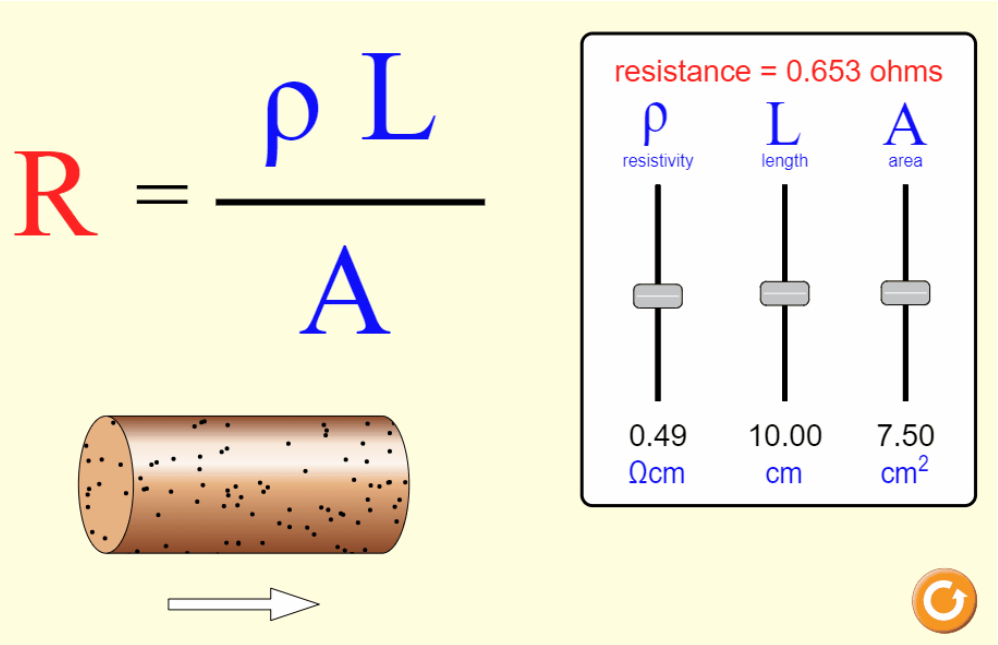
Resistivity

IB PHYSICS | ELECTRICITY

Resistance

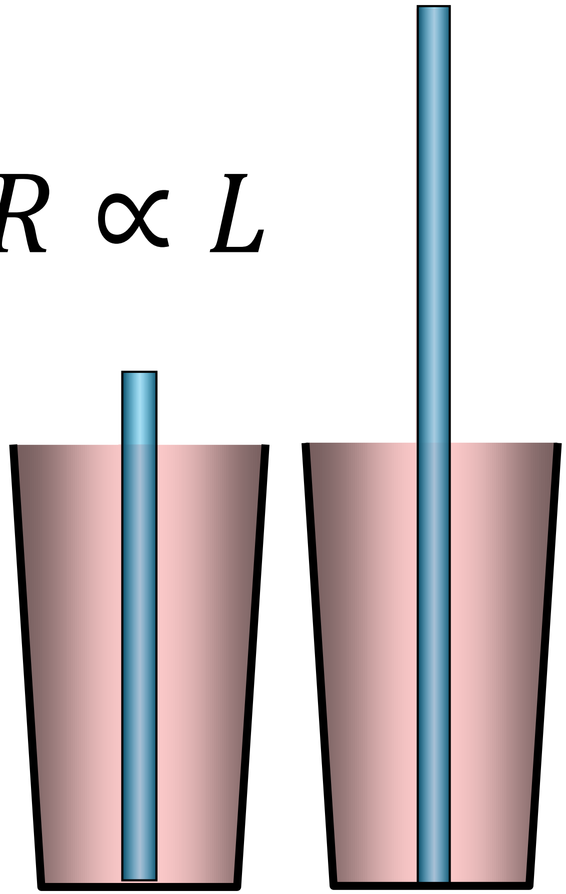
What factors affect the resistance of a wire?

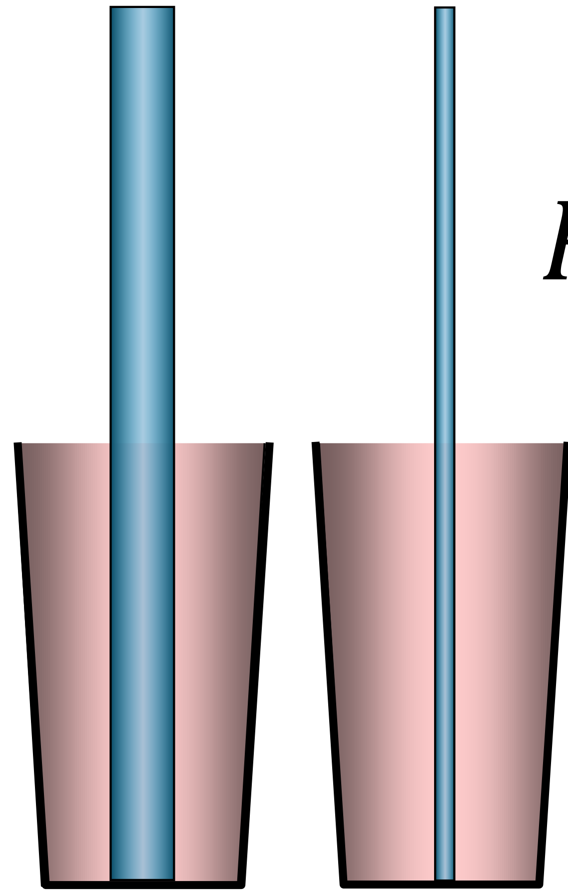


Resistance

Imagine that you are testing the resistance of a straw while drinking a milkshake…

$$R \propto L$$





$$R \propto \frac{1}{A}$$

Calculating Resistance

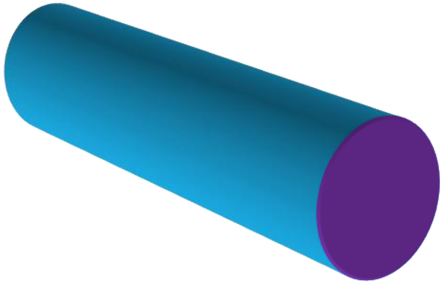
$$R = \rho \frac{L}{A}$$

R →

L →

A →

ρ →



IB Physics Data Booklet

Sub-topic 5.1 – Electric fields	Sub-topic 5.2 – Heating effect of electric currents
$I = \frac{\Delta q}{\Delta t}$ $F = k\frac{q_1 q_2}{r^2}$ $k = \frac{1}{4\pi\varepsilon_0}$ $V = \frac{W}{q}$ $E = \frac{F}{q}$ $I = nAvq$	Kirchhoff's circuit laws: $\Sigma V = 0$ (loop) $\Sigma I = 0$ (junction) $R = \frac{V}{I}$ $P = VI = I^2 R = \frac{V^2}{R}$ $R_{\text{total}} = R_1 + R_2 + \cdots$ $\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$ $\boxed{\rho = \frac{RA}{L}}$
Sub-topic 5.3 – Electric cells	**Sub-topic 5.4 – Magnetic effects of electric currents**
$\varepsilon = I(R + r)$	$F = qvB\sin\theta$ $F = BIL\sin\theta$

$$R = \rho\frac{L}{A}$$

Resistivity

Resistivity ρ changes depending on the material used.

Conductor Material	Resistivity (Ohm meters @ 20 °C)
Silver	1.64×10^{-8}
Copper	1.72×10^{-8}
Aluminum	2.83×10^{-8}
Tungsten	5.50×10^{-8}
Nickel	7.80×10^{-8}
Iron	12.0×10^{-8}
Constantan	49.0×10^{-8}
Nichrome II	110×10^{-8}

Resistivity – Try This #1

Conductor Material	Resistivity (Ohm meters @ 20 °C)
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$$R = \rho \frac{L}{A}$$

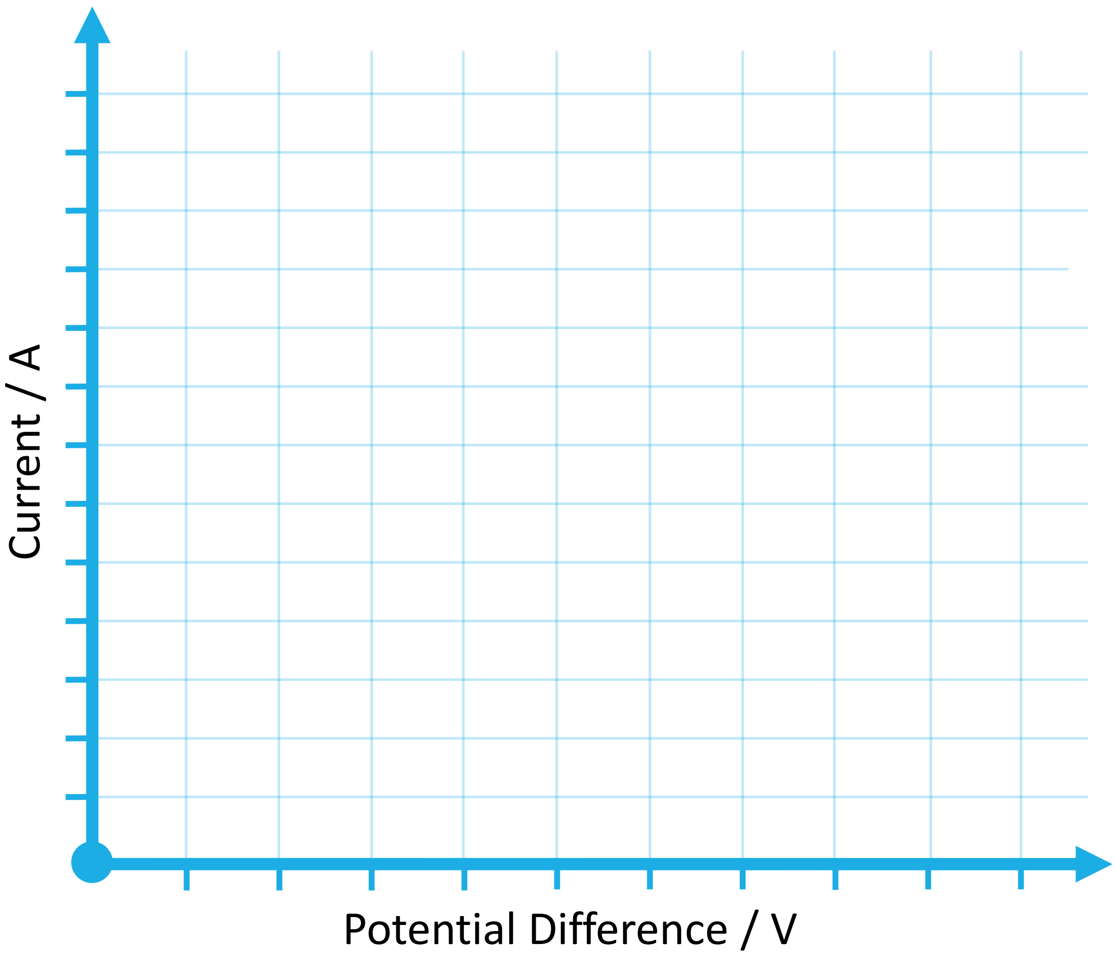
Calculate the resistance of a 1.8 m length of iron wire of with a diameter of 3 mm

Resistivity – Try This #2

A current of 4 A flowed through a 75 m length of metal alloy wire of area 2.4 mm^2 when a p.d. of 12 V was applied across its ends. What was the resistivity of the alloy?

$$\rho = \frac{RA}{L}$$

Graphing Ohm's Law

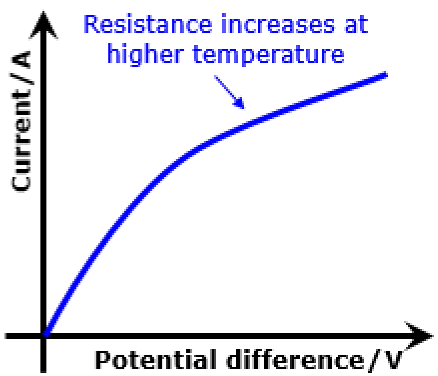


Linear Relationship means that our component is

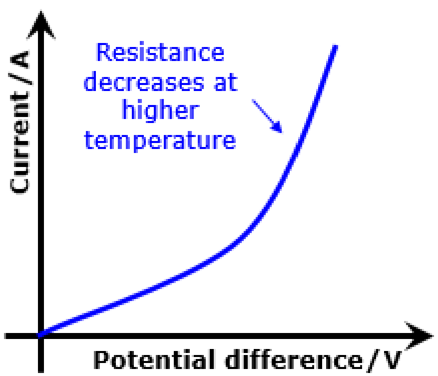
____

Graphing Ohm's Law

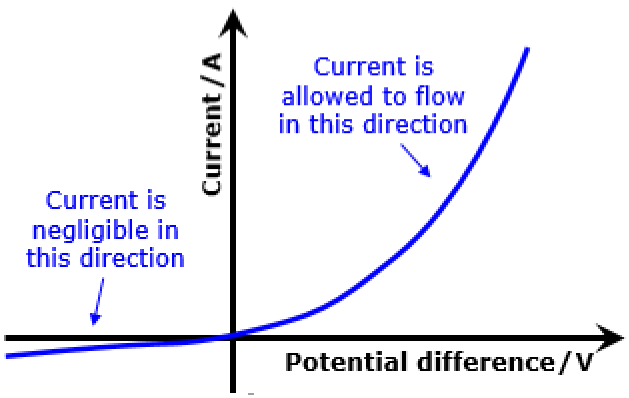
Many/most electrical resistors don't follow Ohm's Law all of the time… For example, incandescent light bulbs have much more resistance as they heat up



***I-V* Graph For A Filament Lamp**



***I-V* Graph For A Thermistor**



***I-V* Graph For A Semiconductor Diode**

Non-linear Relationship means that our component is _____________

Graphing Ohm's Law

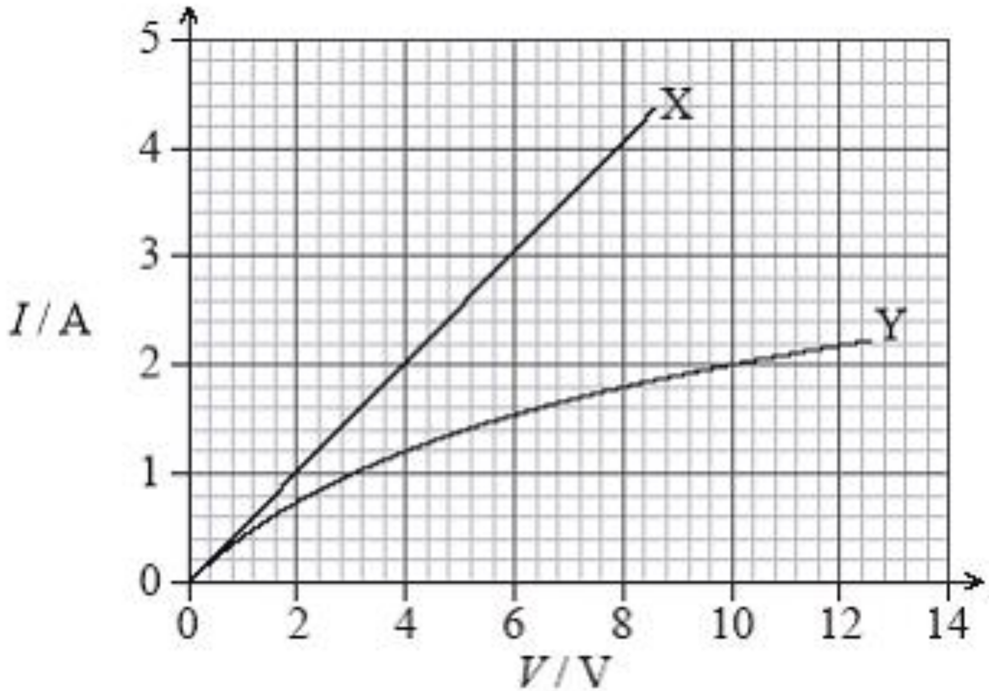
Find V and R for the resistors X and Y when the current is 2A

X

V	
I	
R	

Y

V	
I	
R	



Lesson Takeaways

- ❑ I can describe the different factors the affect resistance
- ❑ I can define resistivity as a property of a material
- ❑ I can compare ohmic and non-ohmic resistors