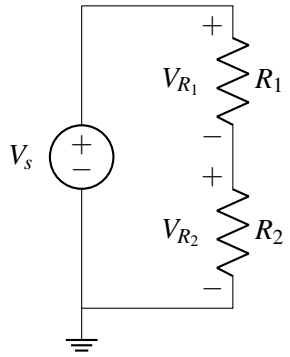
EECS 16A Designing Information Devices and Systems I
Spring 2023 Discussion 7A

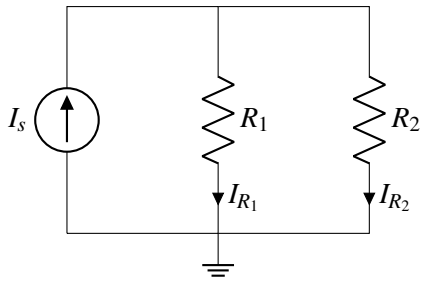
1. Volt and Ammeter

(a) For the voltage divider below, how would we connect a voltmeter to the circuit to measure the voltage V_{R_2}?



(b) What would happen if we accidentally connected an ammeter in the same configuration instead? Assume our ammeter is ideal.

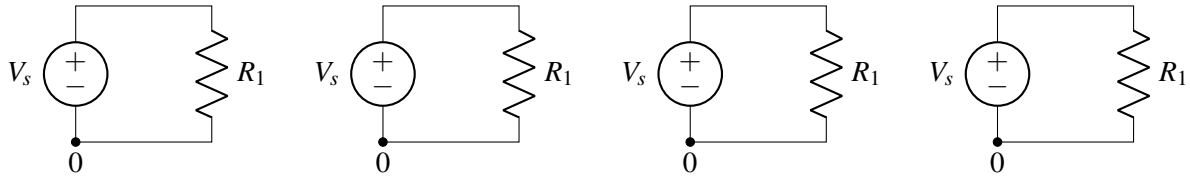
(c) For the current divider below, how would we connect an ammeter to the circuit to measure the current I_{R_2}?



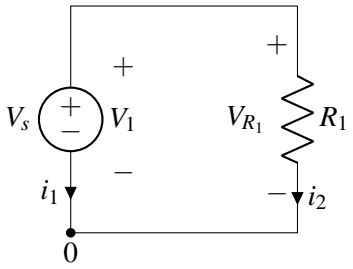
(d) What would happen if we accidentally connected a voltmeter in that configuration instead? Assume the voltmeter is ideal.

2. Passive Sign Convention and Power

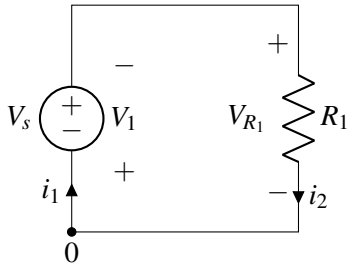
(a) Below are four copies of the same single-resistor circuit. On each copy, provide a distinct choice of labels for each circuit's voltage polarities and current directions (there should be 4 possible choices in total!) while keeping with passive sign convention.



(b) Suppose we consider the following labeling. Calculate the power dissipated or supplied by every element in the circuit. Let $V_s = 5\,\text{V}$ and let $R_1 = 5\,\Omega$. What does a negative value of power represent?



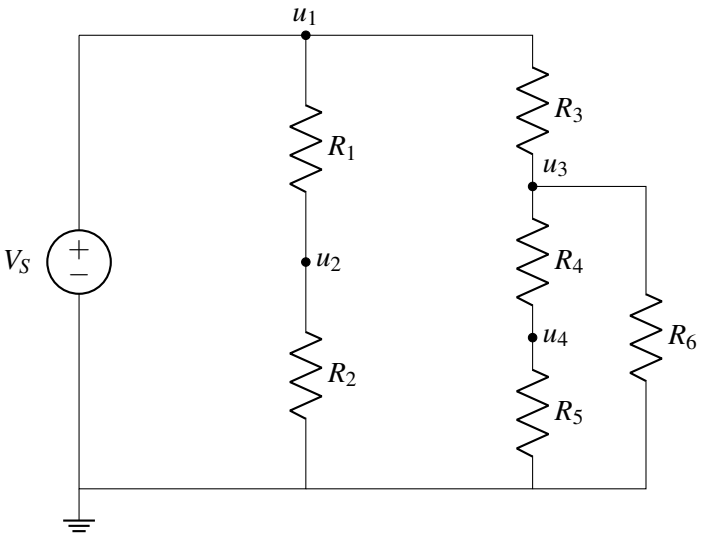
(c) Suppose we choose a second labeling of the circuit as shown below. Calculate the power dissipated or supplied by every element in the circuit. Again, let $V_s = 5\,\text{V}$ and let $R_1 = 5\,\Omega$.



(d) Did the values of the element voltages and element currents change with the different labeling? Did the power for each circuit element change? Did the node voltages change? If a quantity didn't change with a difference in labeling, discuss what would have to change for quantity to change.

3. NVA Equations

Suppose we have the following circuit. All nodes (including the reference node) have already been labeled for you.



(a) Label all of the branch currents. Do the directions you pick matter?

(b) Draw the $+/-$ voltage labels on every element. What convention must you follow?

(c) Identify and simplify any redundant currents or known node voltages.

(d) Write a KCL equation at every node with an unknown voltage potential.

(e) Use Ohm's law and node voltage differences to find the remaining equations to solve the circuit.

(f) Finally, write a system of node voltage equations. How could we solve this system for the unknowns?

In general we can treat the sources and resistances as knowns. The only unknowns should be the node voltages.