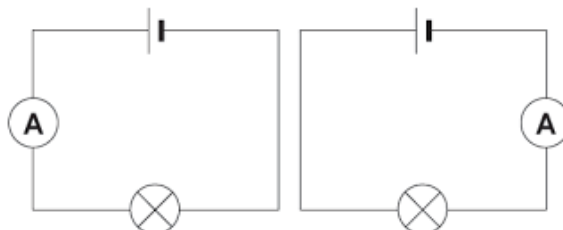
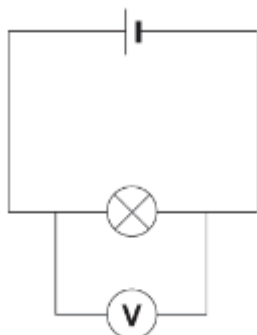


Section 10.1.3 – Voltmeters & Ammeters

Using Analogue Meters

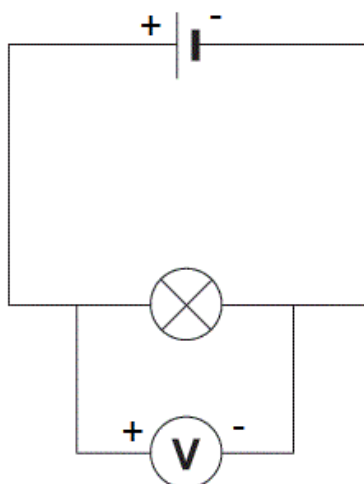
When using a voltmeter or ammeter it is important to:

- Insert the meter correctly into the circuit



Voltmeters are connected in **parallel** across the component and **ammeters** are placed in **series** through the circuit.

- Make sure the **polarity** of the meters is correct



The **positive terminal** of the power supply should be connected to the **positive socket** of the ammeter/voltmeter.

Likewise, the **negative terminal** of the power supply should be connected to the **negative socket** of the ammeter/voltmeter

- Connect to the **highest scale first** and work down to a lower one



If the current is larger than the meter can handle it will damage the device.

So always start on the highest scale.

- Read off the correct scale

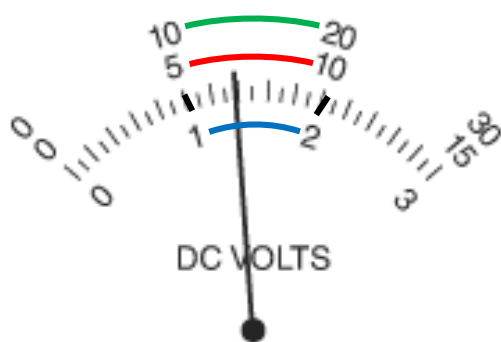


If reading off the **3V** (full deflection) scale, the meter reads **between 1 and 2 volts**

If reading off the **15V** (full deflection) scale, the meter reads **between 5 and 10 volts**

If reading off the **30V** (full deflection) scale, the meter reads **between 10 and 20 volts**

- Read the divisions of each scale correctly



The 3 Volt Scale

1 Volt is shared between 10 divisions
 \therefore each division is worth $(1V/10 = 0.1 \text{ Volts})$
 So this meter reads **1.4 Volts** on the 3 Volt scale.

The 15 Volt Scale

5 Volts are shared between 10 divisions
 \therefore each division is worth $(5V/10 = 0.5 \text{ Volts})$
 So this meter reads **7.0 Volts** on the 15 Volt scale.

The 30 Volt Scale

10 Volts are shared between 10 divisions
 \therefore each division is worth $(10V/10 = 1.0 \text{ Volt})$
 So this meter reads **14.0 Volts** on the 30 Volt scale.

Example 1

Read the following meter displays for the:

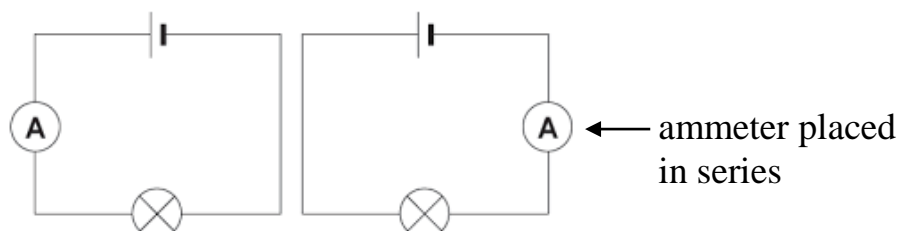
- 3 Volt scale
- 15 Volt scale
- 30 Volt scale

3 Volt Scale:	3 Volt Scale:	3 Volt Scale:
15 Volt Scale:	15 Volt Scale:	15 Volt Scale:
30 Volt Scale:	30 Volt Scale:	30 Volt Scale:

Analogue Meters - Resistance

Consider both an ammeter and a voltmeter. Should these meters have high or low resistance when placed in a circuit?

An ammeter is placed in **series** as part of the circuit. An ammeter's job is to measure the rate at which charge passes a point.



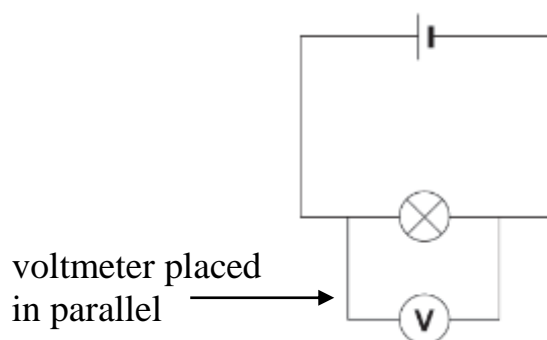
✗ If it had **high resistance**

“it would slow down the current and change what it is meant to measure”

✓ If it had **low resistance**

“it would allow the current to flow without impeding it”

A voltmeter is placed in **parallel** as part of the circuit. A voltmeter's job is to measure the energy (J) upon each Coulomb of charge.



✗ If it had **low resistance**

“all the current would flow along its parallel branch and effectively short circuit the component across which the voltage is being measured”

✓ If it had **high resistance**

“only a small number of Coulombs of charge would flow along its parallel branch. This is all that is required to measure the energy of a Coulomb”