

Resistors Notes

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What is a resistor? A resistor is a component that slows down the rate at which current moves through it.

All components have their own resistance. Even the wires, which carry the current, have their own resistance. If a component has no resistance at all we call this a superconductor.

A quick reminder of the definitions 😊

Current: the rate of flow of charged particles (usually electrons). Current is measured in amps (A).

Potential difference: the energy transferred per unit charge. It is the "**work done**" on each coulomb of charge that passes between two points. It is measured in volts (V).

A potential difference produces an electric field, this will then produce a force on the charged particles in the field.

The bigger the potential difference the bigger the force on the particles 😊

Resistance: the ability of a component or a material to resist the movement of current through it.

Resistance is measured in Ohms (Ω)

Ohm's Law

All resistors fall into one of two categories. They are either **ohmic conductors** or **non-ohmic conductors**.

Ohmic conductors are resistors that **obey Ohm's law** and **non-ohmic conductors do not obey Ohm's law**.

What is Ohm's law? Ohm's law says that as the potential difference (V) increases, the current (I) increases in direct proportion at a constant temperature.

What is direct proportion? It means an increase or decrease between two values in the same ratio.

For example, if the potential difference doubles, the current will also double. This means a graph of current vs. potential difference will always be a straight line through the origin (0,0).

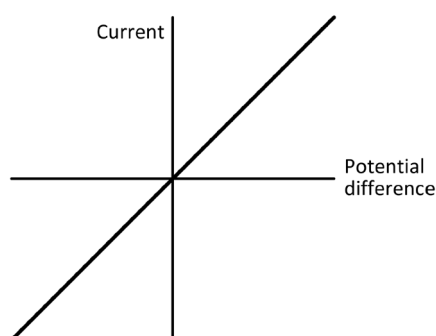
Why does increasing the temperature affect the resistance?

If the temperature of a metal conductor increases, the ions of the metal vibrate more vigorously. This will increase the number of collisions between the delocalised electrons and the metal ions. Therefore, for a metal, as the temperature increases so too does resistance.

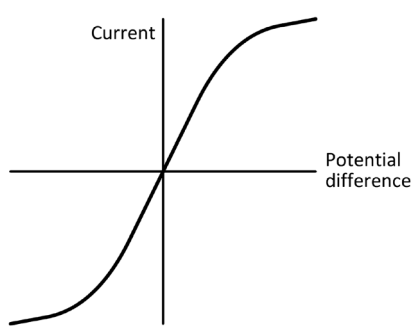
How could I be asked a question about Ohmic or non-ohmic conductors?

The most common question is **the resistance profiles** of a fixed resistor, a lamp and a diode.

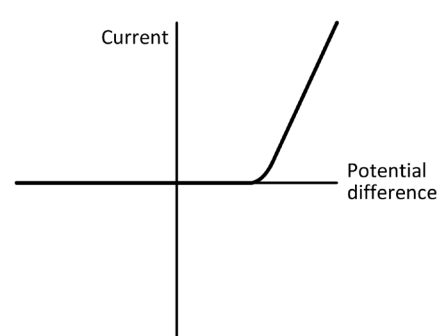
Please learn the profiles of these diagrams. They usually appear as a match up or label activity. 😊



A fixed resistor – an ohmic conductor.



A lamp – a non-ohmic conductor.



A diode – a non-ohmic conductor.

The Resistors

A Fixed Resistor

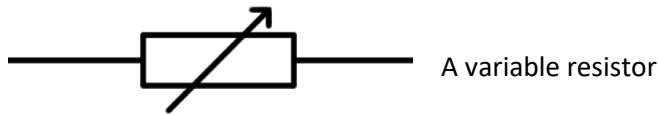
A fixed resistor is a resistor whose resistance has a set or fixed value. For example, if a fixed resistor has a value of $50\ \Omega$ this value cannot be changed.



A Variable Resistor

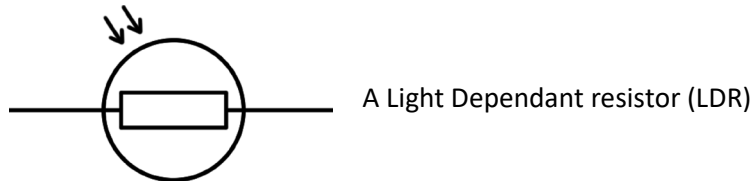
A variable resistor is a resistor whose resistance can be varied or changed. The most common variable resistor that most people would encounter is a dimmer switch which can make lights dimmer or brighter.

How does a dimmer switch work? When you turn a dimmer switch, you are changing the amount of wire that the current must flow through. More wire means a higher resistance, which means dimmer lights. Less wire means less resistance and therefore brighter lights 😊



A Light Dependent Resistor (LDR)

What is a light dependent resistor? An LDR is a resistor whose resistance depends on the amount of light that hits it.

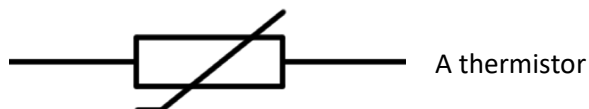


At high light levels, an LDR's resistance is low, so more current can flow through the circuit.
At low light levels (in the dark), an LDR's resistance is high, so less current can flow through the circuit.

Where are LDR's used? They have quite a few uses. They are found in the light sensors for smart phones and other cameras, they are also used in security lighting and portable road lights.

A Thermistor

What is a thermistor? A thermistor is a resistor whose resistance depends on the temperature.
The resistance of a thermistor decreases as temperature increases.



At high temperatures, the resistance of a thermistor is low so more current can flow through the circuit.
At low temperatures, the resistance of a thermistor is high so less current can flow through the circuit.

Where are thermistors used? Thermistors are used to control home heating systems and in some larger fire alarm systems.