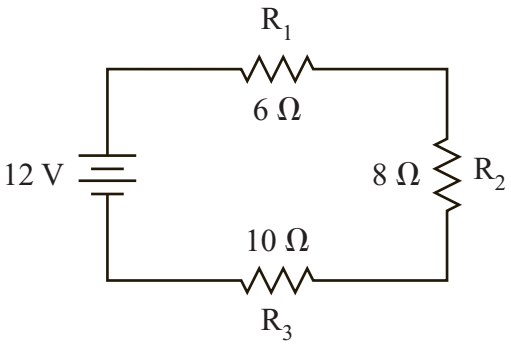
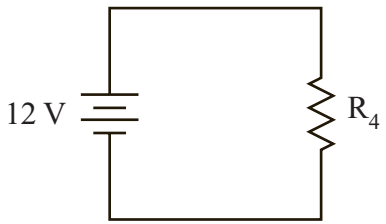
45 Two circuits, W and X, are shown in the diagrams.

Circuit W



Circuit X



Circuit X has the same total resistance as circuit W, but circuit X has only one resistor, R_4.

a. Calculate the resistance of R_4. Show your calculations and include units in your answer.

b. Calculate the current through R_4. Show your calculations and include units in your answer.

Another circuit, Y, has the same battery and resistor as circuit X but also has another resistor, R_5, as shown.

Circuit Y

c. Determine whether adding R_5 increases or decreases the total current in circuit Y. Explain your reasoning.

d. In your Student Answer Booklet, copy circuit Y. On your circuit, add a third resistor labeled "R_{new}" in a location that will **not** change the current through R_4.