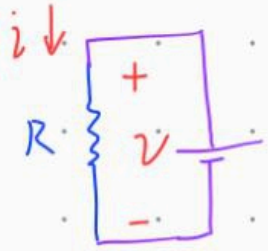
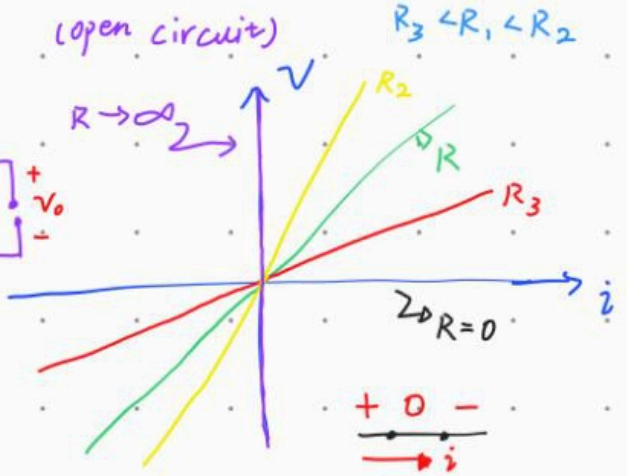
Lecture 3

Ohm's Law:

$R: 10^{\Omega} \to 10^{K\Omega} \to 10^{M\Omega}$





$V \propto i$

$V = Ri$ → Resistance (Ω)

$i = \frac{V}{R}$ → $i = \frac{V}{R}$ → 0 / $\to \infty$

$P = V \cdot i = V \cdot \frac{V}{R} = \frac{V^2}{R}$

$= Ri \cdot i = Ri^2$

short circuit

$i = \frac{1}{R} V = GV$

G (conductance) mho or ℧ or S

$P = Vi$

$= V \cdot GV$

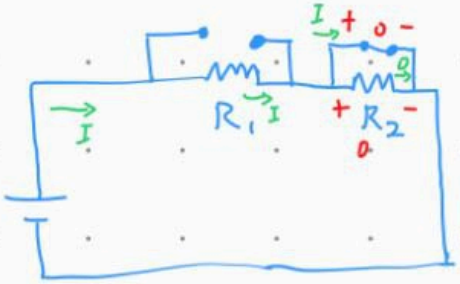
$= GV^2$

$V = \frac{i}{G} \Rightarrow$

$P = Vi$

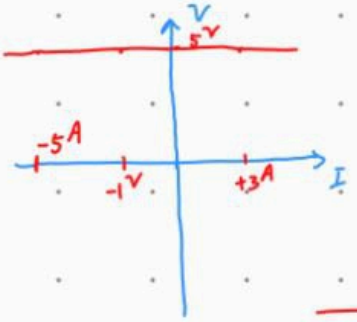
$= \frac{i}{G} \cdot i$

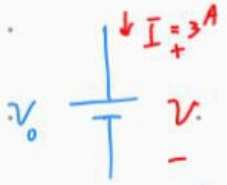
$= \frac{i^2}{G}$ (W)



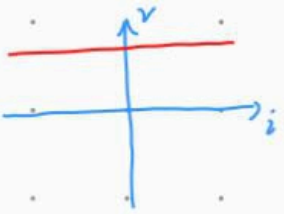
$V = R_2 i \to 0$

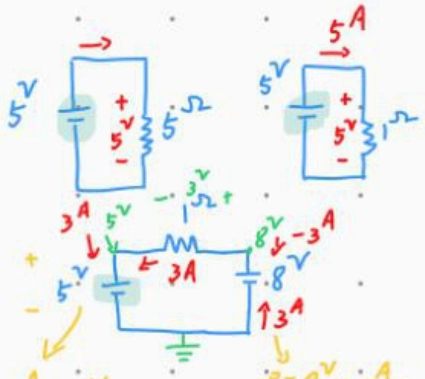
$0 \quad \neq \infty$





Voltage Source:

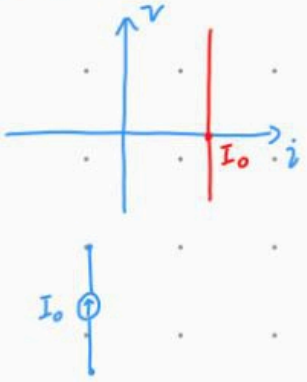


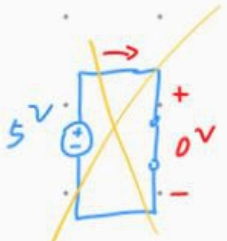


$P = 5^V \times 3^A = 15^W > 0$

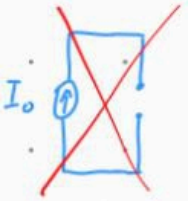
$P = 8^V \times -3^A = -24^W$

Current Source:



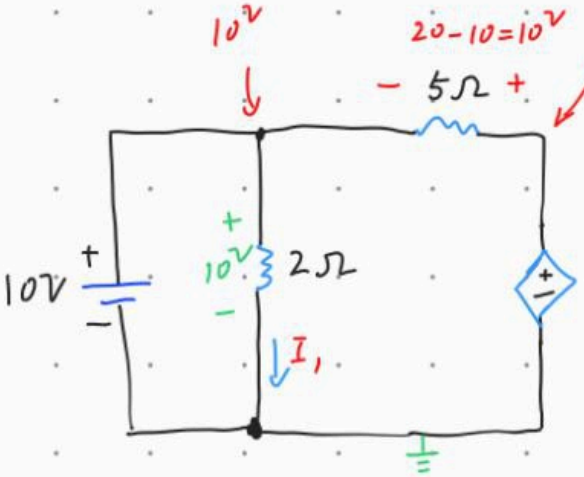


Voltage Source in parallel with short circuit (S.C)



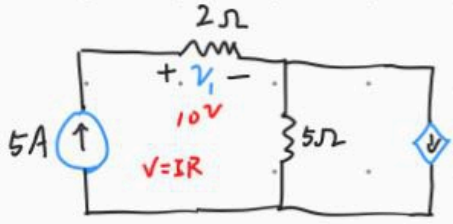
Current source in series open circuit (O.C)

⇓ Not Allow



↳ current-controlled voltage source

$I = \frac{V}{R}$ $R = \frac{V}{I}$

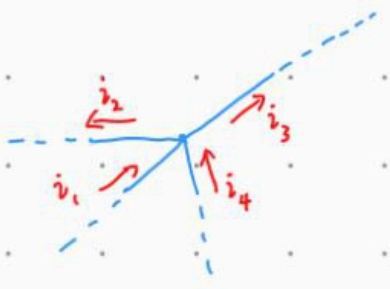


$I_x = \frac{V_1}{4} = \frac{10^V}{4} = 2.5^A$

↳ voltage-controlled current source

Kirchhoff's Laws:

Kirchhoff's Current Law (KCL):

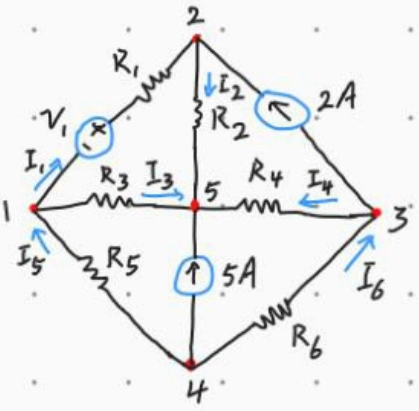


$i_1 + i_4 = i_2 + i_3$

- \+ → Currents entering a node
- − → " leaving " "

$\sum_{n=1}^{\infty} i_n = 0$

$i_1 - i_2 - i_3 + i_4 = 0$



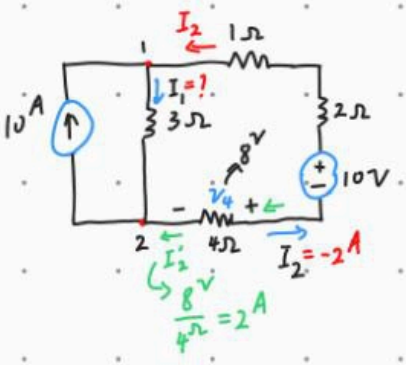
KCL at node 1: $-I_1 - I_3 - I_5 = 0$

KCL at Node 2: $I_1 + 2^A - I_2 = 0$

KCL at Node 3: $-I_6 - I_4 - 2^A = 0$

KCL at Node 4:

$-I_5 - I_6 - 5 = 0$

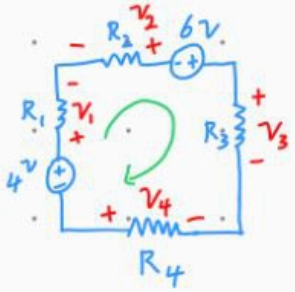


KCL: $10 + I_2 = I_1$

$I_2 = -2^A$

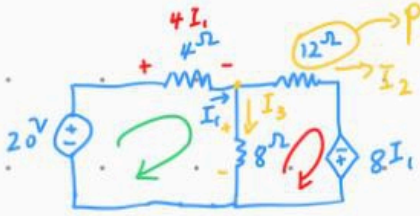
$I_1 = 10 - 2 = 8^A$

Kirchhoff's Voltage Law (KVL):



$\sum_{n=1}^{\infty} V_n = 0$

$-V_2 - 6 + V_3 - V_4 - 4 + V_1 = 0$



$P = 12^{\Omega} \times I_2^2 = 12 \times \left(\frac{20}{7}\right)^2 = 97.86^W$

KCL: $I_1 = I_2 + I_3$

KVL: $-20 + 4I_1 + 8I_3 = 0$

KVL: $-8I_3 + 12I_2 - 8I_1 = 0$