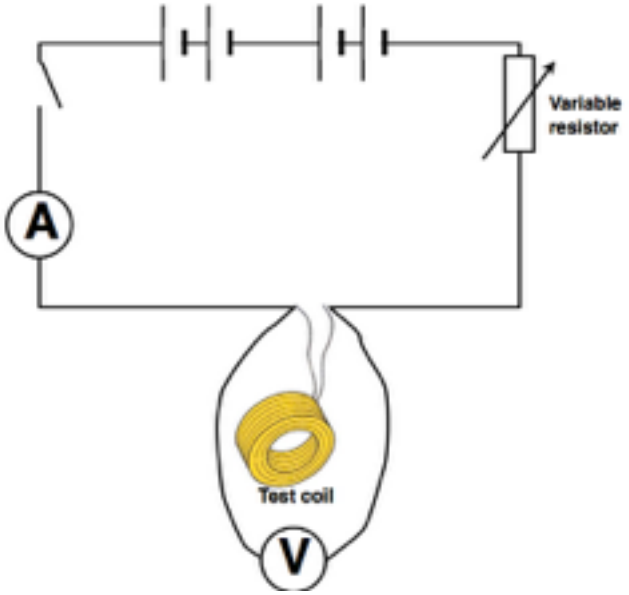
In order to **calculate the resistivity** we need to measure the length, diameter and resistance of our sample of wire

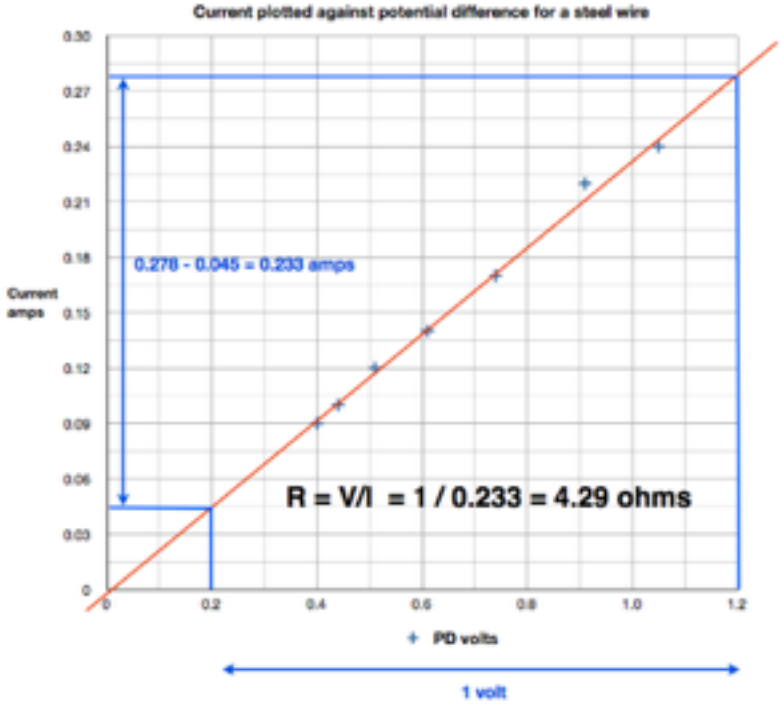
The length is measured with a long tape and the diameter measured (in at least three places with accurate callipers or micrometer

To measure the resistance of a sample wire it is best to measure a range of values of potential difference (volts) and current (amps).



The variable resistor is adjusted to give as wide a range as possible with values evenly spaced.

From the range the graph plotted will provide a reliable value of resistance



The graph is plotted with PD, the controlling factor, on the x axis and current on the y axis.

The line of best fit helps to even out small errors and would highlight any major mistakes in taking a result. The line does not have to pass through the origin.

The value of resistance V/I is the inverse of the gradient. Select any two convenient values, providing they employ most of the graph line, to make the calculation.

PD volts	I amps
0.4	0.09
0.44	0.10
0.51	0.12
0.61	0.14
0.74	0.17
0.91	0.22
1.05	0.24

WHAT IS RESISTIVITY

Electrical resistivity is a property of a material, irrespective of the size or shape of the sample being tested. It gives a value to how much the material opposes the flow of an electrical current.

In absolute terms it is the resistance of a one metre cube between opposite faces.

The value is usually represented by the Greek letter ρ and the units are ohm-metres (Ωm)

CALCULATING RESISTIVITY AND CONDUCTIVITY

THE FIZZICS ORGANIZATION
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CALCULATING RESISTIVITY

From the measurements taken for the sample of steel wire:
Length 2.78m
Diameter 0.38mm
Resistance 4.29 ohms

$$\text{Resistivity} = \frac{\text{Cross sectional area} \times \text{resistance}}{\text{length}}$$

$$= \frac{\pi d^2}{4} \frac{R}{L}$$

$$= \frac{\pi \times 0.38 \times 10^{-3} \times 0.38 \times 10^{-3} \times 4.29}{2.78}$$

$$= 6.99 \times 10^{-7}\ \Omega m$$

CALCULATING THE MAXIMUM POSSIBLE ERROR

$$\text{Resistivity} = \frac{\pi d^2}{4} \frac{R}{L}$$

diameter 0.38 mm ± 0.02mm which is ± 5%
but diameter is used twice so the total possible error for this measurement is 10%

Resistance is calculated from V/I The meter manufacturer states an accuracy better than ±1% but the current reading was only to two decimal places, with a maximum value taken of only 0.24 the best we can expect from that is ±0.005 which is 2%
So there is an additional error of 1% for the voltmeter and 2% for the ammeter reading.
The total length of the wire was 2.778m with an uncertainty I estimate at 5mm, a percentage error possible of about 0.2%, almost negligible compared to other possible errors.
So the total uncertainty (possible error) in our calculation is 13.2%

WHAT IS CONDUCTIVITY

Electrical conductivity is a measure of the ability of a material to conduct an electrical current.
It is usually represented by the Greek letter σ and the units are siemens per metre.

It is opposite of or more accurately the reciprocal of resistivity.
that is $\sigma = \frac{1}{\rho}$
and for a test specimen, like the wire we have just used:

$$\text{Conductivity} = \frac{\text{length}}{\text{resistance} \times \text{cross sectional area}}$$

and so conductance, usually given the symbol G is the reciprocal of resistance R
so $\frac{1}{R(\Omega)} = G\ (S)$ and $S = \frac{I}{V}$