Electromagnets

2. Current

CONCEPT 2

PARALLEL CIRCUITS

NOTES

What are electrical circuits

Electrical circuits are used in devices in order to convert electrical energy into something useful, for example heat, light or sound. This energy is transferred when small particles called electrons move in an electrical conductor. We can measure the flow of these charges in a circuit by counting how many units of charge pass a point in the circuit per second. This is called the current in the circuit. This can be modelled using rope (see topic 2.1). Circuits must be made of complete loops otherwise charge cannot flow and energy cannot be transferred.

Most circuits used in electrical devices have combinations of series and parallel circuits within them.

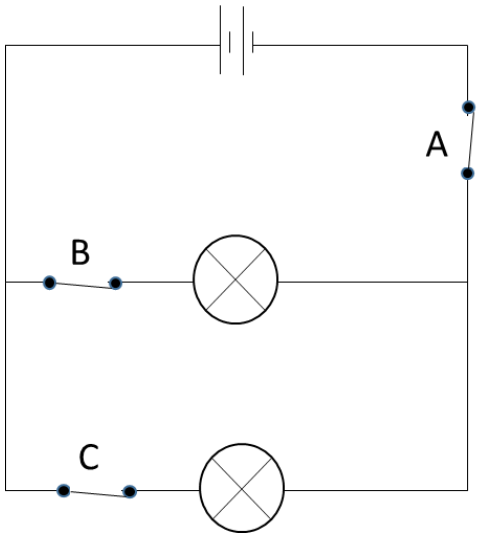
Parallel Circuits

In a parallel circuit:

- Each component is connected in loops between the two terminals of a cell or battery.
- There are several paths that the current can take.

This diagram shows a parallel circuit.

Start with your finger on the battery and follow the wires around the circuit. You will soon need to make a decision about which path to follow before you return back to the battery. This means that there is more than one loop in the circuit so it must be parallel.



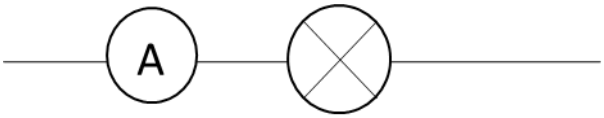
Changing components in parallel circuits

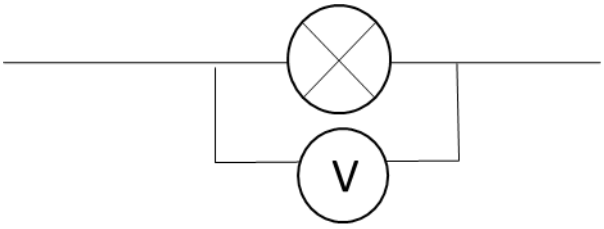
In the parallel circuit above, components can be changed with the following effects:

Component changed	Effect	Why?
Adding another cell	The brightness of the bulbs increase	The potential difference of the circuit has been increased so there is more energy being transferred by the current. Each bulb will now get a greater amount of energy per unit charge so the brightness of all the bulbs increases.
Adding another bulb in parallel	The brightness of the bulbs stays the same	The resistance of each loop in the circuit is unchanged and each bulb is receiving the same amount of energy per unit charge so the brightness of the bulbs stays the same.
Opening switch A	Both bulbs do not light	The circuit has been broken along the path of both loops in the parallel circuit therefore current cannot flow to either bulb.
Opening switch B	The bulb nearest the battery does not light	The circuit has been broken on the loop that only includes the bulb nearest the battery. The current can still pass the bulb furthest away from the battery so it will continue to stay lit.
Opening Switch C	The bulb furthest away from the battery does not light	The circuit has been broken on the loop that only includes the bulb furthest from the battery. The current can still pass the bulb nearest to the battery so it will continue to stay lit.

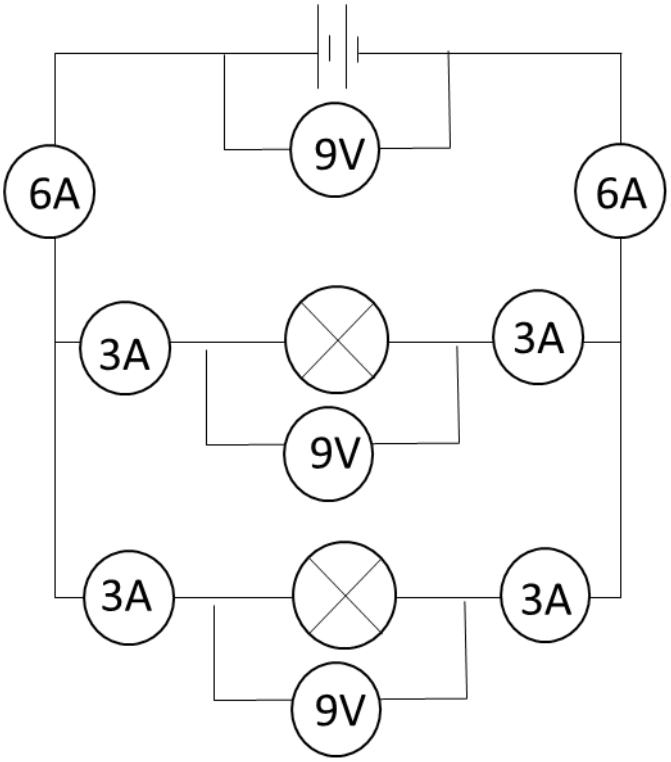
Analysing Current and Potential Difference in Parallel Circuits

An ammeter measures the current at any point in a circuit i.e. the number of charges passing a point in one second. Think of it like a frictionless revolving door in one of the wires in the circuit counting each unit of charge that passes. It therefore must be connected in series with components in a circuit.





A Voltmeter measures the potential difference between two points in a circuit. It compares the energy that each unit of charge carries between two points in a circuit. In the same way that if you are comparing the height of two people you need to stand back from them, a voltmeter has to stand back from the circuit to make the comparison. It therefore must be connected in parallel with components in a circuit.



In a parallel circuit the potential difference is the same in all parts of the circuit regardless of how many loops there are. However, the current splits up between each loop. In the diagram below you can see how the total current flowing into a junction equals the total current flowing out from a junction.