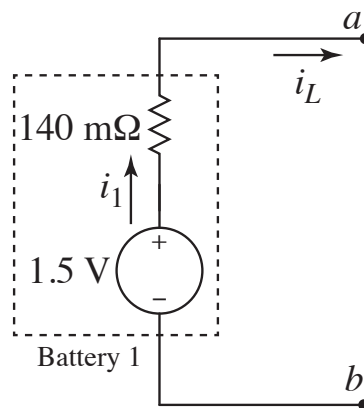


Due Sunday, Feb. 17, 2025 by 11:59 p.m.

NOTE: This is only the “handwritten” portion of Homework 5. There are also problems you must do online via the Mastering site. For this handwritten portion, you must submit a PDF scan of your work at Canvas. Please ensure your work is contained in a *single file* and is legible.

In a previous homework you considered batteries that were in parallel. In one scenario the batteries were both “fresh” while in another, one was fresh and the other was old. Here we want to understand why you might want to use parallel batteries—provided they are well matched.

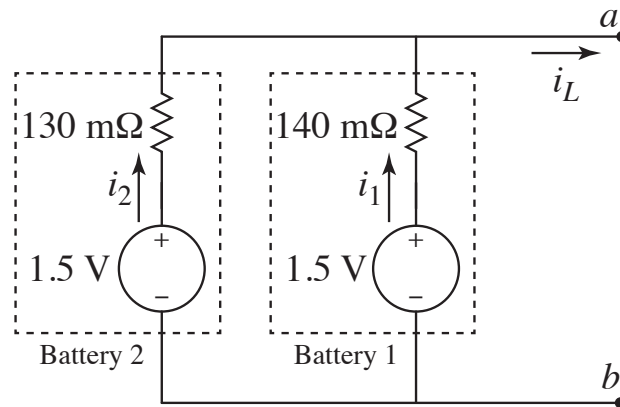
1. Consider the following model of a single fresh battery. This is the Thévenin representation of the battery.
 - (a) What is the Norton equivalent circuit?
 - (b) Assume a $20\ \Omega$ load is attached between the terminals a and b . Using either the Thévenin or Norton representation, what is the voltage across this load and i_L , the current through it? (Note that the current through the battery, i_1 , is the same as i_L .)



(Continued on next page.)

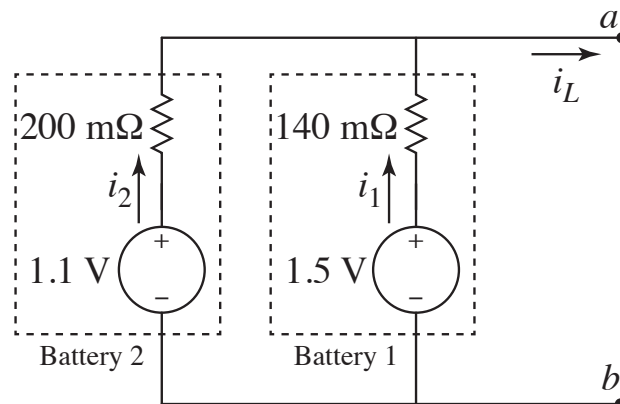
2. Consider two fresh batteries (which differ slightly) that are placed in parallel as depicted below.

- What is the Thévenin equivalent circuit?
- What is the Norton equivalent circuit?
- Assume a $20\ \Omega$ load is attached between the terminals a and b . Using either the Thévenin or Norton representation, what is the voltage across this load and i_L , the current through it?
- With the load present, what are the currents through Battery 1 and Battery 2, i.e., i_1 and i_2 ? (Hint: Having found the voltage across the load and knowing the internal resistances of the batteries, you merely need to apply Ohm's law to find these currents.)



3. Now consider a fresh and an old battery in parallel as depicted below.

- What is the Thévenin equivalent circuit?
- What is the Norton equivalent circuit?
- Assume a $20\ \Omega$ load is attached between the terminals a and b . Using either the Thévenin or Norton representation, what is the voltage across this load and i_L , the current through it?
- With the load present, what are the currents through Battery 1 and Battery 2, i.e., i_1 and i_2 ? (The hint given for the previous problem is still applicable.)



(Continued on next page.)

4. Use mesh analysis to find i_x and i_g in the circuit shown below. You are free to “reconfigure” the circuit in anyway that may aid your analysis provided that reconfiguration does not change what i_x and i_g are.

