PH 220

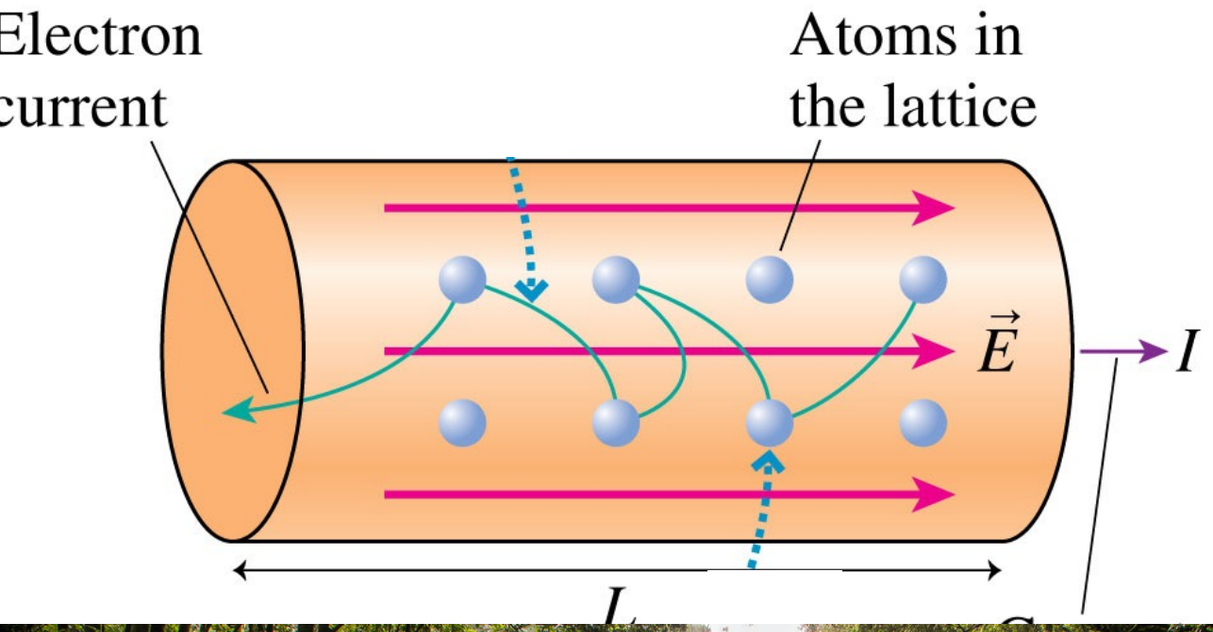
Lance Nelson

Demo Ideas:

1 - Blow a fuse: Connect a fuse to group of lightbulbs all wired in parallel. One by one, add lightbulbs (in parallel) until the fuse blows.

2- Temperature effects on the resistance of a wire. Wind a long wire around a glass rod (insulating) and connect it to a lightbulb. Turn on the power supply and observe that the light burns dimly. Then stick the rod in liquid nitrogen and observe the lightbulb burn brighter. (I found a metal rod with some copper wire wound around it that works ok. The resistance of the copper wire isn't very big so it's not a dramatic effect, but it works.

Deeper Thinking



$$P_{\text{res}} = I\Delta V = I^2 R = \frac{\Delta V^2}{R}$$

Explain how an increase/decrease of the variable will affect the power
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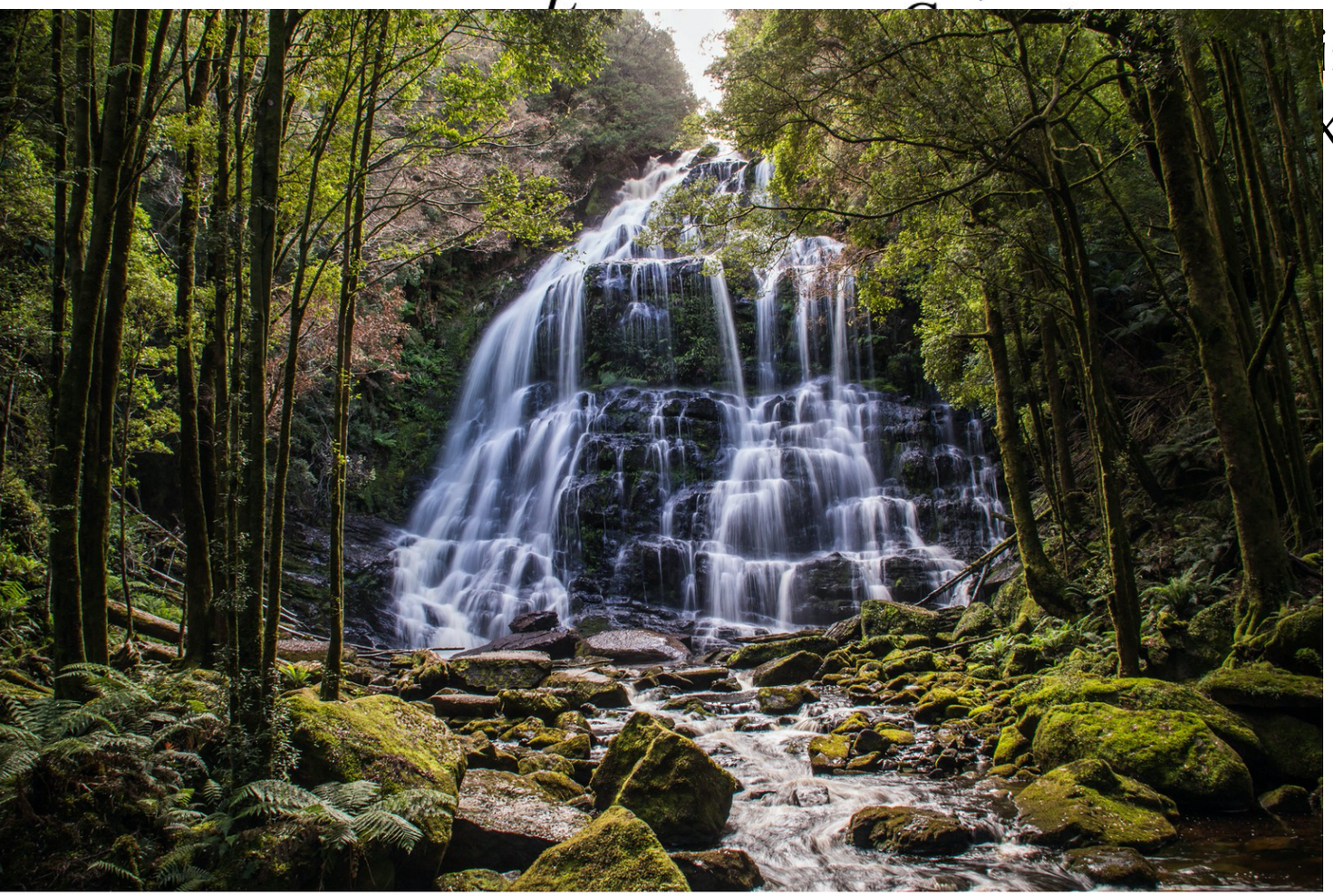
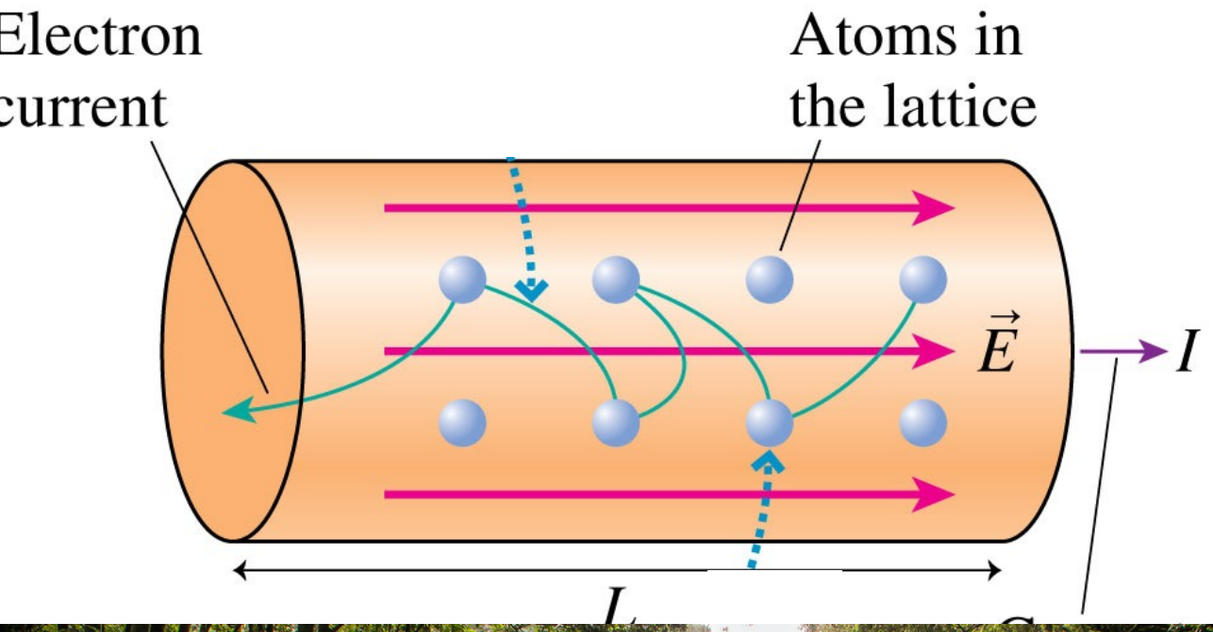
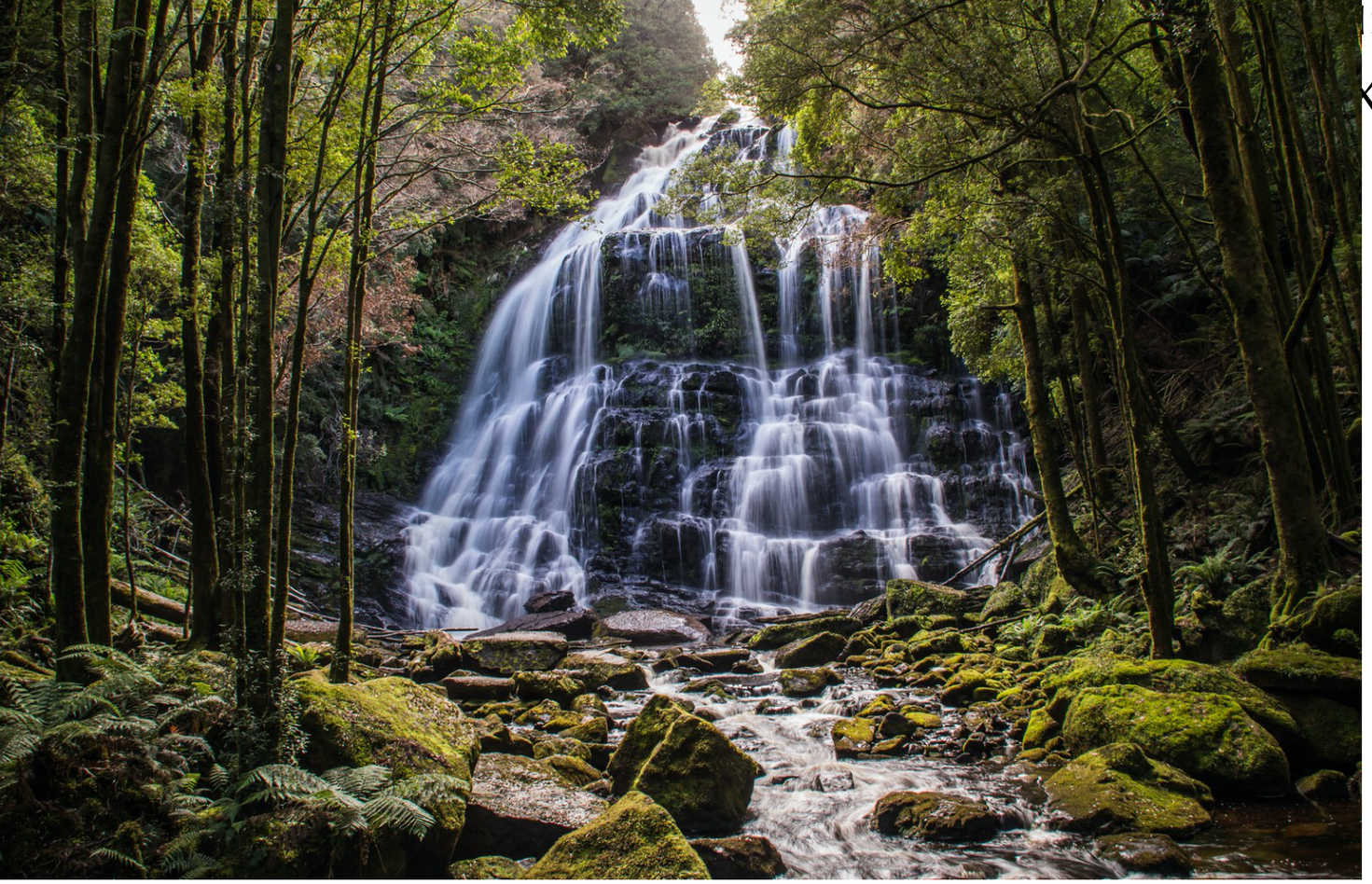


Deeper Thinking



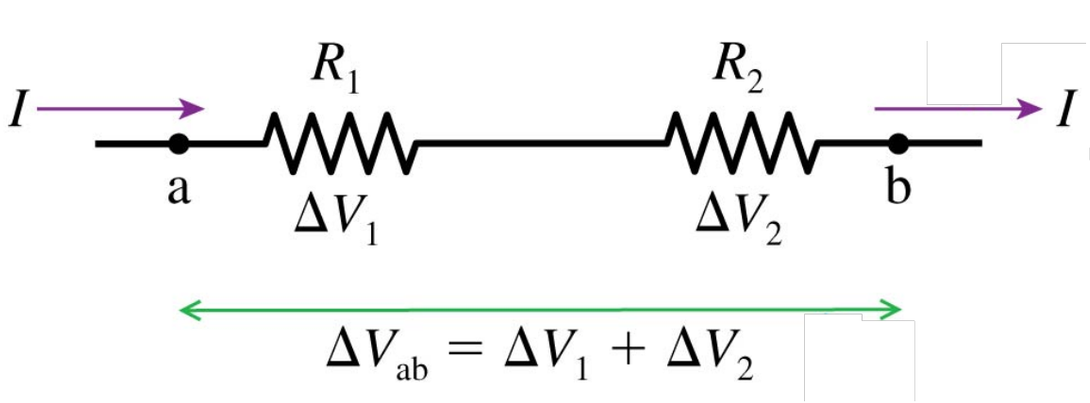
$$P_{\text{res}} = \boxed{1} I\Delta V = I^2 \boxed{3} R = \frac{\boxed{2} \Delta V^2}{R}$$

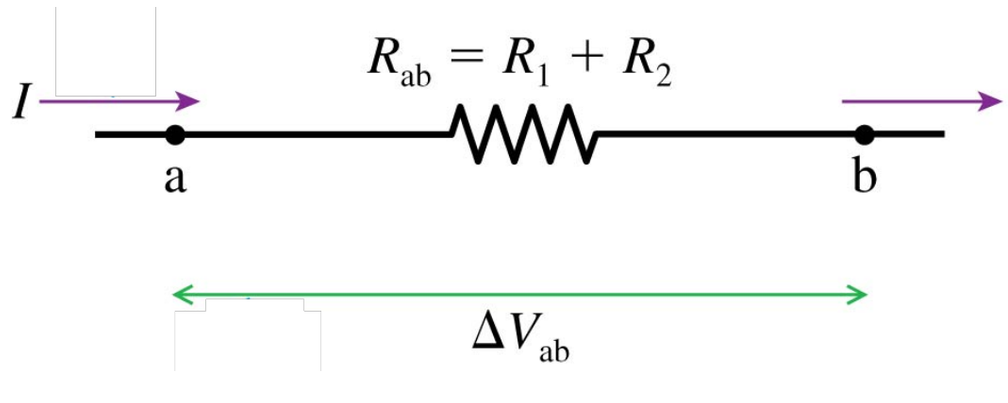
Explain how an increase/decrease of the variable will affect the power dissipated. (Don't just follow the math, explain it conceptually too)



Series Resistors

Write the potential difference between a and b in terms of current and resistance.

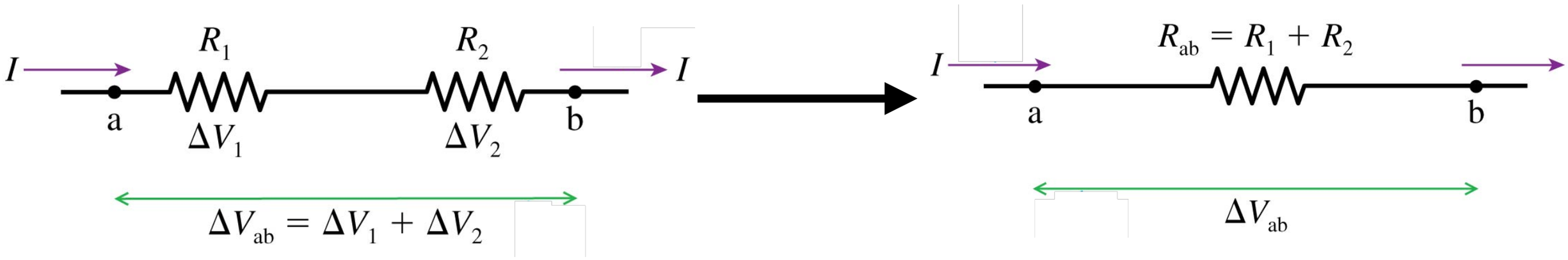




Series Resistors

$$\Delta V_{ab} = \Delta V_1 + \Delta V_2 = IR_1 + IR_2 = I(R_1 + R_2)$$

Write the potential difference between a and b in terms of current and resistance.

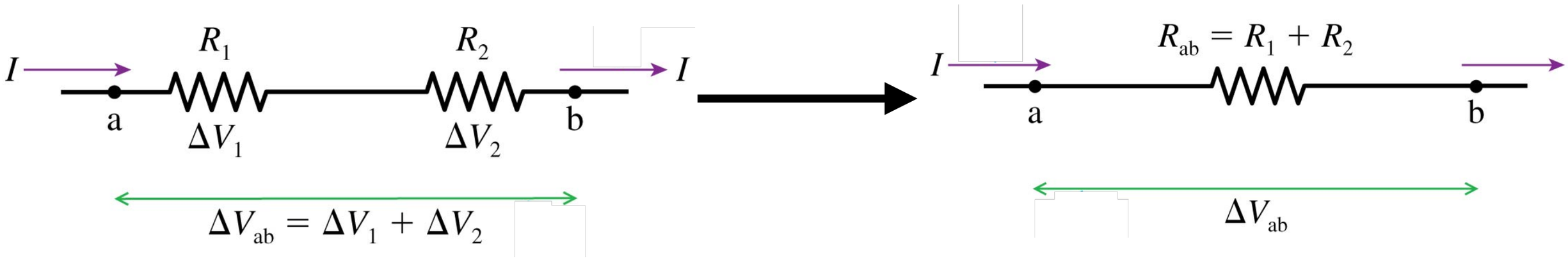


Series Resistors

$$\Delta V_{ab} = \Delta V_1 + \Delta V_2 = IR_1 + IR_2 = I(R_1 + R_2)$$

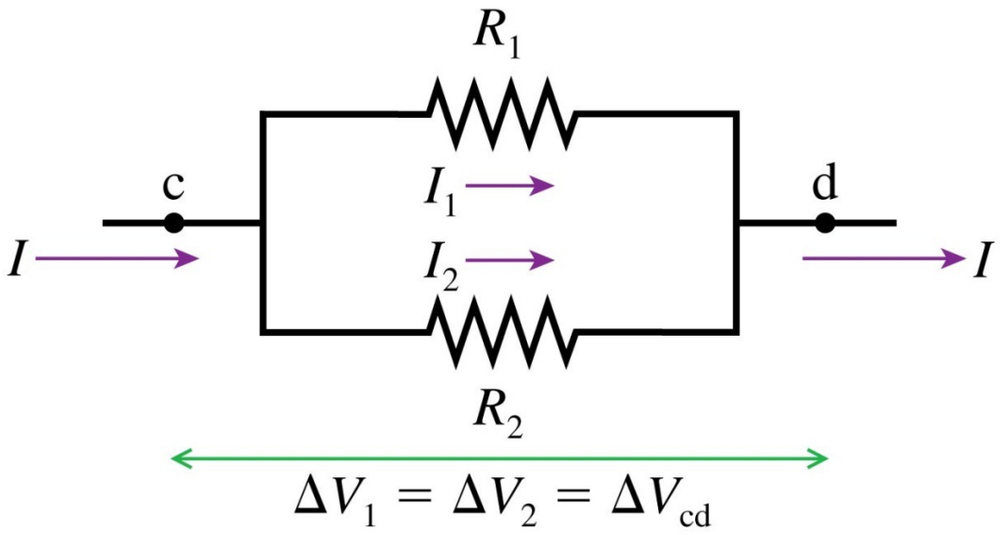
$$R_{ab} = \frac{\Delta V_{ab}}{I} = \frac{I(R_1 + R_2)}{I} = R_1 + R_2$$

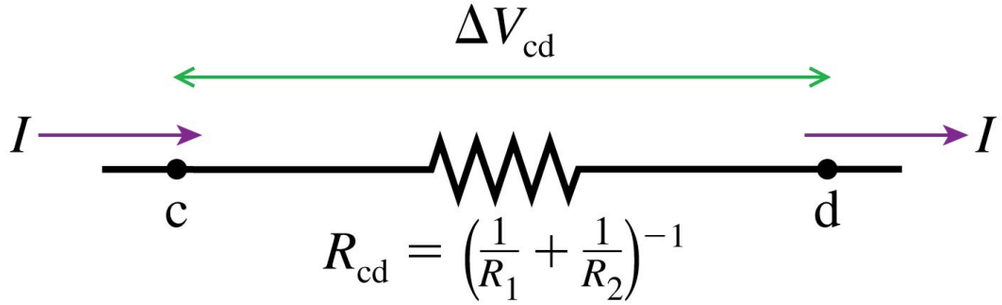
Write the potential difference between a and b in terms of current and resistance.



Resistors in Parallel

Write the current flowing through point c in terms of resistor voltages and resistances.

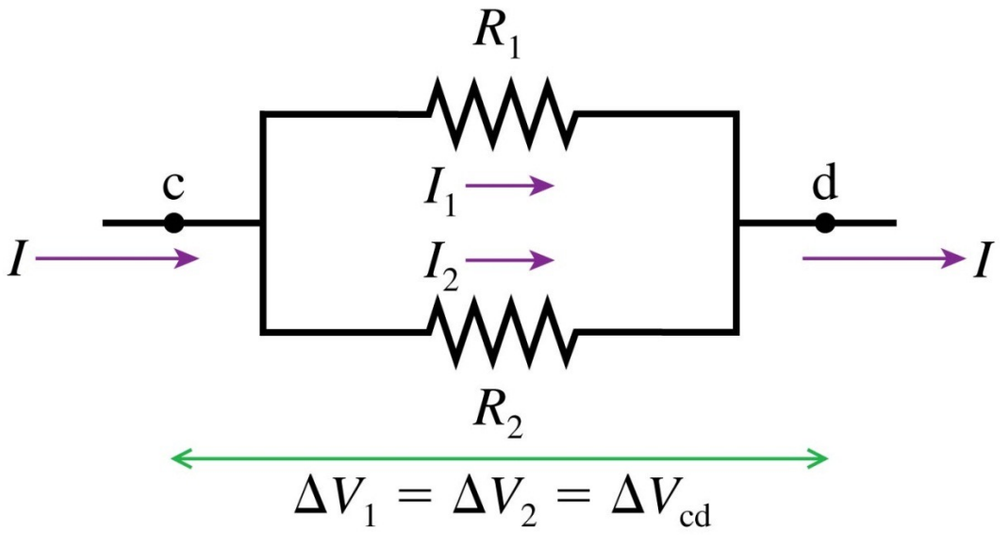


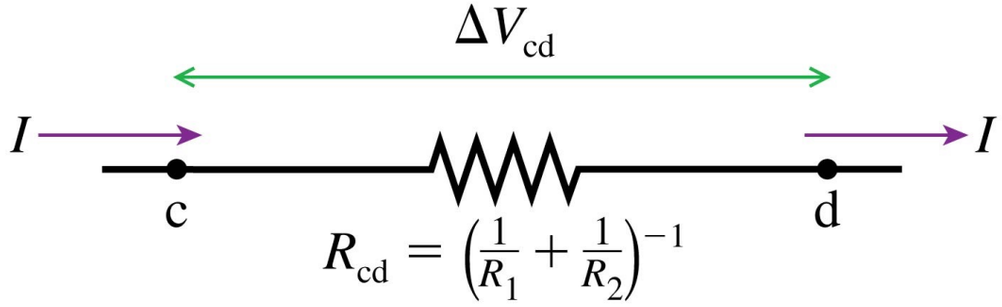


Resistors in Parallel

Write the current flowing through point c in terms of resistor voltages and resistances.

$$I = \frac{\Delta V_1}{R_1} + \frac{\Delta V_2}{R_2} = \frac{\Delta V_{cd}}{R_1} + \frac{\Delta V_{cd}}{R_2} = \Delta V_{cd}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$



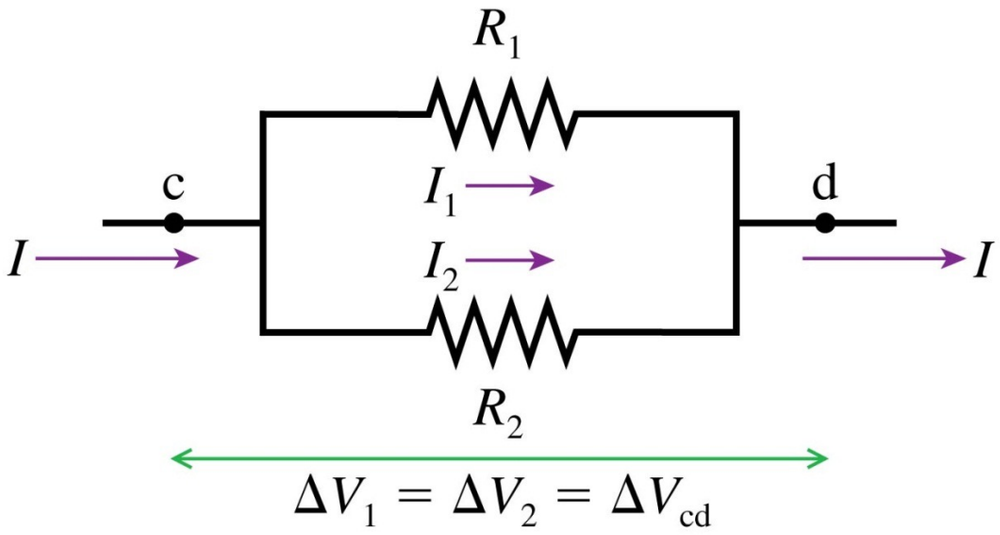


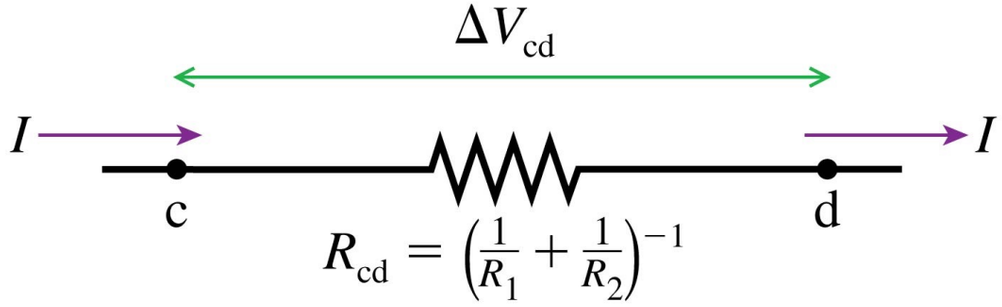
Resistors in Parallel

Write the current flowing through point c in terms of resistor voltages and resistances.

$$I = \frac{\Delta V_1}{R_1} + \frac{\Delta V_2}{R_2} = \frac{\Delta V_{cd}}{R_1} + \frac{\Delta V_{cd}}{R_2} = \Delta V_{cd}\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

$$R_{cd} = \frac{\Delta V_{cd}}{I} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$$





Circuit analysis tools

Describe the tool and the math needed to use the rule!

Kirchoff's loop rules

Power delivered to a resistor

Kirchoff's junction rules

Resistors in series

Resistors in parallel

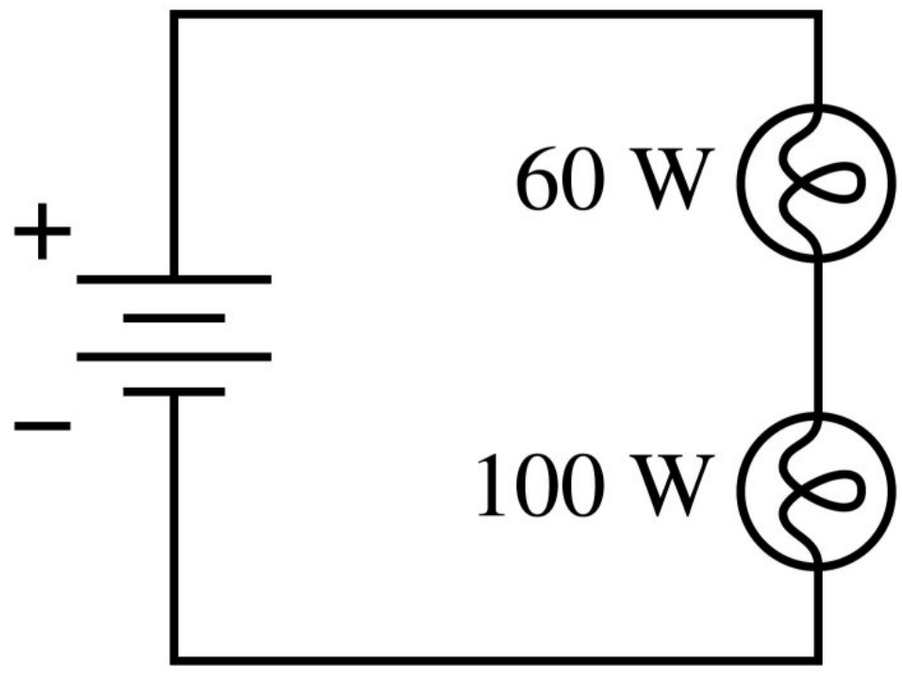
Power delivered by a source

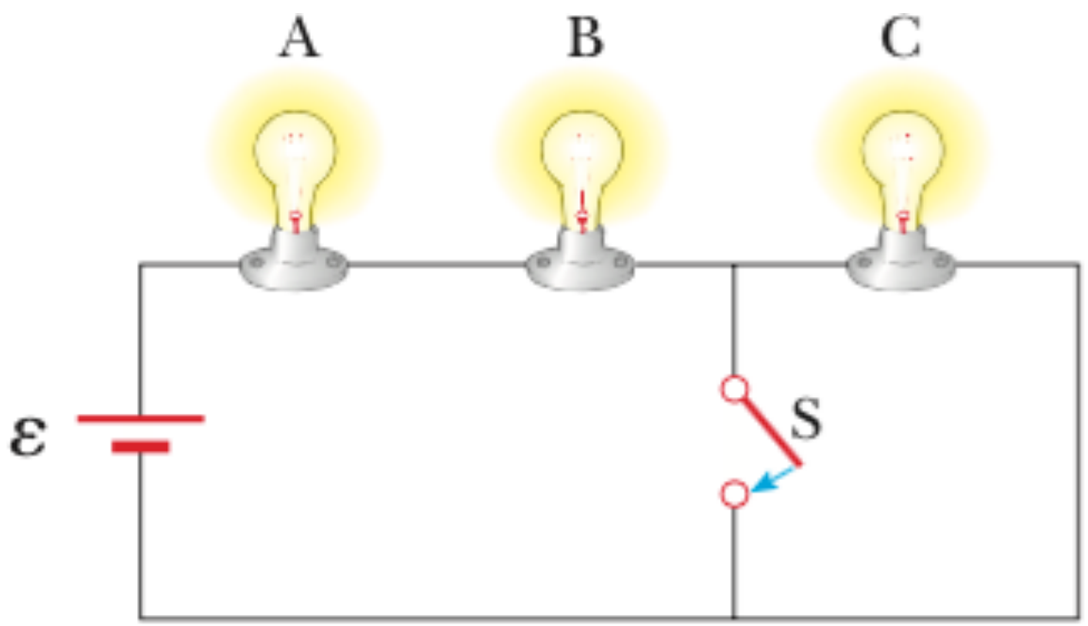
$$P_{\text{res}} = I\Delta V = I^2 R = \frac{\Delta V^2}{R}$$

Quiz Question

Which bulb is brighter?

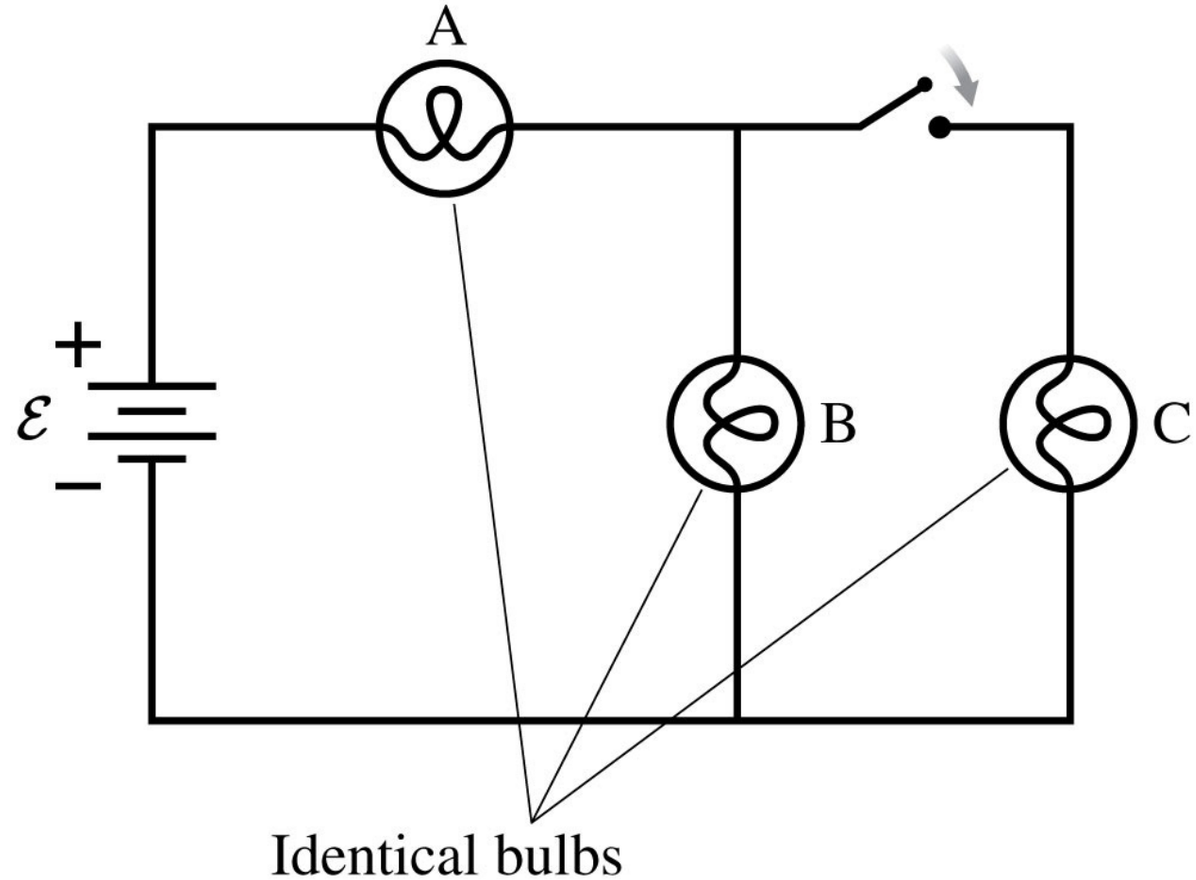
A. The 100 W bulb.
B. The 60 W bulb.
C. Their brightnesses are the same.
D. There's not enough information to tell.





What will happen to the brightness of the bulbs when the switch is closed

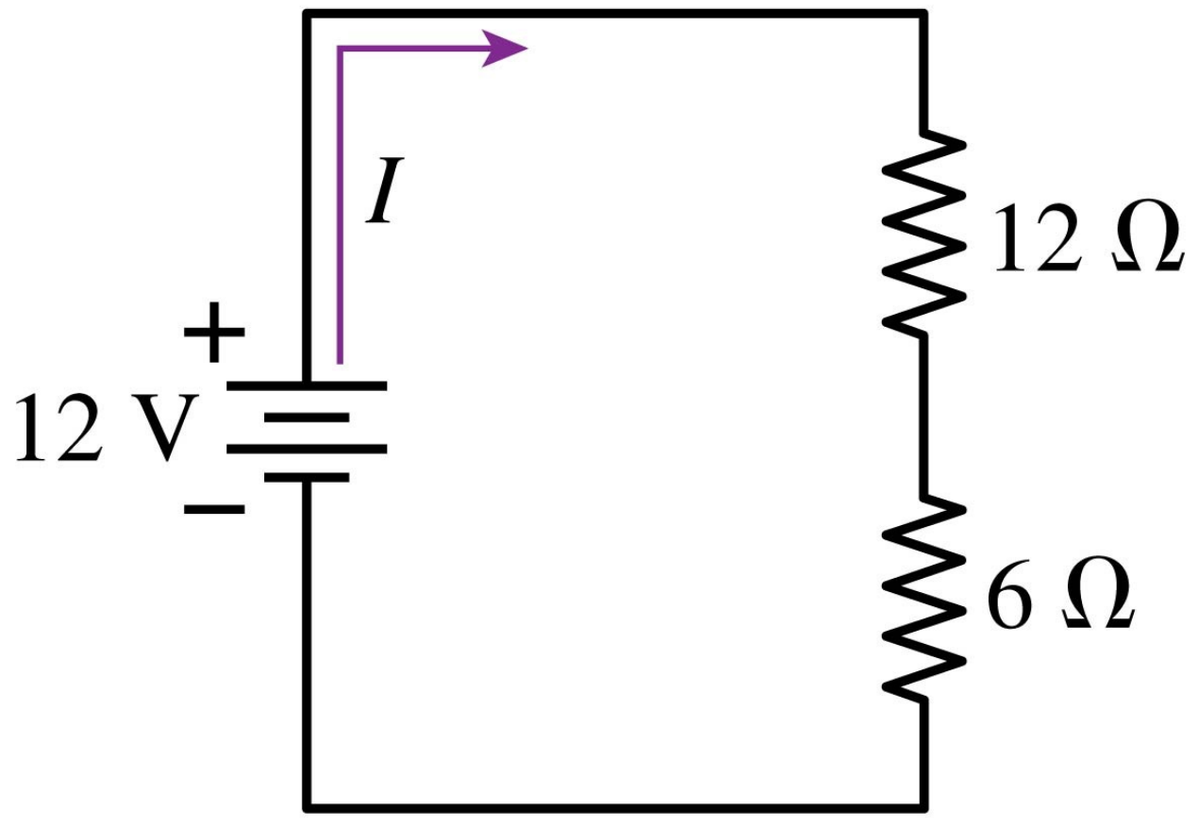
What happens to the brightness of the bulbs when the switch closes?



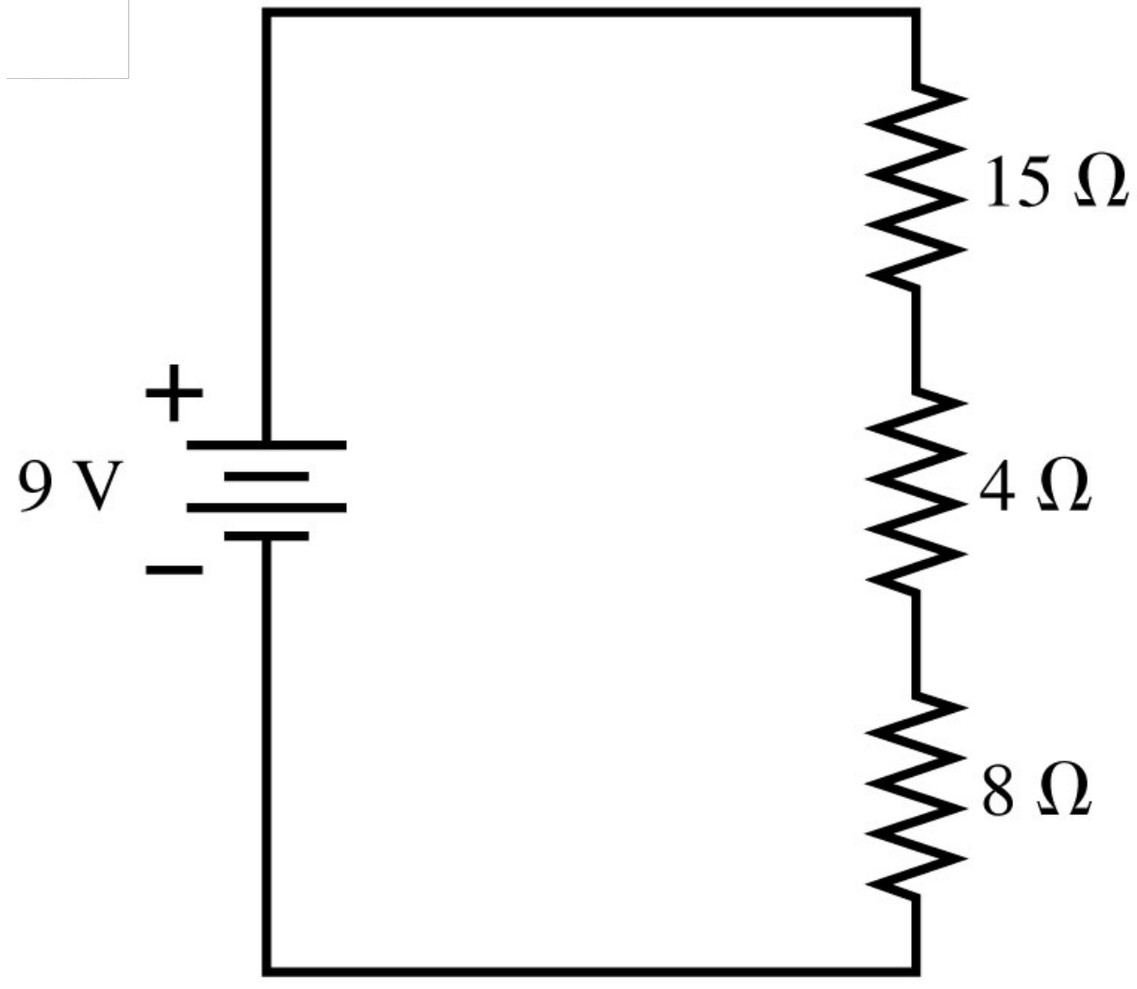
Quiz Question

The battery current *I* is

A. 3 A.
B. 2/3 A.
C. 1 A.
D. 2 A.
E. 1/2 A.



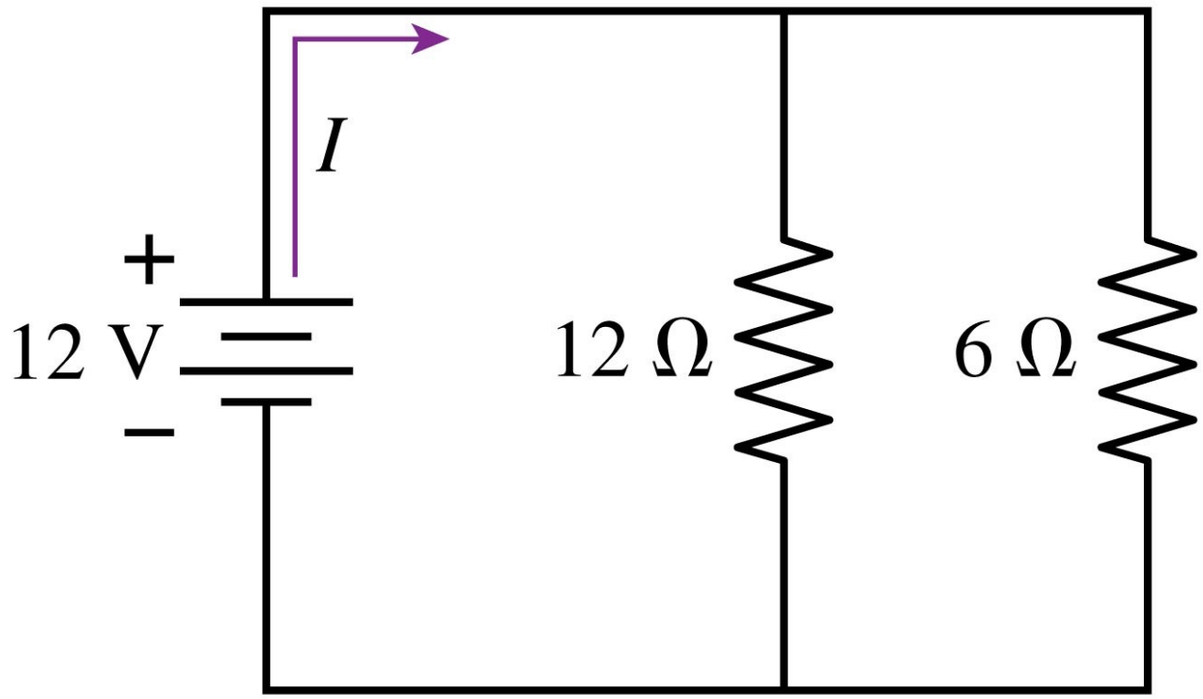
What will be the potential drop across each resistor?



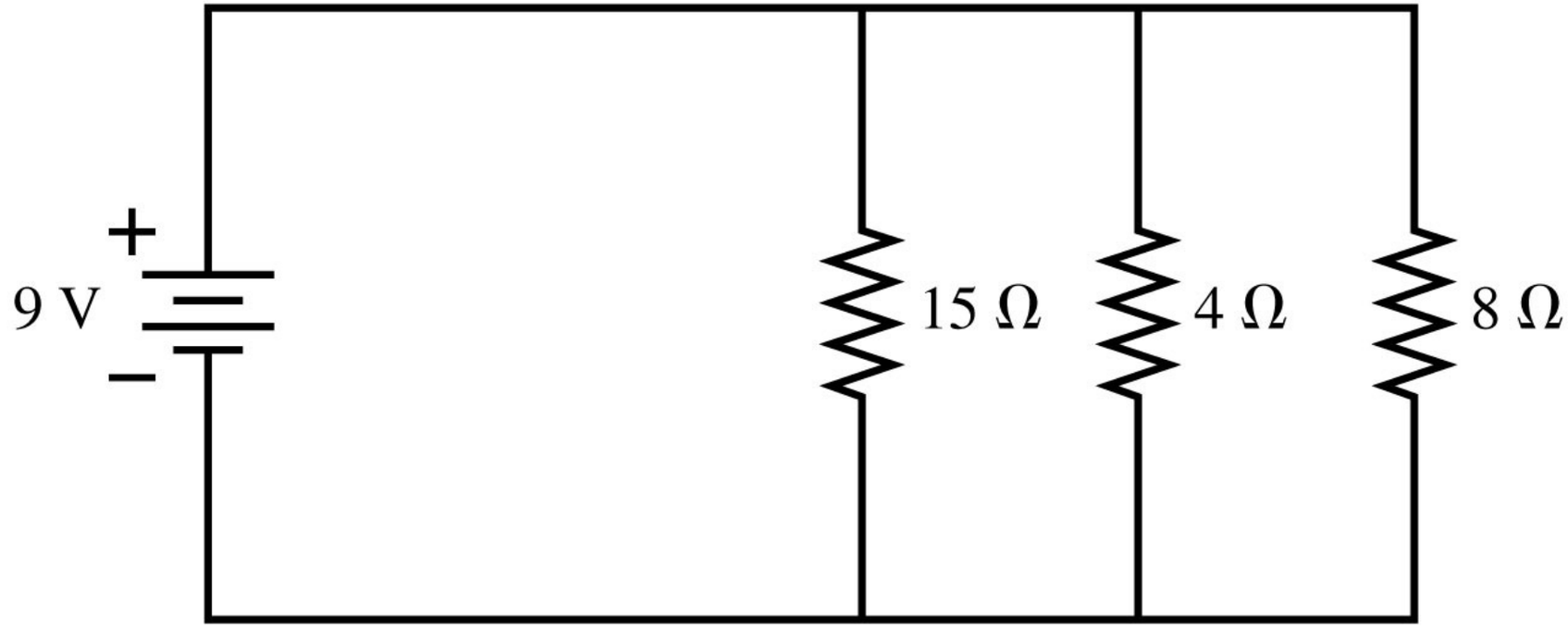
Question #11

The battery current *I* is

A. 3 A.
B. 2 A.
C. 1 A.
D. 2/3 A.
E. 1/2 A.

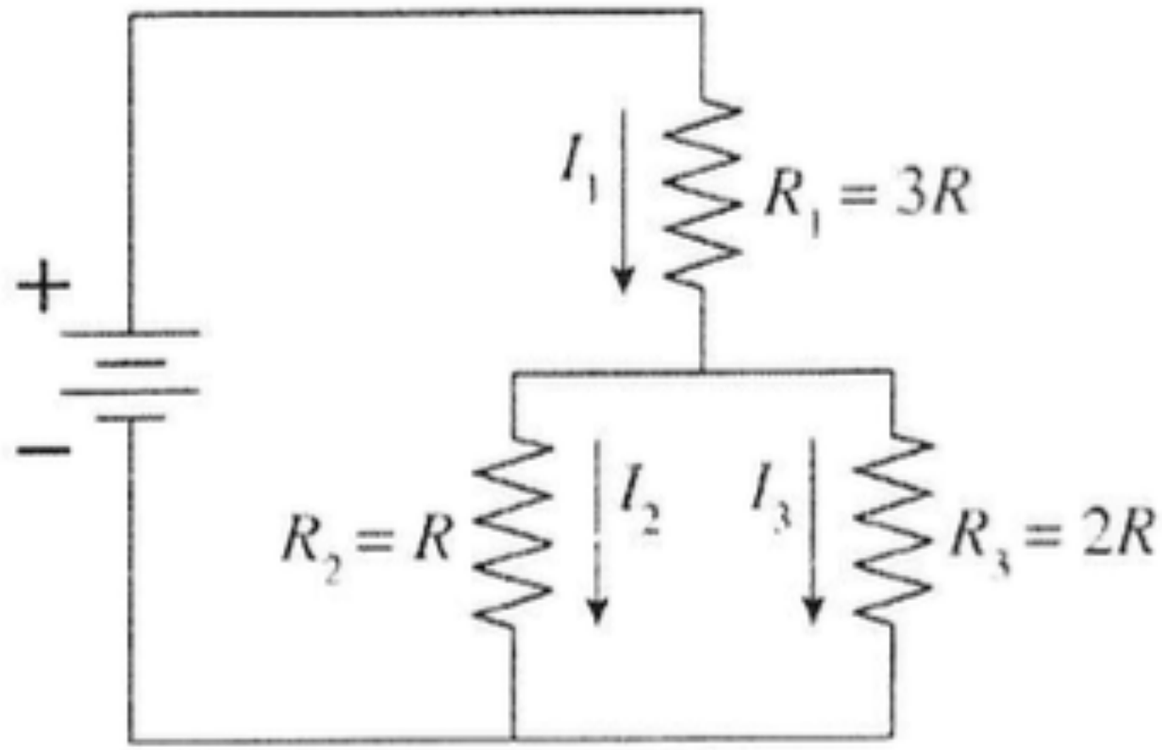


Find the current and voltage for each resistor.



Question #12

Rank the currents in the circuit



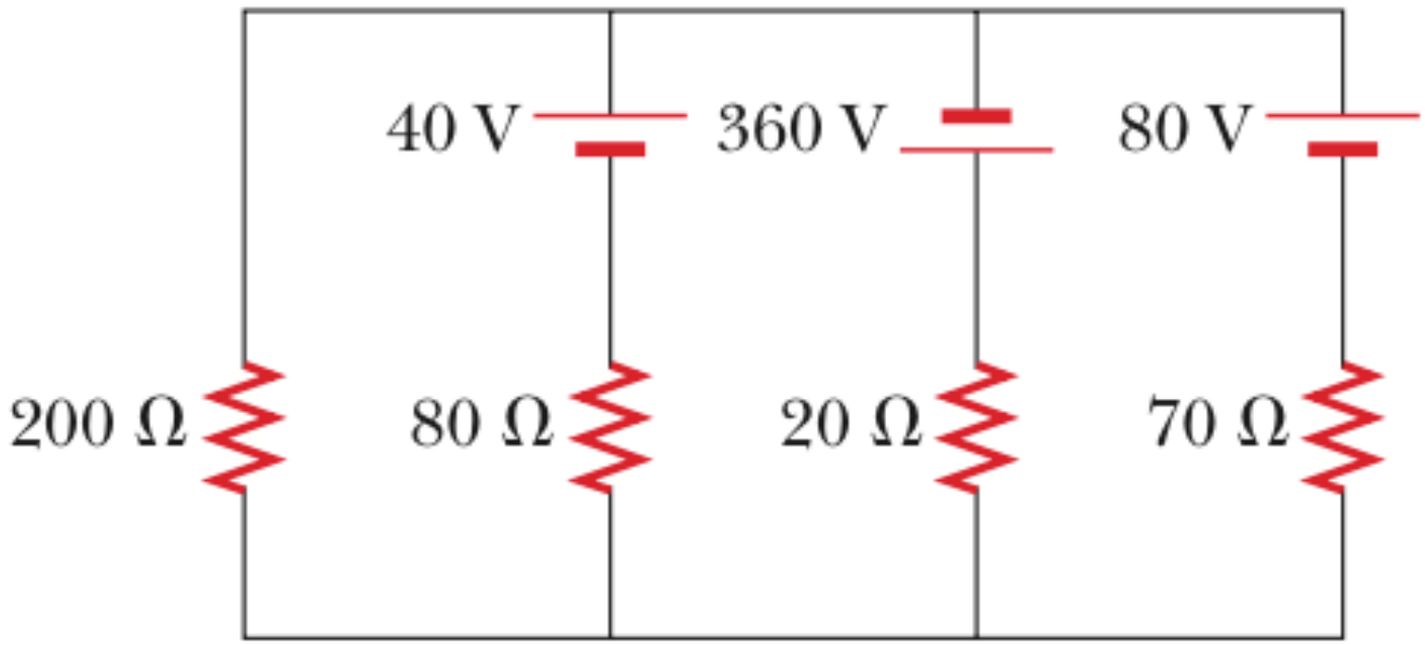
a) $I_1 = I_2 = I_3$

b) $I_1 > I_2 = I_3$

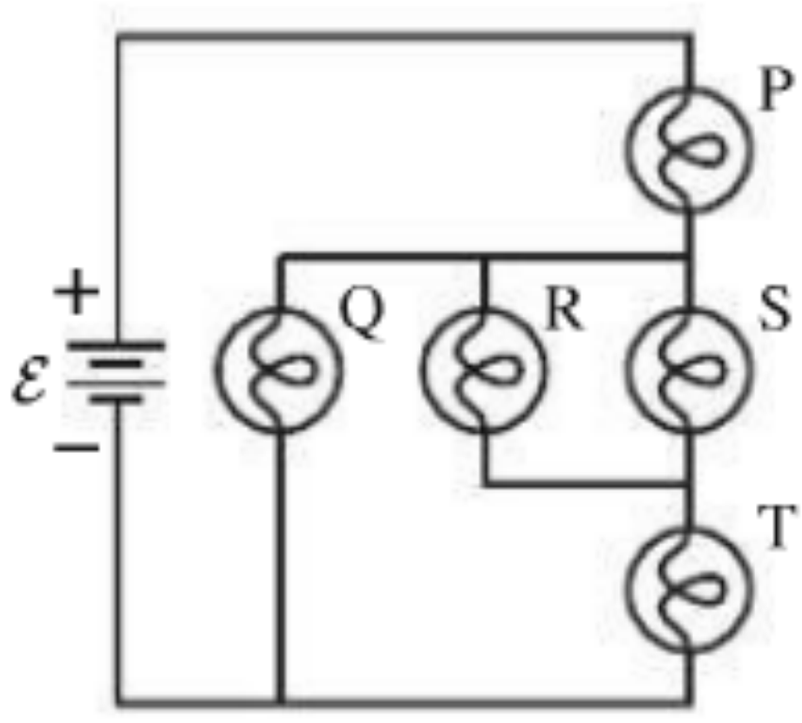
c) $I_1 < I_2 = I_3$

d) $I_1 > I_2 > I_3$

Find the current through each resistor and the voltage across the 200 Ohm resistor.

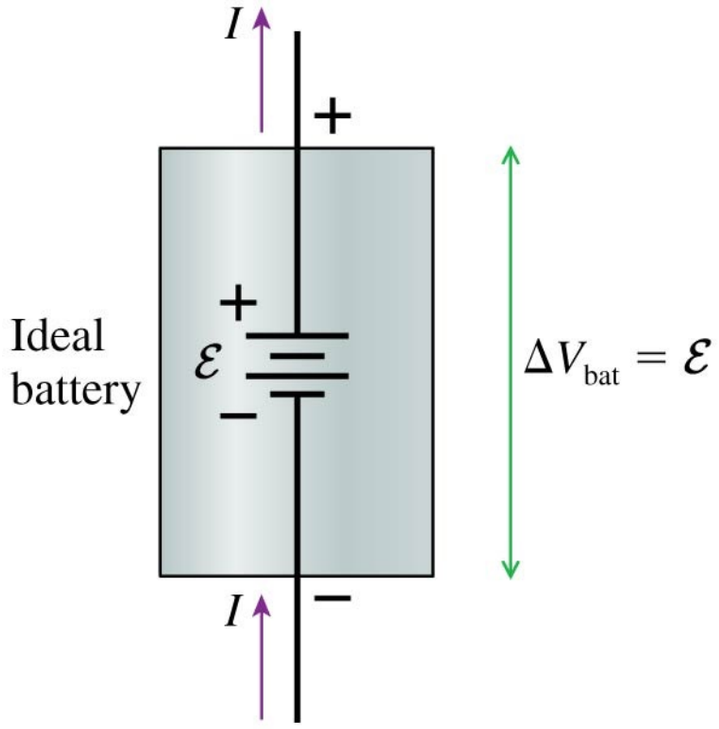


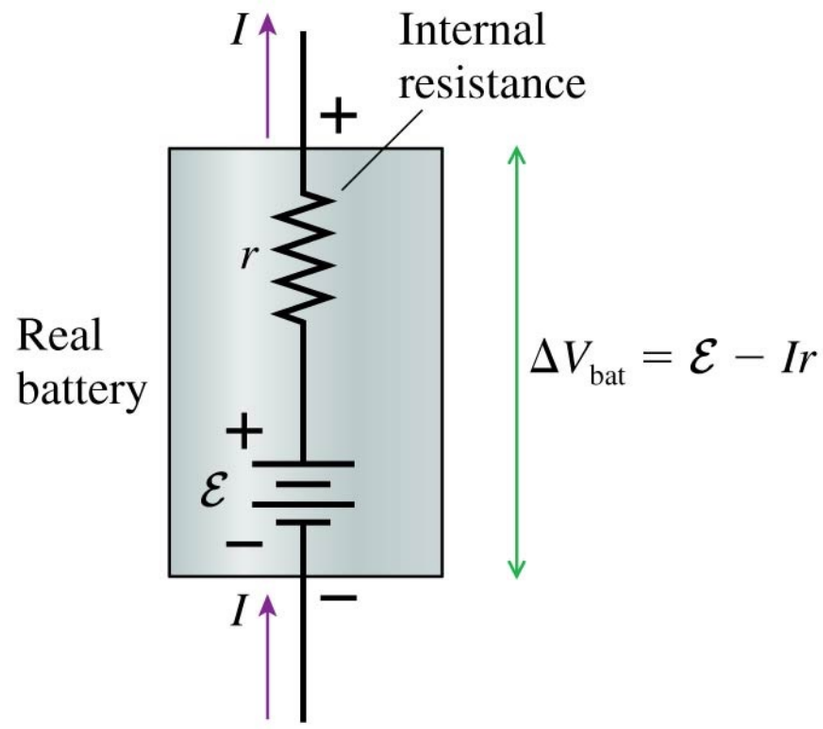
Rank the brightness of the bulbs



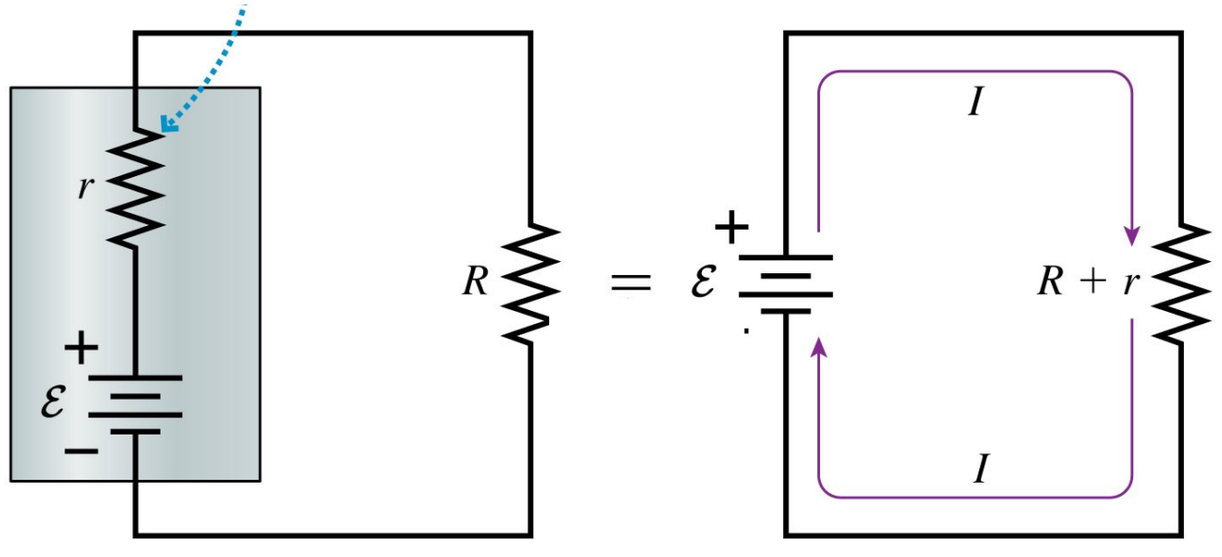
Real Batteries

The batterie's internal resistance limits the max current.





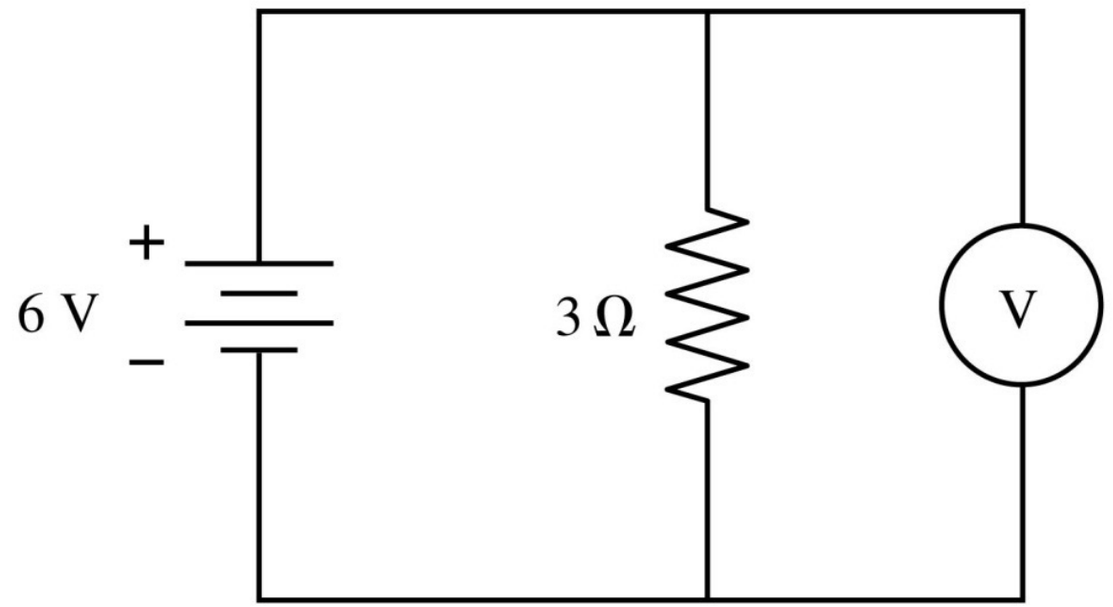
$$\Delta V_R = IR = \frac{\mathcal{E}}{R+r}R$$



Quiz Question

What does the voltmeter read?

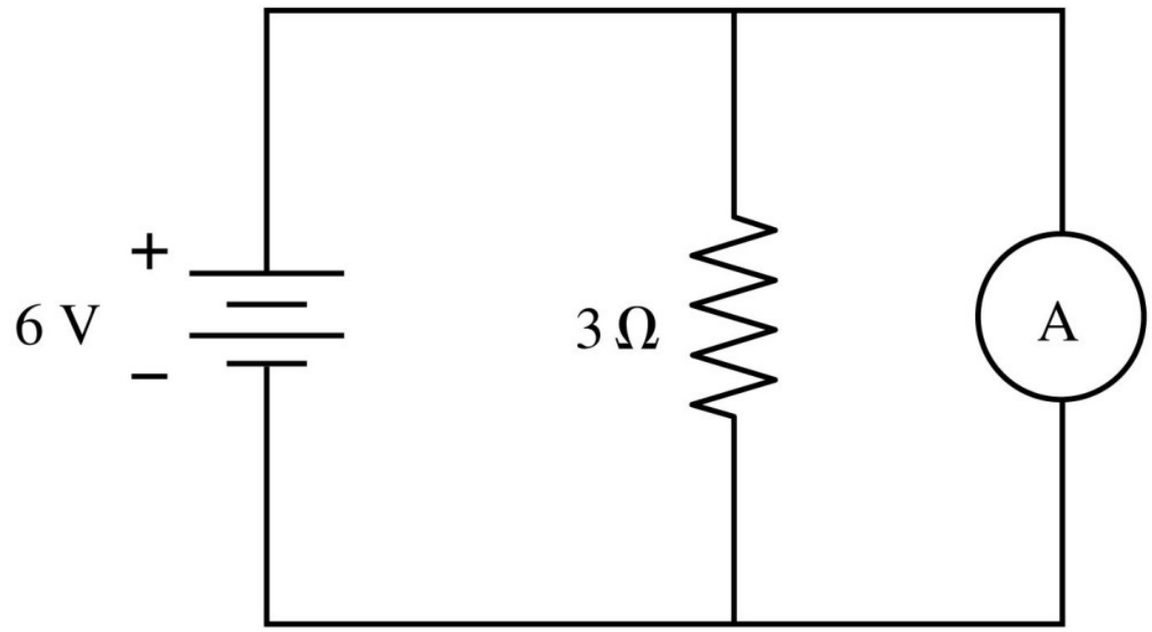
A. 3 V.
B. 6 V.
C. 2 V.
D. Some other value.
E. Nothing because this will fry the meter.



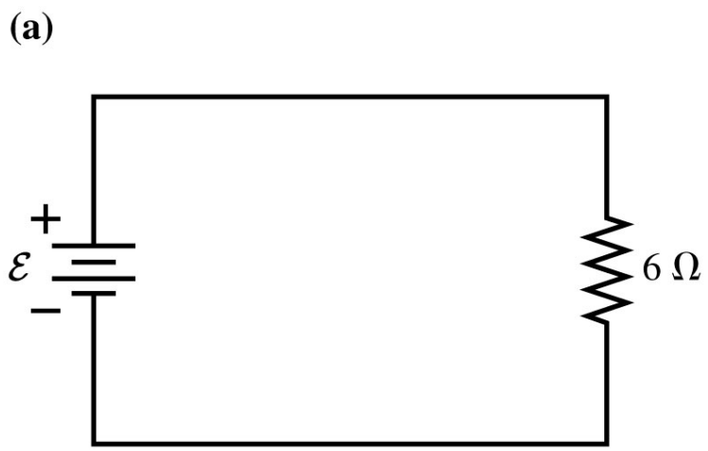
Question #14

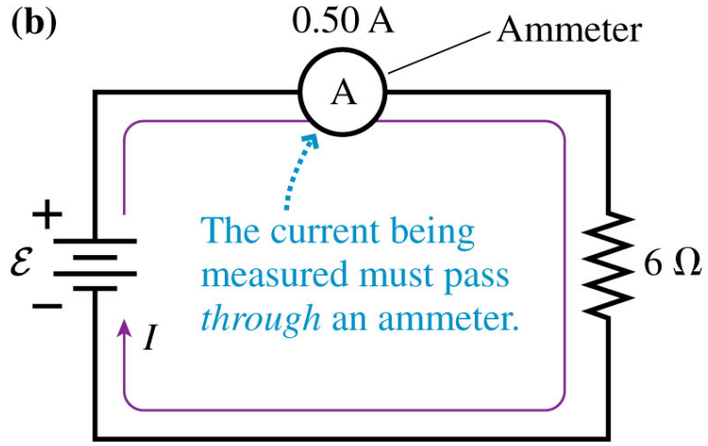
What does the ammeter read?

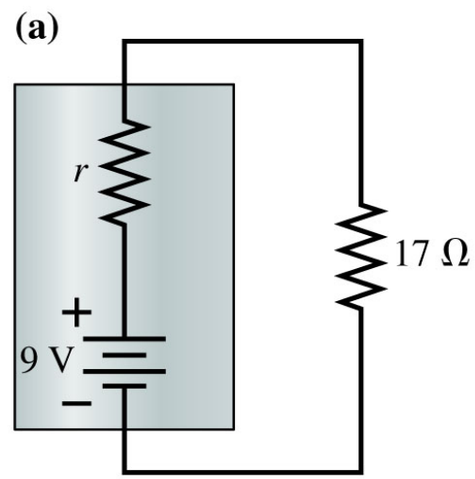
A. 6 A.
B. 2 A.
C. 3 A.
D. Some other value.
E. Nothing because this will fry the meter.

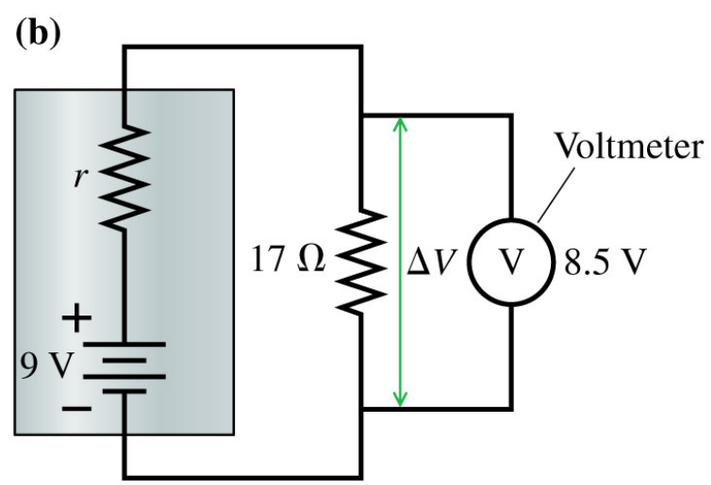


Ammeters and Voltmeters

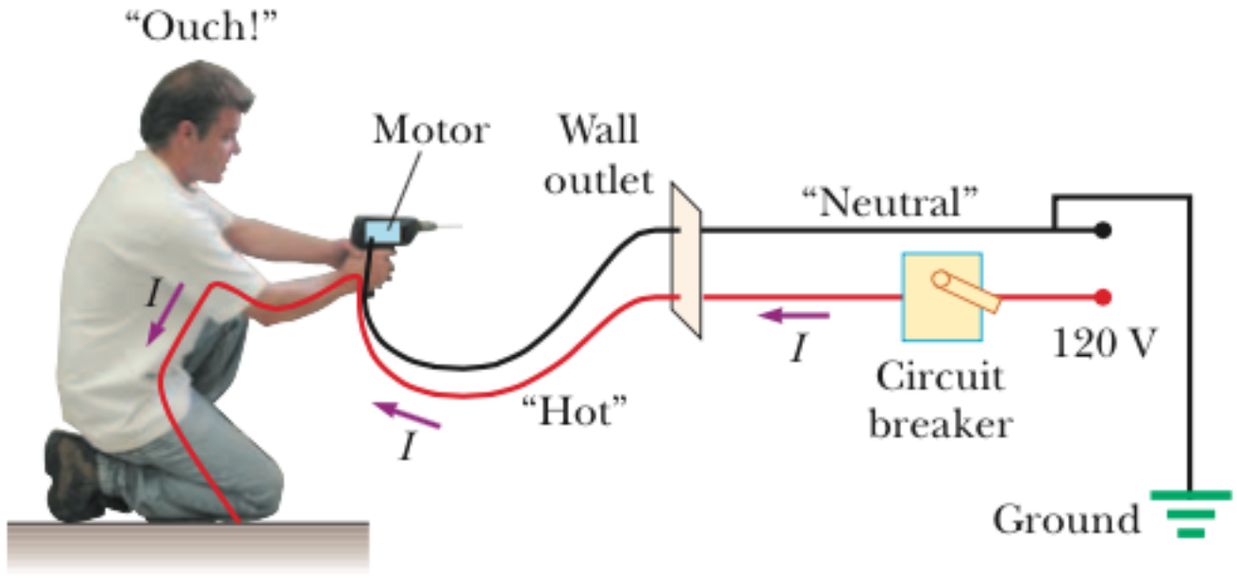




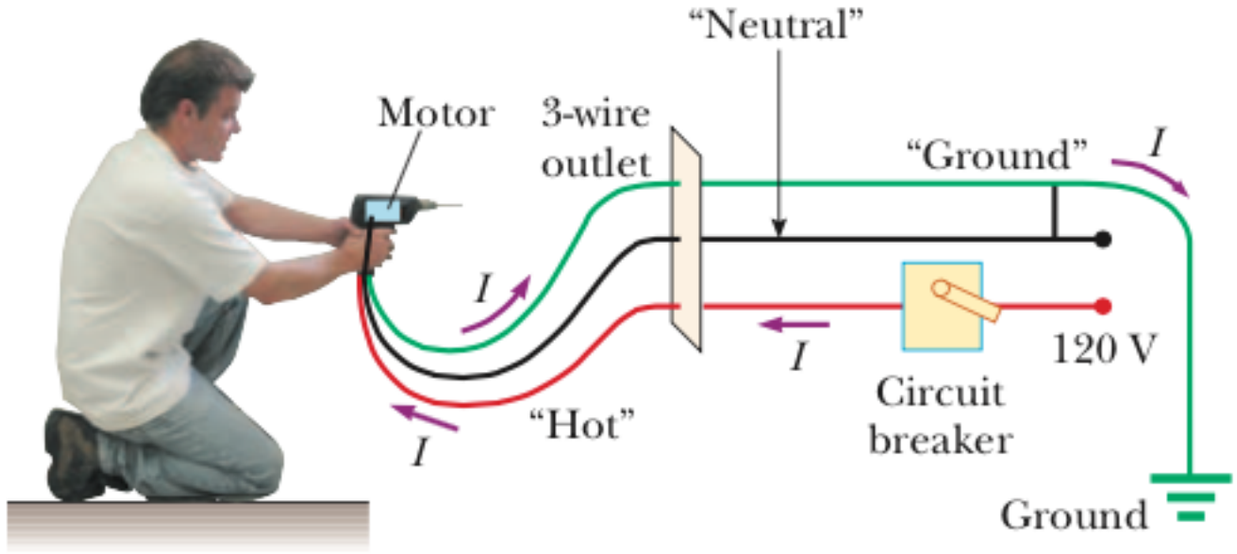




Getting Grounded



(a)



Grounding a circuit