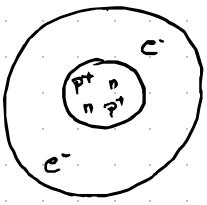
OSNOVNI ELEKTRONIČKI KONCEPTI

ATOM



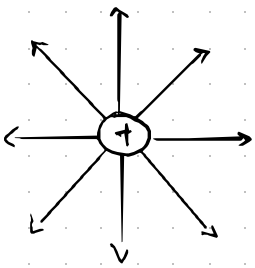
NABOJ - fiz. veličina koja opisuje temeljno svojstvo nabijenih čestica
↳ uzajamno djeluje el. silama

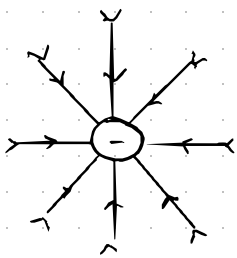
$Q \rightarrow [Q]$ - C (Kulon)

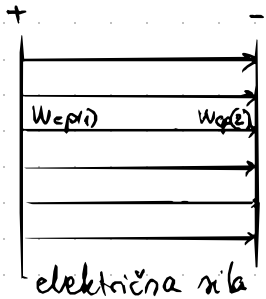
Elementarni naboj: naboj protona i elektrona

$Q_{p^+} = Q_{e^-} = 1{,}6 \times 10^{-19} C$

Električno polje: prostor u kojem el. naboj djeluje na drugo nabijeno tijelo







ELEKTRIČNA POTENCIJALNA ENERGIJA

$A = W_{ep(1)} - W_{ep(2)}$ $\quad [A] = [W] = J$ (Džul)

ELEKTRIČNI POTENCIJAL - el. pot. energ. koju ima jedinični naboj u nekoj točki el. polja

$$\varphi_{(x)} = \frac{W_{ep(x)}(Q)}{Q}$$

$[\varphi] = V$ (Volt)

ELEKTRIČNI NAPON $U_{AB} = \varphi_A - \varphi_B \quad [U] = V$

$$U_{AB} = \frac{W_{cp(A)}(q)}{q} - \frac{W_{cp(B)}(q)}{q} = \frac{W_{cp(A)} - W_{cp(B)}}{q}$$

razlika potencijalnih energija : jednaka radu isključenom da se naboj prenjesti iz A u B

$$\Rightarrow U_{AB} = \frac{\Delta W_{cp(A-B)}(q)}{q} = \frac{A_{(A-B)}(q)}{q}$$

$q(t)$ - koliko smo naboja prebacili do trenutka t

$w(t)$ - koliko je električne energije utrošeno do trenutka t

$$\overline{U}_{[t_1,t_2]} = \frac{W(t_2) - W(t_1)}{q(t_2) - q(t_1)} = \frac{\Delta W}{\Delta q} \qquad \Delta q \to 0$$

$$u = \lim_{\Delta q \to 0} \frac{\Delta W}{\Delta q} = \frac{dW}{dq}$$

ZADATAK:

Da bi el. polje čestice čiji je naboj jednak $-80nC$ iz točke u kojoj je $\varphi_0 = 0V$ prenijelo u točku x u kojoj je φ_x, el. polje obavi rad od $25\mu J$. Pretpostavljamo da je el. polje homogeno

Koliki je potencijal od točke x? ($\varphi_x = ?$)

$Q = -80nC$

$\varphi_0 = 0V$

$\varphi_x = ?$ } $0 \to x$

$A = 25\mu J$

a) $\varphi_x = \frac{W_{ep(x)}(q)}{q} = \frac{A_{(x\to 0)}(q)}{q}$ → obrnuti smjer $A_{(x\to 0)} = -A_{(0\to x)}$

$$\varphi_x = \frac{-25\times10^{-6}\,J}{-80\times10^{-9}\,C} = \frac{25}{80}\times10^3\,V$$

$$\varphi_x = \frac{5}{16}\times10^3\,V = 312{,}5\,V$$

b) $U_{xy} = 100V$, $f_y = ?$

$U_{xy} = f_x - f_y$

$100 = 312.5V - f_y$

$f_y = 212.5V$

c) Koliki rad treba obaviti da polje kako bi čestica naboja iz točke 0 u točku y? Naboj čestice je -80nC, a $\varphi_y =$

$Q = -80nC$

$0 \to y$

$A_{0 \to y} = ?$

$\varphi_y = \frac{W_{ep(y)}(Q)}{Q} =$

$-W_{ep(y)} = -\varphi_y \cdot Q$

$= 212,5V \cdot 80C \times 10^{-9}$

$A_{0 \to y} = W_0^{=0} - W_y$

$A_{0 \to y} = -W_y \Rightarrow -A_{0 \to y} = W_y$

$A_{0 \to y} = 17\mu J$

a) $Q = 50nC$

$0 \to y$

$A_{0 \to y} = -\varphi_y \cdot Q = -10,625\mu J$

1.2. $q(t) = a t^2/2$, $a = 5\,C/s^2$

a) $W(t) = b \cdot t^3$, $b = 8\,J/s^3$ } parametarski zadana fija

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$U_{AB}(t) = ?$

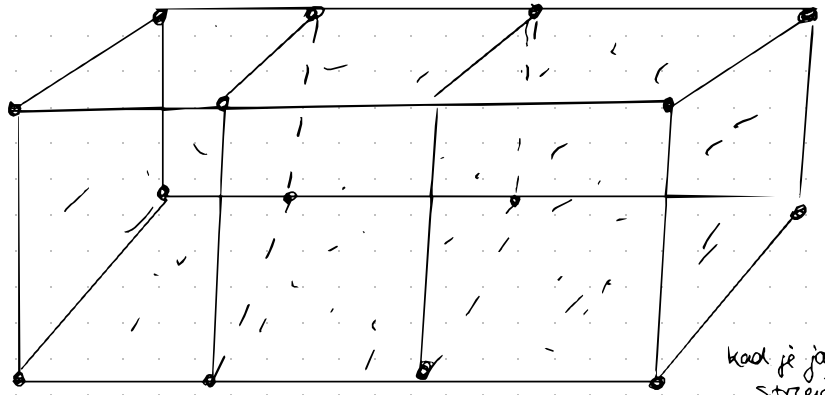
$$U = \frac{dW}{dq} = \left| \begin{matrix} W = W(t) \\ q = q(t) \end{matrix} \right| = \frac{\frac{dW}{dt}}{\frac{dq}{dt}} = \frac{3bt^2}{at} = \frac{3b}{a} \cdot t$$

(deriviramo po t)

b) $U(t = 0{,}5s) = ?$

$$U = \frac{3 \cdot 8^J}{5C} \cdot 0{,}5^{0{,}1} = \boxed{2{,}4\,V}$$

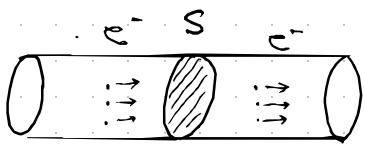
ELEKTRIČNA STRUJA



kad je jakost struje stalna

AC - izmjenične struje

DC - istosmjerne -||-



$$I = \frac{Q}{\Delta t}$$

$[I] = A$ (ampera)

Prosječna vrijednost struje: $\bar{I} = \frac{\Delta Q}{\Delta t}$

$\hookrightarrow \Delta t \to 0$ $\quad \bar{I} = \lim_{\Delta t \to 0} \frac{\Delta Q}{\Delta t} = \frac{dq}{dt}$

(1.3.) Vodičem presječe DC k kroz njegov S u $t = 6s$ protekne naboj od 18 C. Kolika je jakost struje u promatranom vodiču?

$t = 6s$

$Q = 18C$

$I = ?$

$$I = \frac{Q}{t} = \frac{18nC}{6s} = \boxed{3A}$$

(1.4) Imamo $q(t)$. Odredite I u $t_1 = 5s$ ako je $q(t) = a\sin(\omega t)$ pri čemu su a, ω neke konstante; $a = 0,18C$, $\omega = 2,76\pi/s$.

1. odredit ćju po kojoj se mijenja, struja => deriviram

$$I(t) = \frac{dq}{dt} = (a\sin(\omega t))' = a\cos(\omega t)\cdot\omega$$

$$I = 0,18\cdot\cos(2,76\pi\cdot 5)\cdot 2,76\pi \approx \boxed{1.263\ A}$$

ELEKTRIČNA SNAGA

~> brzina obavljanja rada

$$P = \frac{A}{T} \qquad [P] = W \quad (VAT)$$

$$\bar{P} = \frac{A}{T} = \frac{W(t_2) - W(t_1)}{t_2 - t_1} = \frac{\Delta W}{\Delta t}$$

$\Delta t \to 0 \rightsquigarrow \lim_{\Delta t \to 0} \frac{\Delta W}{\Delta t} = \bar{P}$

$$P = \frac{dw}{dt}$$

$W = W[t]$

$q = q[t]$

$$u = \frac{dw}{dt} \qquad u = \frac{\frac{dw}{dt}}{\frac{dq}{dt}} = \frac{P}{I} \Rightarrow P = u \cdot i$$

u ovom trenutku

u ovom trenutku

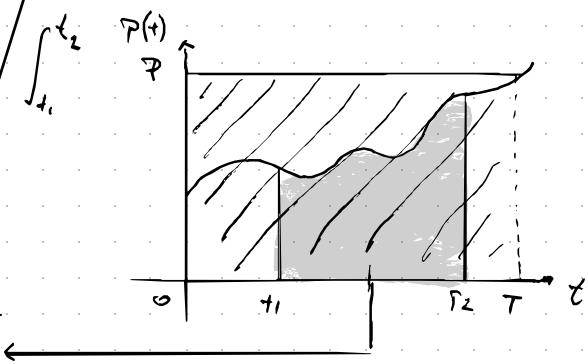
=> mijenjaju se u, i zato malo slovo

POTROŠNJA ENERGIJE

$$P = \frac{dw}{dt} \Rightarrow dw = P \cdot dt \quad / \int_{t_1}^{t_2}$$

$$\int_{t_1}^{t_2} dw = \int_{t_1}^{t_2} P \cdot dt$$

$$\Delta W_{t_1 - t_2} = A_{t_1 - t_2} = \int_{t_1}^{t_2} P \cdot dt$$



→ da gledamo /// onda bi formule bile kao u srednjoj P·t

1.5 $t = 1\,min \quad \Delta W = 30\,kJ$

$P = ? \rightarrow P = \frac{A}{T} = \frac{30 \times 10^3\,J}{60\,s} = \underline{500\,W}$

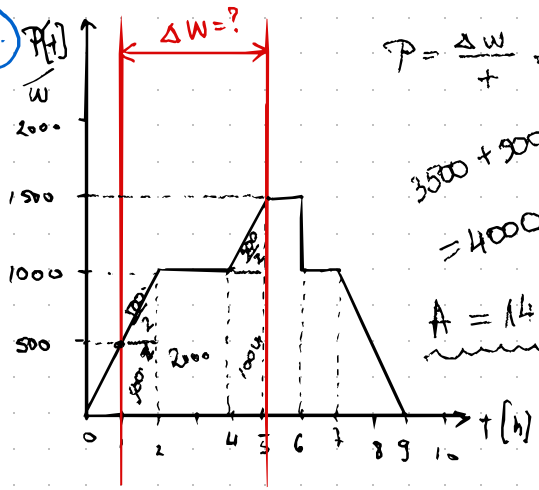
1.6

Na bateriju napona od 12 V izravno je spojena žarulja na kojoj se razvija snaga od 10 W. Odredite jakost struje koja protječe žaruljom.

$U = 12\,V \quad I = ? \rightarrow P = U \cdot I$

$\underline{P = 10\,W} \qquad I = \frac{P}{I} = \frac{10}{12} \rightarrow I = 0{,}83\,A$

1.7



$P = \frac{\Delta W}{t} = \frac{A}{T}$

$3500 + 500$

$= 4000\,W \cdot 3600\,s$ ↓ jer je u h

$A = 1440\,000\,J$