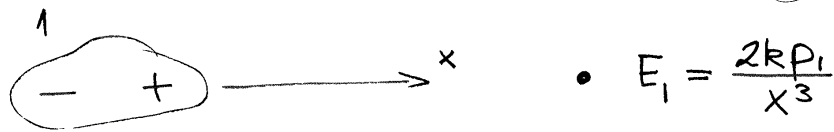
9

Vixlverkan milli tvi skauta

Vixlverkan milli spanaetra tvi skauta i ohlöðnum atömunum veldur veikunum krafti, vander Waals.

flökt i hleðsludreif. i einu atömi
→ tímabundið vogi P_1

→ fjarni atömi samhlida as tvi skauts



atöm sem er i þessu sviði skautast



vegna kraftsins frá ① $F_2 = P_2 \frac{dE_1}{dx}$
i stefnu ①

10

$$P_2 \sim E_1 \quad \text{og} \quad \frac{dE_1}{dx} \sim \frac{1}{x^4}$$

→ Krafturinn \bar{a} milli tveggja spanaetra tvi skauta

$$\text{er} \quad F \sim \frac{1}{x^7}$$

↑
Skammtlægur Kraftur

Eindir i einsteitu tímaohæðu rafsviði

'A þar verkar Kraftur

$$\bar{F} = q\bar{E} \quad q: \text{hleðsla eindar}$$

Aunad Lögmál Newtons

gefur $\bar{F} = m\bar{a}$ Kraftur veldur hroðun

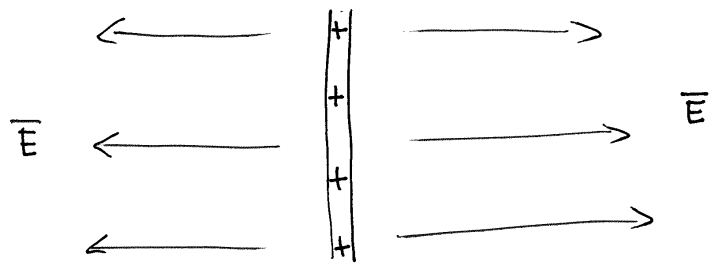
$$\rightarrow \bar{a} = \frac{q\bar{E}}{m}$$

($v \ll c$)

Dæmi

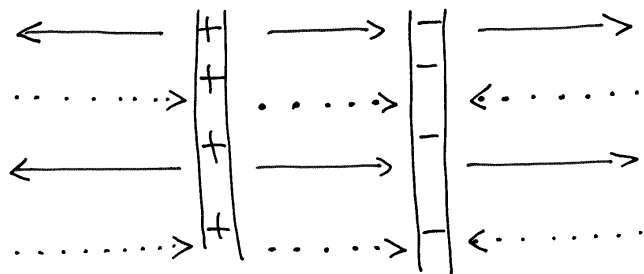
(11)

"Example 21.12" → tafsvið frá
öndanlegum einsleitum fleti
með flatarhleðslu σ [C/m^2]



einsleit $E = |\vec{E}| = \frac{\sigma}{2\epsilon_0}$

Tveir fletir með sömu σ
en sítthvort formerkið



Samlagning vígursviðanna

(12)

