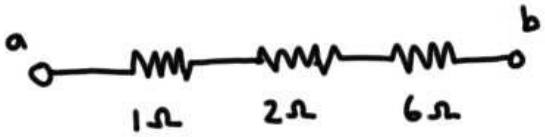
Equivalent Circuits: The concept of equivalent circuits is an extremely useful and mathematically fruitful one. The fundamental idea is the following: if two or more circuits are equivalent, then every time you encounter one circuit then you can replace it with its equivalent circuit, with respect to the terminals of interest. This concept allows for possibility of simplifying larger resistive networks with smaller, more mathematically manageable networks. For purely resistive circuits, this allows for the well-known replacement of resistors in series and in parallel, as well as other combinations.

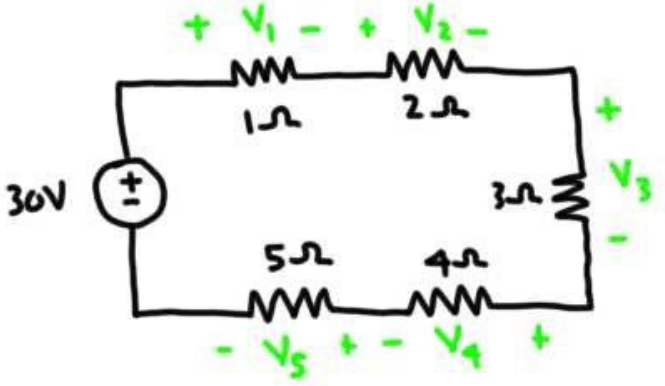
Resistors in Series:

1) How can you tell if two elements (or more) are in series? What must be true, by definition?
2) Consider the network of resistors below. What is the equivalent resistance of the network with respect to terminals a and b, R_{ab}?



Voltage Dividers:

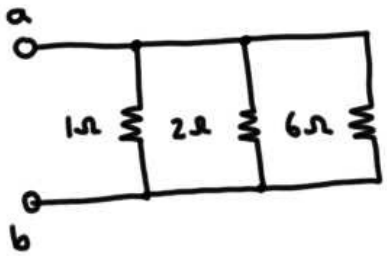
1) Consider the voltage divider shown below. Without doing any calculations, which of the voltages labelled is the smallest? Which one is the largest?



2) Calculate each of the voltages shown in the voltage divider above.
3) Add up all of the voltages calculated. Compare to the voltage of the source. Does this answer surprise you?

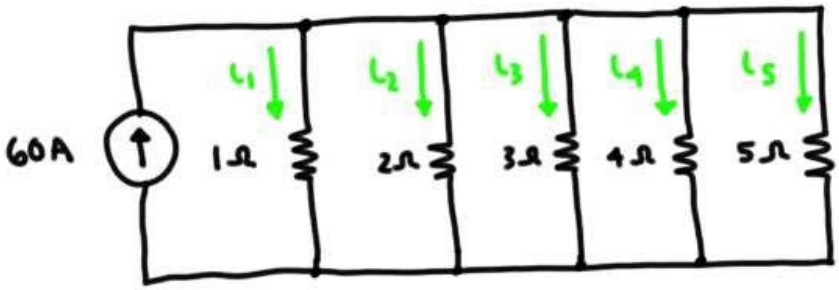
Resistors in Parallel:

1) How can you tell if two elements (or more) are in parallel? What must be true, by definition?
2) Consider the network of resistors below. What is the equivalent resistance of the network with respect to terminals a and b, R_{ab}?



Current Dividers:

1) Consider the current divider shown below. Without doing any calculations, which of the currents labelled is the smallest? Which one is the largest?



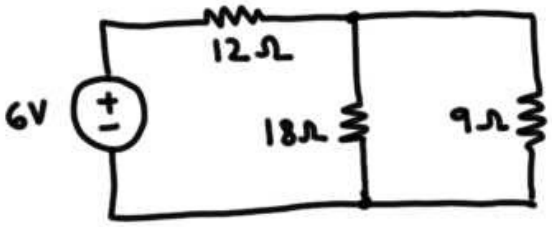
2) Calculate each of the currents shown in the current divider above.
3) Add up all of the currents calculated in the previous step. Compare to the current provided by the source. Does this value surprise you?

Networks with Resistors in Series and Parallel:

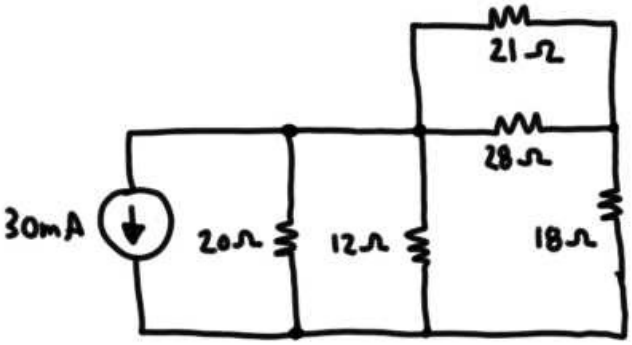
For each of the four circuits shown below calculate the following

a) The equivalent resistance as seen by the source
b) The power delivered by the source

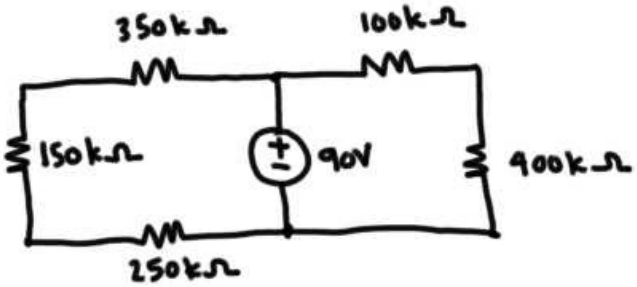
1) Circuit #1:



2) Circuit #2:



3) Circuit #3:



4) Circuit #4: