Physics II - Quiz #3

December 15, 2007

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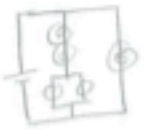
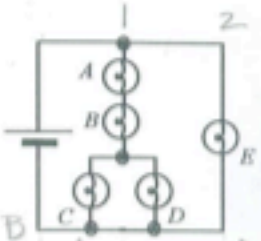


Name Wendy Wong

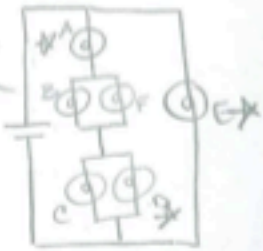
Consider the circuit diagram at right. The bulbs are identical and the battery is ideal. (You may assume that if current is flowing through a bulb that it will light.)



A. Rank the bulbs *A-E* according to brightness. Explain your reasoning – how you determined your ranking.

Bulb E will be the brightest because it is the only bulb creating resistance on its branch. Bulbs A & B are equally bright but dimmer than bulb E because they are in series to each other & in series w/ the parallel network of bulbs C and D. The same current goes through both bulbs A & B, but half the current goes through bulbs C and D. Bulbs C and D are equally bright but dimmer than bulbs A & B. Because the branch where bulbs A, B, C, & D are on has more resistance than the branch where bulb E is on, more current flows through the branch w/ bulb E. Bulbs C and D are in parallel, and the same amount of current flows through each of them, but twice the amount of current flows through their branch and through bulbs A & B. (The ranking of brightness: E > A & B > C & D)

B. Suppose a bulb *F* were added in parallel to bulb *B*. For bulbs A, D and E only, state whether the brightness of that bulb will *increase, decrease,* or *remain the same* in response to this addition. Explain your reasoning in each case.



The brightness of bulb E will not change because its branch is independent of the other branch where another bulb is added. Because two bulbs in parallel creates less resistance than one bulb in series w/ another bulb or network, the addition of bulb F in parallel with bulb B decreases the resistance at that branch. Therefore, bulb A would get brighter w/ more current flowing through it. Bulb D would also get brighter because half of the increased current flows through it. The current flowing through bulb D also increased. Nice!

The resistance of the parallel network of bulbs B & F is less than the resistance of bulb B alone, so the resistance of the entire branch has decreased and the current flow through the entire branch has increased.

Continued on reverse.....