Ohm's Law

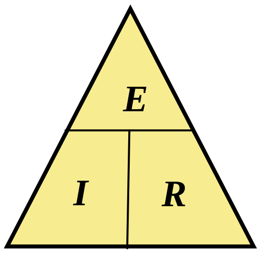
The 3 electrical quantities of Voltage ($\boldsymbol{E}$), Current ($\boldsymbol{I}$) and Resistance ($\boldsymbol{R}$) are related to each other by Ohm's Law.

The greater the Voltage (push) and the lower the Resistance (opposition) the larger the current flowing will be.

The 3 forms of the formula for Ohm's Law are:

$$I = \frac{E}{R} \qquad E = I \times R \qquad R = \frac{E}{I}$$

Triangle short-cut
Cover over the quantity to be calculated and the remaining symbols give the correct formula to use.



Examples:

1. Find the Current ($\boldsymbol{I}$) when a Voltage ($\boldsymbol{E}$) of 12 Volts is applied to a Resistance ($\boldsymbol{R}$) of 10 Ohms.

$I = \frac{E}{R}$ Current ($\boldsymbol{I}$) $= \frac{12}{10} = 1.2$ Current ($\boldsymbol{I}$) is 1.2 Amps

2. Find the value of a Resistance ($\boldsymbol{R}$) required to limit the Current ($\boldsymbol{I}$) to 0.5 Amps when connected to a 240 Volt ($\boldsymbol{E}$) supply.

$R = \frac{E}{I}$ Resistance ($\boldsymbol{R}$) $= \frac{240}{0.5} = 480$ Resistance ($\boldsymbol{R}$) is 480 Ohms

3. Find the Voltage ($\boldsymbol{E}$) across a resistance of 500 Ohms when a Current ($\boldsymbol{I}$) of 0.1 Amps flows through it.

$E = I \times R$ Voltage ($\boldsymbol{E}$) $= 0.1 \times 500 = 50$ Voltage ($\boldsymbol{E}$) is 50 Volts

Try these Questions to find the missing quantities

Voltage (Volts)	Resistance (Ohms)	Current (Amps)
12	6	
1.5	30	
240		2
6		0.5
	50	1
	1000	0.2

When the current or voltage is very small the prefixes of milli (m) or micro (μ) are used
0.001 Amps = 1 mA (1 milliamp) and 0.000 001 Amps = 1μA (1 microamp)

Electrical Power

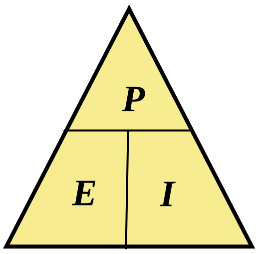
Power is calculated from the voltage supplied and the current which flows. These values are quoted on most electrical appliances like hair dryers, heaters, electric jugs and toasters.

Power (P) is the rate that energy is used in an electrical circuit.
It is measured in Watts.

Power (P), Voltage (E) and Current (I) for an appliance are related by formulae similar to Ohm's Law.

$$I = \frac{P}{E} \qquad P = E \times I \qquad E = \frac{P}{I}$$

Triangle short-cut
Cover over the quantity to be calculated and the remaining symbols give the correct formula to use.



Examples

1. Find the Current (I) flowing when a 1500 Watt (P) heater is connected to a 240 Volt (E) supply.

   $I = \frac{P}{E}$ Current (I) = $\frac{1500}{240}$ = 6.25 Current (I) is 6.25 Amps

2. Calculate the power generated when a Current (I) of 0.2 amps flows from a 12 Volt (E) battery.

   $P = E \times I$ Power (P) = $12 \times 0.2 = 2.4$ Power (P) is 2.4 Watts

3 What will be the maximum Voltage (E) which can be applied across a resistor with a power rating of 2 Watts if the required Current (I) is 0.5 amps?

   $E = \frac{P}{I}$ Voltage (E) = $\frac{2}{0.5}$ = 4 Voltage (E) = 4 Volts

4. **Calculate the missing values**

Power (Watts)	Voltage (Volts)	Current (Amps)
1000	200	
	24	2
10		0.1

5. Note the electrical values on the labels of some appliances.

6. When buying light globes how many watts do you choose?
   How does the wattage affect the brightness of the light?

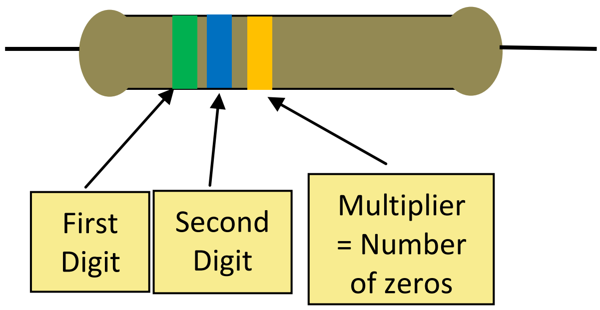
7. Look on the back of a power board (or double adaptor).
   Read its voltage and current (Amps) rating. What would happen if the current flowing was in excess of the rated value? What might cause this to occur?

Resistors

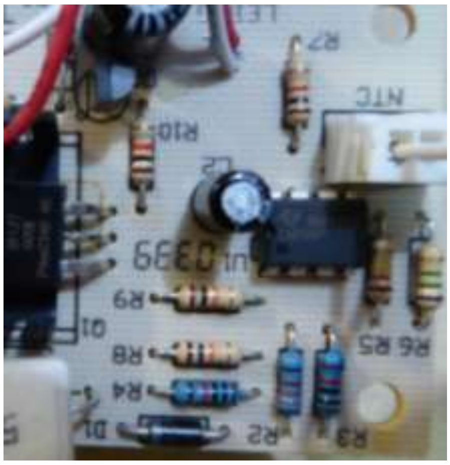
One major component in electrical circuits is the resistor which is used to control the flow of current. The common circuit symbol for a resistor is 
Coloured bands are marked on resistors to designate the value of the resistance.
The unit of resistance is the OHM (Ω). 1000 Ohms = 1 k Ω 1000 000 Ohms = 1 M Ω

- The first band colour is the first digit.
- The second band colour is the second digit.
- The third band colour gives the number of zeros to follow the two digit number.
- If there is a fourth band colour it relates to the percentage accuracy of the resistor compared to the quoted value.

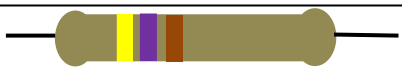
0	1	2	3	4	5	6	7	8	9
Black	Brown	Red	Orange	Yellow	Green	Blue	Violet	Grey	White



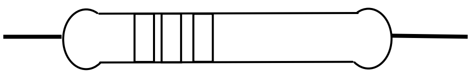
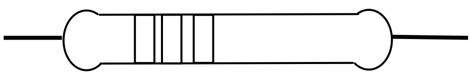
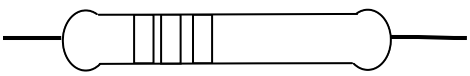
Green = 5 Blue = 6 Orange = 3 zeros
Resistor Value = 56 000 Ohms



1. Work out the values of the resistors below.

RESISTOR	RESISTANCE
	Orange White Green Ω
	Grey Red Black Ω
	Yellow Violet Brown Ω

2. Colour in the bands on these resistors.

RESISTANCE (OHMS)	RESISTOR
150 Ω	
27 k Ω	
1 M Ω	

Answers to Questions

Ohm's Law

Voltage (Volts)	Resistance (Ohms)	Current (Amps)
12	6	2
1.5	30	0.05
240	120	2
6	12	0.5
50	50	1
200	1000	0.2

Electrical Power

Power (Watts)	Voltage (Volts)	Current (Amps)
1000	200	5
48	24	2
10	100	0.1

Resistors

RESISTANCE
Orange White Green 3900000 Ω
Grey Red Black 82 Ω
Yellow Violet Brown 470 Ω

RESISTANCE (OHMS)	RESISTOR
150 Ω	Brown Green Brown
27 k Ω	Red Violet Orange
1 M Ω	Brown Black Green