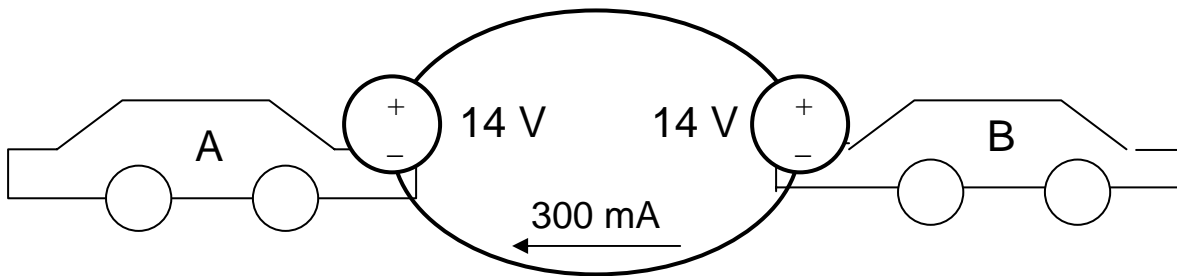


EE 40
Homework #1
Solutions

Problem 1: 6 Points Possible



- a) The circuit diagram should show a multimeter in series with the batteries.

Award 2 points for correct diagram, 0 for incorrect.

- b) Car B belongs to Prof. Ross. Possible explanations: Positive current is flowing over a voltage drop. Or, the power absorbed is negative. Any equivalent reason is fine.

Award 1 point for correct car and 1 point for correct answer.

- c) $14 \text{ V} \times 300 \text{ mA} = 14 \text{ V} \times 0.3 \text{ A} = 4.2 \text{ W}$

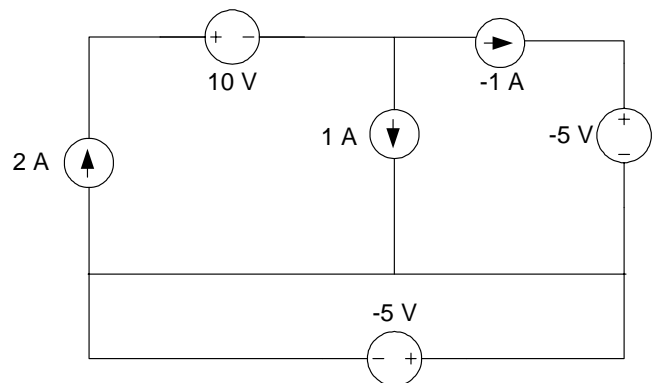
Award 1 point for correct magnitude and 1 point for correct sign.

Problem 2: 6 Points Possible

- a) KCL is violated for this circuit: the currents do not sum to zero at the middle-top node, for example.
- KVL is also violated: the voltage source at the bottom is “shorted out”; KVL is violated in that loop.

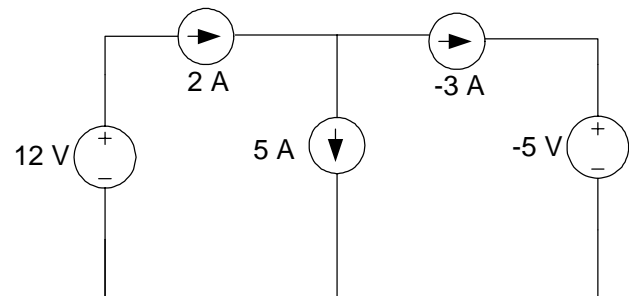
The voltages across the current sources are undetermined. The current through the voltage source is also undetermined.

Award 1 point each for each statement above.



- b) KCL is not violated in this circuit.
- KVL is not violated in this circuit.
- The voltages across the current sources are undetermined.

Award 1 point for each statement.



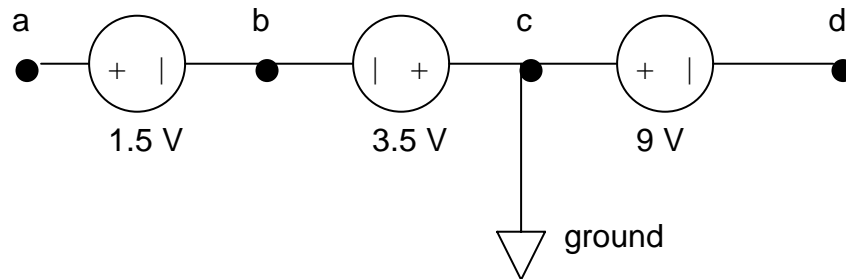
Problem 3: 8 Points Possible

a) -1.5 V

b) 7 V

c) -9 V

d) 0 V



Award 1 point for each correct magnitude and 1 point for each correct sign.

Problem 4: 10 Points Possible

5 Ω resistor:

$$P = VI = (2 \text{ A} \times 5 \Omega) \times 2 \text{ A} = \mathbf{20 \text{ W}}$$

2 A current source:

Let V_x be the voltage associated with the 2 A current. By KVL,

$$V_x + 2 \text{ A} \times 5 \Omega - 6 \text{ V} = 0 \quad V_x = -4 \text{ V} \quad P = -4 \text{ V} \times 2 \text{ A} = \mathbf{-8 \text{ W}}$$

2 Ω resistor:

Let V_y be the voltage over the 2 Ω resistor, positive on the left. By KVL,

$$V_y + 6 \text{ V} - 12 \text{ V} = 0 \quad V_y = 6 \text{ V} \quad P = VI = 6 \text{ V} \times (6 \text{ V} / 2 \Omega) = \mathbf{18 \text{ W}}$$

12 V voltage source:

Current through 2 Ω resistor, left to right = $6 \text{ V} / 2 \Omega = 3 \text{ A}$ (see above)

This current goes from - to + through 12 V source, un-associated with 12 V source!

The associated current is therefore -3 A. $P = 12 \text{ V} \times -3 \text{ A} = \mathbf{-36 \text{ W}}$

6 V voltage source:

Let I_x be the current associated with the 6 V source. By KCL,

$$3 \text{ A} = I_x + 2 \text{ A} \quad I_x = 1 \text{ A} \quad P = 6 \text{ V} \times 1 \text{ A} = \mathbf{6 \text{ W}} \quad (\text{Yes, a source can absorb power.})$$

Award 1 point for each correct magnitude and 1 point for each correct sign.

