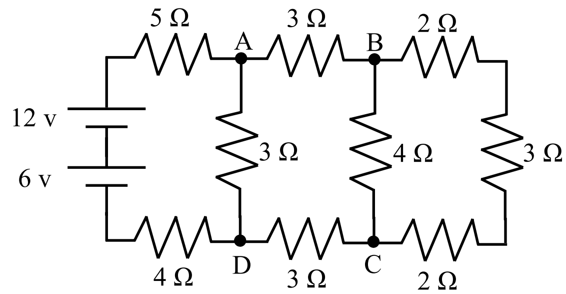
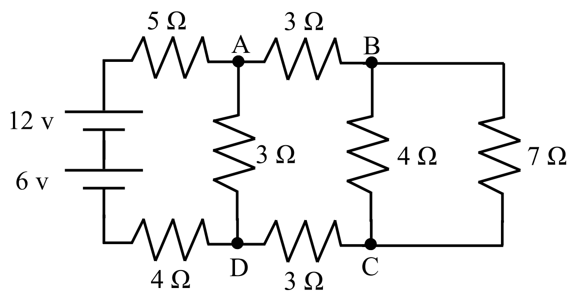
Simplifying Complicated Circuits—

It should be obvious that the 2, 3 and 2 Ω resistors (on the right) are in series and can be easily added together. Notice that there is a split at letter B. That means that the 4 Ω resistor and the 2, 3 and 2 Ω resistors are in parallel. By the same logic, the split at letter A shows the start of another set of parallel branches. This circuit will become obvious by reducing it step-by-step.



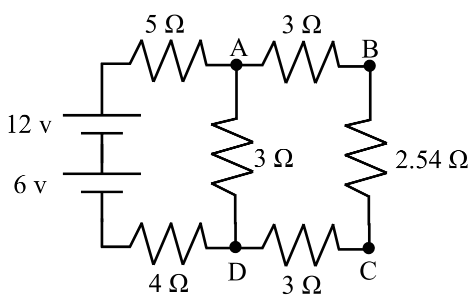
Step 1: The 2, 3, and 2 Ω are in series.

$R_{Total} = 2 + 3 + 2 = 7\ \Omega$



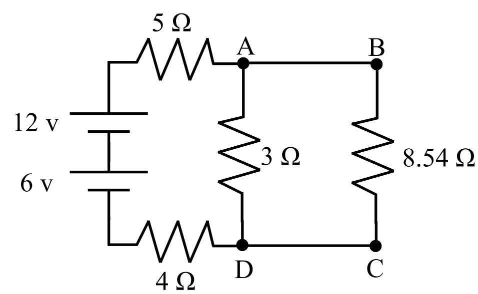
Step 2: The 4 Ω and 7 Ω are in parallel.

$$\frac{1}{R_T} = \frac{1}{4} + \frac{1}{7} = .393 \qquad R_T = \frac{1}{.393} = 2.54\ \Omega$$



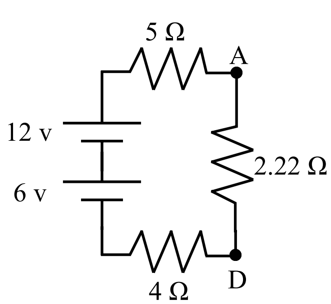
Step 3: The 3 Ω, 2.54 Ω, and 3 Ω are in series.

$R_T = 3 + 2.54 + 3 = 8.54\ \Omega$



Step 4: The 3 Ω and 8.54 Ω are in parallel.

$$\frac{1}{R_T} = \frac{1}{3} + \frac{1}{8.54} = .45 \qquad R_T = \frac{1}{.45} = 2.22\ \Omega$$

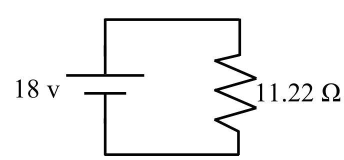


Step 5: All resistors and batteries are in series.

$R_T = 5 + 2.22 + 4 = 11.22\ \Omega$
$V_T = 12 + 6 = 18$ v

Equivalent Circuit

The entire circuit reduces to a 18 v battery and a 11.22 Ω resistor.



$$I_{Total} = \frac{V_T}{R_T}$$

$$I_{Total} = \frac{18}{11.22} = 1.6\text{A}$$

Now that the total current is known it is a simple, though tedious, process to work backwards through the circuit to find the current and/or voltage across each individual resistor in the circuit.