Key - Mr. Sudbury

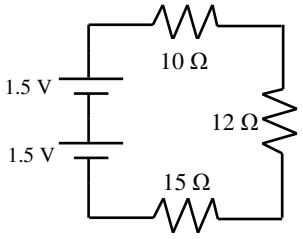
Total Resistance

Read

Resistors in Series

$$R_{total} = R_1 + R_2 + R_3 \ldots$$

As you add resistors in series, you increase resistance. Simply add the amounts together.



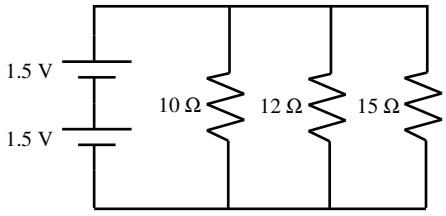
***Example**: Calculate the total resistance of this circuit.*

$R_T = R_1 + R_2 + R_3 \ldots$
$R_T = 10 + 12 + 15$
$R_T = 37\Omega$

Read

Resistors in Parallel

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots$$



***Example**: Calculate the total resistance of this circuit.*

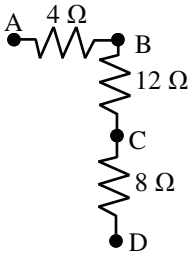
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$$

$$\frac{1}{R_T} = \frac{1}{10} + \frac{1}{12} + \frac{1}{15} = .1 + .083 + .067$$

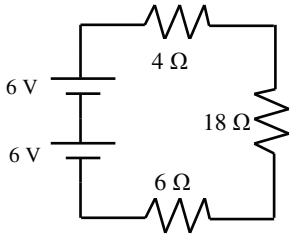
$$\frac{1}{R_T} = .25 \qquad R_T = \frac{1}{.25} = 4\Omega$$

As you add resistors in series, you open more paths for the electricity to flow, increasing total current, and decreasing total resistance. For resistors in parallel, the total resistance is always less than the smallest resistor.

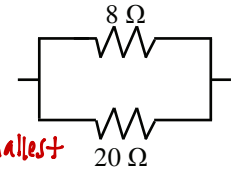
1. These resistors are in: Series
2. What is R_{total} from A to C? 16 Ω
3. What is R_{total} from B to D? 20 Ω
4. What is R_{total} from A to D? 24 Ω



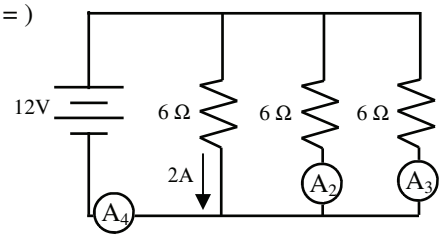
5. Calculate the total resistance.
   $R_T = 28\Omega$
6. Calculate total voltage.
   12V
7. Calculate total current.
   $I = \frac{V}{R} = \frac{12V}{28\Omega} = 0.43$ Amps



8. Calculate the total resistance.
   $\left(\frac{1}{8}\right) + \left(\frac{1}{20}\right) = \frac{1}{R_T} = 0.175^{-1} = 5.7\Omega$
9. How does R_{total} compare with the individual resistors?
   R_T is always smaller than the smallest Resistor in parallel.
10. Why?
    more I (paths) = less R

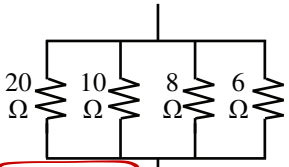


11. A_2 reads (current 2 =)
    $I = \frac{V}{R} = \frac{12V}{6\Omega} = 2A$
12. A_3 = 2A
13. A_4 = 6A
14. Since V = IR and R = V/I, R_{total} =
    2Ω
15. If one of the resistors is removed, R_{total} = 4Ω

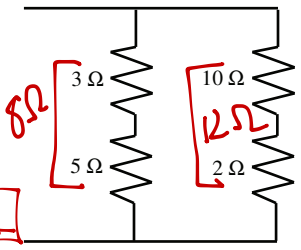


16. You are given four 100 Ω resistors.
    A. If in series R_{total} = 400Ω
    B. If in parallel $R_{total} = \frac{1}{100} + \frac{1}{100} + \frac{1}{100} + \frac{1}{100} = \left(\frac{4}{100}\right)^{-1} = \frac{100}{4} = 25\Omega$

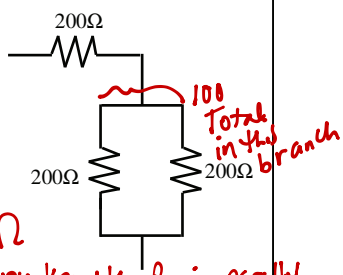
17. Without calculating, you know that R_{total} must be less than:
    6Ω
18. Calculate R_{total}.
    $\frac{1}{20} + \frac{1}{10} + \frac{1}{8} + \frac{1}{6} = (0.4416)^{-1} = 2.26\Omega$



19. Calculate and label the total resistance for each pair of resistors in series.
    8Ω
    12Ω
20. Calculate the total resistance for the two parallel branches.
    $\frac{1}{8} + \frac{1}{12} = (0.208)^{-1} = 4.8\Omega$



21. What is the equivalent resistance of the parallel resistors?
    $\frac{1}{200} + \frac{1}{200} = (.01)^{-1} = 100\Omega$
22. Calculate R_{total} for all three resistors.
    200 + 100 = 300Ω



* Treat the parallel like a series once you know the R_T in parallel.