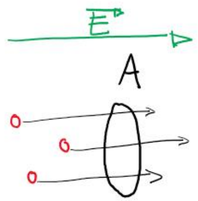
CORRENTE ELETTRICA CONTINUA



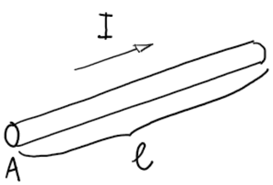
ΔQ attraversa A in Δt

$$I_m = \frac{\Delta Q}{\Delta t}$$ intensità di corrente <u>media</u>

$$I = \lim_{\Delta t \to 0} \frac{\Delta Q}{\Delta t} = \frac{dQ}{dt}$$ intensità di corrente istantanea

Ampere $1\ A = \frac{1C}{1s}$

LEGGI DI OHM



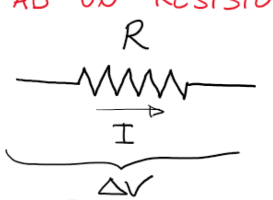
1) $\boxed{\Delta V = R\, I}$

resistenza $1\ \Omega = \frac{1V}{1A}$

2) $\boxed{R = \rho \frac{\ell}{A}}$

resistività

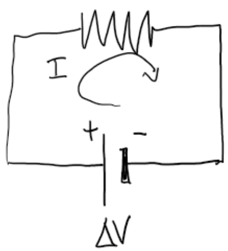
POTENZA TRASFERITA AD UN RESISTORE (→ CONDUTTORE CON R)



$$P = \frac{\mathcal{L}}{\Delta t} = \frac{\Delta U}{\Delta t} = \frac{\Delta Q \cdot \Delta V}{\Delta t} = I\,\Delta V = R\,I^2$$

I

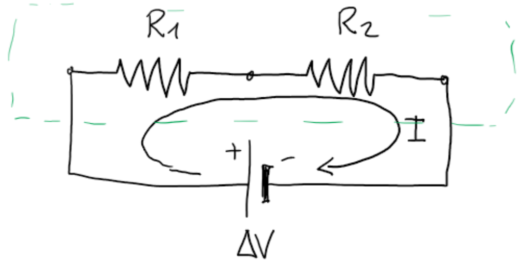
CIRCUITI IN CORRENTE ELETTRICA CONTINUA



ΔV non dipende da I

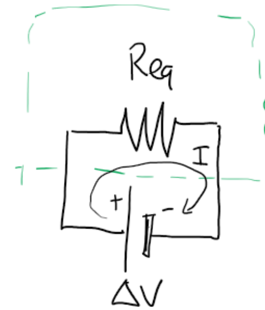
generatore di tensione **perfetto**

RESISTENZE IN SERIE



$$\Delta V_1 = R_1 I_1$$
$$\Delta V_2 = R_2 I_2$$

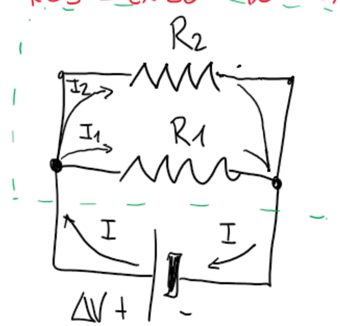
$$I_1 = I_2 = I$$
$$\Delta V = \Delta V_1 + \Delta V_2$$



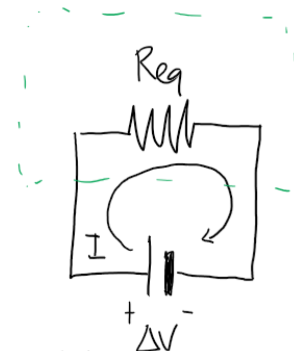
$$\Delta V = R_{eq} I$$

$$R_{eq} I = R_1 I_1 + R_2 I_2$$
$$R_{eq} \cancel{I} = R_1 \cancel{I} + R_2 \cancel{I}$$
$$\boxed{R_{eq} = R_1 + R_2}$$

RESISTENZE IN PARALLELO



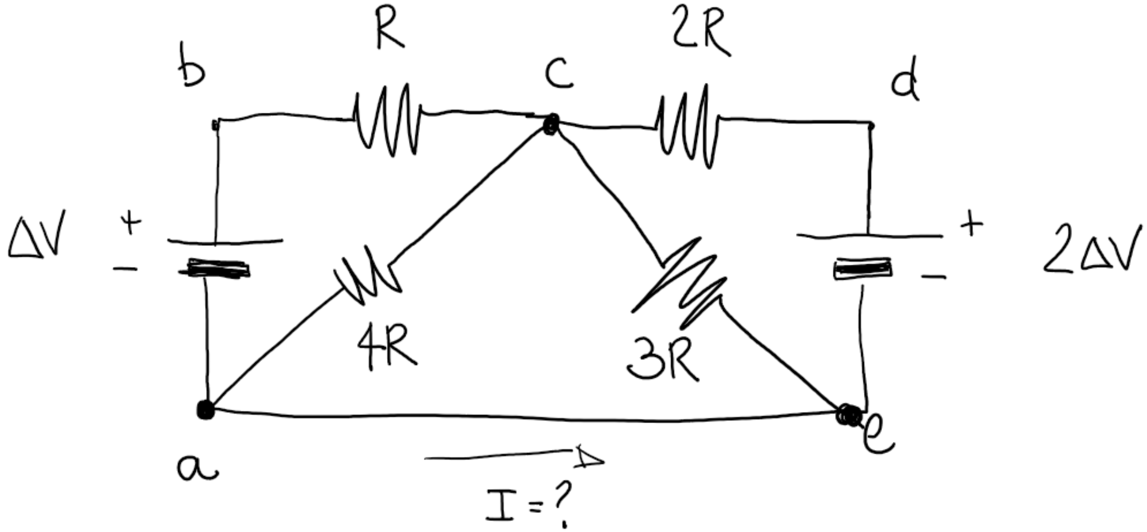
$$I = I_1 + I_2$$
$$\Delta V_1 = \Delta V_2 = \Delta V$$



$$\frac{\Delta V}{R_{eq}} = \frac{\Delta V_1}{R_1} + \frac{\Delta V_2}{R_2}$$

$$\frac{\cancel{\Delta V}}{R_{eq}} = \frac{\cancel{\Delta V}}{R_1} + \frac{\cancel{\Delta V}}{R_2}$$

$$\boxed{\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}}$$



Legsi di Kirchoff

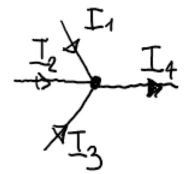
1) $\sum_{\text{nodo}} I = 0$

2) $\sum_{\text{maglia}} \Delta V = 0$

LEGGI DI KIRCHOFF

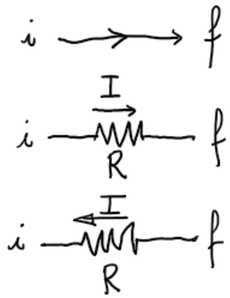
26-05-2021

$$\sum_{nodi} I = 0$$



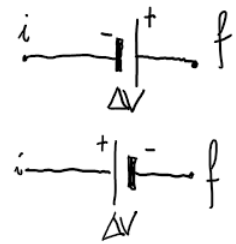
$$I_1 + I_2 + I_3 - I_4 = 0$$

$$\sum_{maglia} \Delta V = 0$$



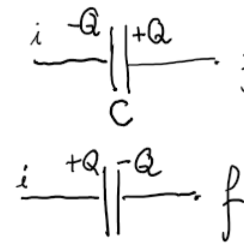
$-RI$

$+RI$



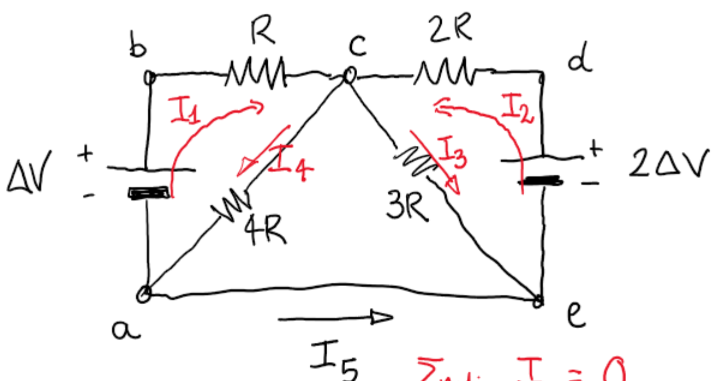
$+\Delta V$

$-\Delta V$



$+\dfrac{Q}{C}$

$-\dfrac{Q}{C}$



$\Delta V = 250\ V$

$R = 1\ k\Omega$

$I_5 = ?$

$\sum_{nodi} I = 0$

c) $I_1 + I_2 - I_3 - I_4 = 0$

a) $-I_1 + I_4 - I_5 = 0$

e) $-I_2 + I_3 + I_5 = 0$

a+e) $-I_1 - I_2 + I_3 + I_4 = 0 \Rightarrow -c)$!

$\sum_{maglie} \Delta V = 0$

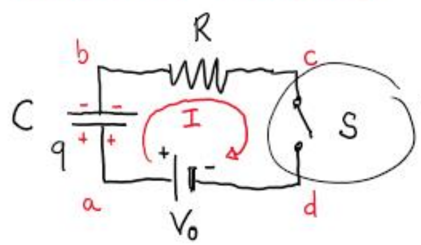
abca) $\Delta V - RI_1 - 4RI_4 = 0$

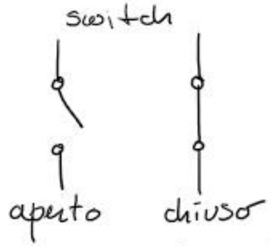
edce) $2\Delta V - 2RI_2 - 3RI_3 = 0$

abcdea) $\Delta V - RI_1 + 2RI_2 - 2\Delta V = 0$

$-\Delta V - RI_1 + 2RI_2 = 0$

CIRCUITO RC (carica)





lo switch si chiude a $t=0$

$Q = CV_0$ configurazione finale: condensatore completamente carico

$\Rightarrow$ non circola più corrente $(I \to 0)$

$t \quad q < Q$ il condensatore si sta caricando

abcda) $-\frac{q}{C} - RI + V_0 = 0$

casi limite

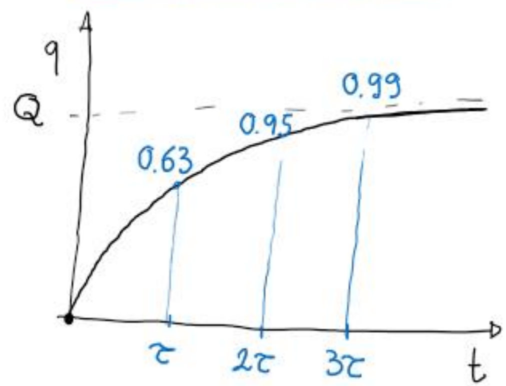
$t \to 0 \quad q \to 0 \quad -RI_0 + V_0 = 0 \quad I_0 = \frac{V_0}{R}$ come se C non ci fosse

$t \to \infty \quad q \to Q \quad I \to 0 \quad -\frac{Q}{C} + V_0 = 0 \quad Q = CV_0$

$-\frac{q}{C} - RI + V_0 = 0 \qquad I = \frac{dq}{dt}$

$-\frac{q}{C} - R\frac{dq}{dt} + V_0 = 0$ equazione differenziale di I° a variabili separabili

$$\boxed{q = Q\left(1 - e^{-\frac{t}{RC}}\right)}$$



$t \geq 0$

$\lim_{t \to 0} q(t) = 0$

$\lim_{t \to \infty} q(t) = Q = CV_0$

$\frac{t}{RC} \to \tau$

costante di tempo

$e^{-1} = 0.37$

$e^{-2} = 0.05$

$e^{-3} = 0.007$

Circuito RC – CARICA - Continued

$$\boxed{q = Q\left(1 - e^{-\frac{t}{RC}}\right)}$$

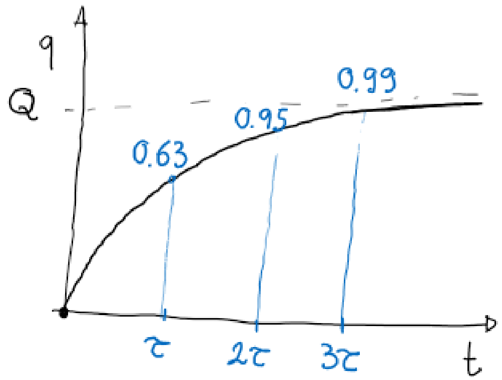
$t \geq 0$

$\lim_{t\to 0} q(t) = 0$

$\lim_{t\to \infty} q(t) = Q = CV_0$

$\frac{t}{RC} \rightarrow \tau$

costante di tempo



$e^{-1} = 0.37$

$e^{-2} = 0.05$

$e^{-3} = 0.007$

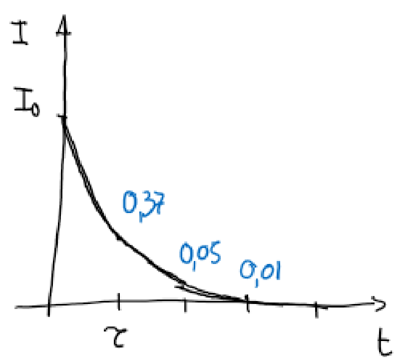
$$V = \frac{q}{C} = \frac{Q}{C}\left(1 - e^{-\frac{t}{RC}}\right) = V_0\left(1 - e^{-\frac{t}{RC}}\right)$$

$$I = \frac{dq}{dt} = Q\frac{d}{dt}\left(1 - e^{-\frac{t}{RC}}\right) = Q\left[-e^{-\frac{t}{RC}}\cdot\left(-\frac{1}{RC}\right)\right] = \frac{Q}{RC}\, e^{-\frac{t}{RC}}$$

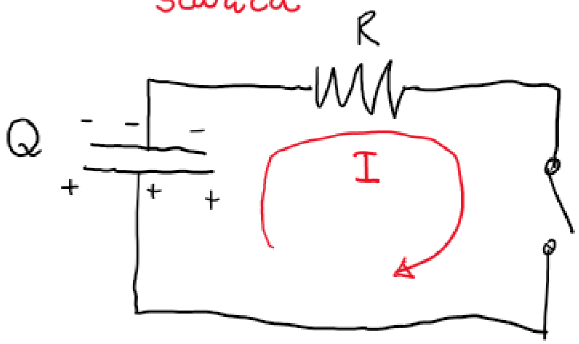
V_0

$\frac{V_0}{R} = I_0$

$$I = I_0\, e^{-\frac{t}{RC}}$$



scarica



$t \to 0 \quad q \to Q$

$t = 0$ si chiude lo switch

$t \quad q$

$t \to \infty \quad q \to 0 \quad I \to 0$

$$-\frac{q}{C} - RI = 0$$

$$-\frac{q}{C} - R\frac{dq}{dt} = 0$$

$$\boxed{q = Q\, e^{-\frac{t}{RC}}}$$

$$\frac{dq}{dt} = Q\, e^{-\frac{t}{RC}} \cdot \left(-\frac{1}{RC}\right) = -I_0\, e^{-\frac{t}{RC}}$$

$$\boxed{I = -I_0\, e^{-\frac{t}{RC}}}$$

POTENZA TRASFERITA ALLA R DURANTE LA SCARICA

$$P = I \cdot \Delta V = RI^2$$

$$P = R\left(-I_0\, e^{-\frac{t}{RC}}\right)^2 = R I_0^2\, e^{-\frac{2t}{RC}}$$

$$U = \int_0^\infty P\, dt = \int_0^\infty R I_0^2\, e^{-\frac{2t}{RC}}\, dt = \dots = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2} Q\Delta V = \frac{1}{2} C\Delta V^2$$

$$\boxed{U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2} Q\Delta V = \frac{1}{2} C\Delta V^2}$$