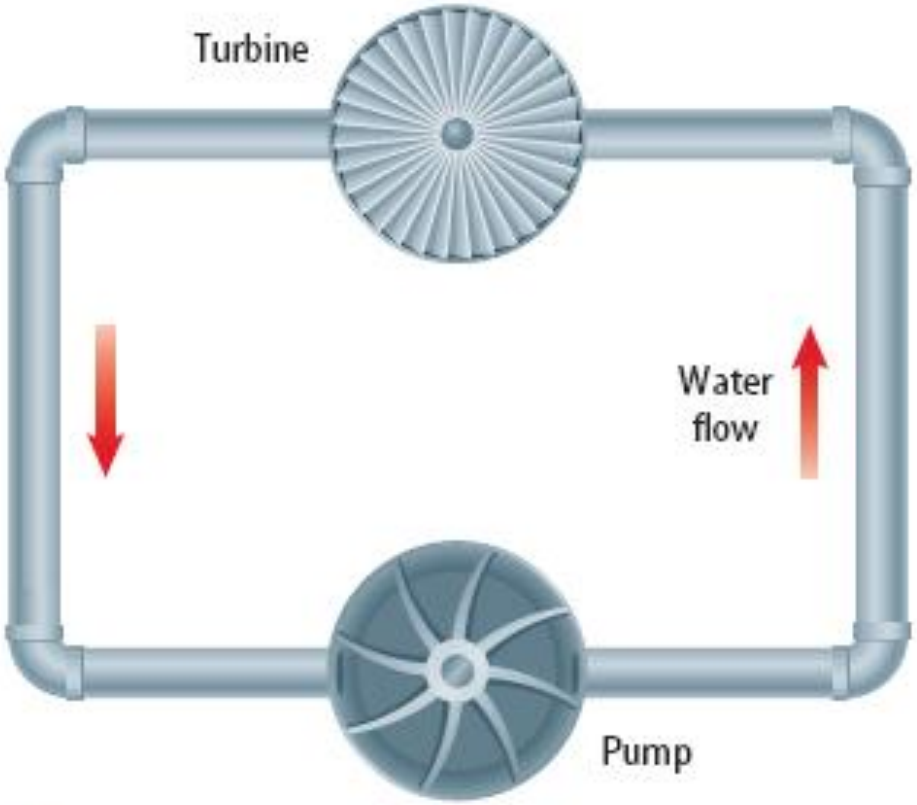
What is the difference between static electricity and current electricity?

Static electricity is stationary or collects on the surface of an object, whereas current electricity is flowing very rapidly through a conductor.

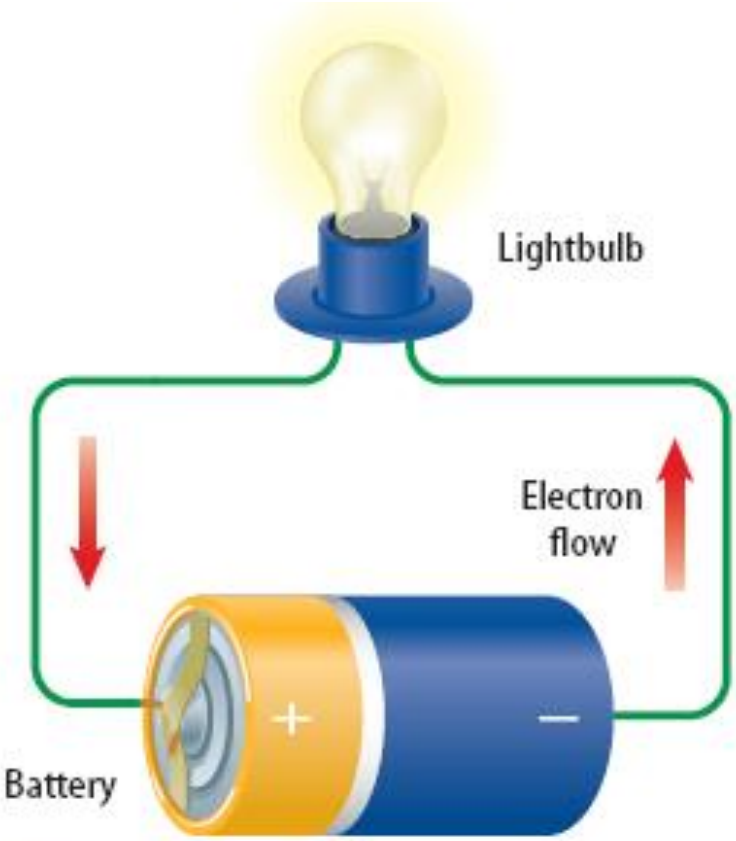
The flow of electricity in current electricity has electrical pressure or voltage. Electric charges flow from an area of high voltage to an area of low voltage.

http://sciencelessons.weebly.com

There are some similarities between the flow of water in a pipe and the flow of electric current through a circuit.



A Water flows only when the pipe makes a closed loop.



B Electric charge flows only when the wire makes a closed loop.

The pressure of the water flowing through the pipes on the last slide compare to the voltage (electric potential) flowing through the wires of the circuit. The unit used to measure voltage is volts (V).

The flow of charges in a circuit is called current. Current (I) is measured in Amperes (A).

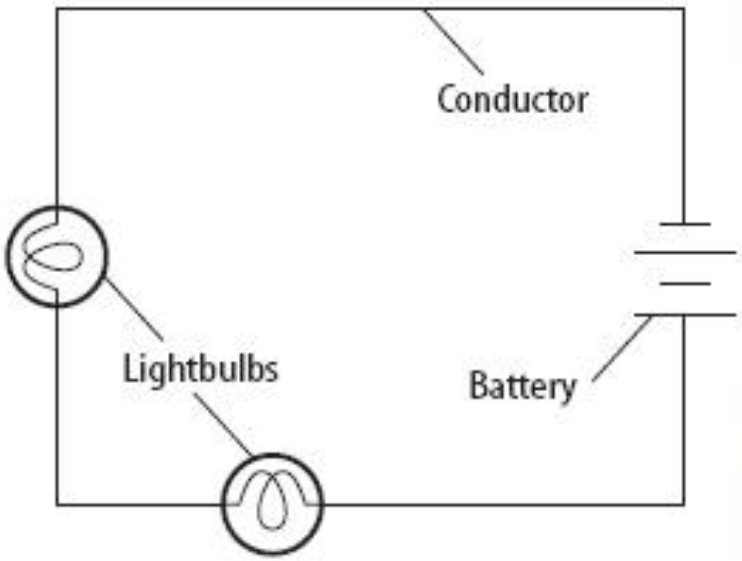
What are electric circuits?

Circuits typically contain a voltage source, a wire conductor, and one or more devices which use the electrical energy.

What is a series circuit?

A series circuit is one which provides a single pathway for the current to flow. If the circuit breaks, all devices using the circuit will fail.

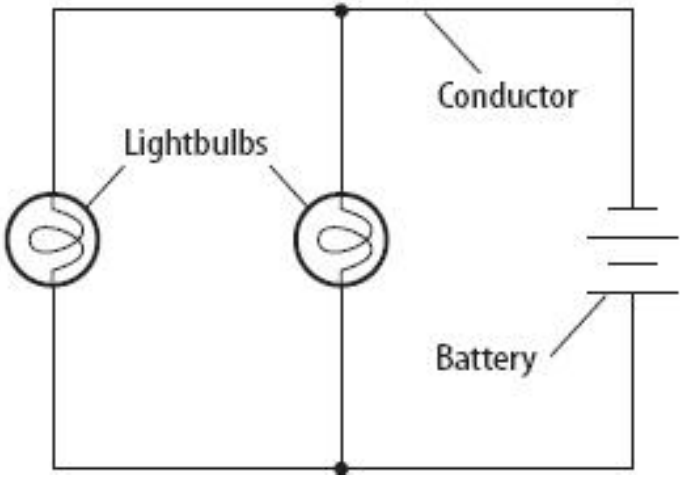
A series circuit provides only one path for the current to follow. *What happens to the brightness of each bulb as more bulbs are added?*

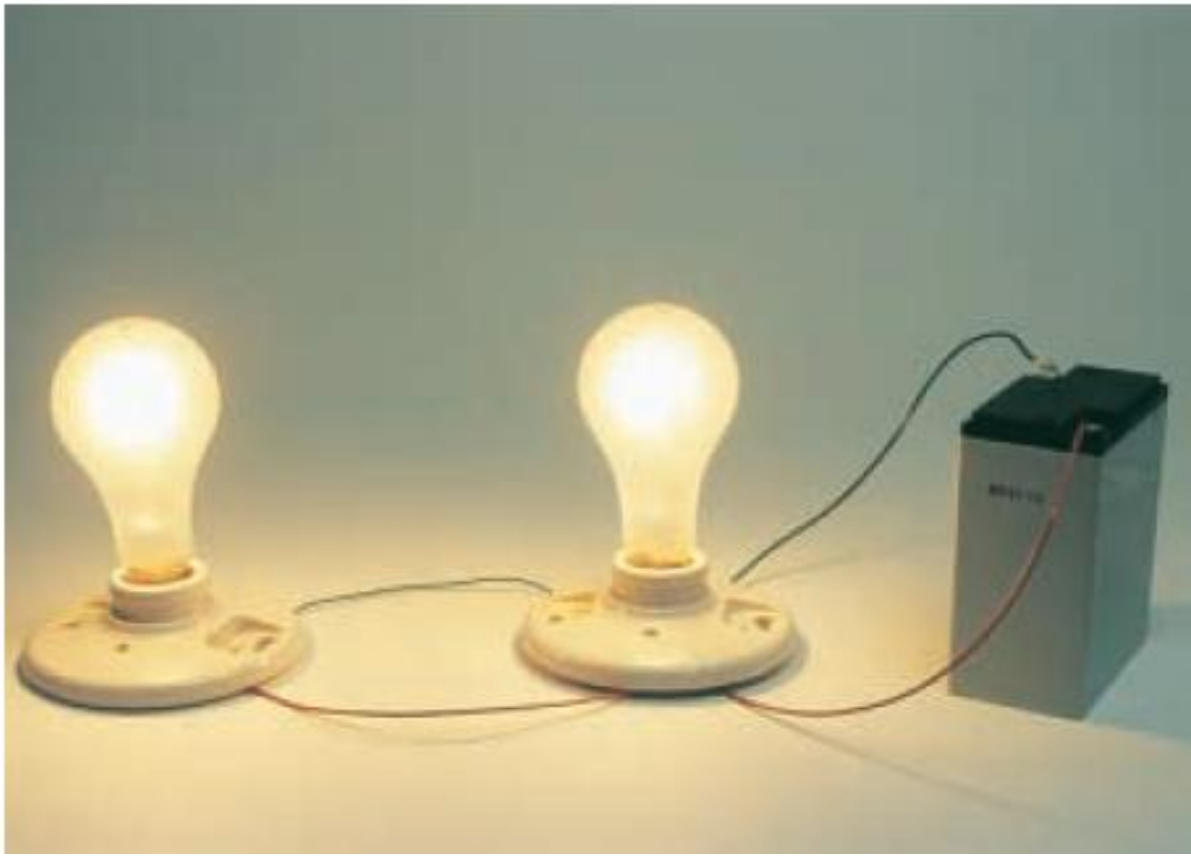


What is a **parallel** circuit?

A parallel circuit has multiple pathways for the current to flow. If the circuit is broken the current may pass through other pathways and other devices will continue to work.

Figure 18
In parallel circuits, the current follows more than one path. *How will the voltage difference compare in each branch?*





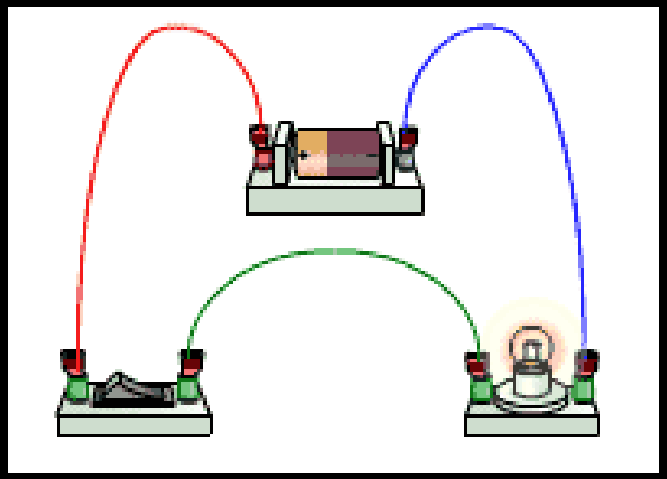
What is the difference between an open circuit and a closed circuit?

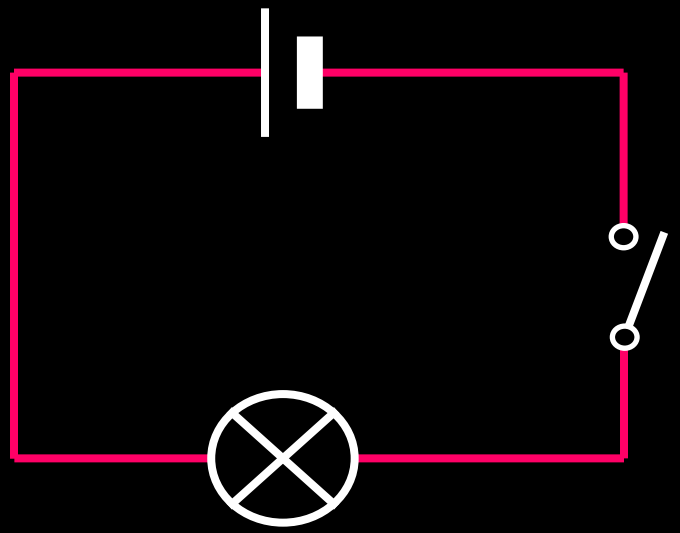
A **closed circuit** is one in which the pathway of the electrical current is complete and unbroken.

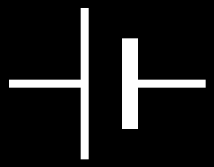
An **open circuit** is one in which the pathway of the electrical current is broken. A switch is a device in the circuit in which the circuit can be closed (turned on) or open (turned off).

circuit diagram

Scientists usually draw electric circuits using symbols;

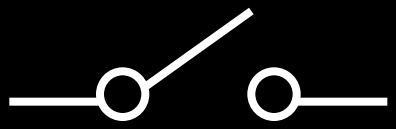






1 battery

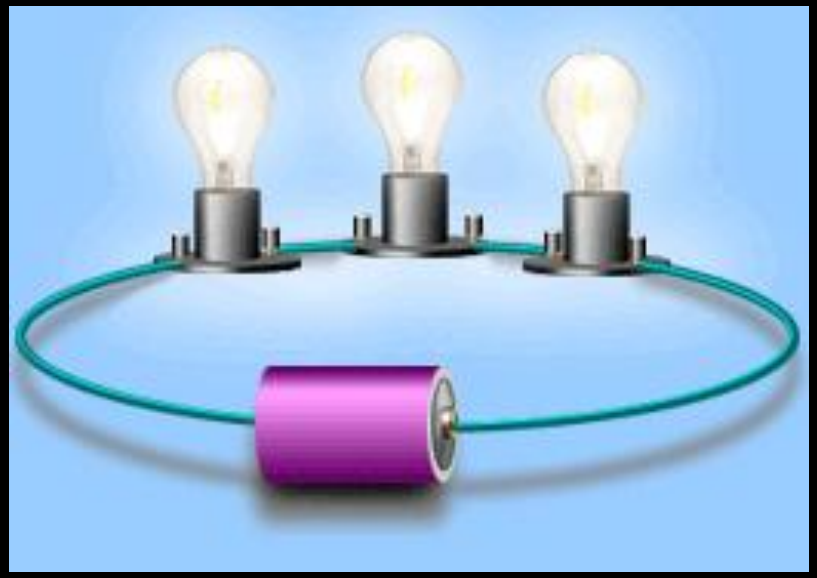
lamp



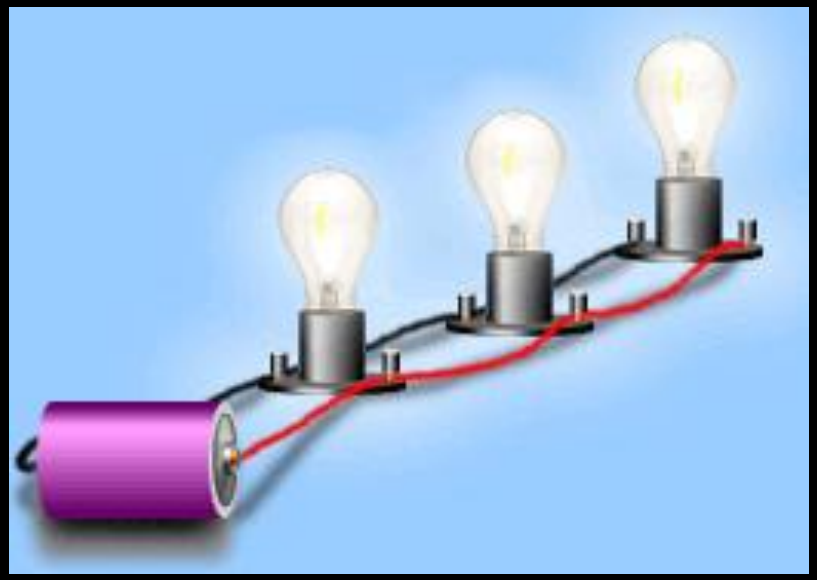
switch

wires

Simple Circuits



- Series circuit
  - All in a row
  - 1 path for electricity
  - 1 light goes out and the circuit is broken

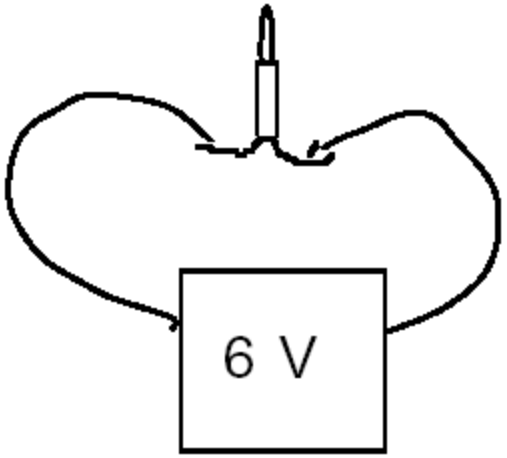


- Parallel circuit
  - Many paths for electricity
  - 1 light goes out and the others stay on

SERIES CIRCUITS

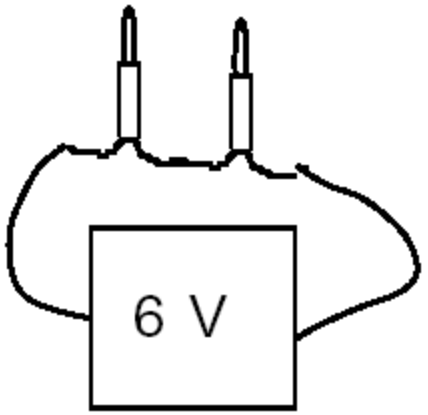
Connect one bulb to the battery.

1



Connect 2 bulbs and the battery to form a series circuit.

2



Connect 3 bulbs and the battery to form a series circuit.

PARALLEL CIRCUIT

- Place two bulbs in parallel. What do you notice about the brightness of the bulbs?
- Add a third light bulb in the circuit. What do you notice about the brightness of the bulbs?
- Remove the middle bulb from the circuit. What happened?

Complete circuit

- For the bulb to light up, the current must be able to flow from the battery to the bulb, the back again to the battery. Electricity will only flow when there is a complete circuit, with a pathway leading back to its source.

Voltage: Energy in the circuit

- Electrons carry potential energy around a circuit. The energy is supplied from the mains supply through the power pack or battery, and used by components such as bulbs which converts electrical energy to light energy.
- The energy supplied by a power source or used by a component is measured in volts(V) by a voltmeter which must be connected in parallel in a circuit.
- A voltmeter measures the ‘potential difference’ between the 2 points in the circuit it is connected to.

Current: Ampere (A)

- The stream of electrons flowing around a circuit is the current. Current is measured in amperes (=Amps) by an ammeter, which must be connected in series in a circuit.
- Ammeter measure the size of the current.

Ohm's Law

$$I = V / R$$

- I= Current (Amperes) (amps)
- V= Voltage (Volts)
- R= Resistance (ohms)

OHM's LAW

- Measure the current and voltage across each circuit.
- Use Ohm's Law to compute resistance.

Series Circuit

Voltage	Current	Resistance

Parallel Circuit

Voltage	Current	Resistance

How you should be thinking about electric circuits:

Voltage: a force that pushes the current through the circuit.

How you should be thinking about electric circuits:

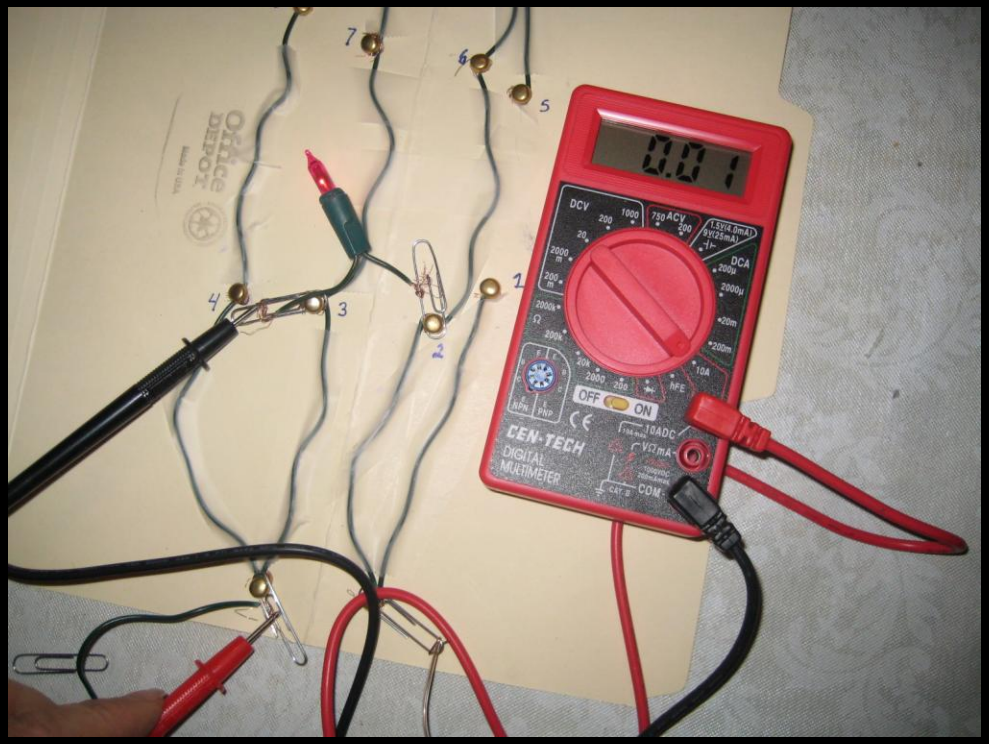
<u>Resistance</u>: friction that impedes flow of current through the circuit.

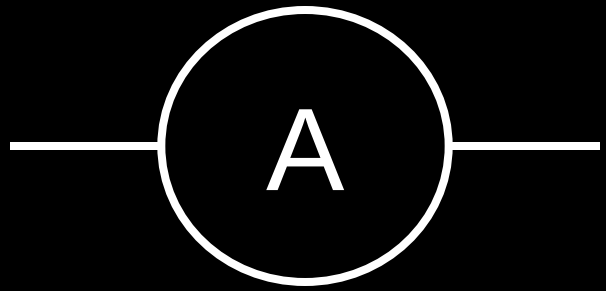
How you should be thinking about electric circuits:

Current: the electrons flowing through the wires of the circuit.

measuring current

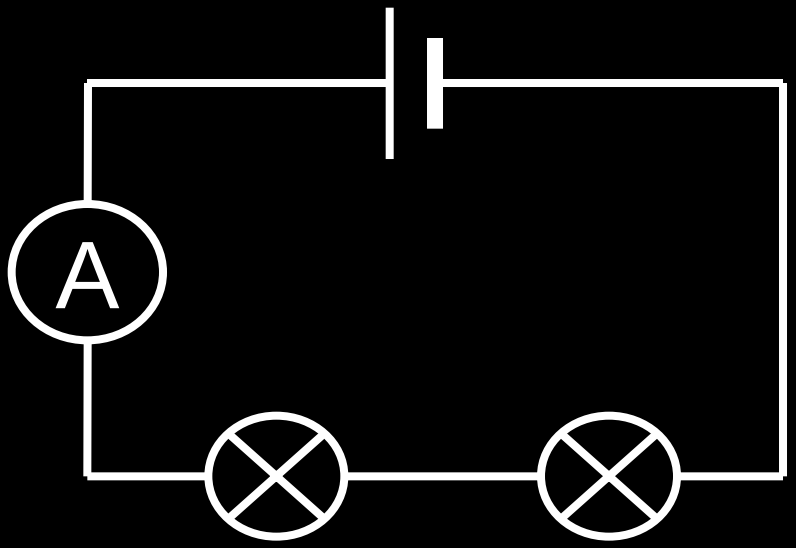
Electric current is measured in **amps** (A) using an ammeter connected in series in the circuit.



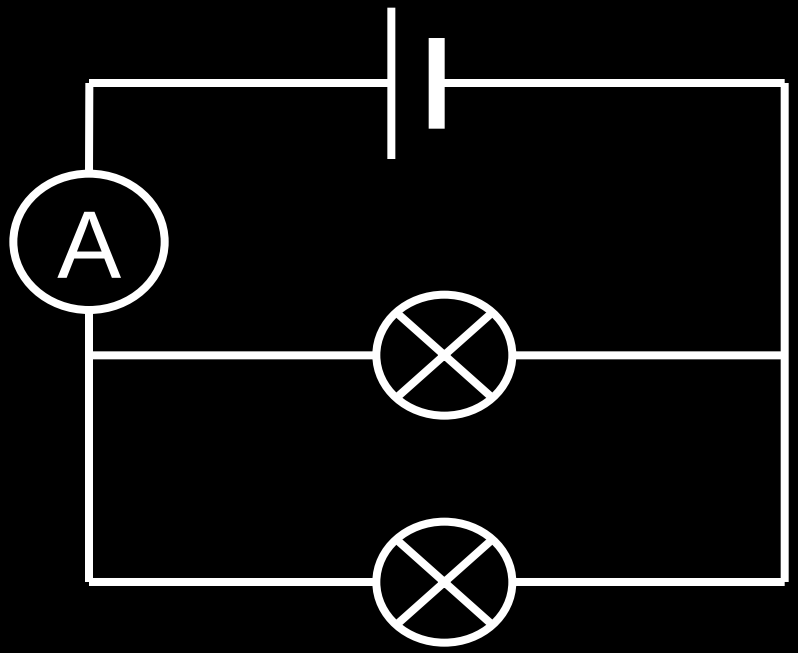


measuring current

This is how we draw an ammeter in a circuit.



SERIES CIRCUIT

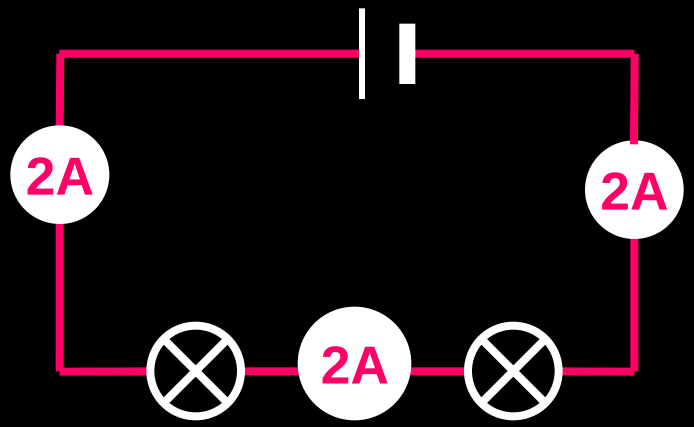


PARALLEL CIRCUIT

measuring current

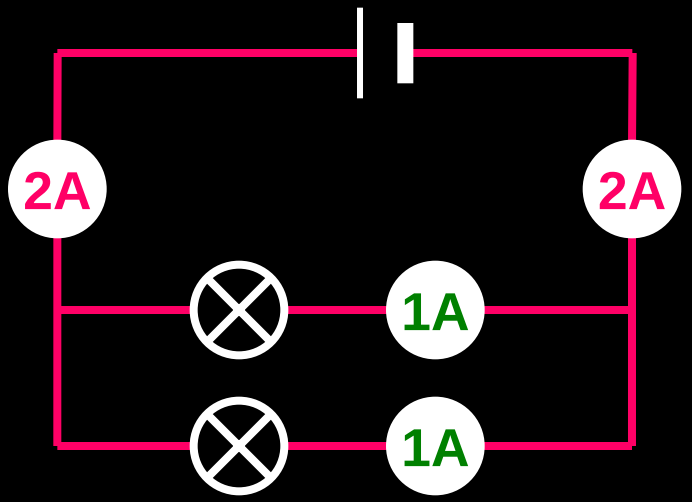
SERIES CIRCUIT

- current is the **same** at all points in the circuit.

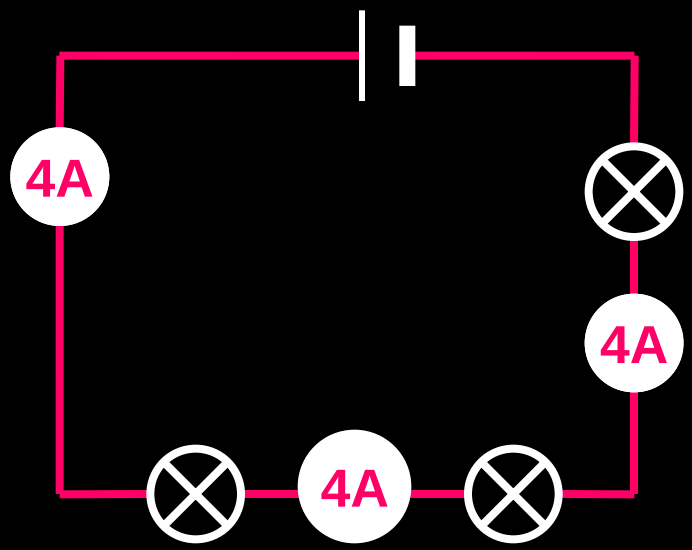


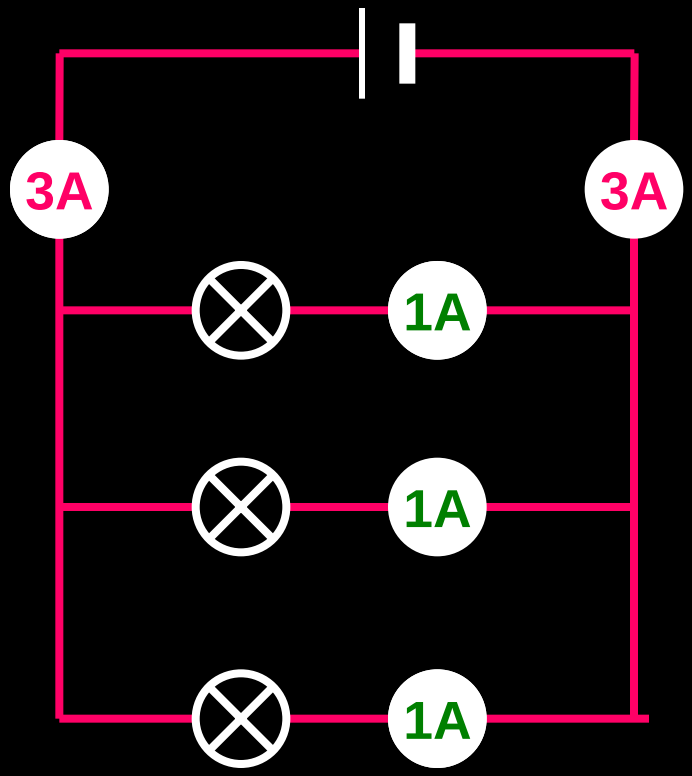
PARALLEL CIRCUIT

- current is **shared** between the components

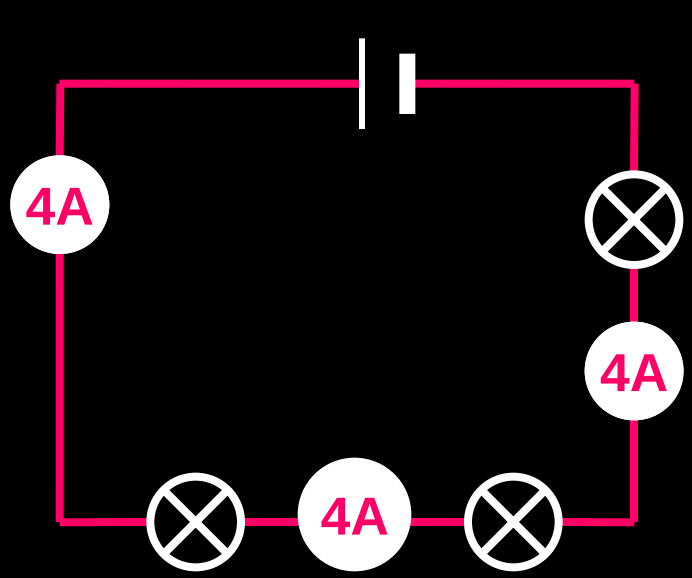


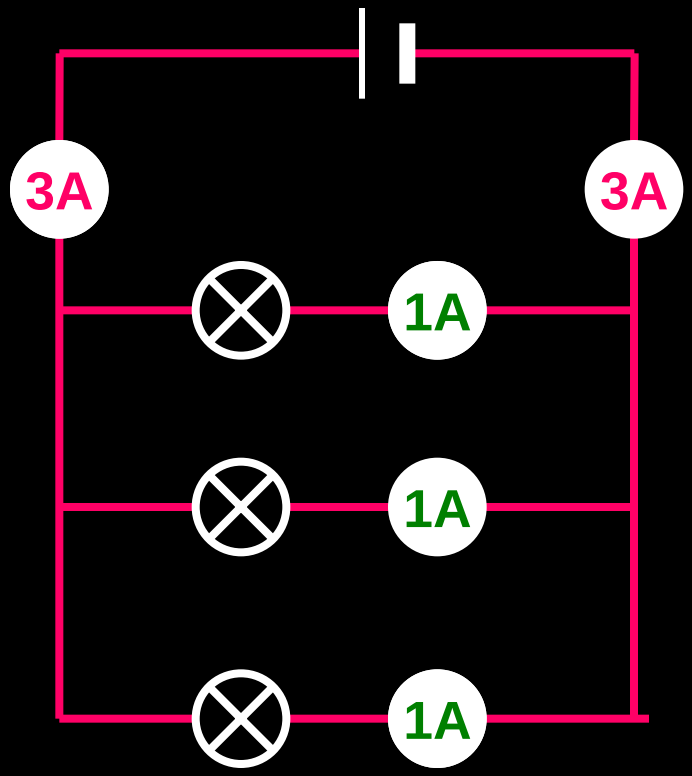
copy the following circuits and fill in the missing ammeter readings.





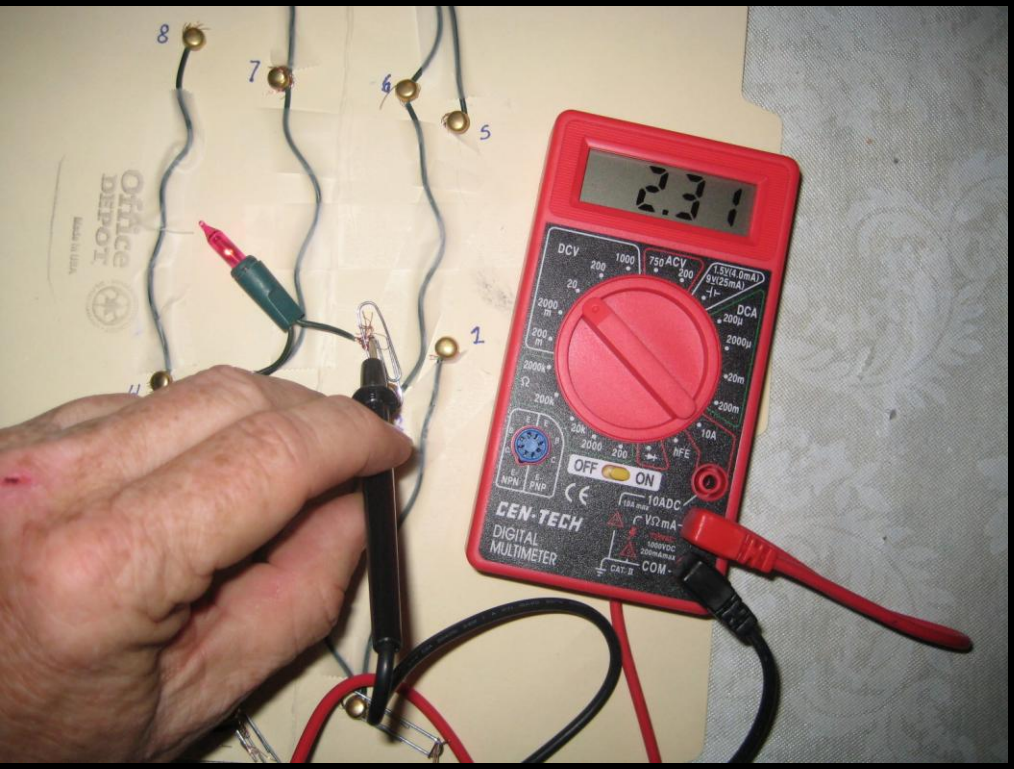
fill in the missing ammeter readings.





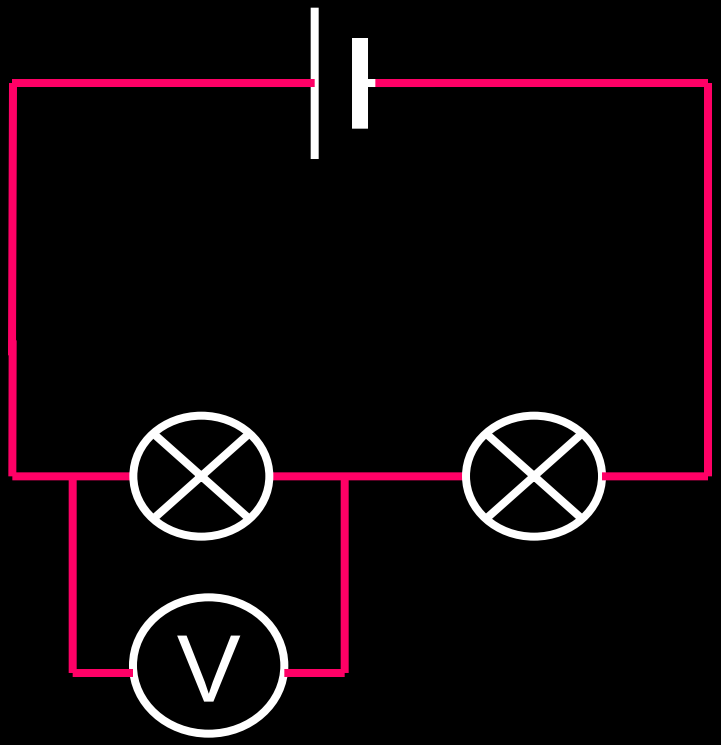
measuring voltage

The ‘electrical push’ which the cell gives to the current is called the voltage. It is measured in **volts** (V) on a **voltmeter**

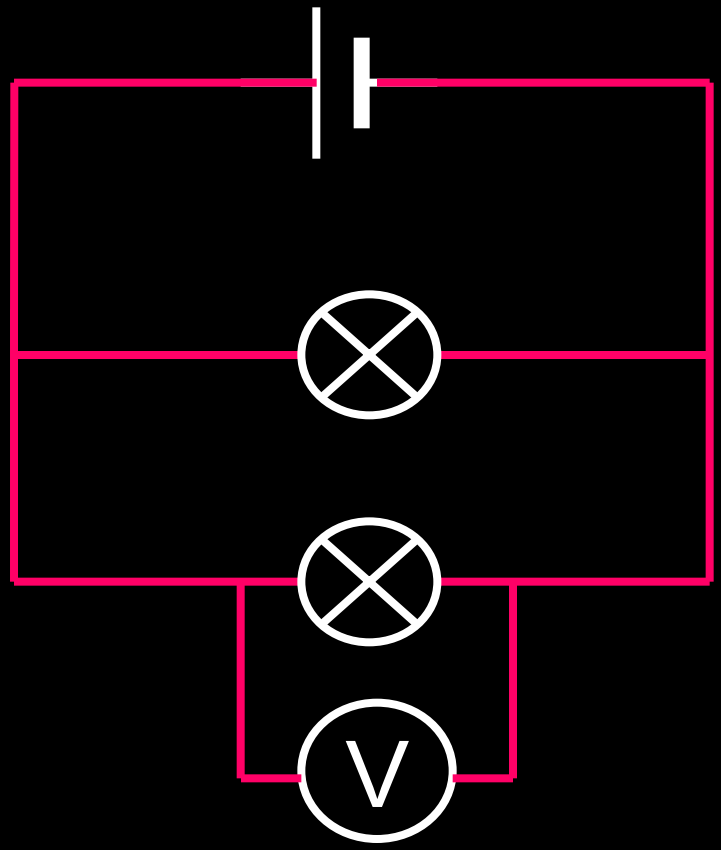


measuring voltage

This is how we draw a voltmeter in a circuit.



SERIES CIRCUIT



PARALLEL CIRCUIT

SERIES CIRCUITS

Explain what happens to the current in a series circuit when there is a break in the circuit.

The circuit is no longer complete, therefore current can not flow

Explain what happens to the voltage across each bulb as more bulbs are added to the circuit.

The voltage decreases because the current is decreased and the resistance increases.

PARALLEL CIRCUITS

Explain what happens to the current in each bulb as more bulbs are added to the circuit.

The current remains the same. The total resistance drops in a parallel circuit as more bulbs are added

Explain what happens to the total current provided by the battery as more bulbs are added to the circuit.

The current increases.

Series and Parallel Circuits

- Series Circuits
  - only one end of each component is connected
  - e.g. Christmas tree lights

- Parallel Circuits
  - both ends of a component are connected
  - e.g. household lighting

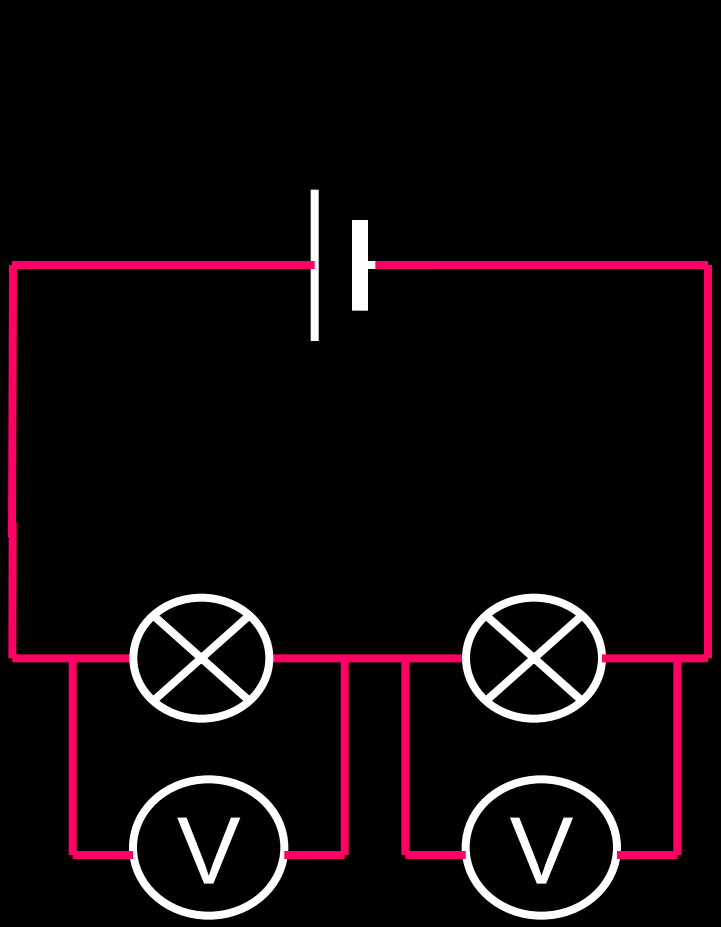
measuring voltage

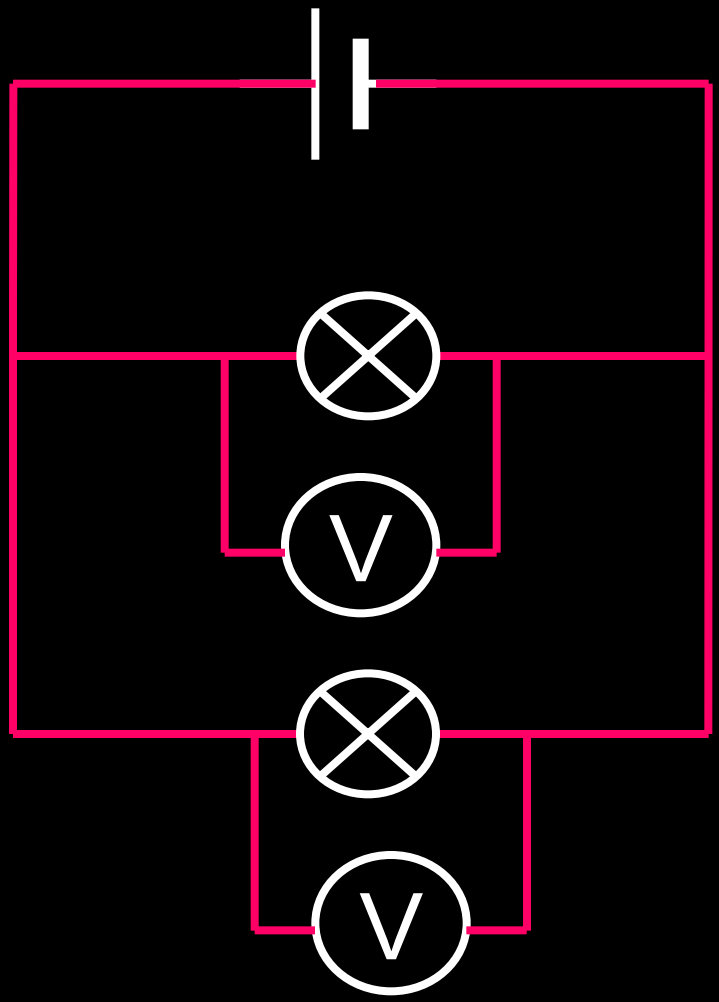
Different cells produce different voltages. The bigger the voltage supplied by the cell, the bigger the current.

Unlike an ammeter, a **voltmeter** is connected **across** the components

Usually use the term **Potential Difference** (pd) when we talk about voltage.

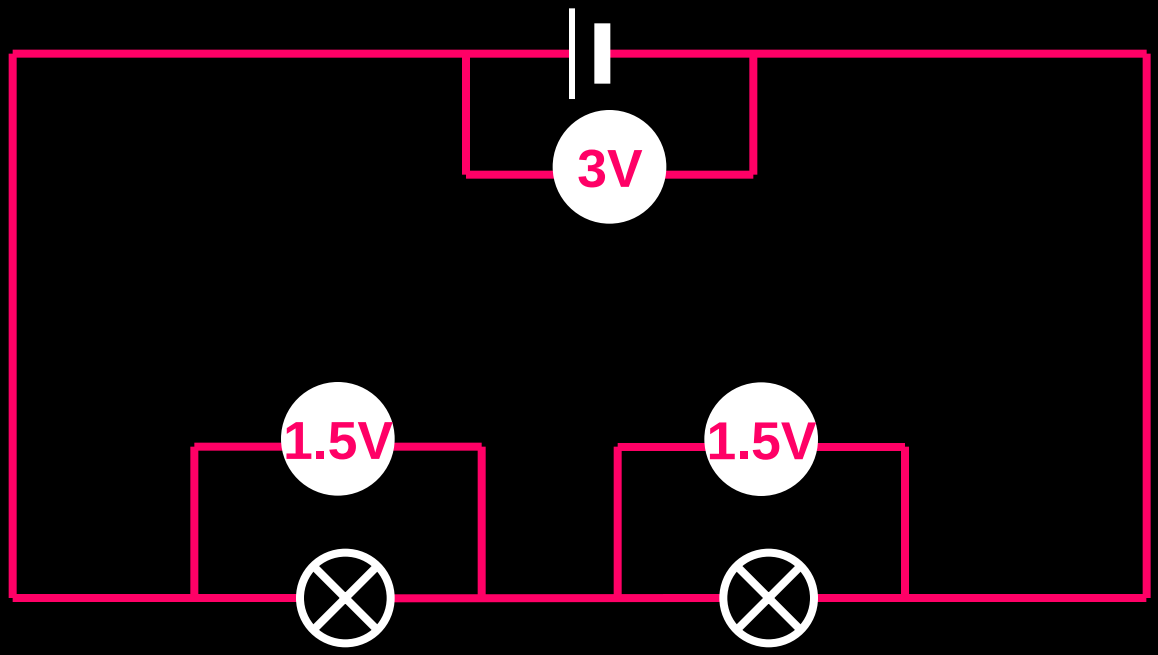
measuring voltage





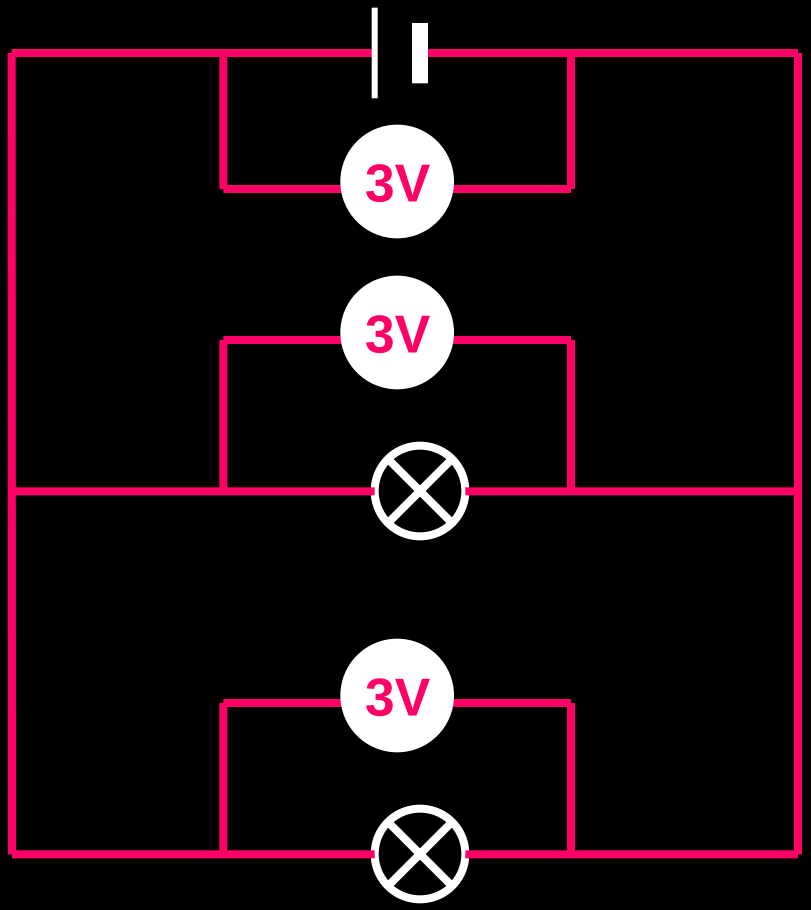
series circuit

- voltage is **shared** between the components



parallel circuit

- voltage is the **same** in all parts of the circuit.



measuring current & voltage

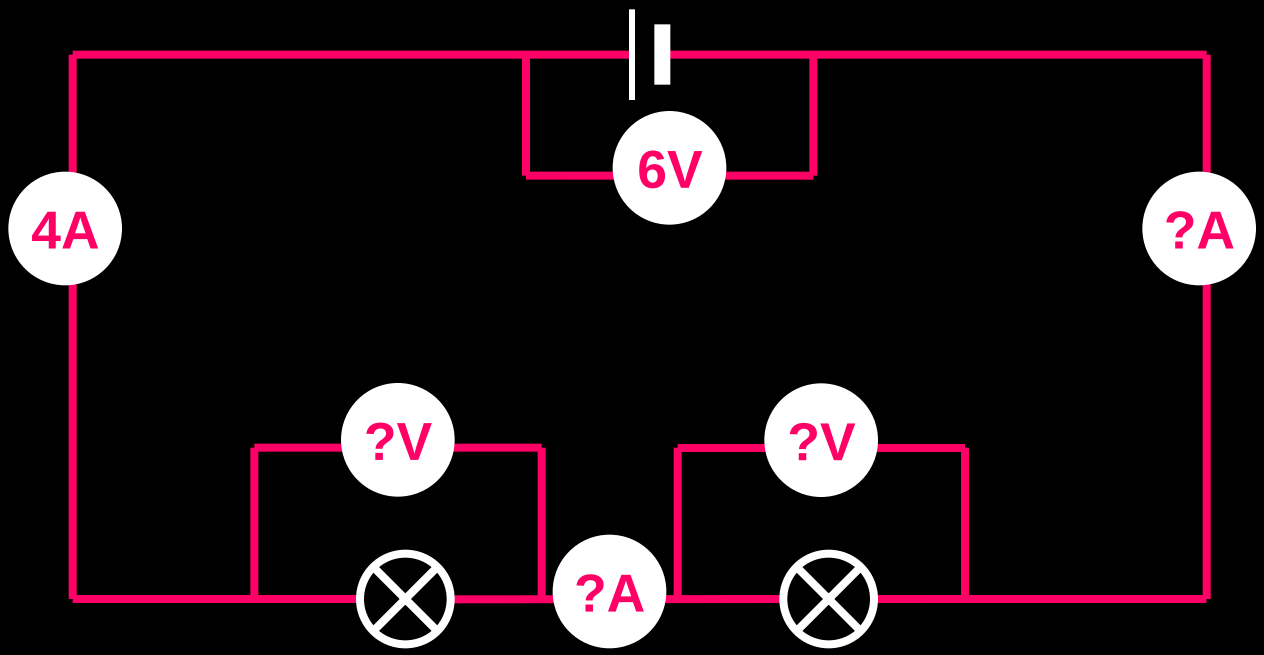
copy the following circuits on the next two slides.

complete the missing current and voltage readings.

remember the rules for current and voltage in series and parallel circuits.

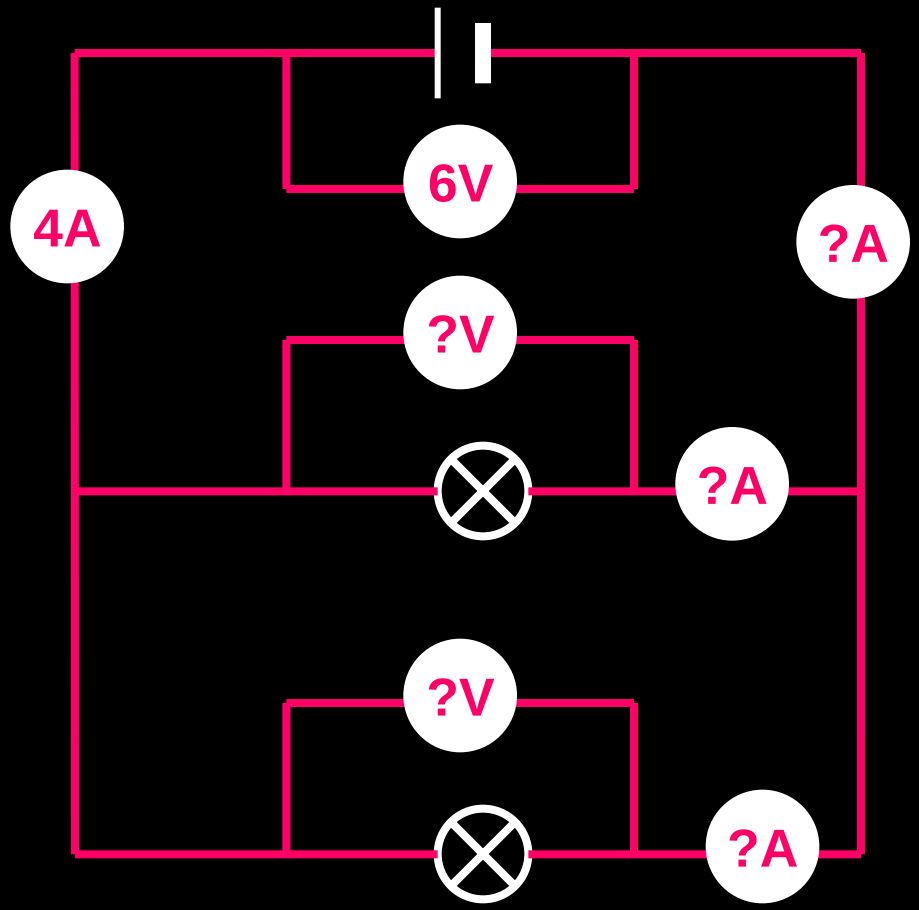
measuring current & voltage

a)



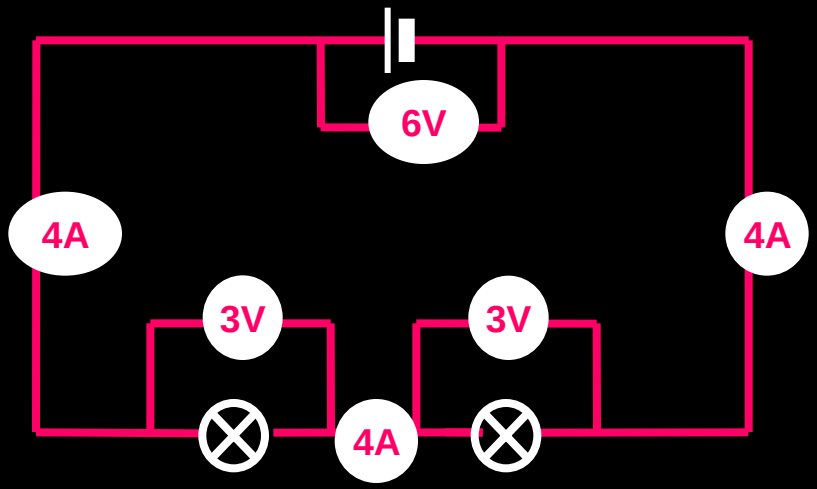
measuring current & voltage

b)

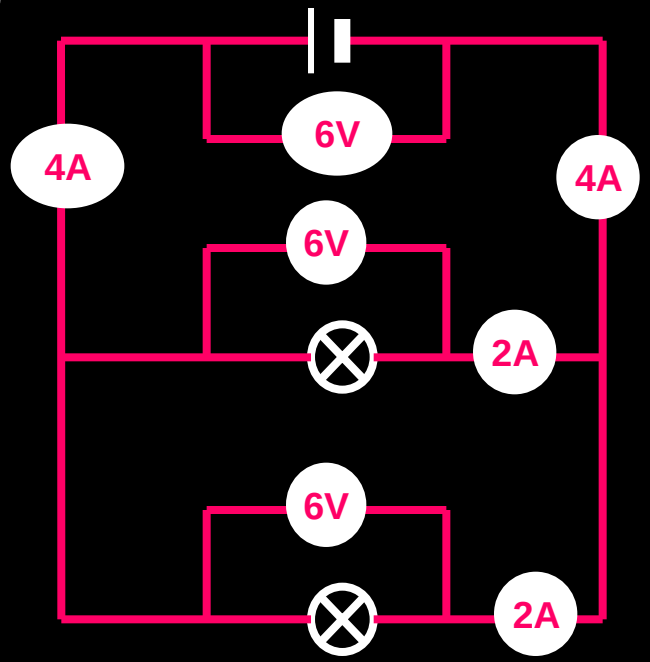


answers

a)



b)



Voltage, Current and Power

- 1 V is 1 Joule per Coulomb (J/C)
- 1 A of current = 1 Coulomb per second
- 1C = 6.24 x10^{18} electrons/second
- If I have one volt (J/C) and one amp (C/s), then multiplying gives Joules per second (J/s)
  - this is power: J/s = Watts
- So the formula for electrical power is just:

  $P = VI$: power = voltage $\times$ current

- More work is done per unit time the **higher the voltage** and/or the **higher the current**

$P = VI$: power = voltage × current

The **total amount of energy** supplied by a battery or power pack depends on the number of **electrons passing each second (current) and the amount of electrical energy supplied to the electrons (voltage gain).**

$P = VI$: power = voltage × current

The total amount of energy gained or used per second by a component is called its power. **Power**, symbol P, is measured in units called watts, symbol **W**.

One watt is one joule of energy gained or used per second. A 100 watt light bulb uses 100 joules of electrical energy each second.

Resistance = Voltage ÷ Current R = V ÷ I

The **resistance, symbol R, of a component is measured in units called ohms, symbol Ω.**

Resistance

- Some components are made of materials which are difficult for electrons to travel through. This property is called **resistance.**
- Increasing the resistance in a circuit decreases the number of electrons that flow through – it reduces the **current. Decreasing the resistance in a circuit allows more current to flow.**

A **fuse is a thin wire that melts and breaks a circuit if the current gets too large.**