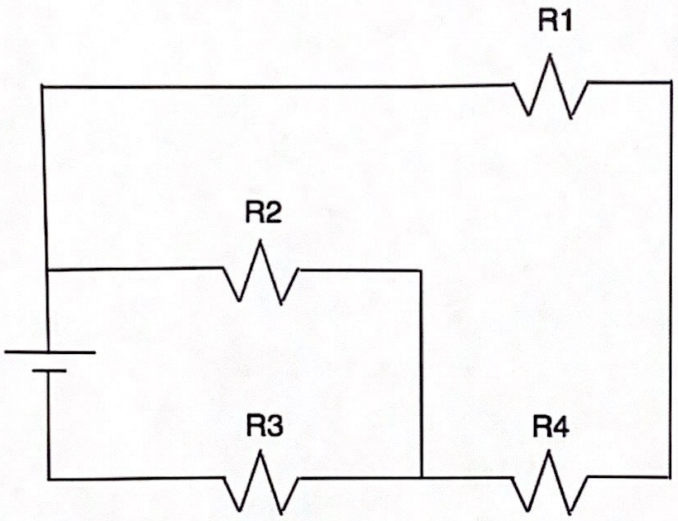
Quiz 20.1E

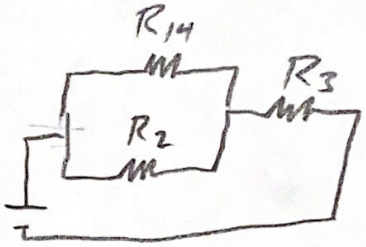
A 12-Volt battery is connected to a circuit as shown below. R1 = 1.3 Ohms, R2 = 2.2 Ohms, R3 = 3.6 Ohms, R4 = 4.1 Ohms.

a) What is the equivalent resistance of the circuit?
b) What is the current passing through resistor R4?
c) If R2 is removed from the circuit, does your answer to (b) increase, decrease or remain the same? Justify your answer.



Series

$R_H = R_1 + R_4 = 5.4\,\Omega$



Parallel

$\frac{1}{R_{142}} = \frac{1}{5.4} + \frac{1}{2.2}$

$\Rightarrow R_{142} = 1.56\,\Omega$

Series: $R_{142} + R_3 = \boxed{R_{TOT} = 5.2\,\Omega}$

b) $I_{TOT} = \frac{\mathcal{E}}{R_{TOT}} = 2.32\,A \Rightarrow \Delta V_{142} = I_{142} R_{142} = 3.63\,V$

$= I_{142} = I_3$

$\Rightarrow \Delta V_{14} = 3.63\,V$

$\Rightarrow I_{14} = \frac{\Delta V_{14}}{R_{14}} = \frac{3.63}{5.4} = 0.67\,A$

$\Rightarrow \boxed{I_4 = 0.67\,A}$

c) If no R_2, $R_{TOT} = R_1 + R_4 + R_3$

$= 9.0\,\Omega$

$\Rightarrow I_{TOT} = \frac{\mathcal{E}}{9} = 1.33\,A$

$= \boxed{I_4 = 1.33A,\ \text{increases}}$