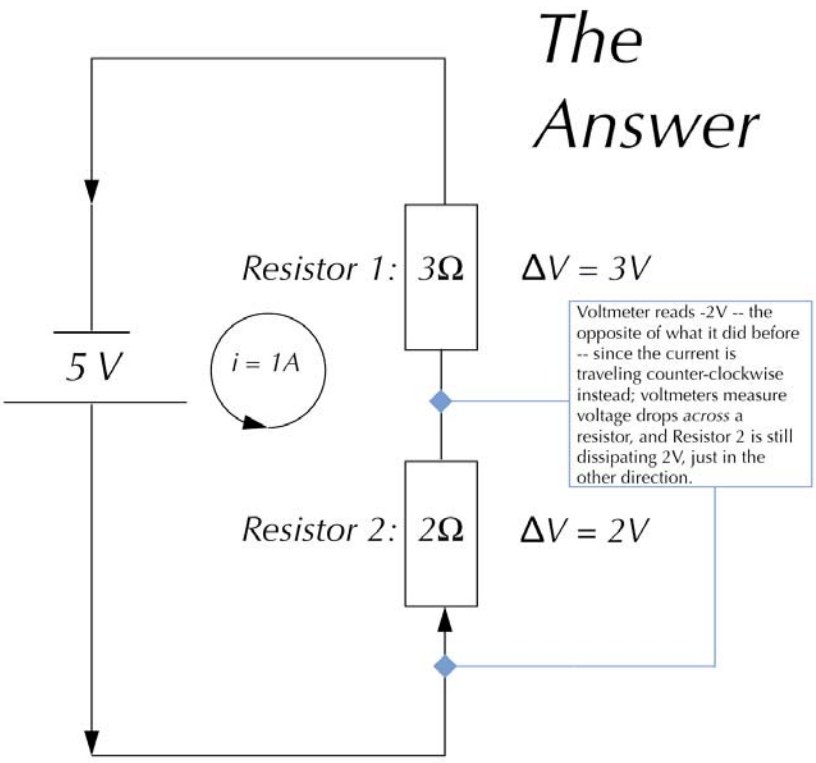
Answer #363

The answer is indeed (a): the voltmeter will read -2V. Click on the image below to view the image in more detail.



While the argument for option (b) is quite plausible -- that the voltage will drop across Resistor 2 first, and therefore the meter reads 3V -- one must keep in mind we aren't exactly measuring *the* voltage between the two resistors; we are measuring the difference in voltage *across* Resistor 2. By Ohm's law, we know Resistor 2 must dissipate 2V, and the magnitude of the voltmeter must be 2V. Whether it's positive or negative indicates it's a positive change or negative change.

Another, slightly more clever approach, is to imagine *what if* the voltage were 3V! This would imply that a change in direction of current affects the voltage across a resistor; that resistors treat positive charge and negative charge differently.

Since calling the current charge carriers "positive" and "negative" is purely arbitrary, then depending on what he defined the electron, our Law would change! Certainly then we would have to invent "better math" to model the situation, not just + and - to describe charge.

Furthermore, *if* this were true, this would mean that when electrons were actually discovered to be "negative" (in opposition to what our dear Ben Franklin assumed) all the existing circuits would have to be redone -- electronic devices would no longer function normally -- chaos would ensue!

While this certainly *could* have been the way the world works, for some reason it does not; the phenomena of current does not depend on whether we push electrons or positrons. Therefore the mathematical model need not be written, and we know the magnitude the voltmeter reads must still be 2V.

Take home point? Voltmeters don't measure voltage *at* a point, but the voltage difference *between* two points.

Question of the Week

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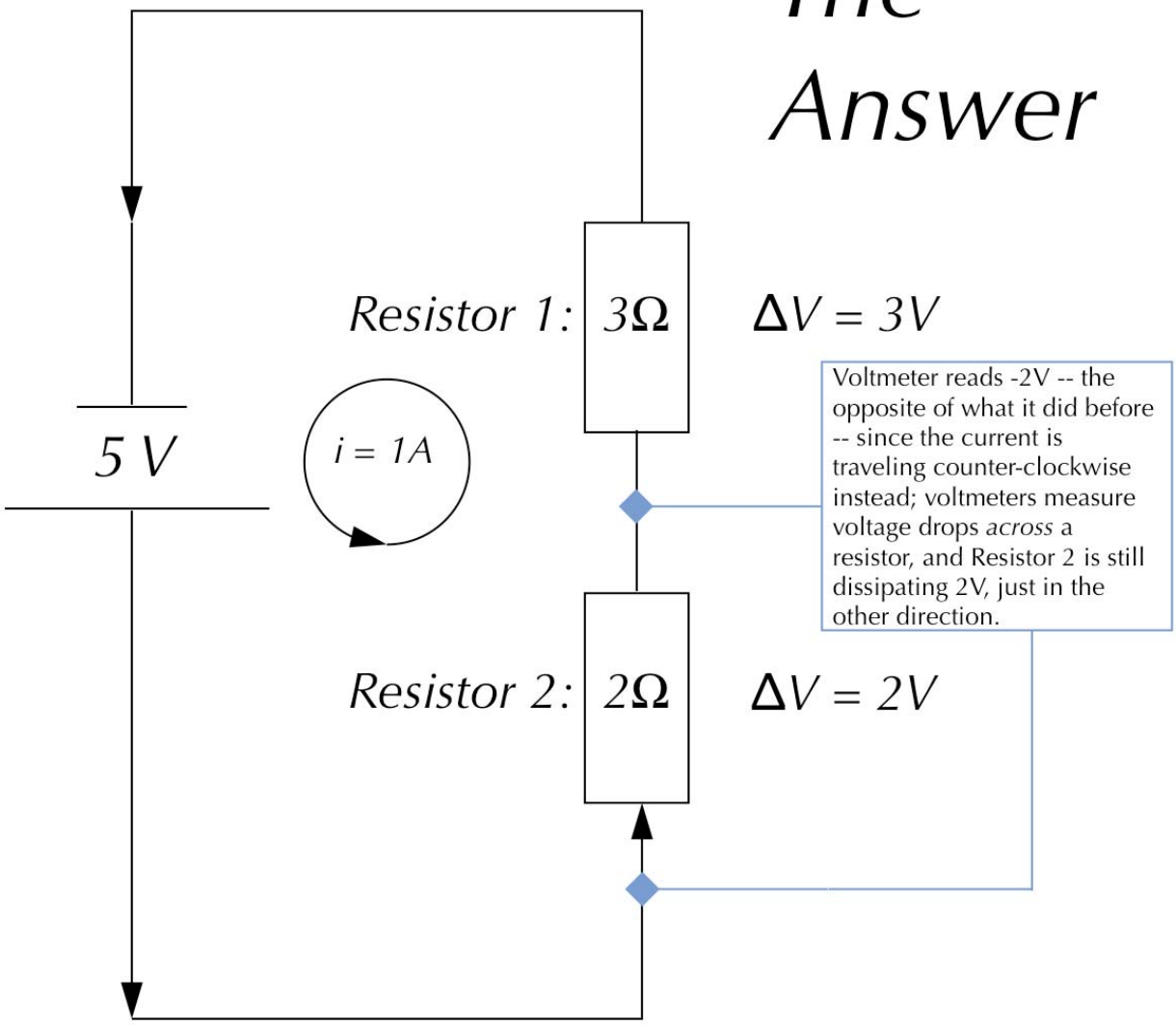
For questions and comments regarding the *Question of the Week* contact
Dr. Richard E. Berg by e-mail or using phone number or regular mail address
given on the Lecture-Demonstration Home Page.

The Answer


Resistor 1: 3Ω
ΔV = 3V
5 V
i = 1A
Voltmeter reads -2V -- the opposite of what it did before -- since the current is traveling counter-clockwise instead; voltmeters measure voltage drops *across* a resistor, and Resistor 2 is still dissipating 2V, just in the other direction.
Resistor 2: 2Ω
ΔV = 2V