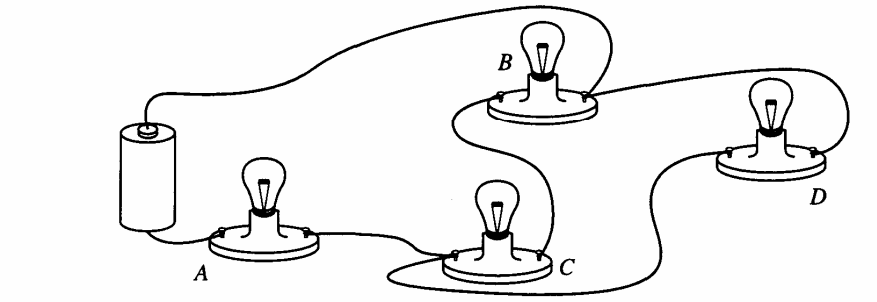
A-Day Due Mon., May 4
B-Day: Due Tues., May 5

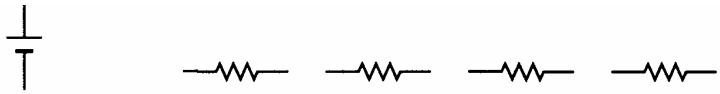
2009 PreAP Circuits 5

These are questions Mr. Parsons have for us to do. B-day should have been given them in class.



Part I. In the circuit shown above, A, B. C, and D are identical lightbulbs. Assume that the battery maintains a constant potential difference between its terminals (i.e., the internal resistance of the battery is assumed to be negligible) and the resistance of each lightbulb remains constant.

a. Draw a diagram of the circuit in the box below, using the following symbols to represent the components in your diagram. Label the resistors A, B. C, and D to refer to the corresponding lightbulbs.



Battery Resistors

Draw your diagram in this box only.

b. List the bulbs in order of their brightnesses, from brightest to least bright. If any two or more bulbs have the same brightness, state which ones. Justify your answer.

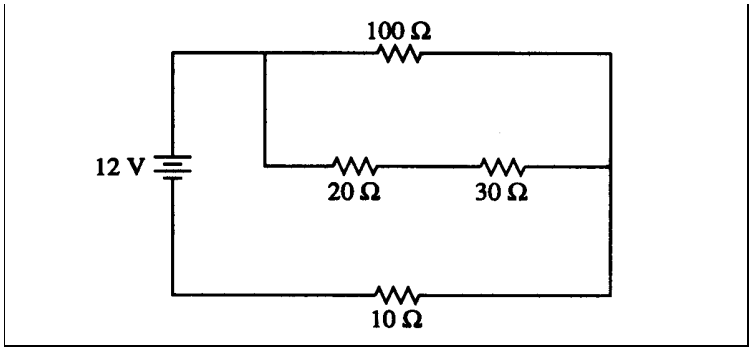
c. Bulb D is then removed from its socket.
   i. Describe the change in the brightness, if any, of bulb A when bulb D is removed from its socket. Justify your answer.

   ii. Describe the change in the brightness, if any, of bulb B when bulb D is removed from its socket. Justify your answer.

Part II—A student is provided with a 12.0-V battery of negligible internal resistance and four resistors with the following resistances: 100 W, 30 W, 20 W, and 10 W. The student also has plenty of wire of negligible resistance available to make connections as desired.

a. Using all of these components, draw a circuit diagram at the right in which each resistor has nonzero current flowing through it, but in which the current from the battery is as small as possible.

b. Using all of these components, draw a circuit diagram at the right in which each resistor has nonzero current flowing through it, but in which the current from the battery is as large as possible (without short circuiting the battery).

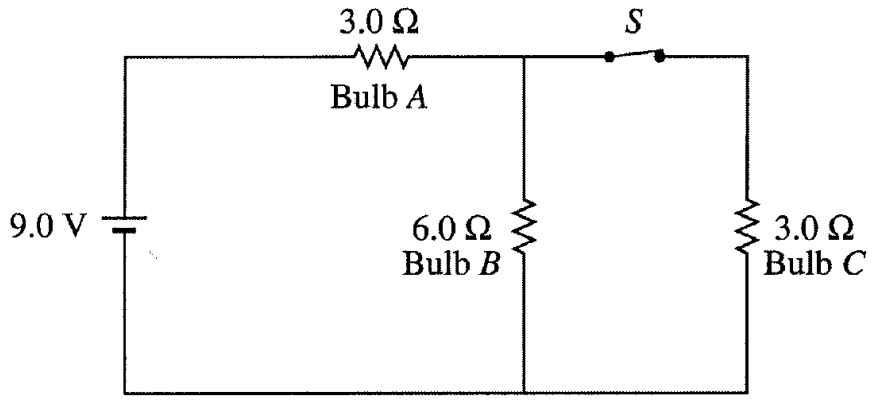


The battery and resistors are now connected in the circuit shown at the left.

c. Determine the following for this circuit.
   i. The current in the 10-W resistor

   ii. The total power consumption of the circuit

d. Assuming that the current remains constant, how long will it take to provide a total of 10 kJ of electrical energy to the circuit?



Part III—Lightbulbs of fixed resistance 3.0 W and 6.0 W, a 9.0 V battery, and a switch *S* are connected as shown in the schematic diagram above. The switch *S* is closed.

A. Calculate the current in bulb *A*.

B. Which lightbulb is brightest?
Justify your answer.

C. Switch *S* is then opened. By checking the appropriate spaces below, indicate whether the brightness of each light bulb increases, decreases, or remains the same. Explain your reasoning for each lightbulb.

i. Bulb *A*: The brightness ____ increases ____decreases ____ remains the same
Explanation:

ii. Bulb *B*: The brightness ____increases ____decreases ____remains the same
Explanation:

iii. Bulb *C*: The brightness ____increases ____decreases ____ remains the same
Explanation: