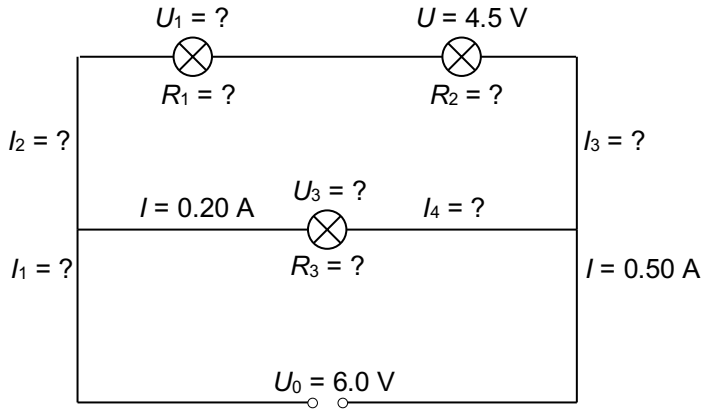
1. Three light bulbs are connected in a circuit as shown in the diagram. Determine the missing values.



2. Three identical light bulbs are connected in series to a battery of 4.5 V. The total current that flows out of the battery is 78 mA.

a) What is the current through one of the lamps?

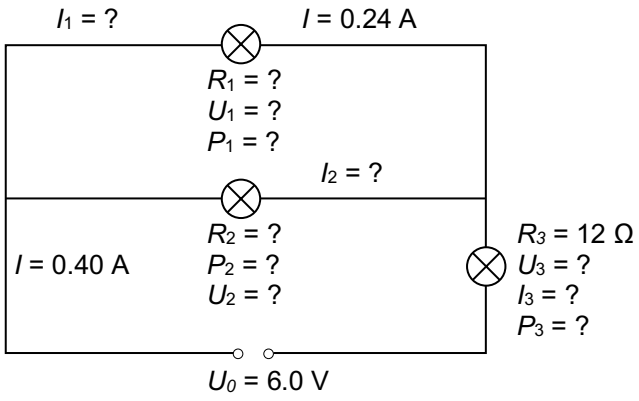
b) What is the voltage across one of the lamps?

3. Three identical light bulbs are connected in parallel to a battery of 4.5 V. The total current that flows out of the battery is 78 mA.

c) What is the current through one of the lamps?

d) What is the voltage across one of the lamps?

4. Three light bulbs are connected in a circuit as shown in the diagram. Determine the missing values.



5. A lamp for 12.0 V and 2.50 A is to be operated at a power outlet of 230 V. A resistor connected in series to the lamp can supply the correct voltage for the lamp.

a) What is the resistance of the resistor in series?
Hint: First calculate the voltage needed across the resistor for the voltage over the lamp to be 12.0 V. Then determine the magnitude of the current passing through the resistor and calculate the resistance.

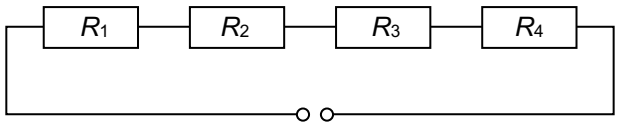
b) Compare the power of the lamp with the power absorbed by the resistor. Why is this way of operating a lamp unreasonable?

6. A current of 0.100 A flows through a resistor of 6.00 Ω. A second resistor is to be connected to the first one in parallel, so that the total current will be 6.00 A. Determine the magnitude of the second resistor.

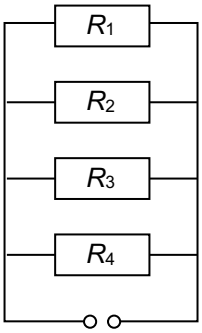
7. Four resistors R_1 = 10 Ω, R_2 = 20 Ω, R_3 = 50 Ω, R_4 = 100 Ω are connected according to A, B, C, and D. The total voltage applied across each circuit is 24 V. Determine for A, B, C and D

a) the equivalent resistance
b) the voltage applied across each resistor
c) the magnitude of the current that passes through each resistor

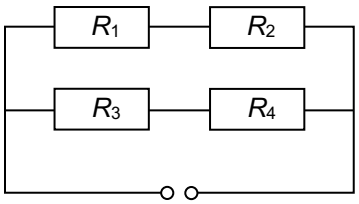
A



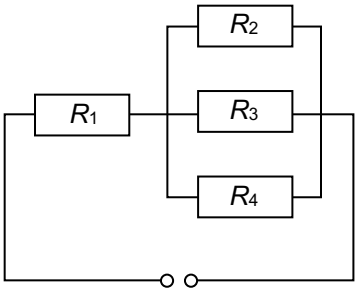
B



C



D



8. An incandescent light bulb of 60 W/220 V and a light bulb of 100 W/220 V are connected in series to a power outlet of 220 V. None of them is a bright as it should be.
Assumption: The resistance of the light bulbs is a constant.

a) Calculate the indiviual resistances of both light bulbs, as well as their equivalent resistance.
b) What is the current passing through both lamps?
c) What are the voltages across each lamp?
d) What is the electric power supplied to each lamp?

Solutions:

1. U_1 = 1.5 V U_3 = 6.0 V I_1 = 0.50 A I_2 = 0.30 A I_3 = 0.30 A I_4 = 0.20 A R_1 = 5.0 Ω R_2 = 15 Ω R_3 = 30 Ω
2. a) 78 mA b) 1.5 V
3. a) 26 mA b) 4.5 V
4. I_1 = 0.24 A, R_1 = 5 Ω, U_1 = 1.2 V, P_1 = 0.288 W
   I_2 = 0.16 A, R_2 = 7.5 Ω, U_2 = 1.2 V, P_2 = 0.192 W
   I_3 = 0.4 A, U_3 = 4.8 V, P_3 = 1.92 W
5. a) 87.2 Ω b) P_{lamp} = 30.0 W, $P_{resistor}$ = 545 W
6. 0.102 Ω
7. A: a) 180 Ω b) U_1 = 1.33 V, U_2 = 2.66 V, U_3 = 6.66 V, U_4 = 13.3 V c) I = 0.133 A
   B: a) 5.55 Ω b) U = 24 V c) I_1 = 2.4 A, I_2 = 1.2 A, I_3 = 0.48 A, I_4 = 0.24 A
   C: a) 25 Ω b) U_1 = 8 V, U_2 = 16 V, U_3 = 8 V, U_4 = 16 V
   c) I (upper branch) = 0.8 A, I (lower branch) = 0.16 A
   D: a) 22.5 Ω b) U_1 = 10.66 V, U_2 = U_3 = U_4 = 13.3 V c) I_1 = 1.066 A, I_2 = 0.66 A, I_3 = 0.266 A, I_4 = 0.133 A
8. a) R_{60W} = 807 Ω, R_{100W} = 484 Ω, R_{eq} = 1291 Ω b) 0.17 A
   c) U_{60W} = 138 V, U_{100W} = 82 V d) P_{60W} = 23.5 W, P_{100W} = 13.9 W