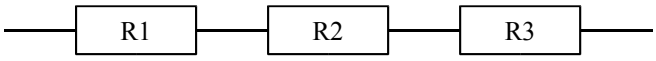
Resistors in series and parallel worksheet

Resistors in series

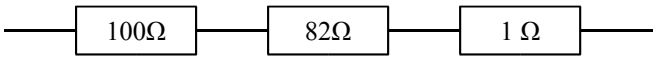
When resistors are connected one after each other this is called a series connection. This is shown below.



To calculate the total overall resistance of a number of resistors connected in this way you add up the individual resistances. This is gives the following formula:

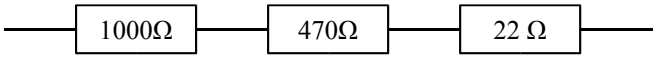
$Rtotal = R1 + R2 + R3$ and so on

Example: To calculate the total resistance for these three resistors in series



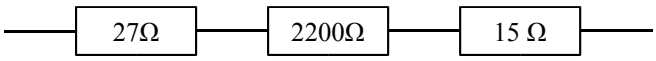
$$Rtotal = R1 + R2 + R3$$
$$= 100\,\Omega + 82\,\Omega + 1\,\Omega$$
$$= 183\,\Omega$$

Task 1: Calculate the total resistance of the following resistor in series



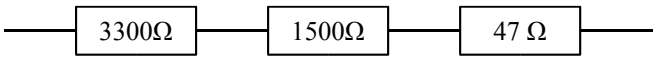
Rtotal = ……...

= ……...



Rtotal = ……...

= ……...

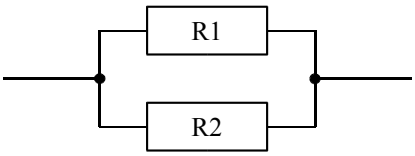


Rtotal = ……...

= ……...

Resistors in parallel

When resistors are connected across each other (side by side) this is called a parallel connection. This is shown below.

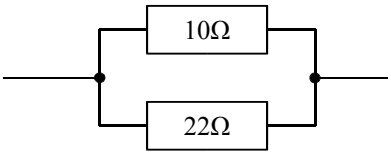


Two resistors in parallel

To calculate the total overall resistance of two resistors connected in this way you can use the following formula:

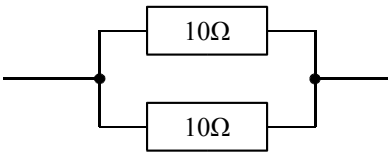
$$Rtotal = \frac{R1 \times R2}{R1 + R2}$$

Example: To calculate the total resistance for these two resistors in parallel

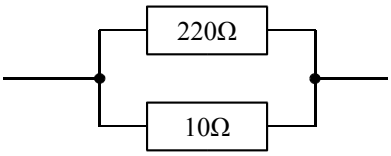


$$Rtotal = \frac{R1 \times R2}{R1 + R2} = \frac{10\Omega \times 22\Omega}{10\Omega + 22\Omega} = \frac{220\Omega}{32\Omega} = \mathbf{6.88\Omega}$$

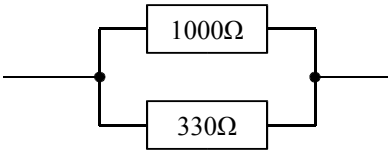
Task 2: Calculate the total resistance of the following resistors in parallel



$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots\ldots$$

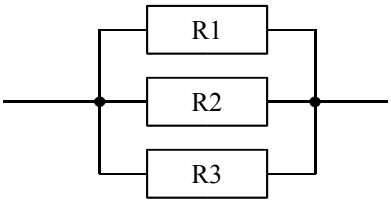


$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots\ldots$$



$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots\ldots$$

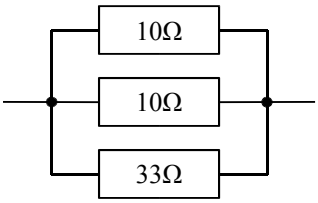
Three or more resistors in parallel



To calculate the total overall resistance of three or more resistors connected in parallel you can use the following formula:

$$\frac{1}{Rtotal} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \text{ and so on}$$

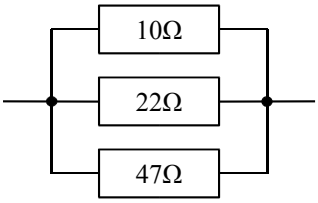
Example: To calculate the total resistance for these three resistors in parallel



$$\frac{1}{Rtotal} = \frac{1}{10\Omega} + \frac{1}{10\Omega} + \frac{1}{33\Omega} = 0.1\Omega + 0.1\Omega + 0.03\Omega = \mathbf{0.23\Omega}$$

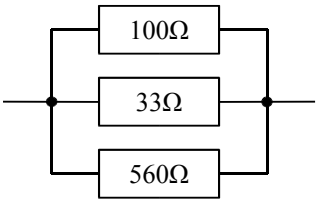
$$Rtotal = \frac{1}{0.23\Omega} = \mathbf{4.34\ \Omega}$$

Task 3: Calculate the total resistance of the following resistors in parallel



$$\frac{1}{Rtotal} = \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} = \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots\ldots$$

$$Rtotal = \frac{1}{\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$



$$\frac{1}{Rtotal} = \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} = \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots\ldots$$

$$Rtotal = \frac{1}{\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$

Answers

Task 1

1 = 1492 Ω
2 = 2242 Ω
3 = 4847 Ω

Task 2

1 = 5.00 Ω
2 = 9.57 Ω
3 = 248.12 Ω

Task 3

1 = 6.00 Ω
2 = 23.76 Ω