When resistors are connected in parallel, the same voltage difference or potential difference is present across all of the resistors.

$$V_p = I_{Total}R_p = I_1R_1 = I_2R_2 = I_3R_3 = \cdots$$

but $$I_{Total} = I_1 + I_2 + I_3 + \cdots$$

Therefore $$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$

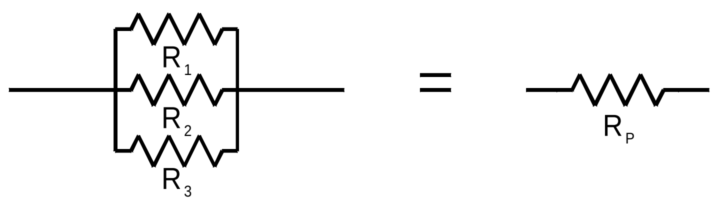


Figure 3.1:—

Example 1
Calculate the equivalent resistance for the parallel resistor circuit shown in the Figure 3.2.

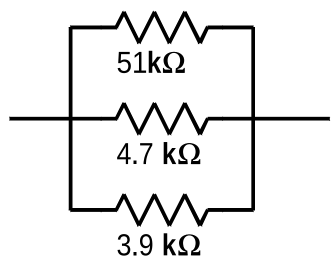


Figure 3.2:—

$$\begin{aligned} \frac{1}{R_p} &= \frac{1}{51k\Omega} + \frac{1}{4.7k\Omega} + \frac{1}{3.9k\Omega} \\ &= 4.89 \times 10^{-4}\Omega^{-1} \\ \text{Therefore} \quad R_p &= 2046\Omega \\ &= 2.046k\Omega \end{aligned}$$

Example 2

In the circuit shown in Figure 3.3, if the current in the 820Ω resistor is measured to be 2.5mA, calculate the battery voltage and also calculate the total current flowing through the battery. Calculate the current in the 3.9$k\Omega$ resistor.

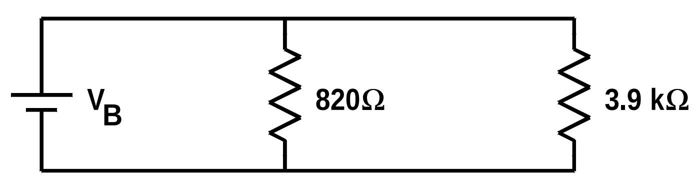
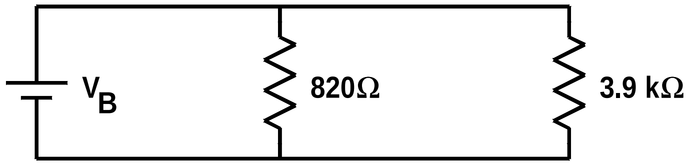


Figure 3.3:—



$$\begin{aligned}
V_{Battery} &= 2.5mA \times 820\Omega \\
&= 2.5 \times 10^{-3} \times 820V \\
&= 2.05V \\
\frac{1}{R_p} &= \frac{1}{820} + \frac{1}{3900} \\
&= 1.48 \times 10^{-3} \\
\text{Therefore} \quad R_p &= 677\Omega \\
\text{Hence} \quad I_{Total} &= \frac{2.05V}{677\Omega} \\
&= 3.03 \times 10^{-3} A \\
&= 3.03mA \\
\text{and} \quad I_{3.9k\Omega} &= \frac{2.05V}{3.9 \times 10^{3}\Omega} \\
&= 5.26 \times 10^{-4} A \\
&= 0.526mA \quad \text{or} \quad 526\mu A
\end{aligned}$$