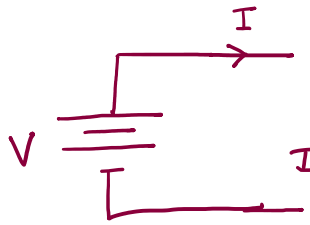
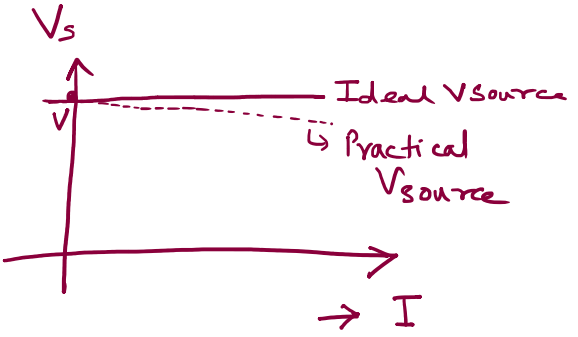
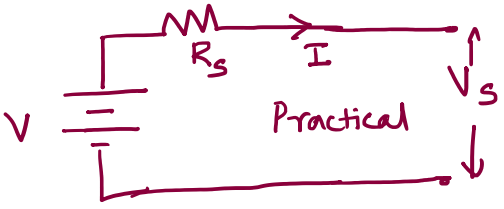
Ideal Voltage Source & Ideal Current Source



Resistance of Source = 0 .

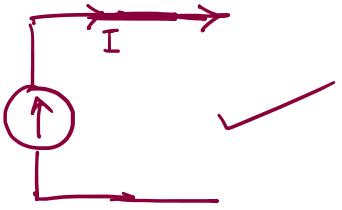
=

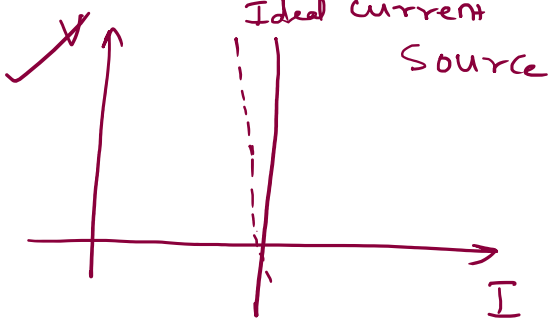




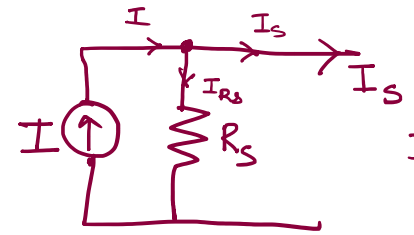
$V_s = V - IR_s$

Ideal current Source

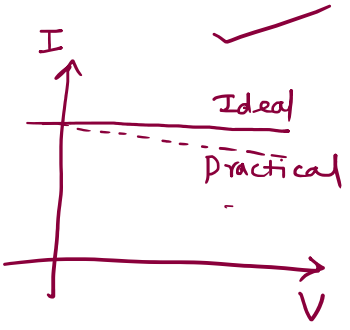


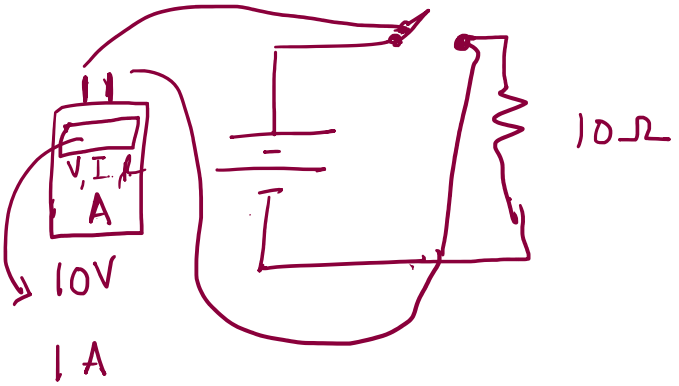


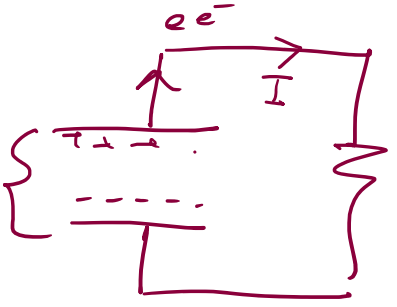
Practical Current Source



$I = I_{Rs} + I_s$







Can a Capacitor be considered as a Current Source ?

Power ⇒ Work done

1 Joule transf 1 coulomb over 1 sec

Power ⇒ $\frac{\text{Work done}}{\text{Time}}$ 1 Joule transf 1 coloum over 1 sec

$$P = VI = \frac{V^2}{R} = I^2R$$

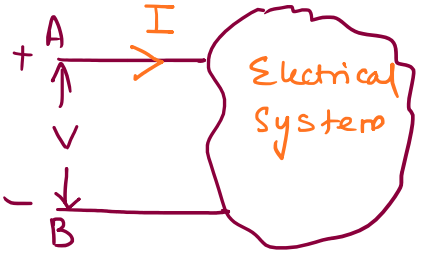
$$p(t) = v(t)\, i(t)$$

$$= \frac{v^2(t)}{R} = i^2(t) \cdot R$$

Generate Power : Generator, DC / AC, battery, Solar Panel
↓ turbine ↓ Diesel Gen, ↓ Dc Generator

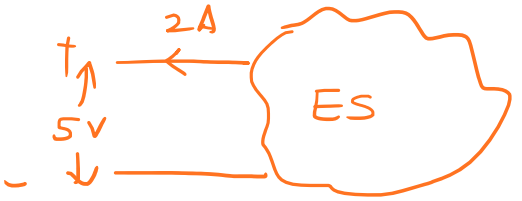
Power Aboorbing :→ Load, Motor, Lighting load, Resistance

Power is absorbed by the ckt



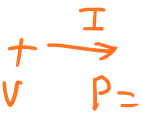
Power absorbed by the electrical System (ES) } = VI

Power Generated by the ES } = −VI



Power absorbed by ES → −10 W

P = −10 J/Sec



P = VI
= (5)(−2)

$T = -10$ J/Sec

$V \quad P = VI$

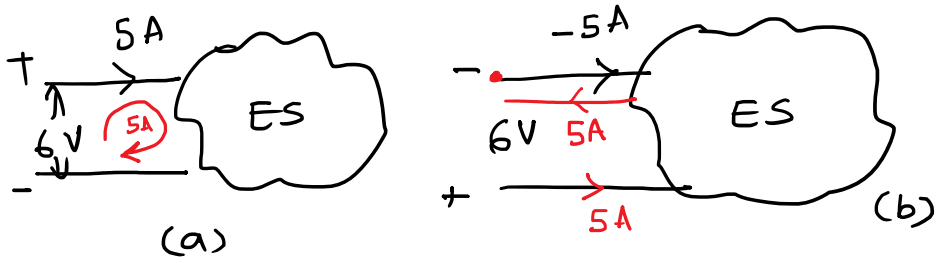
$- \quad = (5)(-2)$

Power Generated by ES = 10 W

$$\text{Power} = V \; i$$

$$= \frac{E}{q} \cdot \frac{q}{\text{Sec}} = \frac{\text{Joules}}{\text{coloumb}} * \frac{\text{Coloumbs}}{\text{Sec}}$$

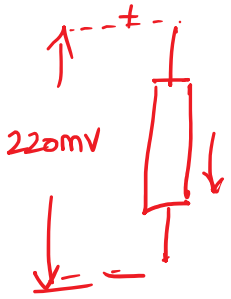
$$= \frac{\text{Joules}}{\text{Sec}} = \text{Watt}$$



Power absorbed by ES

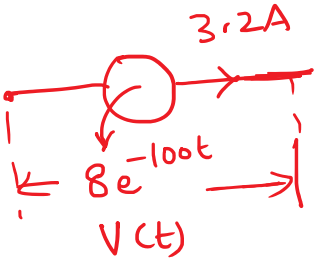
30W

(a)



$= +880$mW

30W



$P(t) = V(t)\, i(t)$

$= 8e^{-100t} \times 3.2\,A$

$= 25.6\, e^{-100t}$

What is the power at $t = 5$ msec

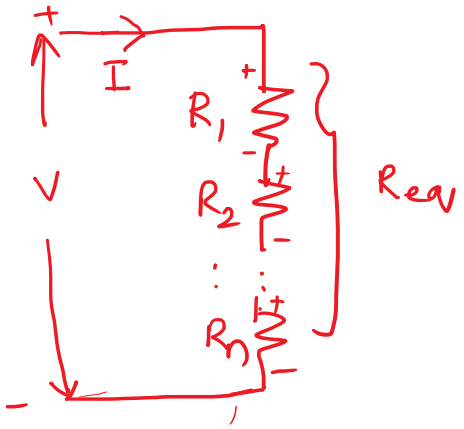
$P(t) = 25.6\, e^{-(100 \times 5 \times 10^{-3})}$

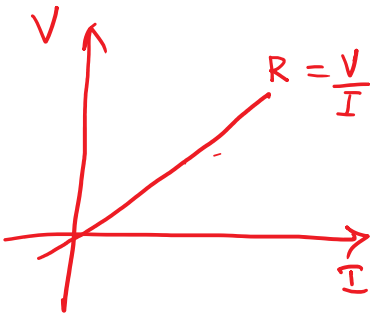
$= 25.6\, e^{-0.5}$

$= 25.6\ e$

RESISTANCE

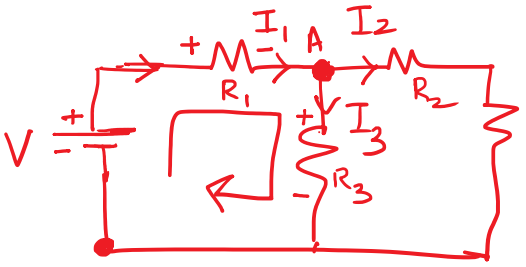
OHM LAW : $V = IR$





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

Kirchoff's current Law :-



Direction of Current entering A : +ve

Direc. of current leaving 'A' } ⇒ -ve

Algebraic sum of currents enering a node = 0

$$I_1 - I_2 - I_3 = 0$$

Kirchoff's Voltage Law

$$V - I_1 R_1 - I_3 R_3 = 0$$

Equivalent Resistance of Series 'R' ckt

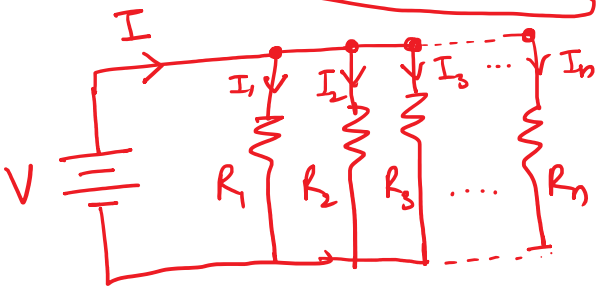
$$V = I\ R_{eq}$$

$V = I R_{eq}$

$V = IR_1 + IR_2 + IR_3 + \cdots + IR_n$

$I R_{eq} = I(R_1 + R_2 + \cdots + R_n)$

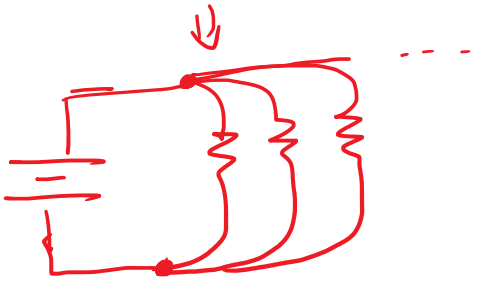
$$R_{eq} = R_1 + R_2 + \cdots R_n$$



Equivalent Resistance in ||^{el}

KCL

$I = I_1 + I_2 + \cdots I_n$

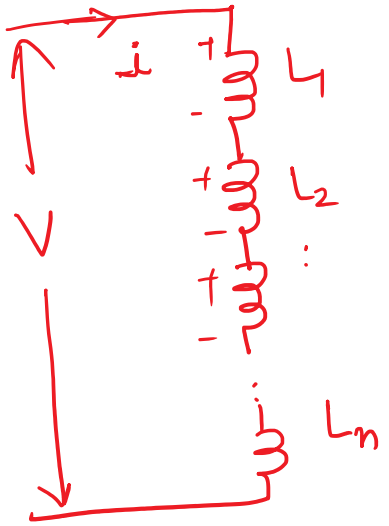


$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \cdots + \frac{V}{R_n}$$

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

R, L, C

Equivalent Inductance



$$V = L_{eq}\frac{di}{dt} \leftarrow$$

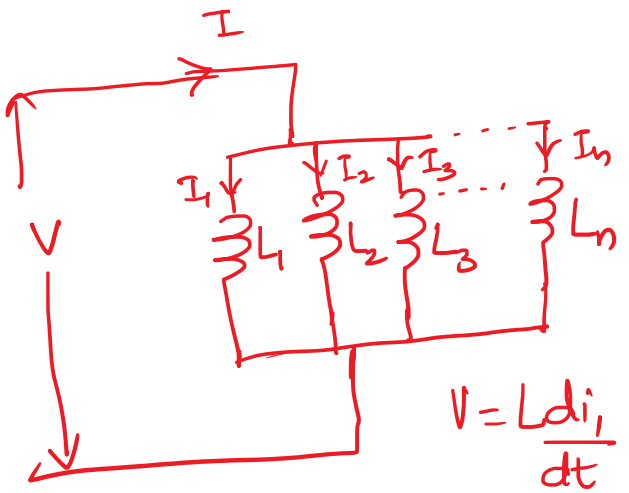
$$V = L_1\frac{di}{dt} + L_2\frac{di}{dt} + \cdots + L_n\frac{di}{dt}$$

$$i = C\frac{dV}{dt}$$

$$C = \frac{q}{V}$$

$$L_{eq} = L_1 + L_2 + \cdots + L_n$$

$$L_{eq} = L_1 + L_2 + \cdots + L_n$$



$$I = I_1 + I_2 + \cdots + I_n$$

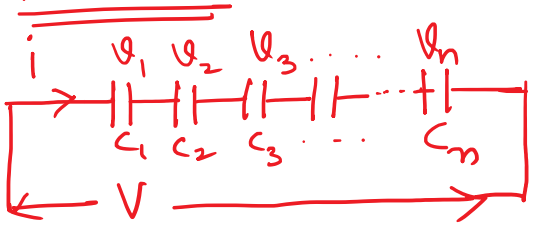
$$\frac{dI}{dt} = \frac{dI_1}{dt} + \frac{dI_2}{dt} + \cdots + \frac{dI_n}{dt}$$

$$V = L\frac{di_1}{dt}$$

$$\frac{V}{L_{eq}} = \frac{V}{L_1} + \frac{V}{L_2} + \cdots + \frac{V}{L_n}$$

$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \cdots + \frac{1}{L_n}$$

CAPACITANCE



$$C = \frac{q}{V} \Rightarrow V = \frac{q}{C}$$

$$V = \frac{q}{C_{eq}}$$

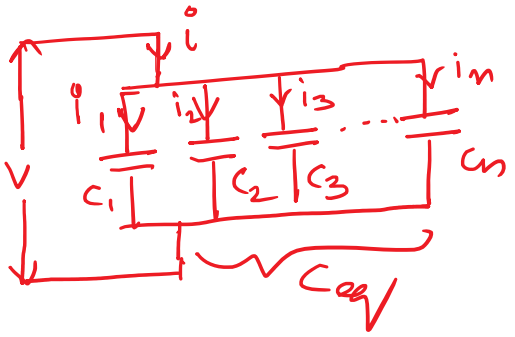
Applying KVL

$$V = V_1 + V_2 + \cdots + V_n$$

$$\frac{q}{C_{eq}} = \frac{q}{C_1} + \frac{q}{C_2} + \cdots + \frac{q}{C_n}$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n}$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n}$$



$$q = q_1 + q_2 + \cdots + q_n$$

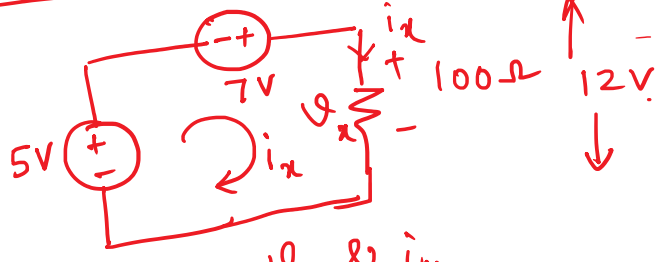
$$V = \frac{q}{C}$$

$$q = q_1 + q_2 + \cdots q_n$$

$$V C_{eq} = V C_1 + V C_2 + V C_3 + \cdots V C_n$$

$$\boxed{C_{eq} = C_1 + C_2 + \cdots + C_n}$$

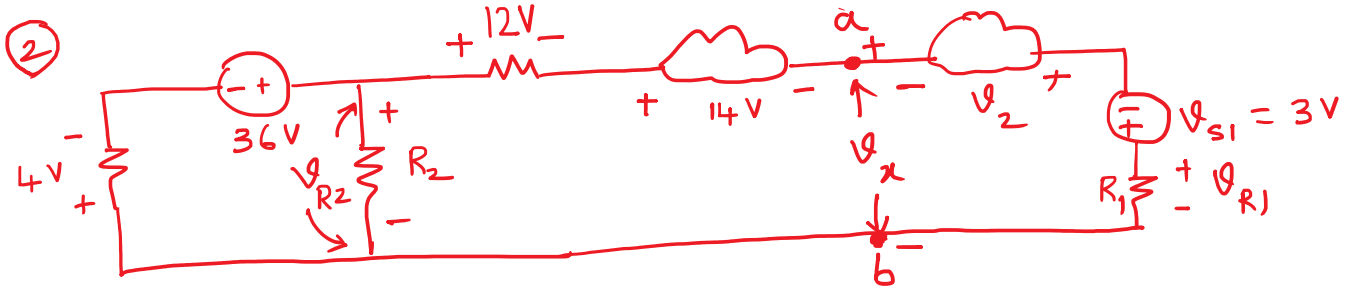
Kirchoff's Voltage Law

① 

Compute v_x & i_x

$$5 + 7 - v_x = 0 \Rightarrow v_x = 12V$$

$$i_x = \frac{12}{100} = 0.12A$$

② 

Find v_{R2} & v_x.

a) In this circuit, find v_{R2} & v_x.

b) Find v_2 if $v_{R1} = 1V$

(a) v_{R2}: $-4V + 36V - v_{R2} = 0 \Rightarrow v_{R2} = 32V$

v_x: $32 - 12 - 14 - v_x = 0 \Rightarrow v_x = 6V$

(b) v_2: $6 + v_2 + 3 - 1 = 0 \Rightarrow v_2 = -8V$

(3)

Determine V_x & i_x.