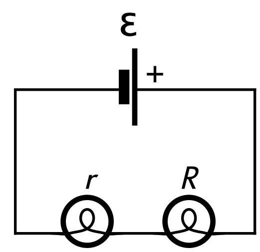
An ideal emf source is connected in series to two light bulbs with different resistances r and R, where $r < R$. (Ignore changes in bulb resistance due to temperature changes.)



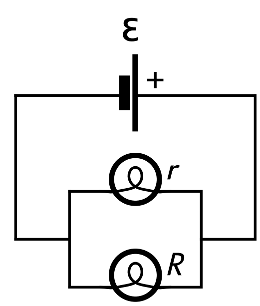
1. The light bulb __________ has [more current flowing through it / a larger potential difference / more power dissipated in it].

(A) r.
(B) R.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

2. If the r light bulb was [removed (leaving a gap) / replaced with a wire], the brightness of the R light bulb will:

(A) decrease to zero.
(B) decrease slightly, but remain lit.
(C) remain constant.
(D) increase.
(E) (Unsure/guessing/lost/help!)

An ideal emf source is connected in parallel to two light bulbs with different resistances r and R, where $r < R$. (Ignore changes in bulb resistance due to temperature changes.)



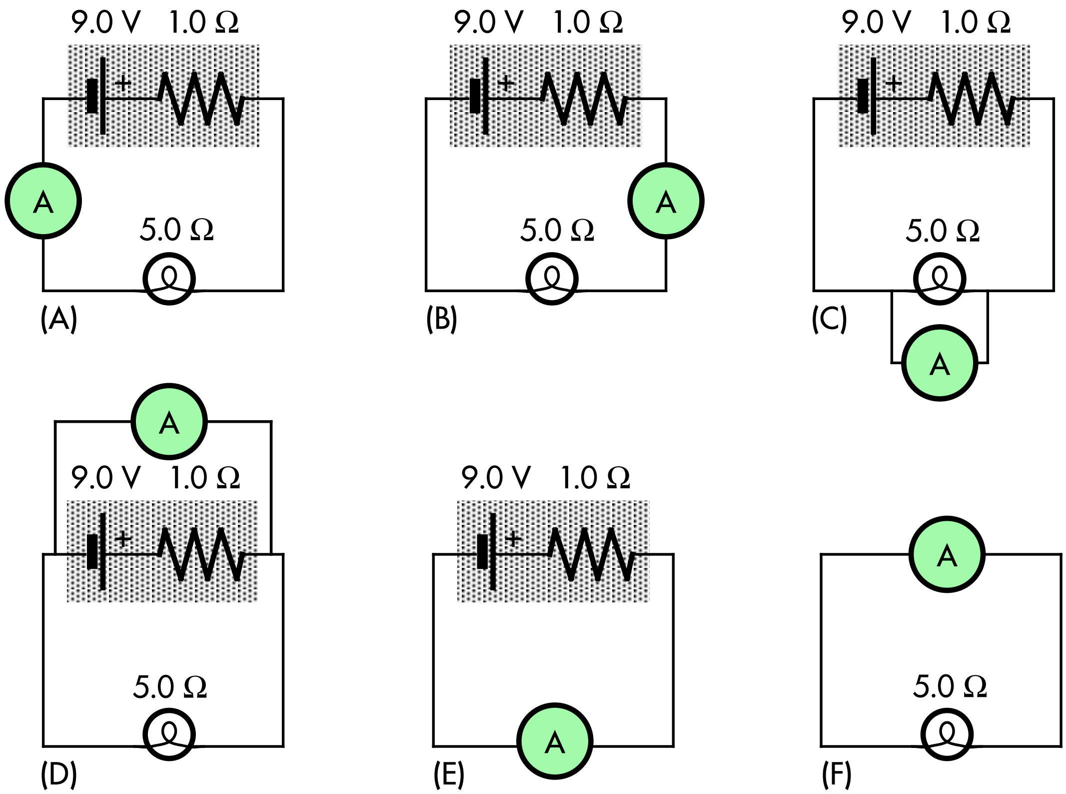
3. The __________ light bulb has [a larger potential difference / more current flowing through it / more power dissipated in it].

(A) r.
(B) R.
(C) (There is a tie.)
(D) (Unsure/guessing/lost/help!)

4. If the r light bulb was [removed (leaving a gap) / replaced with a wire], the brightness of the R light bulb will:

(A) decrease to zero.
(B) decrease slightly, but remain lit.
(C) remain constant.
(D) increase.
(E) (Unsure/guessing/lost/help!)

A real 9.0 V battery (internal resistance 1.0 Ω) is connected to a 5.0 Ω light bulb. An ideal ammeter (of negligible resistance) is then connected in different ways, as shown below.



5. Rank the ammeters from least to greatest amount of current flowing through it. Indicate ties, if any.

________ ________ ________ ________ ________ ________

(least *I*) (greatest *I*)

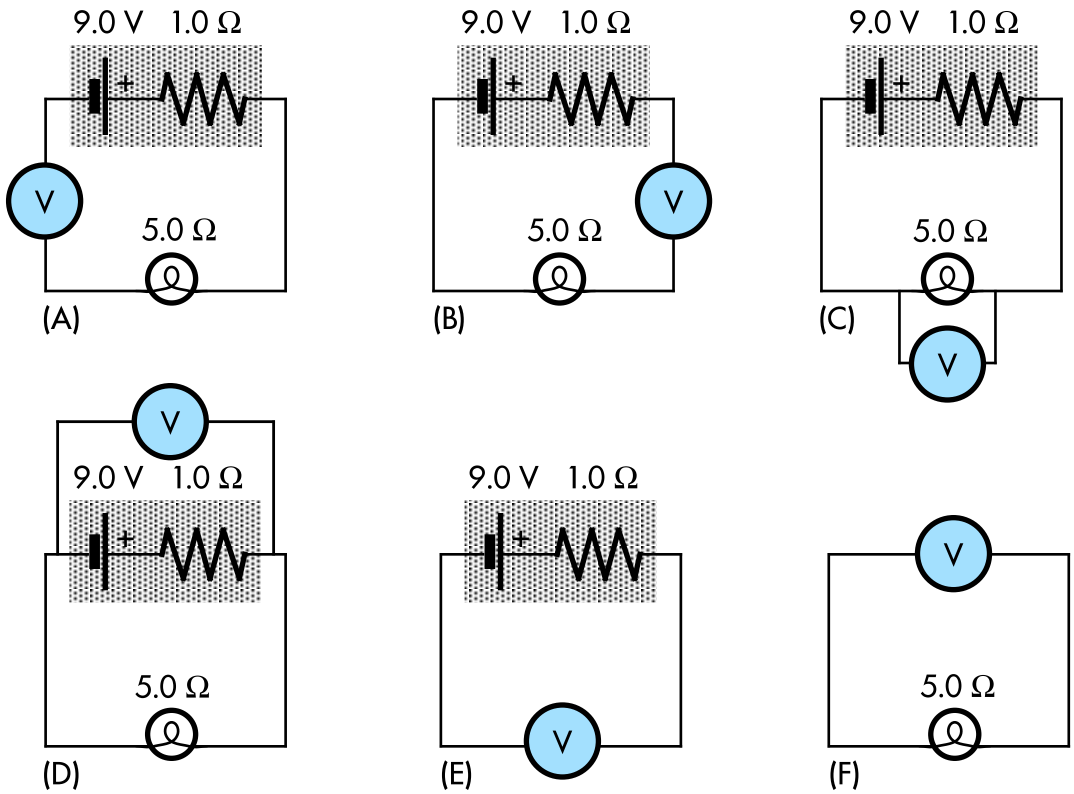
6. Identify the circuit(s) (if any) where the ammeter is properly connected to measure the current flowing through the light bulb while it is connected to the battery.

Circuit(s) with a properly connected ammeter:

7. Identify the circuit(s) (if any) where the ammeter is improperly connected such that there may be an electrical hazard.

Circuit(s) with a hazardously connected ammeter:

A real 9.0 V battery (internal resistance 1.0 Ω) is connected to a 5.0 Ω light bulb. An ideal voltmeter (of extremely high resistance) is then connected in different ways, as shown below.



8. Rank the voltmeters from lowest to highest potential difference ("voltage") reading. Ignore ± signs. Indicate ties, if any.

__________ __________ __________ __________ __________ __________

(lowest ΔV) (highest ΔV)

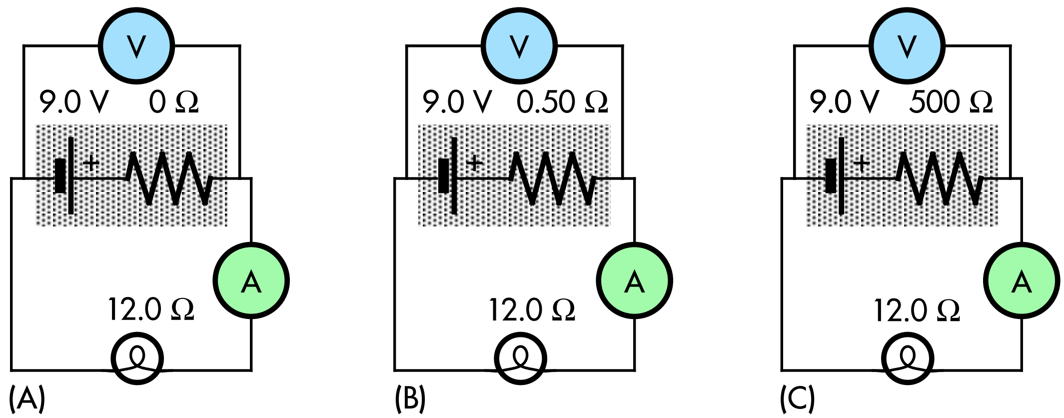
9. Identify the circuit(s) (if any) where the voltmeter is properly connected to measure the potential drop of the light bulb while it is connected to the battery.

Circuit(s) with a properly connected voltmeter:

10. Identify the circuit(s) (if any) where the voltmeter is connected such that there is a useless reading.

Circuit(s) with a uselessly connected voltmeter:

A real 9.0 V battery (with an internal resistance that increases over time with continued use) is connected to a 12.0 Ω light bulb, along with a (properly connected) ideal ammeter and (properly connected) ideal voltmeter.



11. Rank the ammeters from least to greatest amount of current flowing through it. Indicate ties, if any.

________ (least *I*) ________ ________ (greatest *I*)

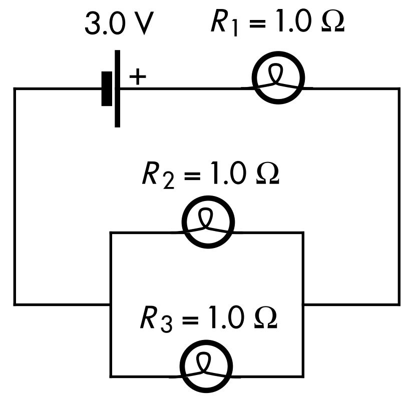
12. Rank the voltmeters from lowest to highest potential difference ("voltage") reading. Ignore ± signs. Indicate ties, if any.

________ (lowest ΔV) ________ ________ (highest ΔV)

13. Rank the light bulbs from lowest to highest power dissipated ("brightness"). Indicate ties, if any.

________ (lowest *P*) ________ ________ (highest *P*)

An ideal 3.0 V emf source and ideal identical ($R_1 = R_2 = R_3 =$ 1.0 Ω) light bulbs are connected in the circuit shown at right. (Ignore changes in bulb resistance due to temperature changes.)



14. The __________ light bulb has the [most current flowing through it / largest potential difference / most power dissipated in it].

(A) R_1.
(B) R_2.
(C) R_3.
(D) (There is a tie.)
(E) (Not enough information is given.)
(F) (Unsure/guessing/lost/help!)

15. If bulb 1 was [removed (leaving a gap) / replaced with a wire], the brightness of both bulb 2 and bulb 3 will:

(A) decrease to zero.
(B) decrease slightly, but remain lit.
(C) remain constant.
(D) increase.
(E) (Not enough information is given.)
(F) (Unsure/guessing/lost/help!)

16. If bulb 2 was [removed (leaving a gap) / replaced with a wire], the brightness of [bulb 1 / bulb 3] will:

(A) decrease to zero.
(B) decrease slightly, but remain lit.
(C) remain constant.
(D) increase.
(E) (Not enough information is given.)
(F) (Unsure/guessing/lost/help!)

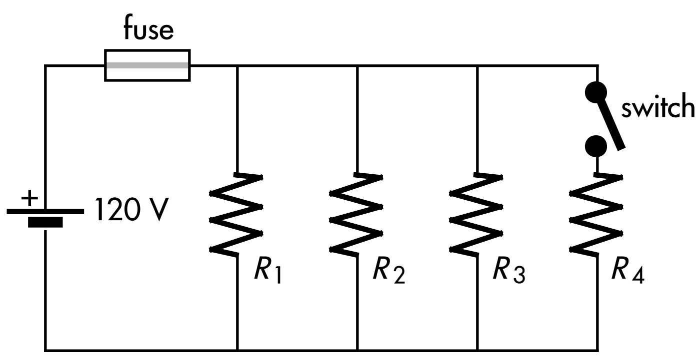
17. A 40 W bulb and a 100 W bulb are both plugged into separate 120 V electrical outlets, and both are turned on. The __________ light bulb has [more current flowing through it / a larger resistance].

(A) 40 W bulb.
(B) 100 W bulb.
(C) (There is a tie.)
(D) (Not enough information is given.)
(E) (Unsure/guessing/lost/help!)

18. A room heater from Europe that plugs into a 240 V outlet is brought back home by a Physics 205B student, (somehow) plugging it into a 120 V outlet. (Assuming that the resistance remains constant with respect to temperature), the [current through / power used by] the room heater when it is used at home will be __________ compared to Europe.

(A) greater than.
(B) the same as.
(C) less than.
(D) (Unsure/guessing/lost/help!)

Electrical appliances of the same resistance *R* are connected in parallel to an ideal 120 V emf, approximating the wiring in a typical room.



19. If the switch is closed to connect the fourth appliance, the current(s) flowing through [each of the other three appliances / the safety fuse] will __________. (Assume that the safety fuse will not blow, and that resistances remain constant with respect to temperature.)

(A) increase.
(B) remain constant.
(C) decrease.
(D) (Unsure/guessing/lost/help!)

20. $\left[\begin{array}{l}\text{electric field}\\ \text{electric potential}\\ \text{electric potential energy}\\ \text{power}\\ \text{charge}\\ \text{current}\\ \text{resistance}\\ \text{capacitance}\end{array}\right]$ is measured in units of:

(A) A (amperes).
(B) C (coulombs).
(C) F (farads).
(D) J (joules).
(E) N/C (newtons per coulomb).
(F) Ω (ohms).
(G) V (volts).
(H) W (watts).

21. The unit of $\left[\begin{array}{l}\text{A (amperes)}\\ \text{C (coulombs)}\\ \text{F (farads)}\\ \text{J (joules)}\\ \text{N/C (newtons per coulomb)}\\ \Omega\text{ (ohms)}\\ \text{V (volts)}\\ \text{W (watts)}\end{array}\right]$ is a measure of:

(A) electric field.
(B) electric potential.
(C) electric potential energy.
(D) power.
(E) charge.
(F) current.
(G) resistance.
(H) capacitance.

Equations and constants:

$m_p = 1.673\times10^{-27}$ kg; $m_e = 9.109\times10^{-31}$ kg; $m_n = 1.675\times10^{-31}$ kg; $|e| = 1.602\times10^{-19}$ C.

$$C = \frac{Q}{\Delta V};\ C = \frac{A}{4\pi kd} = \frac{\varepsilon_0 A}{d};\ k = 8.99\times10^9\ \frac{\text{N}\cdot\text{m}^2}{\text{C}^2};\ \Delta V = -Ed;\ U_E = \frac{1}{2}Q(\Delta V).$$

$$I = \frac{\Delta q}{\Delta t};\ I = \frac{\Delta V}{R};\ P = I(\Delta V);\ \sum I_{in} = \sum I_{out};\ \sum_{loop}\Delta V_{rises} = \sum_{loop}\Delta V_{drops};\ R_{eq} = \sum R_i;\ \frac{1}{R_{eq}} = \sum\frac{1}{R_i}.$$