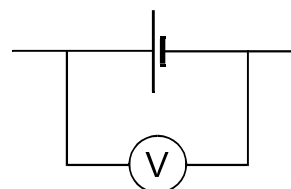


The Internal Resistance of a Cell or Battery (Introductory Observations)

When we measure the voltage of a battery we say we are measuring the *terminal potential difference* of the battery.

1. The battery (cell) in the diagram on the right is *not supplying any current* (assuming that the voltmeter has infinite resistance).

The terminal potential difference measured under these circumstances is called the emf, E , of the battery (cell).

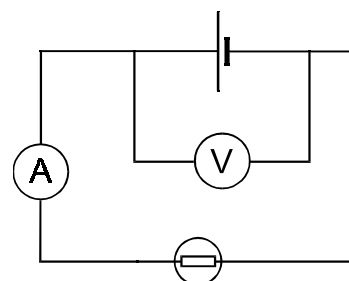


$$E = \text{_____ Volts}$$

2. The same battery is now supplying a current of _____ Amps.

The terminal potential difference, V , is now

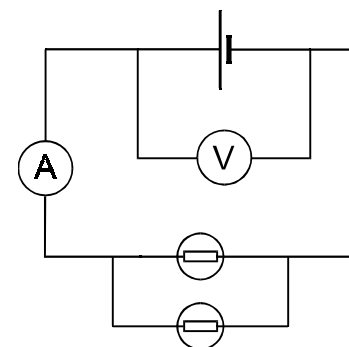
$$V = \text{_____ Volts}$$



3. The same battery is now supplying a current of _____ Amps.

The terminal potential difference, V , is now

$$V = \text{_____ Volts}$$



Conclusions

1. When a battery is not supplying any current, its terminal potential difference is equal to its _____.
2. As the current flowing through a battery increases, its terminal potential difference _____.
3. The difference between the emf and the terminal potential difference is referred to as the “lost voltage”. The lost voltage represents energy converted to _____ by the _____.

Experiment to Measure the Internal Resistance of a Battery

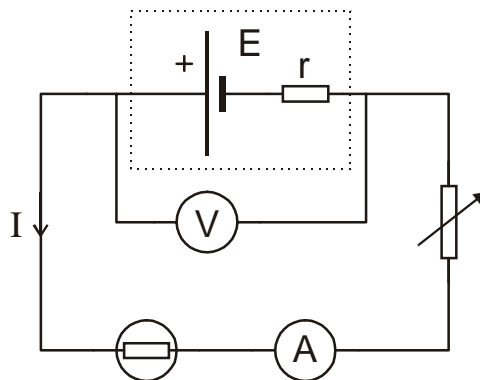
As illustrated by the introductory observations, the terminal potential difference, V , of a battery is given by

$$V = \text{emf} - \text{lost voltage}$$

$$V = E - Ir$$

The aim of the experiment is to measure the internal resistance of a battery by plotting a characteristic of the battery. (See expt. 1EM for a definition the word “characteristic”.)

In the following circuit a bulb is included simply to limit the maximum current.



If the equation above is rearranged, we have $V = (-r)I + E$ and so we see that the battery characteristic (plotted with V on the vertical axis) should be a straight line of *negative* slope. Hence we can use the graph to find the internal resistance.

The internal resistance of a battery is *not* constant but increases as the battery is used. For this reason do not leave the circuit connected longer than is necessary to take the readings.