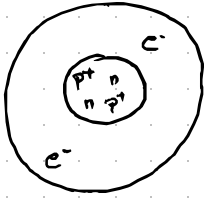


OSNOVNI ELEKTRONIČKI KONCEPTI

ATOM



NABOJ - fiz. veličina koja opisuje temeljnu svojstvo nabojenih čestica

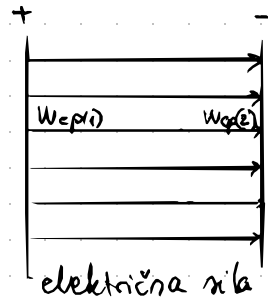
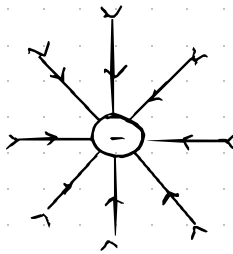
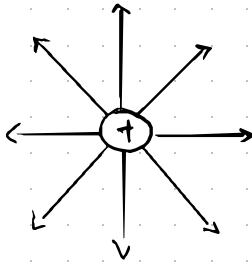
→ usvajamo djeluje el. naboja

$$Q \rightarrow [Q] = C \text{ (Kulon)}$$

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 nabojeno tijelo



ELEKTRIČNA POTENCIJALNA ENERGIJA

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

ELEKTRIČNI POTENCIJAL - el. pot. energ. koje ima jedinичni nab. u nekoj točki el. polja

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

$$[\varphi] = V \text{ (Volt)}$$

ELEKTRIČNI NAPON

$$U_{AB} = \varphi_A - \varphi_B \quad [u] = V$$

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

razlika potencijalnih energija: jednaka radu iskorisćenom da se nabo premjesti iz A u B

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

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

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

$$\bar{U}_{[t_1, t_2]} = \frac{w(t_2) - w(t_1)}{q(t_2) - q(t_1)} = \frac{\Delta w}{\Delta q} \quad \Delta q \rightarrow 0$$

$$\bar{u} = \lim_{\Delta q \rightarrow 0} \frac{\Delta w}{\Delta q} = \frac{dw}{dq}$$

ZADATAK:

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

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

$$Q = -80nC$$

$$\varphi_0 = 0V$$

$$\varphi_x = ?$$

$$A = 25\mu J$$

$$\left. \begin{array}{l} \varphi_0 = 0V \\ \varphi_x = ? \end{array} \right\} 0 \rightarrow x$$

$$a) \varphi_x = \frac{W_{ep(x)}(q)}{q} = \frac{A(x \rightarrow 0)(q)}{q}$$

$$\varphi_x = \frac{-25 \times 10^{-6} J}{-80 \times 10^{-9} C} = \frac{25}{80} \times 10^3 V$$

$$\varphi_x = \frac{5}{16} \times 10^3 V = \boxed{312.5 V}$$

obrnuti smjer
 $A(x \rightarrow 0) = -A(0 \rightarrow x)$

$$b) \begin{array}{l} U_x = 100V \\ U_y = ? \end{array}$$

$$U_{xy} = U_x - U_y$$

$$100 = 312.5 - U_y$$

$$U_y = 212.5V$$

c) Koliki rad treba dati da polje kaže bi čestici naboja iz bčle 0 u točku y.² Naboj čestice je -80 nC , a $\varphi_y =$

$$Q = -80\text{ nC} \quad \varphi_y = \frac{W_{\text{ep}(y)}(Q)}{Q} =$$

$$0 \rightarrow y$$

$$A_{0 \rightarrow y} = ?$$

$$A_{0 \rightarrow y} = W_0 - W_y$$

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

$$-W_{\text{ep}(y)} = -Q_y \cdot \varphi$$

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

$$A_{0 \rightarrow y} = 17 \mu\text{J}$$

d) $Q = 80\text{ nC}$

$$0 \rightarrow y$$

$$A_{0 \rightarrow y} = -Q_y \cdot \varphi = \underline{\underline{-10,625 \mu\text{J}}}$$

a) 1.2. $g(t) = a + \frac{t^2}{2}$, $a = 50 \text{ s}^2$ } parametarski zedane
 $w(t) = b \cdot t^3$, $b = 8 \text{ J/s}^2$ fija

$u_{AB}(t) = ?$

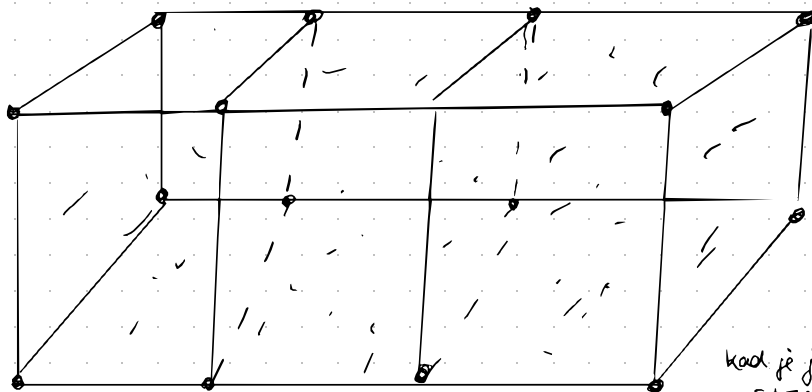
deriviramo
po t

$$u = \frac{dw}{dg} = \left| \frac{w - w(t)}{g - g(t)} \right| = \frac{\frac{dw}{dt}}{\frac{dg}{dt}} = \frac{3bt^2}{a} = \frac{3b}{a} \cdot t$$

b) $w(t=0,5) = ?$

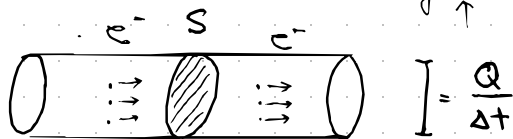
$$u = \frac{3 \cdot 8 \text{ J}}{50} \cdot 0,5 = \boxed{2,4 \text{ V}}$$

ELEKTRIČNA STRUJA



kad je jakost
struje stalna
↑

AC - izmenične struje
DC - istosmerne struje



[I] = A (amper)

Povprečna vrednost struje: $\bar{I} = \frac{\Delta Q}{\Delta t}$

$\hookrightarrow \Delta t \rightarrow 0$ $\bar{I} = \lim_{\Delta t \rightarrow 0} \frac{\Delta Q}{\Delta t} = \frac{dQ}{dt}$

1.3. Vodičom protječe DC te kroz njega S u $t = 6s$ protječe nabo $Q = 18C$. Kolika je jakost struje u promatranom vodiču?

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

$$Q = 18C$$

$$I = ?$$

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

1. odrediti fiju po kojoj se mijenja, mjenja \Rightarrow deriviram.

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

$$I = 0,18 \cdot \cos(2,76\pi \cdot 5s) \cdot 2,76\pi = \boxed{1,263 A}$$

ELEKTRIČNA SNAGA

→ brzina stvaranja i ulog rada

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

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

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

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

$$W = W(t) \quad Q = Q(t)$$

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

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

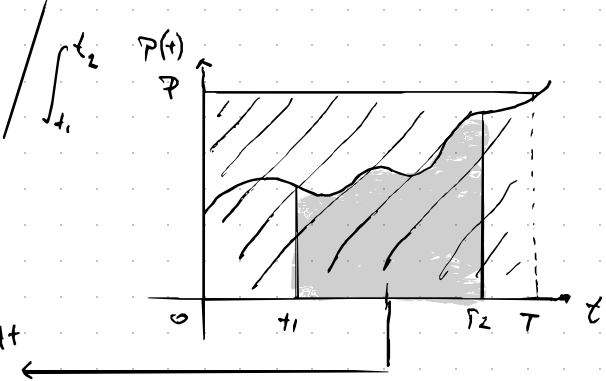
u konstantna
u konstantna
⇒ najjeftinije se u · i zato malo klona

POTROŠNJA ENERGIJE

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

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

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



→ da gledamo /// onda bi formule bile kao u srednjim $P \cdot t$

1.5 $t = t_{\min} \quad \Delta W = 30 \text{ kJ}$

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

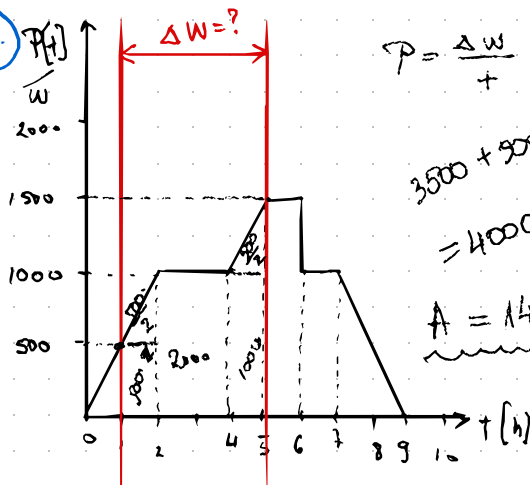
1.6

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

$W = 12 \text{ V} \quad I = ? \rightarrow P = U \cdot I$

$P = 10 \text{ W} \quad I = \frac{P}{U} = \frac{10}{12} \rightarrow I = 0,83 \text{ A}$

1.7



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

$3500 + 500 = 4000 \text{ W} \cdot 3600 \text{ s}$
 $\rightarrow \text{jer je u h}$

$A = 1440000 \text{ J}$