principle of E

F, H, C

F, H, C

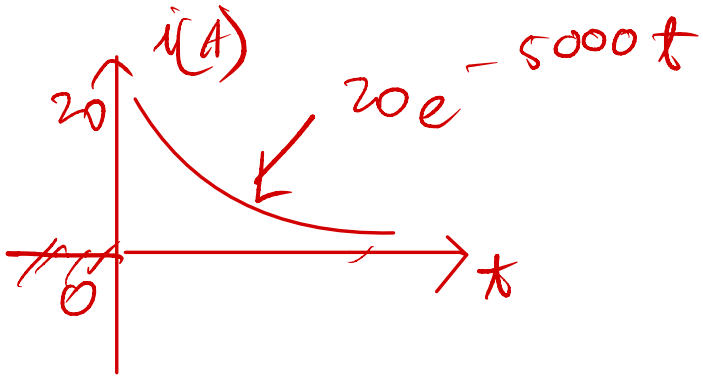
F

$$i = \frac{dq}{dt}$$

$$q = \int_0^t i\,dt = \int_0^t 5\,dx = 5t$$

$$q = 5 \times 10 = 50C$$

$$q(t) = \int_0^t i(x)\,dx$$



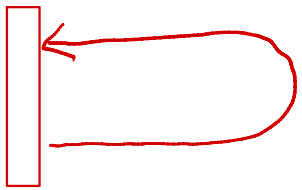
$$\frac{d}{dx} = 0 \Rightarrow i_{max}$$

$p > 0$ { absorbed, dissipated, received

$p < 0$ { generated, extracted

current enter leave

if not $p = -vi$



$$P_B = -vi = -12 \times 30 = 360\ W$$

$$P_A = +vi = 360\ W$$

nguồn phụ thuộc

$v_s = 2v_x$

does not violate anything

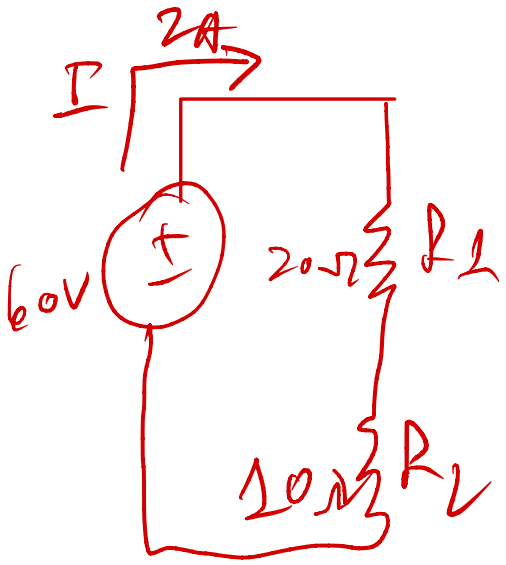
by theirs

điện áp cho cực tính

current

$$G = \frac{1}{R}(S, U)$$

$v = i R$



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

$$R_T = R_1 + R_2 = 20 + 10 = 30\,\Omega$$

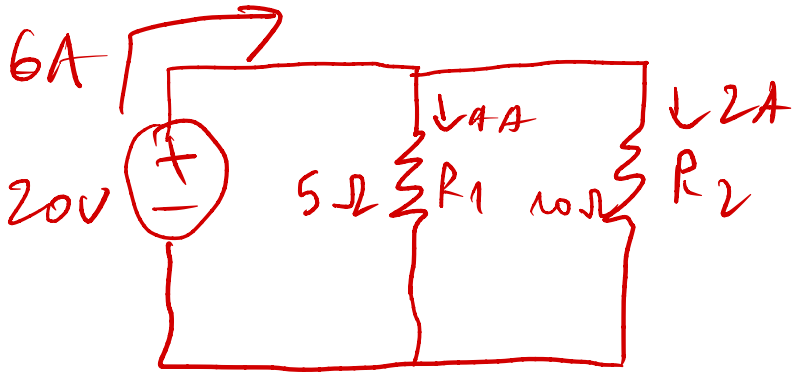
$$I = \frac{V}{R_T} = \frac{60\,V}{30\,\Omega} = 2A$$

$$P_1 = I^2 R_1 = 2^2 \cdot 20 = 80\,W$$

$$P_2 = I^2 R_2 = 2^2 \cdot 10 = 40\,W$$

$$P = VI = 60\,(2A) = 120\,W$$

correct



$V = IR$

$I_1 = \frac{V}{R_1} = \frac{20}{5\Omega} = 4A$

$I_2 = \frac{V}{R_2} = \frac{20}{10\Omega} = 2A$

$\Big\} 6A$

$P_1 = I_1^2 R = 4^2(5) = 80W \qquad P_2 = I_2^2 R = 2^2(10) = 40W$

$P_B = VI = (20V)(6A) = 120W$ (correct)

$v = iR$

I

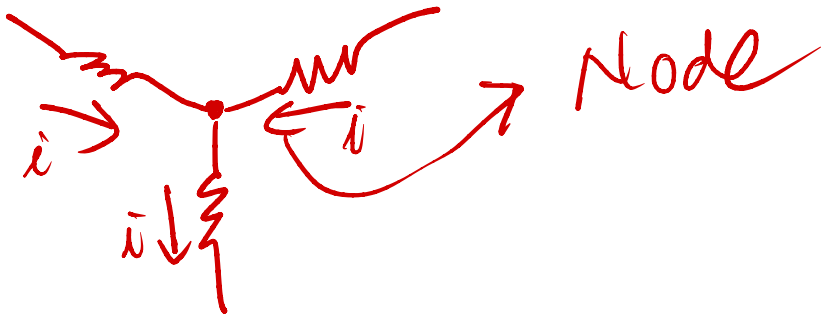
$i = G v$

$v = iR$

i

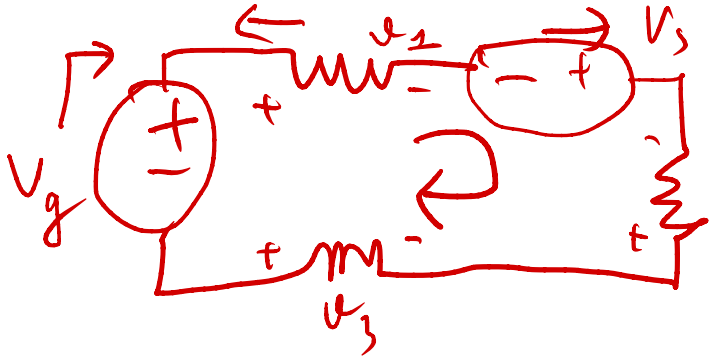
Loop ≡ Close path

$i_3 - i_1 - i_2 = 0$



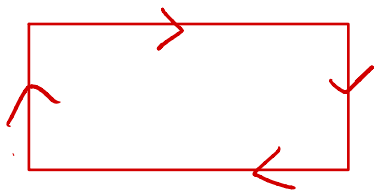
$$\sum_{n=1}^{k} i_n = 0$$

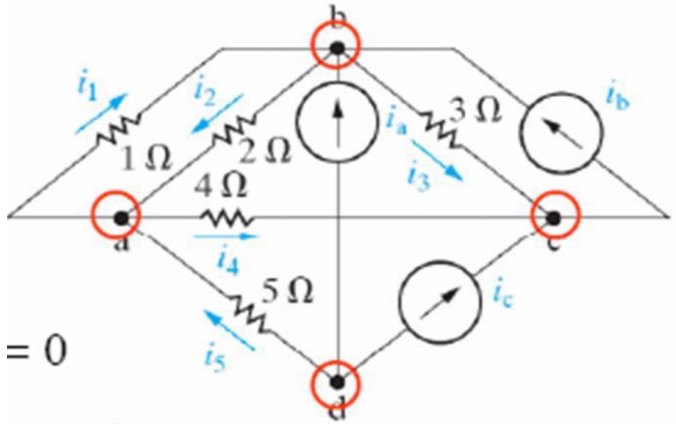
$$\sum_{n=1}^{k} v_n = 0$$



$$-V_g + v_1 - v_3$$

$$-v_2 - v_3 = i$$





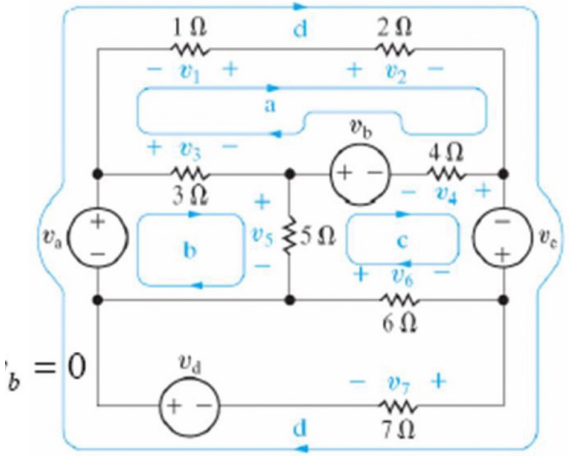
Node A : $i_1 + i_4 - i_2 - i_5 = 0$

Node B : $i_5 + i_2 - i_1 - i_a - i_b = 0$

Node C : $i_b - i_3 - i_c - i_4 = 0$

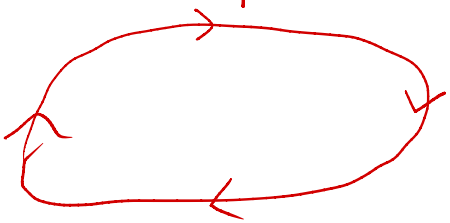
Node D : $i_a + i_c + i_5 = 0$

• Apply KVL, positive sign and voltage drop.



Follow this loop:

drop:



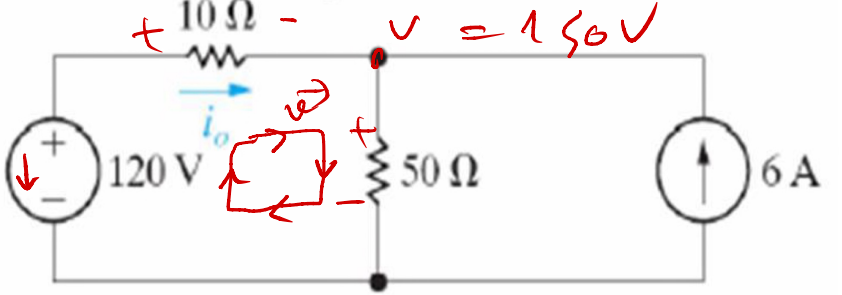
Loop a: $v_2 - v_1 - v_3 + v_4 - v_b = 0$

Loop b: $-v_a + v_3 + v_5 = 0$

Loop c: $v_b - v_4 - v_c - v_6 - v_5 = 0$

Loop d: $v_2 - v_1 - v_c + v_7 - v_d - v_a = 0$

Resistors have to be dissipated



KCL: $i_1 - i_0 - 6 = 0$ (1)

KVL: $v_1 - v_0 - 120 = 0$

$\Leftrightarrow 50 i_1 + 10 i_0 - 120 = 0$

(1)(2): $\begin{cases} i_1 - i_0 = 6 \\ 50 i_1 + 10 i_0 = 120 \end{cases} \Rightarrow \begin{cases} i_1 = 3A \\ i_0 = -3A \end{cases}$

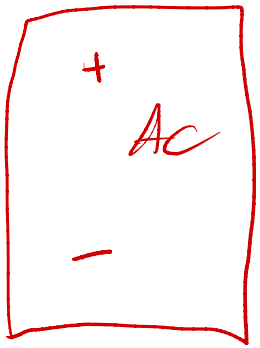
- Node Voltage: $\frac{V - 120}{10} - 6 + \frac{V}{50} = 0 \Rightarrow V = 150$

$- i_0 = \frac{150 - 120}{10} \Rightarrow i_0 = -3A$

$i_1 = \frac{150}{50} = 3A$

Power

ore source => P < 0

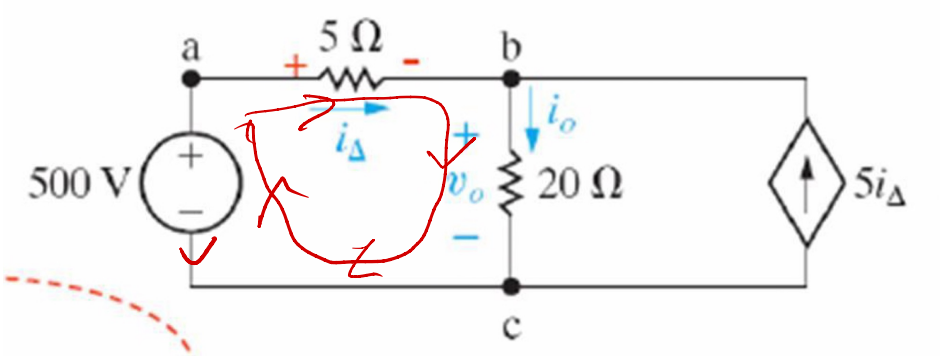


Dc

verify

P_{120V} =

c  => $P = -vi$



$V = iR$

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

KCL at b: $i_o - i_\Delta - 5i_\Delta = 0$

$\Rightarrow i_o = 6i_\Delta$

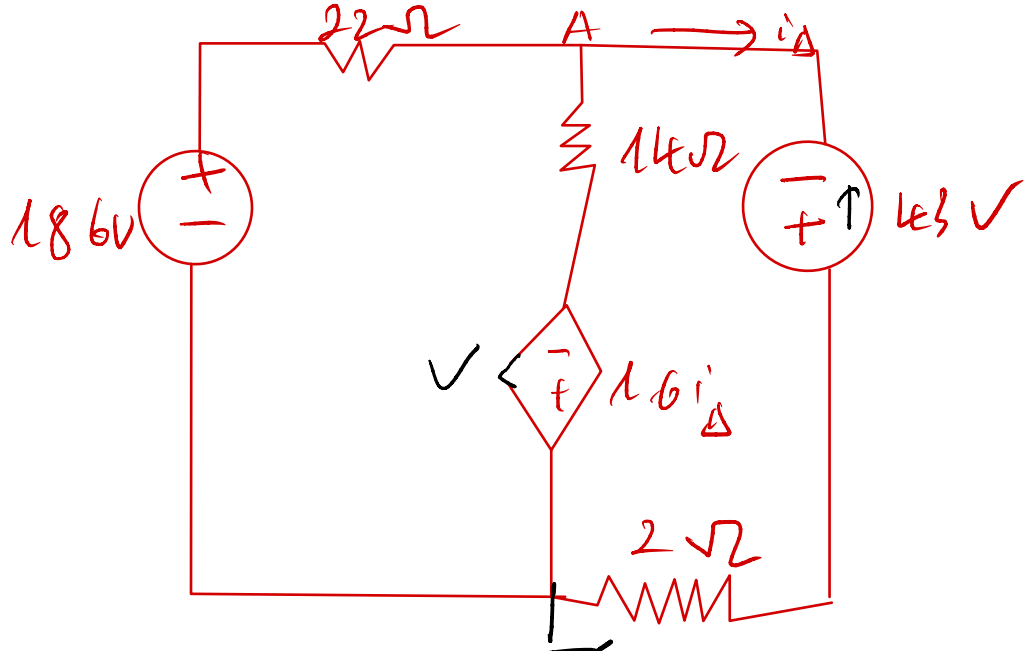
KVL a,b,c: $5i_\Delta + 20i_o - 500 = 0$

$\Rightarrow 5i_\Delta + 20 \times 6i_\Delta = 500$

$\Rightarrow i_\Delta = 4\ A$

$i_o = 24\ A$

$v_o = i_o \times 20 = 24 \times 20 = 480\ V$



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

$V = iR$

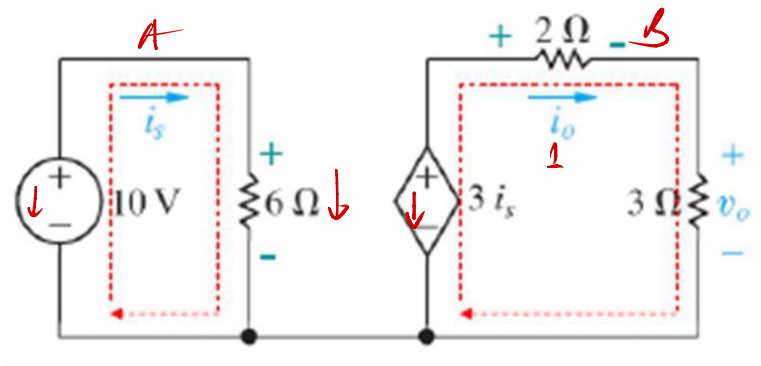
Node Voltage at A: $\frac{V-186}{22} + \frac{V--1.6\,i_\Delta}{14} + \frac{V--43}{2\Omega}$ (*)

Constraint eq: $i_\Delta = \frac{V--43}{2} = \boxed{\frac{V+43}{2}}$

(*) $\frac{V-186}{22} + \frac{V+\left(\frac{V+43}{2}\right)}{14} + \frac{V+43}{2} = 0$

$\Rightarrow V = -23A$

Find P_{dis} and $P_{deliver}$



$v = ir$

$i = \frac{v}{r}$

$P = i^2 r$

$P = \frac{v^2}{R}$

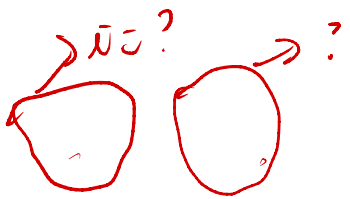
KVL path A: $6 i_s - 10 = 0 \Rightarrow i_s = \frac{5}{3}$ (A)

KVL path B: $(2+3) i_o - 3 i_s = 0 \Rightarrow i_o = 1$ (A)

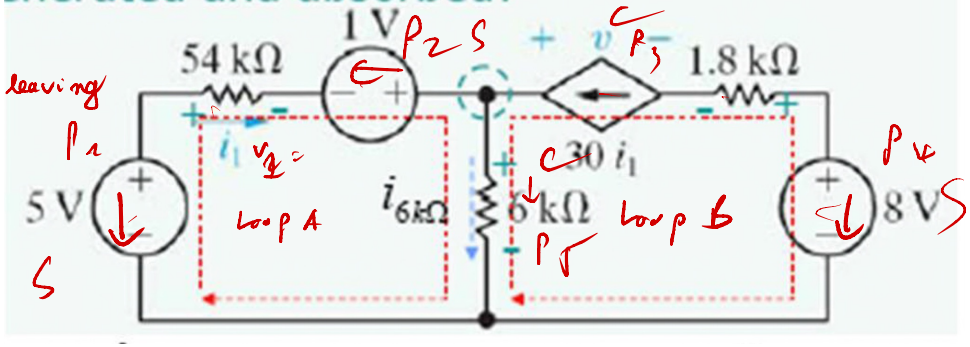
Power dissipated: $P_{6\Omega} + P_{2\Omega} + P_{3\Omega} = \frac{5}{3}^2 \cdot 6 + 1^2 \cdot 2 + 1^2 \cdot 3 = 21.67$ W

Power delivered: $P_{10V} + P_{3i_s} = 10 i_s + i_o 3 i_s = 10 \cdot \frac{5}{3} + 1 \times 3 \times \frac{5}{3}$

$= 21.67$ W



$$P = v\dot{v} = \frac{v^2}{R}$$



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

$V = iR$

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

$P = iV$

KCL: $i_{6k\Omega} - i_1 - 30 i_1 \Rightarrow \boxed{i_{6k\Omega} = 31 i_1}$

$i_{6k\Omega} = 7.8 \times 10^{-4}$ A

KVL and Ohm's law at loop A: $51k\Omega\, i_1 - 1 + 6k\Omega\, i_{6k\Omega} - 5 = 0$

$\Leftrightarrow 51k\Omega\, i_1 + 6k\Omega \times 31 i_1 = 6 \Rightarrow i_1 = 2.53 \times 10^{-5}$ A

KVL and Ohm's law at loop B: $-30 i_1 \times 1.8k\Omega + 8V - i_{6k\Omega} \times 6k\Omega + v = 0$

$\Rightarrow -30 \times 2.5 \times 10^{-5} \times 1.8 \times 10^{3} + 8 - 31 \times 2 \times 10^{-5} \times 10^{3} + v = 0$

$\Rightarrow v = -2$ V

$P_{5k\Omega} = i_1^2 R = 1.35$ W ; $P_{1V} = 1 \times i_1 = 2.5 \times 10^{-5}$ W ; $P_{6k\Omega} = 31 i_1 \times 6000 = 5.6375 \times 10^{-3}$ W

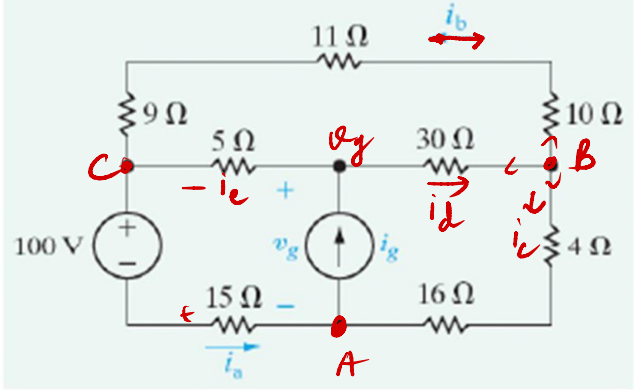
$P_{30 i_1} = -(-2 \times 30 i_1) = 1.5 \times 10^{-3}$ W ; $P_{8V} = ?$

$P_{5V} = i_1 \times -5 = -1.25 \times 10^{-4}$ W ; $P_{1.8k\Omega} = ?$

EE2	Cal 3	Phy 3
4	4	4
CNXHH	Critical	Program
2	3	4

$i_a = 4A \quad i_b = +2$

Find i_g, v_g



$i = \frac{v}{r}$

$v = ir$

$P = i^2 r$

$P = vi$

KVL at bottom left loop

$-5i_e + v_g - 15i_a - 100 = 0$

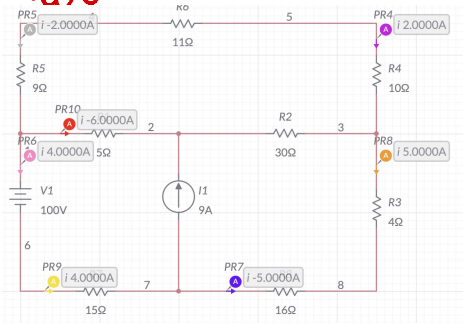
$\Rightarrow v_g = 190\ V$

Ohm's Law :

KVL outside loop: $v_{9\Omega} + v_{11\Omega} + v_{10\Omega} + v_{4\Omega} + v_{16\Omega} - v_{15\Omega} - 100 = 0$

$\Leftrightarrow 9\times 2 + 11\times 2 + 10\times 2 + 4i_c + 16i_c - 15\times 4 - 100 = 0$

$\Rightarrow i_c = 5\ A$



KCL at node A: $i_g - i_a - i_c = 0 \Rightarrow i_g = 5 + 4 = 9\ A$

KCL at node B: $i_c - i_a - i_d \Rightarrow i_d = i_c - i_b = 5 - 2 = 3A$

KCL at node C: $i_a - i_e + i_b \Leftrightarrow 4 - i_e + 2 \Rightarrow i_e = 6\ A$

$P_{9\Omega} = 2^2 \times 9 = 36\ W$, $P_{11\Omega} = 2^2 \times 11 = 44\ W$, $P_{10\Omega} = 2^2 \times 10 = 40\ W$ $P_{4\Omega} = 5^2 \times 4 = 100\ W$

$P_{16\Omega} = 5^2 \times 16 = 400\ W$, $P_{15\Omega} = 4^2 \times 15\Omega = 240\ W$, $P_{5\Omega} = 6^2 \times 5 = 180W$, $P_{30W} = 3^2 \times 30 = 270W$

$P_{i_g} = -(190)(9) = -1710\ W$ $P_{100V} = 1e\times 100 = 1400\ W$ ✓

$P_{dissipated} : 1310\ W$ $P_{generated} = 1310\ W$