Homework #2

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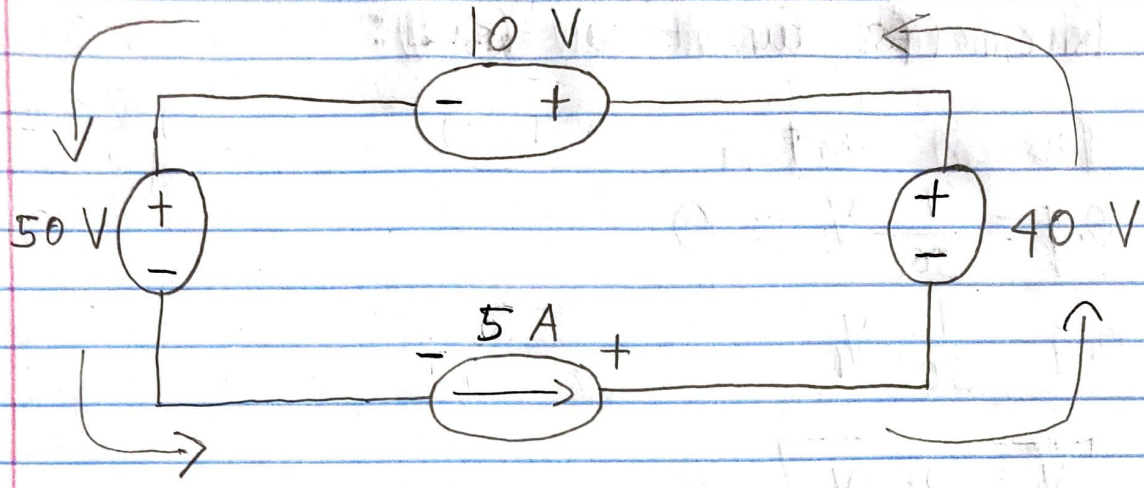
2.2.



$$50 + 10 + 40 + V_{6A} = 0$$
$$V_{6A} = -100 \text{ V}$$

Element (Power source)	Voltage (V)	Current (Amp)	Power (W)
50 V	50	5	$P_{50V} = (50)(5) = 250$ W
10 V	10	5	$P_{10V} = (10)(5) = 50$ W
40 V	40	5	$P_{40V} = (40)(5) = 200$ W
5 Amps	-100	5	$P_{5A} = (-100)(5) = -500$ W
		TOTAL	0 W //

The interconnection is valid.

Reason:
Total power is 0 W. //

2.6. a. Kirchhoff's Current Law (KCL):

$400\ mA = 0.4\ A$

$0.4 - \frac{1}{50} V_1 = 0$

$0.4 = \frac{1}{50} V_1$

$\boxed{V_1 = 20\ V}$ //

b. $P_{V_1} = i_{V_1} \cdot V_1$

$= (0.4)(20)$

$= \boxed{8\ W}$ //

2.11. Given: $i = 15\ mA = 0.015\ A$

$R = 3\ K\Omega = 3000\ \Omega$

a. $V = iR$

$= (0.015)(3000)$

$= \boxed{45\ V}$ //

b. $P = i^2 R$

$= (0.015)^2 (3000)$

$= \boxed{0.675\ W}$ //

c. Reversed: $i = -15\ mA = -0.015\ A$

$R = 2\ K\Omega = 2000\ \Omega$

$V = iR = (-0.015)(3000) = \boxed{-45\ V}$ //

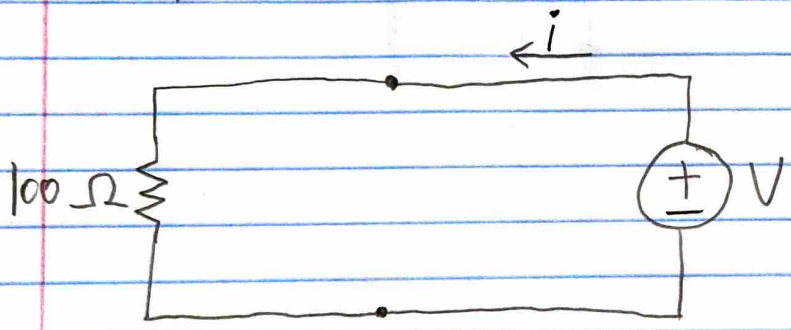
$P = i^2 R = (0.015)^2 (3000) = \boxed{0.675\ W}$ //

2.15.

V (V)	P (mW)	P (W)	$i = \frac{P}{V}$ (A)	$R = \frac{V}{i}$ (Ω)
−8	640	0.64	0.64 / (−8) = −0.08	−8 / (−0.08) = 100
−4	160	0.16	0.16 / (−4) = −0.04	−4 / (−0.04) = 100
4	160	0.16	0.16 / 4 = 0.04	4 / 0.04 = 100
8	640	0.64	0.64 / 8 = 0.08	8 / 0.08 = 100
12	1440	1.44	1.44 / 12 = 0.12	12 / 0.12 = 100
16	2560	2.56	2.56 / 16 = 0.16	16 / 0.16 = 100

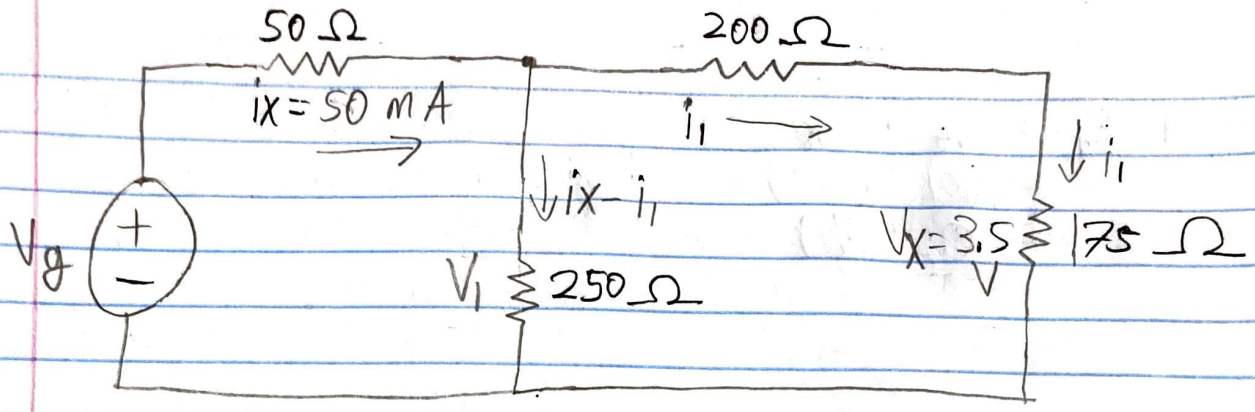
As the table above demonstrates, the device should consist a (100 Ω) resistor. //

Hence, a circuit model may be constructed as per following:



//

2.20



KVL: $-V_g + 50(0.05) + V_1 = 0$ — ①

$-V_1 + 200 i_1 + 3.5 = 0$ — ②

$-V_g + 2.5 + V_1 = 0$

$+ 200 i_1 + 3.5 - V_1 = 0$ → (Gaussian Elimination)

$200 i_1 - V_g + 6 = 0$ — ③

a. $V_x = i_1 \cdot 175$

$3.5 = i_1 \cdot 175$

$i_1 = \frac{3.5}{175} = \underline{0.02 \text{ A}}$

b. Substitute i_1 in Eq. #2 with 0.02 A:

$-V_1 + 200(0.02) + 3.5 = 0$

$-V_1 + 4 + 3.5 = 0$

$-V_1 + 7.5 = 0$

$-V_1 = -7.5$

$V_1 = \underline{7.5 \text{ V}}$

c. $-V_g + 2.5 + V_1 = 0$

$-V_g + 2.5 + 7.5 = 0$

$-V_g = -10$

$V_g = \underline{10 \text{ V}}$

d. $P_g = V_g \cdot I_x$

$= (10)\ (0.05)$

$= \underline{0.5\ W}$