1

a

$$V = V_1 + V_2 \Rightarrow I \cdot R_1 = V_1, I \cdot R_2 = V_2$$

$$\hookrightarrow V = I \cdot R_1 + I \cdot R_2 = I(R_1 + R_2)$$

$$\Rightarrow I = \frac{V}{R_1 + R_2}$$

b

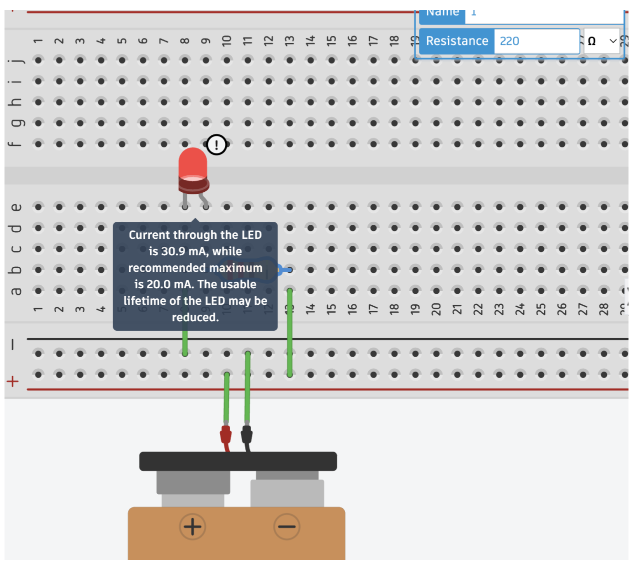
$$R_{eq} = R_1 + R_2 = 1.5k\Omega = 1500\Omega$$

$$V_{eq_1} = I \cdot R_1 \Rightarrow I = \frac{V}{R_{eq}} = \frac{9}{1500}A$$

$$V_{eq_1} = \frac{9}{1500} \cdot 500 = 9 \cdot \frac{1}{3} = 3V$$

$$V_{eq_2} = \frac{9}{1500} \cdot 1000 = 9 \cdot \frac{2}{3} = 6V$$

2



Using KVL:

$$9V - 2V - IR = 0 \quad \Rightarrow \quad I = \frac{7V}{R}$$

- Smaller $R \Rightarrow$ Larger $I \Rightarrow$ Brighter LED
- But $I > 20\text{mA}$ may damage the LED

3

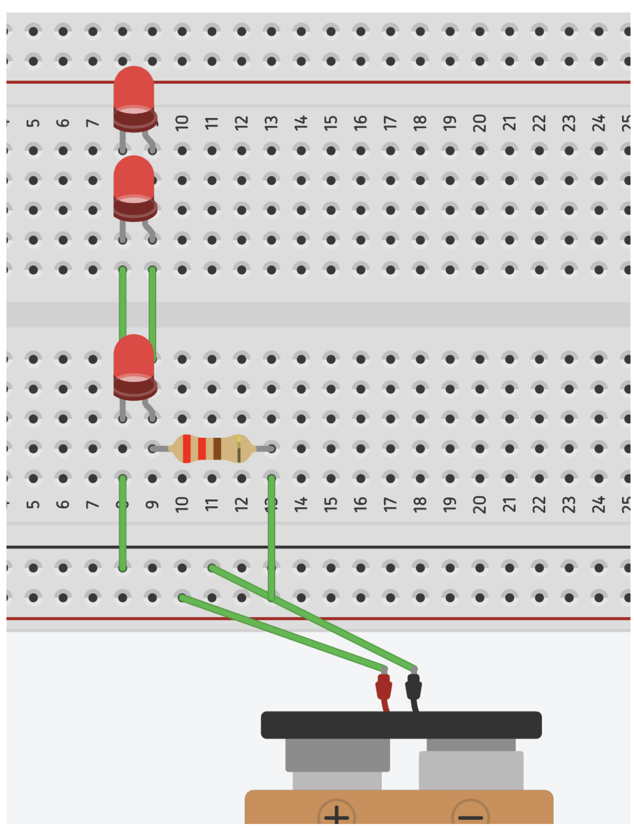
Using Ohm's Law for each branch:

$$
\begin{aligned}
I_1 &= \frac{V}{R_1} = \frac{9\,\mathrm{V}}{900\,\Omega} = 0.01\,\mathrm{A} \\
I_2 &= \frac{V}{R_2} = \frac{9\,\mathrm{V}}{450\,\Omega} = 0.02\,\mathrm{A} \\
I_3 &= \frac{V}{R_3} = \frac{9\,\mathrm{V}}{450\,\Omega} = 0.02\,\mathrm{A}
\end{aligned}
$$

4

$$
\begin{gathered}
\frac{1}{R_{eq}} = \frac{R_2R_3 + R_1R_3 + R_1R_2}{R_1R_2R_3} \\
R_{eq} = \frac{R_1R_2R_3}{R_1R_2 + R_1R_3 + R_2R_3} \\
\frac{1}{R_{eq}} = \frac{1}{900\,\Omega} + \frac{1}{450\,\Omega} + \frac{1}{450\,\Omega} \\
\frac{1}{R_{eq}} = \frac{1}{900\,\Omega} + \frac{2}{900\,\Omega} + \frac{2}{900\,\Omega} \\
\frac{1}{R_{eq}} = \frac{1+2+2}{900\,\Omega} = \frac{5}{900\,\Omega} \\
R_{eq} = \frac{900\,\Omega}{5} = 180\,\Omega
\end{gathered}
$$

5



With one LED, the current is $I = (V_{\text{supply}} - V_{\text{LED}})/R = (9\,\text{V} - 2\,\text{V})/470\,\Omega \approx 14.9\,\text{mA}$. With three LEDs in parallel, the total current through R remains $14.9\,\text{mA}$, but by KCL, this current divides among the three LEDs ($\approx 4.96\,\text{mA}$ each), causing each LED's brightness to **decrease**.