Series Circuits

1. Two resistors, R_1 and R_2 are in series with a 12 V battery. $R_1 = 10\ \Omega$ and $R_2 = 14\ \Omega$ Find I_1, I_2, V_1 and V_2. *(0.50 A, 0.50 A, 5.0 V, 7.0 V)*

2. Three resistors are in series with an ammeter and a battery. If R_1, R_2 and R_3 are $3\ \Omega, 2\ \Omega$, and $1\ \Omega$ respectively and the ammeter is reading 7.5 A, find I_1, V_T, V_1, V_2, and V_3. *(7.5 A, 45 V, 22.5 V, 15 V, 7.5 V)*

3. A battery has a terminal voltage of 24 V, and is in series with $R_1 = 8\ \Omega$, and R_2. If the current is 2 A, find R_2, V_1, V_2, and I_2. *($4\ \Omega, 16V, 8.0V, 2.0A$)*

4. A battery is connected in series with two resistors of 10 Ω and 20 Ω respectively. If the current in the circuit is 2.0 A, find the potential difference across each resistor and the potential difference of the battery. *(2.0 V, 4.0 V, 6.0 V)*

5. The load across a 12 V battery consists of a series combination of three resistances of $15\ \Omega, 21\ \Omega$, and $24\ \Omega$.
   a. What is the total resistance? *($60\ \Omega$)*
   b. What is the circuit current? *($0.20A$)*
   c. What is the potential difference across each of the resistances? *(3.0 V, 4.8 V, 4.2 V)*

6. What resistances must be added to the following so that they may be properly used with a 6.6 V battery?
   a. A 100 Ω resistance using 5.0 mA. *($1220\ \Omega$)*
   b. A lamp using 0.20 A at 4.8 V *($9.0\ \Omega$)*
   c. A 15 Ω resistance that requires 3.6 V *($12.5\ \Omega$)*
   d. A 5.0 Ω resistance using 0.80 A *($3.3\ \Omega$)*
   e. A device that requires 3.0 A at 5.0 V *($0.53\ \Omega$)*
   f. A 25 Ω resistance using 5.0 V *($8.0\ \Omega$)*

Parallel Circuits

1. A 6.0 V battery is combined in parallel with two resistors of 50 Ω and 10 Ω respectively. Find I_T and the current through each resistor. *(0.72 A, 0.12 A, 0.60 A)*

2. A 40 volt battery is connected in parallel with three resistors: $R_1 = 50\ \Omega$, $R_2 = 10\ \Omega$, and $R_3 = 20\ \Omega$. Find I_T, V_1, V_2, V_3, I_1, I_2, and I_3. *(6.8 A, 40 V, 40 V, 40 V, 0.80 A, 4.0 A, 2.0 A)*

3. Find the resistance of
   a. three 15 Ω resistances in parallel; *($5.0\ \Omega$)*
   b. eight 24 Ω resistances in parallel; *($3.0\ \Omega$)*
   c. and one thousand 47 Ω resistances in parallel. *($0.047\ \Omega$)*

4. A 4.0 Ω and a 6.0 Ω resistance are connected in parallel across a 6.0 V battery.
   a. What is the total current in the circuit? *(2.5 A)*
   b. What is the current in each of the two resistances? *(1.5 A, 1.0 A)*

5. A battery and three resistances are in parallel: $R_1 = 100\ \Omega$, $R_2 = 200\ \Omega$, and $R_3 = 300\ \Omega$. If $I_T = 2.0A$, find the current through each resistance and the terminal voltage of the battery. *(1.09 A, 0.55 A, 0.36 A, 109 V)*

6. In building a circuit, a 20 Ω resistor is desired, but none of this magnitude are available, although one of 25 Ω is. What resistance could be put in parallel with the 25 Ω to give the desired value? Could you do this with only 25 Ω resistors? How? *(100 Ω)*

7. An outlet in a North American home typically supplies 120 V. If you were to use a device that required 200 W of power, what would the current be? When you plug more than one device into the same outlet (via extension cord, power bar, etc.) you are actually connecting these in parallel. If you were to plug six 200 W devices into the same outlet, what would the current in the circuit be then (I_T)? Using this, explain why a fuse may blow when you "overload" a circuit. *(1.67 A, 10 A)*

Combination Circuits

1. A load connected across a 12 V battery consists of the resistance $R_1 = 40\ \Omega$ in series with the parallel combination of $R_2 = 30\ \Omega$ and $R_3 = 60\ \Omega$.
   a. What is the current through R_1? *(0.20 A)*
   b. What is the potential drop across each resistor? *(8.0 V, 4.0 V, 4.0 V)*
   c. What are the currents through R_2 and R_3? *(0.13 A, 0.067 A)*

2. Resistors R_1, R_2, and R_3 have resistances of $15\ \Omega, 9.0\ \Omega$ and $8.0\ \Omega$ respectively. R_1 and R_2 are in series and the combination is in parallel with R_3 to form the load across two 6.0 V batteries connected in parallel.
   a. Determine the total current in the circuit. *(1.0 A)*
   b. What is the current in the R3 branch? *(0.75 A)*
   c. What is the potential difference across R2? *(2.3 V)*

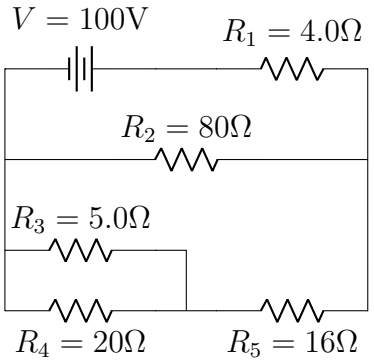
3. Two resistors, R_1 and R_2, are connected in parallel. This combination is in series with R_3, R_4, a battery and an ammeter. If $R_2 = 45\ \Omega$, $R_3 = 10\ \Omega$, $R_4 = 20\ \Omega$, $V_T = 24V$, and the ammeter reads 0.50 A, find
   a. the resistance R_1; *(30 Ω)*
   b. the current through each resistor; *(0.30 A, 0.20 A, 0.50 A, 0.50 A)*
   c. the voltage drop across each resistor; *(9.0 V, 9.0 V, 5.0 V, 10 V)*
   d. the power dissipated in each resistor. *(2.7 W, 1.8 W, 2.5 W, 5.0 W)*

4. Show how one may connect 100 Ω resistances to get a total resistance within 5% of
   a. 300 Ω *(3s)*
   b. 50 Ω *(2p)*
   c. 35 Ω *(3p)*
   d. 80 Ω *(4 x 5p)*
   e. 250 Ω *(2s,2p)*
   f. 14 Ω *(7p)*
   g. 64 Ω *([2p,7p] in series)*
   h. 75 Ω *([2p,4p] in series)*
   i. 40 Ω *(2 x 5p)*
   j. 45 Ω *([5p,4p] in series)*
   k. 120 Ω *([1,5p] in series)*

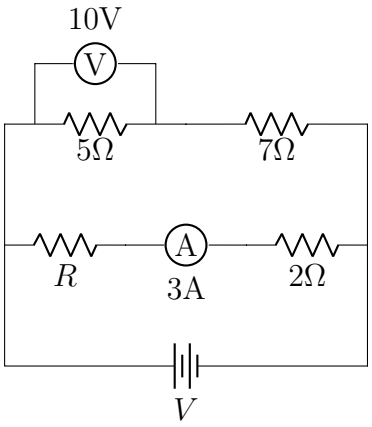
   There are many possible solutions

5. Three resistors of 4.0 Ω, 5.0 Ω and 20 Ω are connected in parallel. Another resistor of 4.0 Ω and a battery of 16 V are placed in series with the parallel group. What is the current in the 5.0 Ω resistor? *(1.1 A)*

6. For the circuit shown to the right, find:
   a. total resistance. *(20 Ω)*
   b. total current. *(5.0 A)*
   c. the current through each resistor and the voltage drop across each resistor *(5.0 A, 1.0 A, 4.0 A, 3.2 A, 0.8 A, 20 V, 80 V, 64 V, 16 V, 16 V)*



7. In the circuit diagram to the right, find the value of the unknown resistor and find the voltage of the battery. *(6 Ω, 24V)*



8. In the circuit shown to the right find
   a. current through each resistor.
   b. voltage drop across each resistor.
   c. power dissipated by each resistor.

   a. *(0.19 A, 0.11 A, 0.21 A, 0.09 A)*
   b. *(4.5 V, 4.5 V, 3.0 V, 3.0 V)*
   c. *(0.86 W, 0.50 W, 0.63 W, 0.27 W)*