Monday Reading Assessment: Unit 2, Terminal Voltage

Prof. Jordan C. Hanson

February 19, 2024

1 Memory Bank

- $V = iR$ ... Ohm's Law, with V for voltage, i for current, and R for resistance.
- $R_{tot} = R_1 + R_2$ ... Total resistance of two resistors in series.

2 Batteries and Internal Resistance

1. Did you know that batteries have resistance? Consider Fig. 1, in which the resistance r of a battery is shown, in series with a resistor R. The AA battery *is supposed to have 1.5 V*, but it also has an internal resistance of $r = 1\Omega$. Think of ϵ as the ideal 1.5 V of the AA battery. (a) If $R = 50\Omega$, what is the current flowing from the battery? You can think of r and R as **in series.** (b) The battery terminal voltage is $V = \epsilon - Ir$, and ϵ is always 1.5 V. If I is the current, what is V? (c) What power is consumed in this circuit, and what fraction is consumed by the battery?

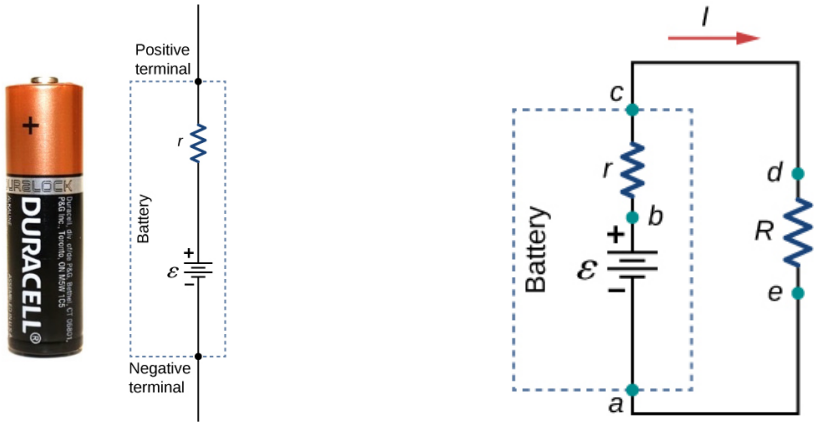

Figure 1: (Left) The AA battery has a voltage ϵ and a resistance r, in series. (Right) Connecting the model battery to a resistance R in series.