NS/SS 123

APPLIED PHYSICS

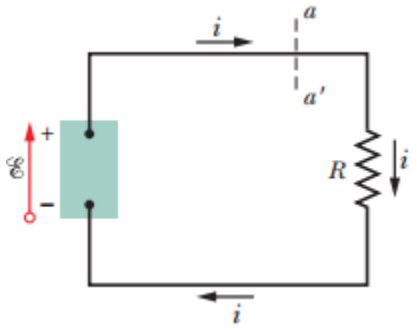
SINGLE LOOP CIRCUITS

- Polarities: Positive and Negative
- AC & DC
- Circuit Elements: Resistors, Capacitors, Inductors
- Sources: Dependent & Independent
- Voltage Source, Current Source

Charge Pumping:

- To maintain the charge flow: emf/potential difference
- Common emf devices: Generator, solar cell, Batteries
- Work on Charge carrier and maintains a potential difference

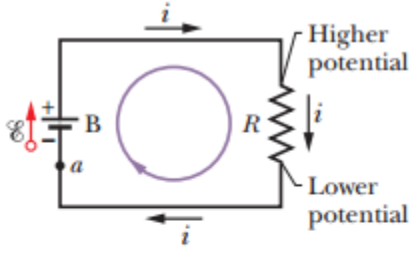
Work, Energy & emf:



- No emf, no net charge flow
- Within emf device: charges flow from negative to positive opposite to electric field (chemicals, mechanical force or light etc)
- EMF: emf of an device is work per unit charge that a device does moving a charge from its lower potential to higher potential
- Ideal emf: Potential difference of device terminals is equal to device emf (no internal resistance)
- Real emf device: when current flows potential difference between terminals differs from device emf
- Emf device is connected in circuit then energy is transferred to the circuit elements

Calculating Current in Single loop

- **Energy Method:**



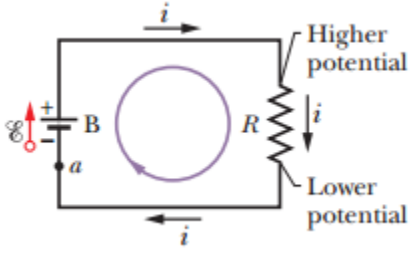
$$dW = \mathscr{E}\, dq = \mathscr{E} i\, dt$$

$$\mathscr{E} i\, dt = i^2 R\, dt$$

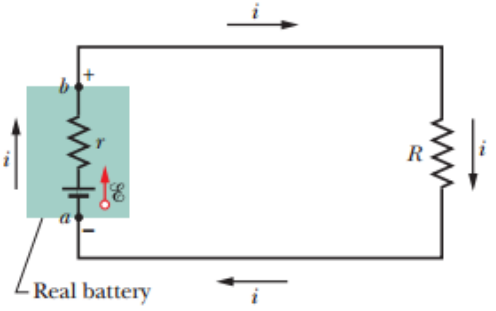
$$\mathscr{E} = iR$$

$$i = \frac{\mathscr{E}}{R}$$

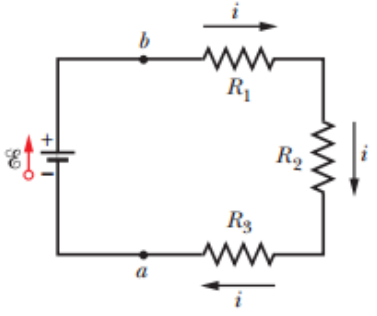
- **Potential Method: Algebraic sum of changes in potential encountered in complete traversal of any loop of circuit must be zero (KVL)**



$$-\mathscr{E} + iR = 0$$



$$i = \frac{\mathscr{E}}{R + r}$$

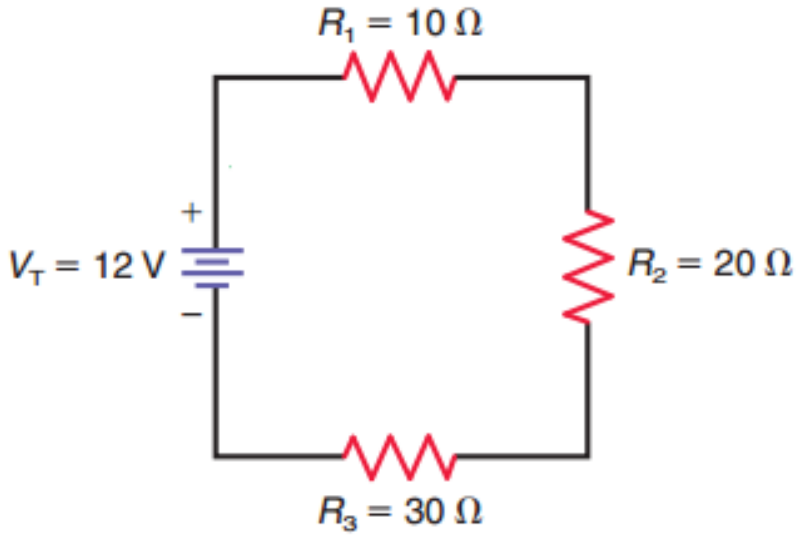


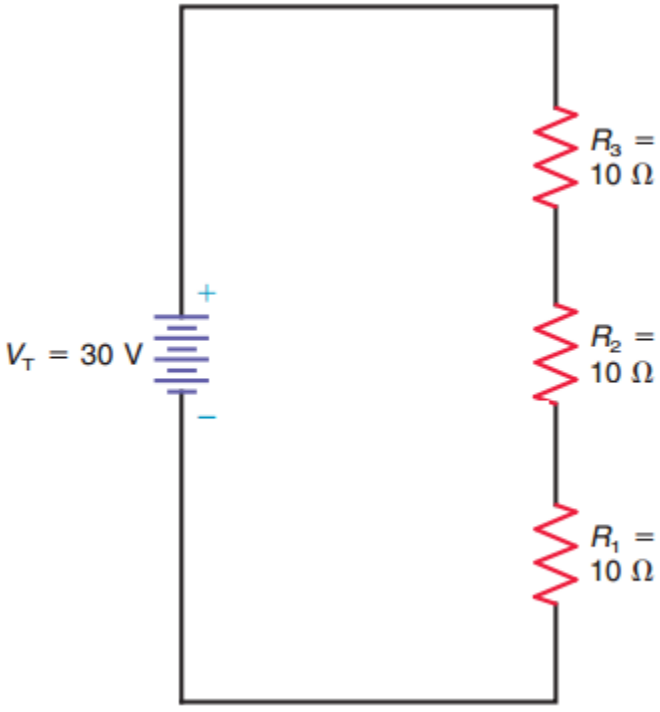
$$i = \frac{\mathscr{E}}{R_1 + R_2 + R_3}$$

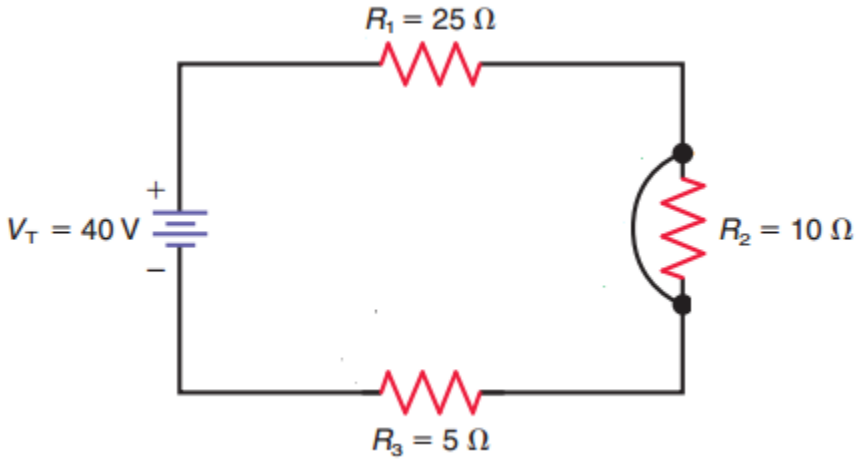
$$i = \frac{\mathscr{E}}{R_{eq}}$$

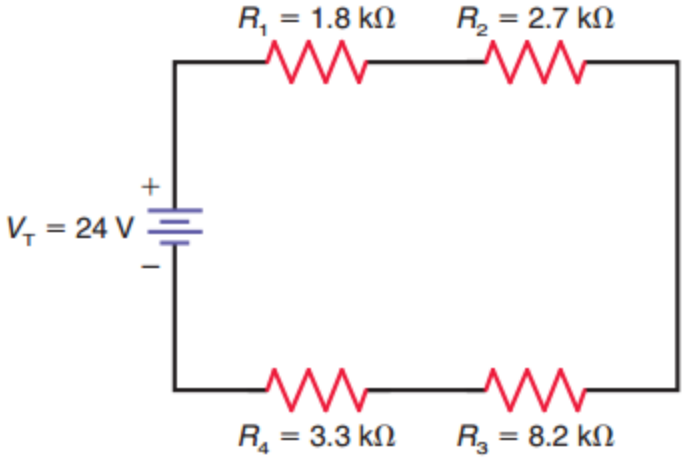
$$R_{eq} = R_1 + R_2 + R_3$$

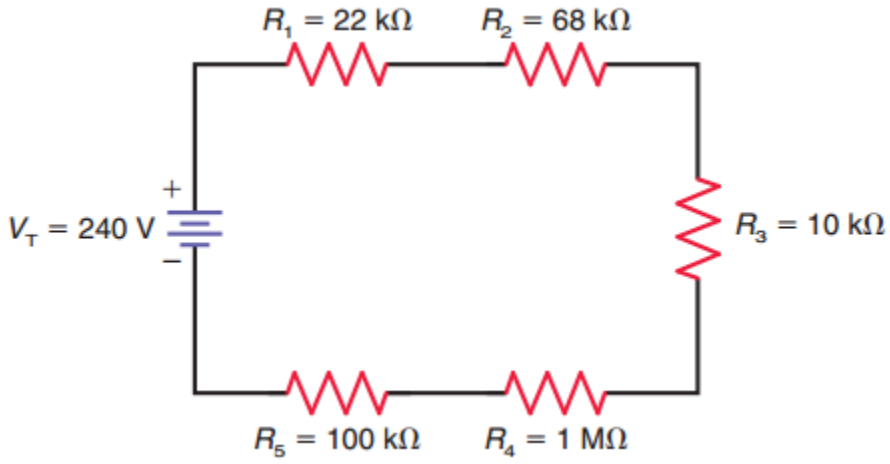
$$R_{eq} = \sum_{j=1}^{n} R_j$$

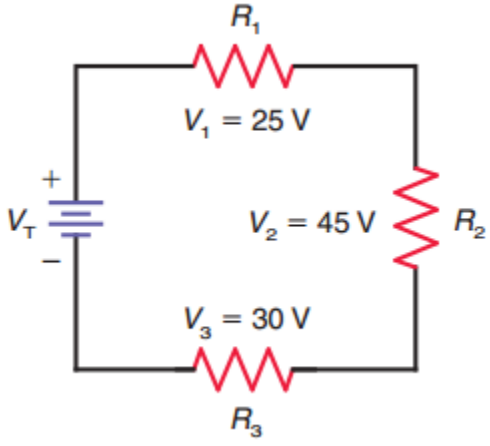

$R_1 = 10\ \Omega$
+
$V_T = 12\ V$
–
$R_2 = 20\ \Omega$
$R_3 = 30\ \Omega$

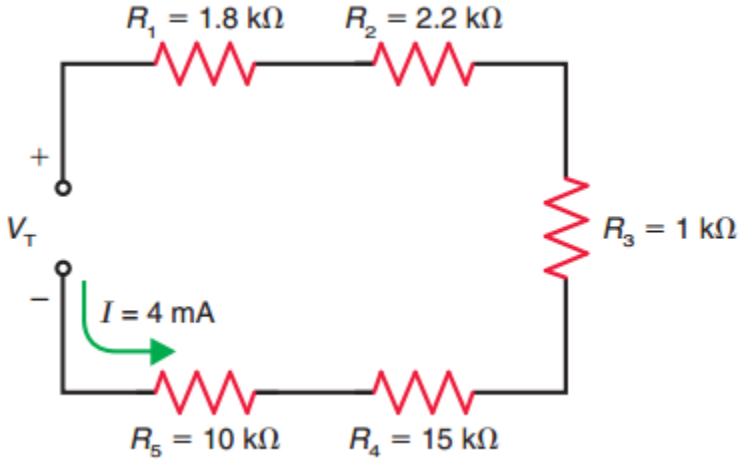

R_3 = 10 Ω
+
V_T = 30 V
−
R_2 = 10 Ω
R_1 = 10 Ω

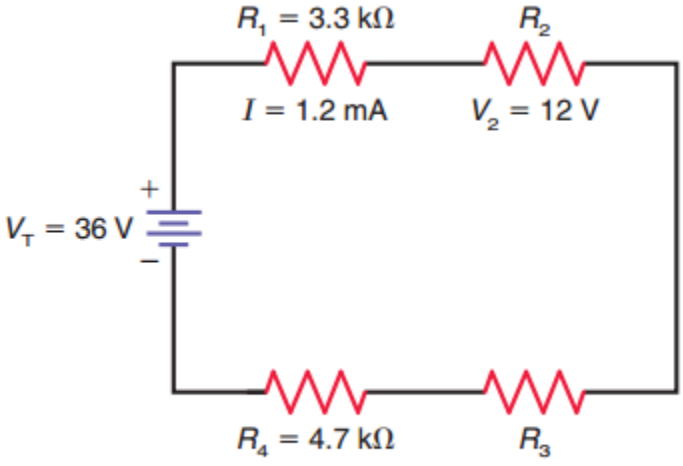

$R_1 = 25\ \Omega$
+
$V_T = 40\ V$
−
$R_2 = 10\ \Omega$
$R_3 = 5\ \Omega$


$R_1 = 1.8\ k\Omega$
$R_2 = 2.7\ k\Omega$
+
$V_T = 24\ V$
–
$R_4 = 3.3\ k\Omega$
$R_3 = 8.2\ k\Omega$

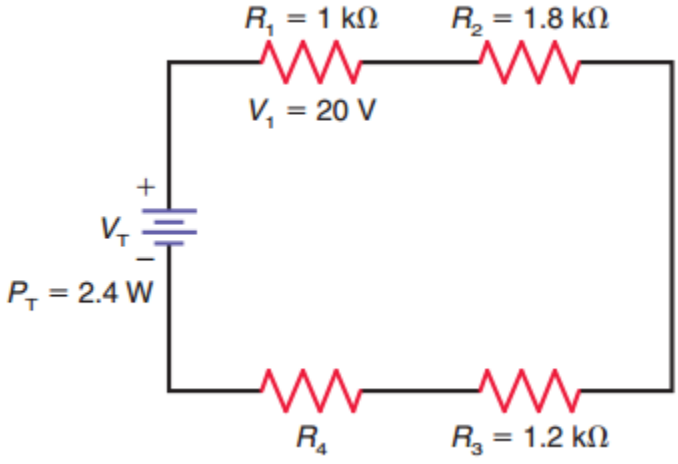

$R_1 = 22\ \text{k}\Omega$
$R_2 = 68\ \text{k}\Omega$
+
$V_T = 240\ \text{V}$
−
$R_3 = 10\ \text{k}\Omega$
$R_5 = 100\ \text{k}\Omega$
$R_4 = 1\ \text{M}\Omega$


R_1
$V_1 = 25$ V
+
V_T
−
$V_2 = 45$ V
R_2
$V_3 = 30$ V
R_3


R_1 = 1.8 kΩ
R_2 = 2.2 kΩ
+
V_T
−
R_3 = 1 kΩ
I = 4 mA
R_5 = 10 kΩ
R_4 = 15 kΩ



$R_T, V_1, V_3, V_4, R_2, R_3, P_T, P_1, P_2, P_3, P_4$



$I, R_T, V_T, V_2, V_3, V_4, R_4, P_1, P_2, P_3, P_4$

THANK YOU!