Question #363
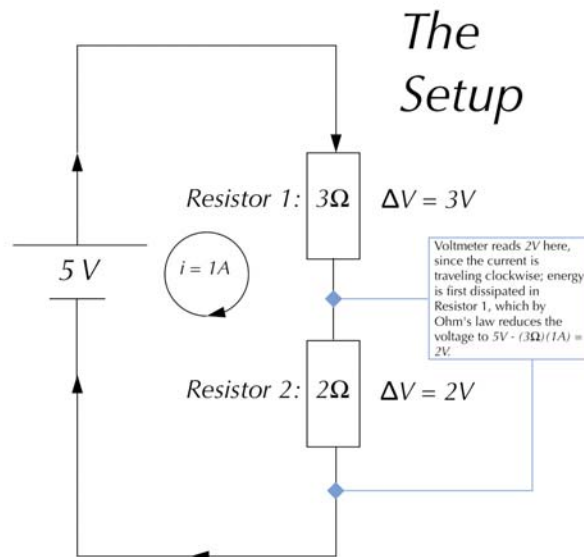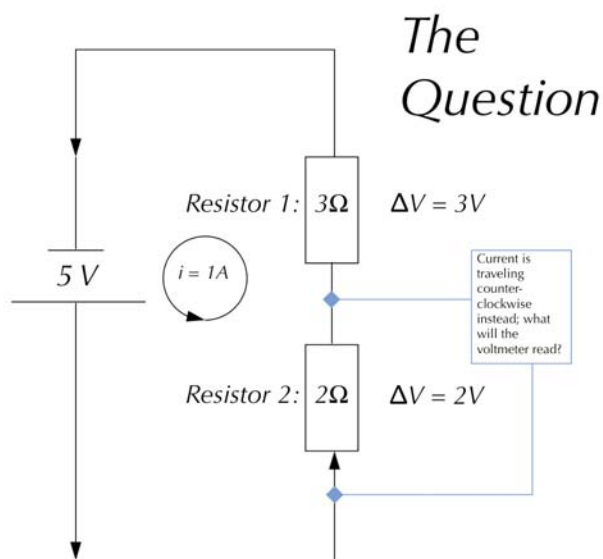
This week we venture into world of circuits for a voltage paradox.

Below is a DC circuit with a 5V battery, 3Ω- and 2Ω-resistor. The current is flowing clockwise, and a voltmeter (in blue) reads 2V. Click on the image below to view the circuit in more detail.

The Setup

Resistor 1: 3Ω   ΔV = 3V

5 V   i = 1A

Voltmeter reads 2V here, since the current is traveling clockwise; energy is first dissipated in Resistor 1, which by Ohm's law reduces the voltage to 5V - (3Ω)(1A) = 2V.

Resistor 2: 2Ω   ΔV = 2V

Now, consider the battery reversed, so that current is instead flowing the counter-clockwise direction.

Question: What will the voltmeter read now?

The Question

Resistor 1: 3Ω   ΔV = 3V

5 V   i = 1A

Current is traveling counter-clockwise instead; what will the voltmeter read?

Resistor 2: 2Ω   ΔV = 2V

- (a) The voltmeter will read -2V, indicating the change in current.
- (b) The voltmeter will read 3V, since the current is traveling counter-clockwise instead; energy is first dissipated in Resistor 2, which by Ohm's law reduces the voltage to 5V - (2Ω)(1A) = 3V.
- (c) The voltmeter will still read 2V, because current *actually* flows in the other direction (electrons are negative); nothing has changed.
- (d) Other (you must explain).

Remember, the true test of understanding is when you can dismiss other, plausible conclusions using physics-based reasoning -- not simply getting the "right" answer.

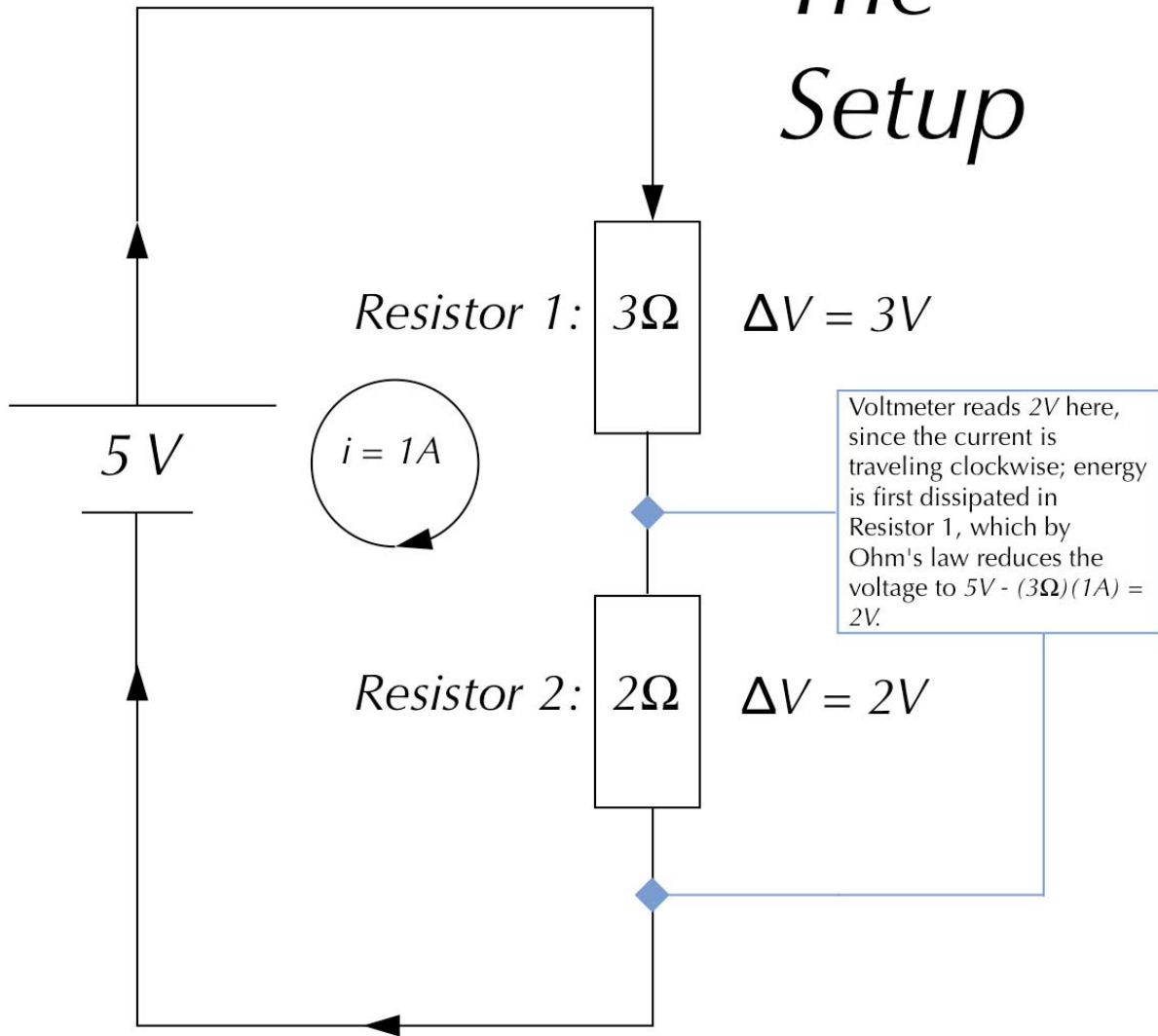Click here for Answer #363 after February 22, 2010.

Question of the Week

Outreach Index Page

Lecture-Demonstration Home Page

For questions and comments regarding the *Question of the Week* contact
Dr. Richard E. Berg by e-mail or using phone number or regular mail address
given on the Lecture-Demonstration Home Page.

The Setup

Resistor 1: 3Ω $\Delta V = 3V$

5 V

$i = 1A$

Voltmeter reads *2V* here, since the current is traveling clockwise; energy is first dissipated in Resistor 1, which by Ohm's law reduces the voltage to *5V - (3Ω)(1A) = 2V.*

Resistor 2: 2Ω $\Delta V = 2V$

The Question

Resistor 1: 3Ω $\Delta V = 3V$

$i = 1A$

5 V

Resistor 2: 2Ω $\Delta V = 2V$

Current is traveling counter-clockwise instead; what will the voltmeter read?