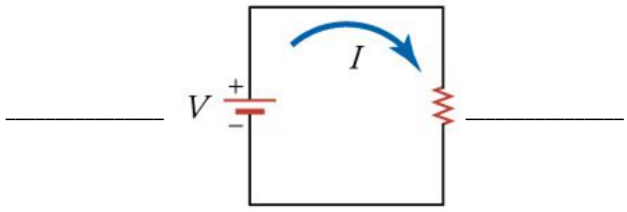
Physics 08-02 Series Circuits *Name:* _____

Electric Circuits

- Must be a complete _____
- The electric _____ at battery is high
- The electric charges flow (current) down to the _____ potential
- Along the way, the electric potential energy is used by the _____ on the circuit
- When the charges reach the low potential, there is _____ potential left. It has all been used.
- Without a complete loop, there is no _____ potential for the charges to be attracted to

- Battery: Long side is _____ , short side is _____
  - Provides the potential to make the _____ flow
- Current flows from _____ side to _____ side
- Resistor: Uses the potential to do _____



Series Wiring

- More than _____ device on _____
- Same _____ through _____ device
- Break in _____ means _____ current
- Form one _____
- The _____ divide the _____ between them

$$R_S = R_1 + R_2 + R_3 + \cdots$$

A 5.17 kΩ resistor and a 10.09 kΩ resistor are connected in series. What is the equivalent resistance?

Bathroom vanity lights are often wired in series. V = 120 V and you install 3 bulbs with R = 8 Ω and 1 bulb with R = 12 Ω. What is the current, voltage of each bulb, and the total power used?

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Practice Work

1. Why must the circuit be a closed loop?
2. What is the voltage across the open switch Figure 1?
3. There is a voltage across an open switch, such as in Figure 1. Why, then, is the power dissipated by the open switch small?

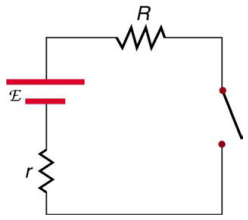

Figure 1

4. Some strings of holiday lights are wired in series to save wiring costs. An old version utilized bulbs that break the electrical connection, like an open switch, when they burn out. If one such bulb burns out, what happens to the others? If such a string operates on 120 V and has 40 identical bulbs, what is the normal operating voltage of each? Newer versions use bulbs that short circuit, like a closed switch, when they burn out. If one such bulb burns out, what happens to the others? If such a string operates on 120 V and has 39 remaining identical bulbs, what is then the operating voltage of each?
5. What is the resistance of ten 275-Ω resistors connected in series? (OpenStax 21.1) **2.75 kΩ**
6. What is the resistance of a 1.00×10^2-Ω, a 2.50-kΩ, and a 4.00-k Ω resistor connected in series? (OpenStax 21.2) **6.60 kΩ**
7. What is the resistance of 100 5-Ω Christmas light bulbs connected in series? (RW) **500 Ω**
8. Two resistors, one having a resistance of 900 kΩ, are connected in series to produce a total resistance of 0.500 MΩ. (a) What is the value of the second resistance? (b) What is unreasonable about this result? (c) Which assumptions are unreasonable or inconsistent? (OpenStax 21.13) **−400 kΩ**
9. A 50 Ω resistor and a 25 Ω resistor are connected in series with a third resistor. What is the size of the third resistor if the total resistance is 90 Ω? (RW) **15 Ω**
10. A 10 Ω, 12 Ω, and a 15 Ω resistor are connected in series with a 9 V battery. What is the (a) equivalent resistance of the circuit, (b) the current of the circuit, and (c) the voltage drop on each resistor? (RW) **37 Ω; 0.24 A; 2.4 V, 2.9 V, 3.6 V**
11. A 150 Ω and a 200 Ω resistor are connected in series with a 120 V battery. The current through the 150 Ω resistor is 0.343 A. (a) What is the current through the 200 Ω resistor? (b) What is the equivalent resistance of the circuit? (c) What is the total current through the circuit? (RW) **0.343 A; 350 Ω; 0.343 A**