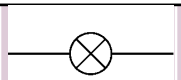
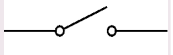
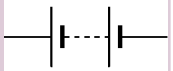
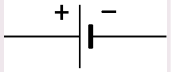
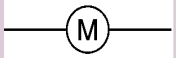
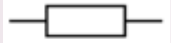
Electricity Page 1

START

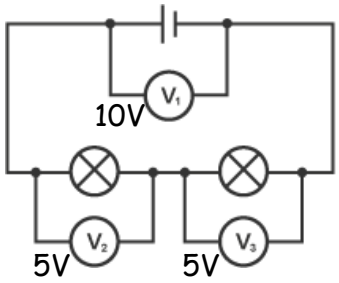
Key Words:

Conductor A material or object that allows electricity to flow through it.
Insulator A material or object that does not allow electricity to flow through it.
Ohmic conductor a conductor that obeys Ohm's Law (V=IxR).
Current The rate of flow of electrical charge around a circuit.
Potential Difference (P.d) A measure of work done. Makes the current flow.
Resistance Opposes the electric current.
Thermistor A temperature dependent resistor
LDR A light dependent resistor.
Diode A component that allows current to flow in only one direction.
Power The rate that energy is transferred.
Alternating P.d Voltage that changes from positive to negative.
Direct P.d Voltage that pushes the current in one direction .
National Grid A system of cables & transformers that connect power stations to consumers and our homes.
Transformer A device that increases or decreases P.d.

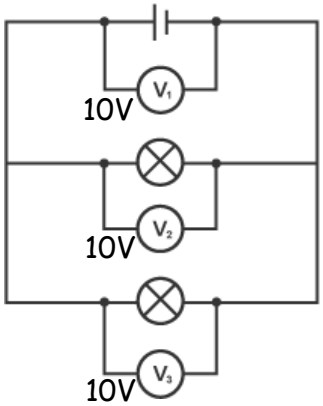
Bulb		Converts electrical energy into light and heat.
Switch		Can be open (breaks the circuit) or closed (completes the circuit)
Battery		A group of cells. A source of power for the circuit.
Cell		Converts chemical energy to electrical energy. Gives a circuit power.
Ammeter		Measures the current in a circuit.
Voltmeter		Measures the potential difference (voltage) of component(s).
Motor		Converts electrical energy into kinetic (movement) energy.
Resistor		Slows down electrons, provides the circuit with resistance.
Wire		Long metal wires which allow electricity to flow through.

- P.d. is measured using a voltmeter connected in parallel across a component.
- In a series circuit the p.d. of the battery is shared between the components.
- In a parallel circuit the p.d. across each branch is the same as the p.d. across the battery.

Series

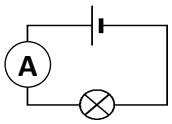


Parallel

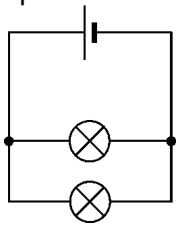


- Current is measured using an Ammeter in series with the circuit.
- In a series circuit the current is the same everywhere.
- In a parallel circuit the current is split when the wires split.
- The circuit needs to be complete for the current to flow.

Series



Parallel



LEARN & USE THE UNITS:

Charge	Coulombs (C)
Current	Amps (A)
P.d.	Volts (V)
Resistance	Ohms (Ω)
Time	Seconds (s)

- A SERIES circuit has ONE loop.
- A PARALLEL circuit has MORE THAN ONE loop.

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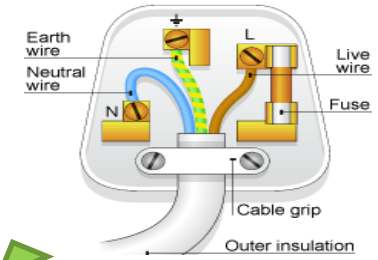
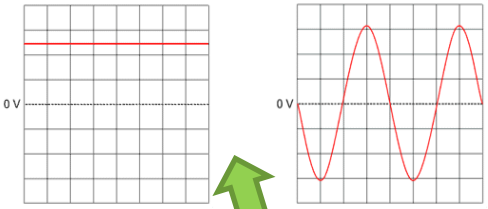
- Blue is neutral and goes on the left
- Green/yellow is Earth and goes to the top
- Brown is live and goes to the right
- A fuse will melt & break the circuit when the current is too high.

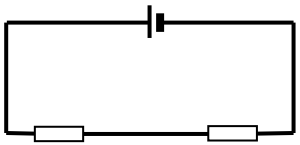


Direct current(DC) only flows in one direction, whereas current from the mains supply is **alternating current (AC)** because it alters direction.



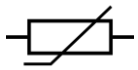
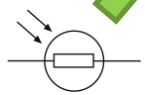
Household electricity has a potential difference of around **230V** and a frequency of **50 Hz (Hertz),** so changes direction 50 times in a second.

The **total resistance** in a **series** circuit is the sum of the resistors in the circuit

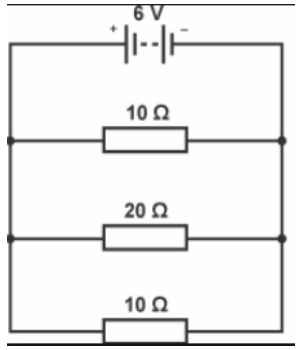


e.g. 6 + 10 = 16 Ω

- A **variable resistor** can alter the resistance in a circuit and is useful for things like controlling volume or light dimmer switches.
- Thermistors decrease resistance when it gets hotter.
- LDR (Light dependent resistors) decrease resistance when it gets brighter.

Thermistor  LDR 

The **total resistance** in a **parallel** circuit is the reciprocals of all of the resistances.



e.g. $\frac{1}{R_{Total}} = \frac{1}{10} + \frac{1}{20} + \frac{1}{10} = 0.25$

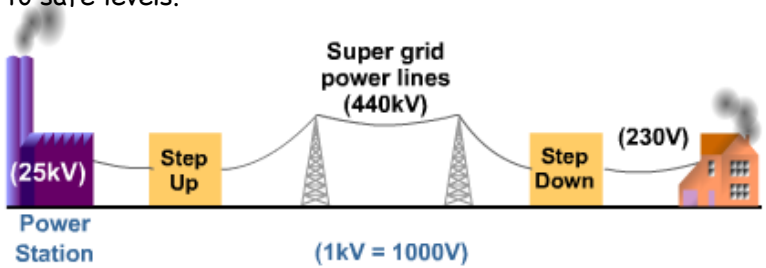
This answer is 1 divided by the total resistance so we need to do 1 divided by our answer:

$$1 \div 0.25 = 4\Omega$$

4Ω is the total resistance for this circuit.
Use your scientific calculator to add the fractions!

The National Grid

- Electricity is transferred from power stations to consumers along cables of the National Grid.
- When a current flows through a wire some energy is lost as heat. The higher the current, the more heat is lost.
- To reduce these losses, the National Grid transmits electricity at a low current. This needs a high voltage.
- Power stations produce electricity at 25,000V. Electricity is sent through the National Grid cables at 400,000V, 275,000V and 132,000V.
- Step-up transformers are used at power stations to produce the very high voltages needed to transmit electricity through the National Grid power lines.
- These high voltages are too dangerous to use in the home, so step-down transformers are used locally to reduce the voltage to safe levels.



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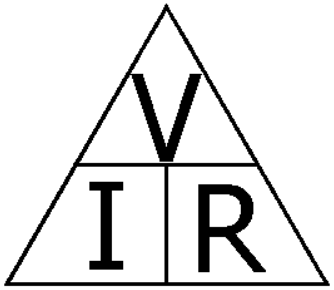
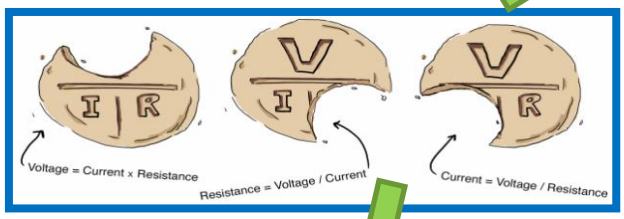
Use the formula triangle to calculate different quantities of a circuit.
I = Current (in Amps)
V = Potential difference (in Volts)
R = Resistance (in Ohms)





Electricity Questions
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1. Draw a circuit diagram to show how the P.d and current of a bulb can be investigated.
2. Name the units for current, potential difference and resistance.
3. What is the total resistance of a series circuit composed of the following resistors: 3Ω, 2Ω, 5Ω?
4. If 60Ω resistor has a P.d of 12V put across it, how much current will flow?
5. Calculate the missing voltages in the circuits below:

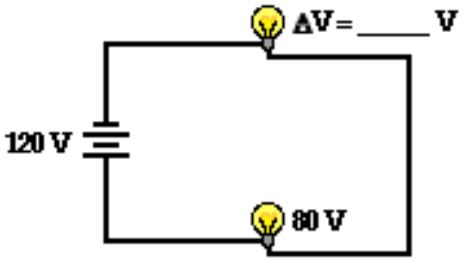

Diagram A

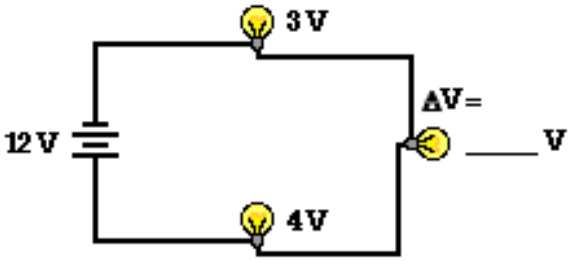

Diagram B

6. What happens to the current in a series circuit?
7. How is the current shared differently in a series circuit versus a parallel circuit?
8. Sketch a wired plug and label each wire.

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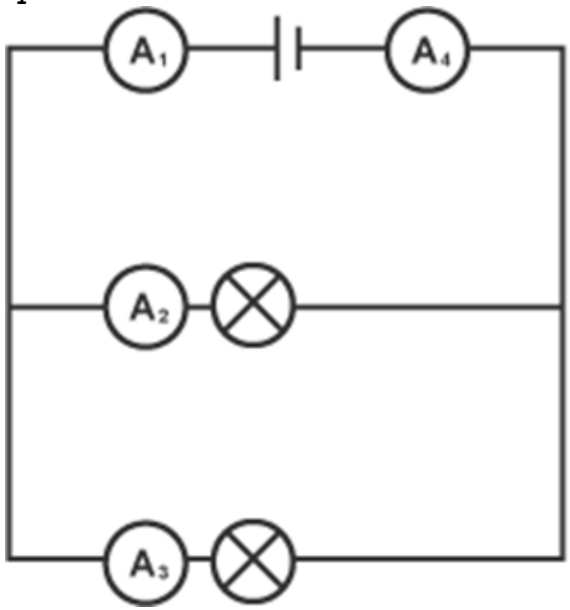
8. The current through A_1 = 6A and the current through A_2 = 4A What is the current through A_3 and A_4 ?



9. Draw a labelled diagram of the National Grid.
10. Why is the P.d. increased to over 400kV for transmitting electricity across the national grid?
11. Explain what potential difference, current and resistance are in words.
12. How does temperature affect the resistance of a thermistor?
13. How does brightness affect the resistance of an LDR?
14. Write the formula triangle for V=IxR. Come up with a rhyme or another way to remember the triangle.

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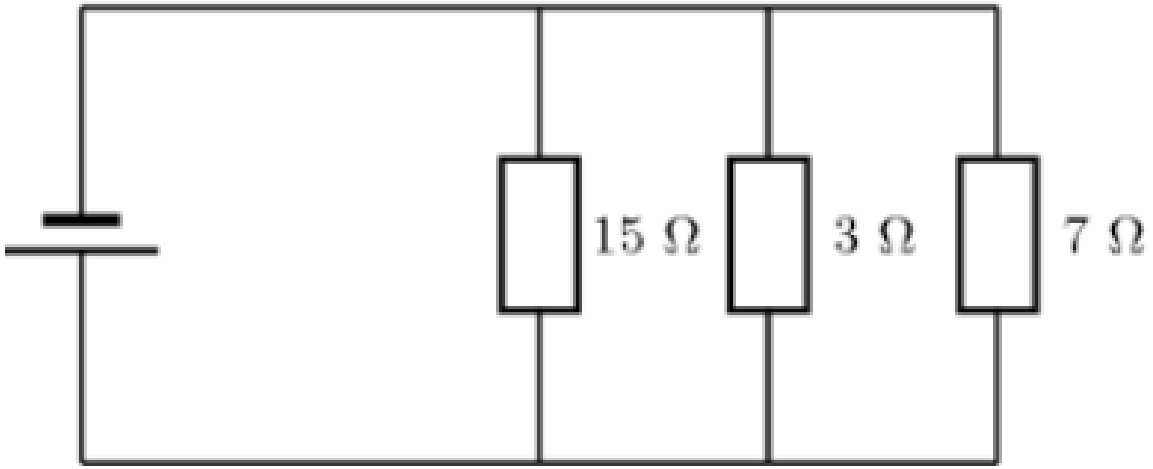
15. What do step-up and step down transformers do and why are they important?

16. What is the total resistance of the followina circuit?



17. LDRs are used when appliances need to change according to the brightness of surrounding. An example is on street lights. When would a thermistor be used? Include at least one example.

18. How is the National Grid made more efficient?

19. Would the total resistance of a circuit be higher if four 5Ω resistors are connected in series, or in parallel? Why?