

Resistor: A material that opposes the flow of current

SI unit: ohms (Ω)

Symbol: 


Inductor: That which stores the charges in the form of magnetic field

SI unit: Henry (H)

Symbol: 

Capacitor: That which stores charges in the form of electric field

SI unit: Farad (F)

Symbol: 

HW: Resistance rating table

BASIC CIRCUIT ELEMENTS

They are of two types:

Passive Elements: An electronic component which can only receive energy.

- Either dissipates, absorbs or store energy in an electric field [or] a magnetic field.
- Do not need any form of electrical power to operate
- Eg: Resistor, inductor, capacitor

Active Elements: Components that supply energy to the circuit

- EXAMPLES

Active Elements: Components that supply energy to the circuit

• EXAMPLES

- Voltage Source: used to create potential difference b/w two points in the circuit (eg: battery)
- Current Source: supplies current to the circuit (eg: DC current source, AC current source)
- Voltage/current sources are of two types: dependent and independent

transformer

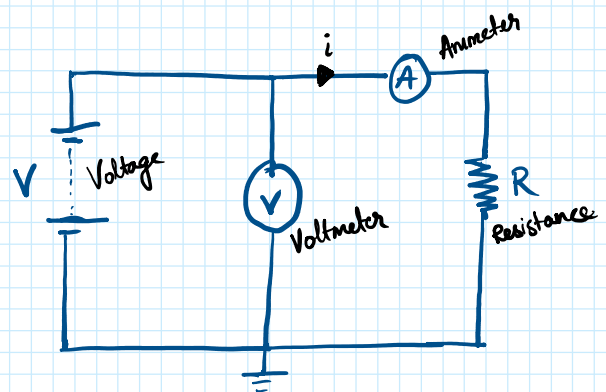
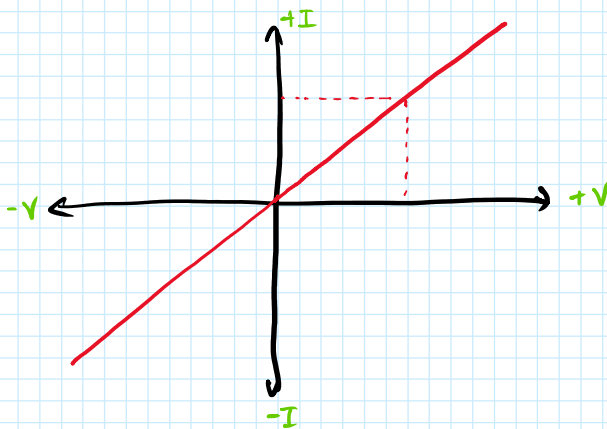
battery

OHM'S LAW

$$V \propto I$$

$$V = IR$$

resistance: proportionality constant



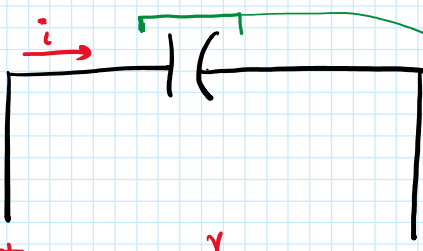
VOLTAGE - CURRENT RELATION IN CAPACITOR

Voltage is proportional to integral of current

$$V \propto \int I \, dt$$

$$V = \frac{1}{C} \int_{t_0}^t I \cdot dt$$
$$I = C \frac{dv}{dt}$$

Doubt



polarized capacitor: has +ve and -ve



VOLTAGE - CURRENT RELATION IN INDUCTOR

Voltage is proportional to the differential of the current in inductor

$$V \propto \frac{dI}{dt}$$

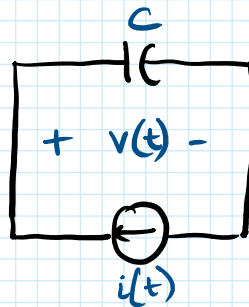
$V = L \frac{dI}{dt}$
$I_L = \frac{1}{L} \int_{t_0}^t V_L dt$

PROBLEMS

- ① The input to the circuit shown in figure ① is the current $i(t) = 3.75e^{-1.2t} A$ for $t > 0$.

The output is the capacitor voltage $v(t) = 4 - 12.5e^{-1.2t} V$ for $t > 0$.

Find capacitance C .



Soln. $v(t) = \frac{1}{C} \int_{t_0}^t i(t) dt$

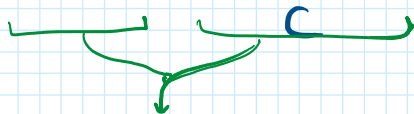
$$4 - 12.5e^{-1.2t} = \frac{1}{C} \int_0^t 3.75e^{-1.2t} dt$$

$$4 - 12.5e^{-1.2t} = \frac{3.75}{C} \left[\frac{e^{-1.2t}}{-1.2} \right]_0^t$$

$$= \frac{3.75}{-1.2C} [e^{-1.2t} - 1]$$

$$= \frac{-3.125}{C} [e^{-1.2t} - 1]$$

$$4 - 12.5e^{-1.2t} = \frac{-3.125e^{-1.2t}}{C} + \frac{3.125}{C}$$



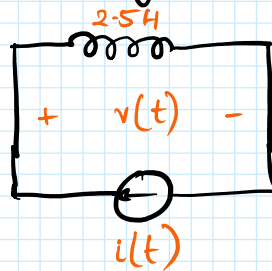
equating coefficients

equating coefficients

$$12.5 = \frac{3.125}{C}$$

$$\Rightarrow C = \frac{3.125}{12.5} = 0.25 \text{ F}$$

② Input to given circuit is $i(t) = 3 - 4.5e^{-6t}$ A for $t > 0$.
Determine the inductor voltage $v(t)$ for $t > 0$



Soln: $v(t) = L \frac{di}{dt}$

$$v(t) = (2.5) \frac{d}{dt} (3 - 4.5e^{-6t})$$
$$= (2.5)(-4.5)(-6)e^{-6t}$$

$$v(t) = 67.5e^{-6t}$$

say for $t=1$,

$$v(t) = 0.167 \text{ V}$$