

ES 1: Carica elettrone:  $e = -1.6 \times 10^{-19} \text{ C}$

(a)  $Q = -1.6 \mu\text{C} \rightarrow 1 \mu\text{C} = 1 \times 10^{-6} \text{ C} \Rightarrow Q = -1.6 \times 10^{-6} \text{ C}$

$\Rightarrow \frac{Q_{\text{TOT}}}{e} = \frac{-1.6 \times 10^{-6}}{-1.6 \times 10^{-19}} = \frac{10^{-6}}{10^{-19}} \rightarrow \frac{10}{10^{-13}} = 10^{13} \text{ elettroni}$  Ans

(b)  $Q = -4.8 \times 10^{-15} \text{ C} \rightarrow N = \frac{Q_{\text{TOT}}}{e} = \frac{-4.8}{-1.6} \cdot \frac{10^{-15}}{10^{-19}} = 3 \times 10^4$  Ans

(c)  $Q = -10 \text{ pC} = -10 \times 10^{-12} \text{ C}$

$N = \frac{-10}{-1.6} \cdot \frac{10^{-12}}{10^{-19}} = 6.25 \times 10^7$  Ans

ES 2:  $i = 1 \text{ mA} = 1 \times 10^{-3} \text{ A}$   
↑  
milli Ampere

Cariche che attraversano S generica

In generale  $dq = \int \vec{J} \cdot \vec{n} ds \cdot dt \rightarrow q = \int_{t_0}^{t_f} \int \vec{J} \cdot \vec{n} ds \cdot dt$

ma  $\int \vec{J} \cdot \vec{n} ds = i \Rightarrow Q = \int_{t_0}^{t_f} i(\tau) d\tau = \int_{t_0}^{t_f} 1 \text{ mA} \cdot dt$

(a)  $t = 1 \text{ s} \rightarrow Q = \int_0^1 10^{-3} \cdot dt = 10^{-3} \text{ A} \cdot [t]_0^1 = 10^{-3} \text{ C}$

Ci serve il numero di cariche elementari ( $e = -1.6 \times 10^{-19} \text{ C}$ )

$\Rightarrow N = \frac{Q}{e} = \frac{10^{-3}}{1.6 \times 10^{-19}} = 6.25 \times 10^{15}$  Ans 1

(b)  $3 \text{ ms} = 3 \times 10^{-3} \text{ s}$

$\Rightarrow Q_{\text{TOT}} = [\text{Corrente}] \cdot [\text{Tempo}]$

$\Rightarrow N_{\text{TOT}} = \frac{Q_{\text{TOT}}}{e}$

Formule derivate dagli integrali

$\Rightarrow N = \frac{10^{-3} \text{ A} \cdot 3 \times 10^{-3} \text{ s}}{e} = \frac{[A \cdot s = C]}{[C]} = 1.875 \times 10^{13}$  Ans 2

(c)  $8 \mu\text{s} = 8 \times 10^{-6} \text{ s}$

$\Rightarrow N = \frac{10^{-3} \cdot 8 \times 10^{-6}}{1.6 \times 10^{-19}} = 5 \times 10^{10}$  Ans 3

ES 3: Sup chiuso  $\Sigma$   $i = ?$   $\hat{n}$  uscente

(a)  $i(t) = \frac{dq}{dt} \rightarrow i_1(t) = \frac{d}{dt} [10 \cdot 10^{-15} t] = 10 \times 10^{-15} = 10^{-14} \text{ A}$  Ans<sub>1</sub>  
 Formula usata

(b)  $i_2(t) = \frac{d}{dt} (-25 \times 10^{-10} t) = -25 \times 10^{-10} = -2.5 \times 10^{-9} \text{ A}$  Ans<sub>2</sub>

(c)  $i_3 = \frac{d}{dt} (5 \times 10^{-10} \sin(314t)) = 314 \cdot 5 \times 10^{-10} \cos(314t) = 1.57 \times 10^{-7} \cos(314t)$  Ans

ES 4 Conv. U.

Potenza Assorbita  $\rightarrow L = \int \vec{F} \cdot d\vec{e} \rightarrow dL = F \cdot de$  ma  $E = \frac{F}{q} \Rightarrow F = q \cdot E$

$\Rightarrow dL = dq \cdot E \cdot de \Rightarrow$  In unita' di tempo  $\rightarrow \underbrace{\left(\frac{dL}{dt}\right)}_{P_a} = \underbrace{\left(\frac{dq}{dt}\right)}_i \cdot \underbrace{E \cdot de}_v$

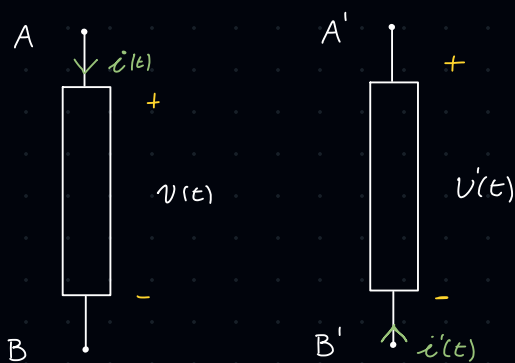
Formula  
 $\Rightarrow P_a = i(t) \cdot v(t)$

(a)  $v = 10 \text{ V}; i = -3 \text{ A} \rightarrow P_a = -3 \text{ A} \cdot 10 \text{ V} = -30 \text{ W} \Rightarrow$  Assorbita

(b)  $v = 30 \text{ V}; i = 0.5 \text{ A} \rightarrow P_a = 30 \text{ V} \cdot \frac{1}{2} \text{ A} = 15 \text{ W} \Rightarrow$  EROGATA

(c)  $v = -10 \text{ V}; i = -2 \text{ A} \rightarrow P_a = -10 \text{ V} \cdot (-2 \text{ A}) = 20 \text{ W} \Rightarrow$  EROGATA

ES 5 Conv. gen



UTILIZZATORE

GENERATORE

$\Rightarrow$  CAMBIA VERSO di  $i$

$\Rightarrow i'(t) = -i(t)$

(a)  $P_a = 10 \text{ V} \cdot 3 \text{ A} = 30 \text{ W}$

(b)  $P_a = 30 \text{ V} \cdot (-\frac{1}{2} \text{ A}) = -15 \text{ W}$

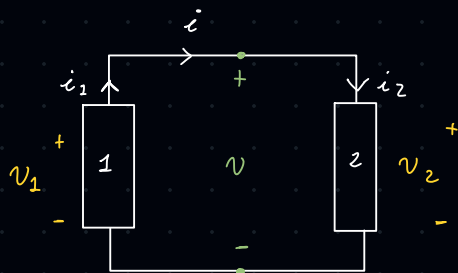
(c)  $P_a = -10 \text{ V} \cdot 2 \text{ A} = -20 \text{ W}$

ES 6

(a)  $V = 10V$   $i = -3A$

$i_1 = i_2 = i$  ;  $V_1 = V_2 = V$

BOH!



ES 7

$V = 18V$   $i = 300mA = 300 \times 10^{-3}A$

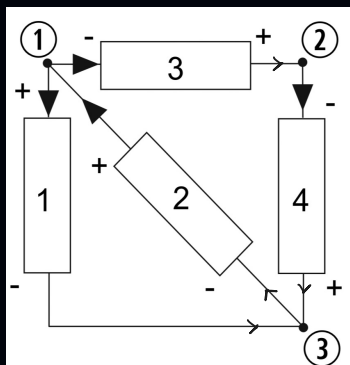
$\Delta t = 3h = 10800s$

$P_a = i \cdot V = 18V \cdot 300 \times 10^{-3}A = 5.4W$

$\mathcal{E} = \int_{t_0}^t P_a dt = 5.4 \cdot [t_f - t_0] = 5.4 \cdot 10800 = 58320 \text{ Joule} = 58.3 \times 10^3 J = 58.3 \text{ kJ}$

Ans

ES 8



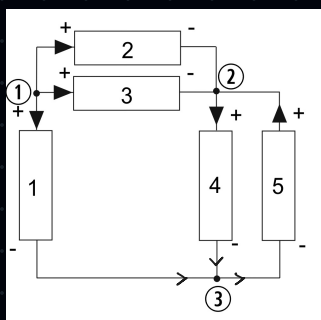
(a) L K C

ENTRANTE = 0 (-)

USCENTE = 0 (+)

(1)  $\begin{cases} i_3 + i_1 - i_2 = 0 \\ i_4 - i_3 = 0 \\ i_2 - i_4 - i_1 = 0 \end{cases}$

L K T  
ORARIO  $\begin{cases} V_2 - V_1 = 0 \\ -V_3 - V_4 - V_1 = 0 \\ -V_3 - V_4 - V_2 = 0 \end{cases}$

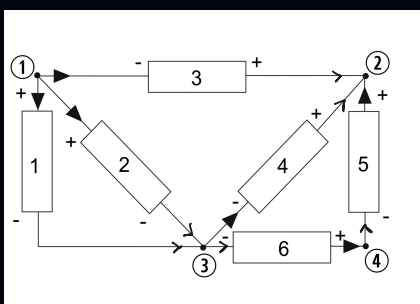


(b) L K C

(1)  $\begin{cases} i_1 + i_3 + i_2 = 0 \\ i_4 - i_5 - i_2 - i_3 = 0 \\ i_5 - i_4 - i_1 = 0 \end{cases}$

L K T ORARIO

$\begin{cases} V_3 + V_4 - V_1 = 0 \\ V_3 + V_5 - V_1 = 0 \\ V_2 - V_3 = 0 \\ V_2 + V_5 - V_4 = 0 \\ V_5 - V_4 = 0 \\ -V_1 + V_2 + V_4 = 0 \end{cases}$



(c) L K C

(1)  $\begin{cases} i_1 + i_3 + i_2 = 0 \\ -i_3 - i_4 - i_5 = 0 \\ i_4 + i_6 - i_2 - i_1 = 0 \\ i_5 - i_6 = 0 \end{cases}$

L K T ORARIO

$\begin{cases} -V_3 + V_5 + V_6 - V_1 = 0 \\ -V_3 + V_5 + V_6 - V_2 = 0 \\ -V_3 + V_4 - V_1 = 0 \\ -V_3 + V_4 - V_2 = 0 \\ V_2 - V_4 = 0 \\ V_2 - V_4 + V_3 = 0 \\ V_2 - V_6 - V_5 + V_3 = 0 \\ -V_6 - V_5 + V_4 = 0 \end{cases}$

