Emfs and Internal resistance

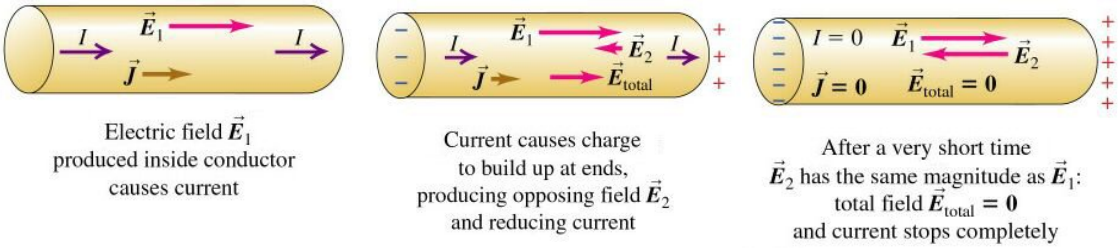
Created: Wednesday, 31 August 2011 06:23 | Published: Wednesday, 31 August 2011 06:23 | Written by Super User | Print

Introduction to Emfs and Internal resistance

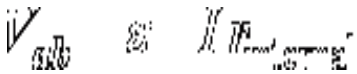
What is EMF?

EMF is the rate at which energy is drawn from a source that produces a flow of electricity in a circuit and is expressed in volts. EMF is another term for electrical potential, or the difference in charge across a battery or voltage source. For a circuit with no current flowing, the potential difference is called EMF.

Electrical sources that convert energy from another form are called seats of EMF. In the case of a complete circuit, such a source performs work on electrical charges, pushing them around the circuit. At a seat of EMF, charges are moved from low electrical potential to higher electrical potential.



Ideally, such a source would have a constant potential difference, e, between its terminals regardless of current. Real sources of EMF have an internal resistance which has to be taken into account. The potential difference across the terminals of the source is then given by



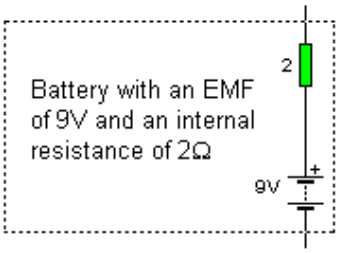
What is Internal Resistance?

Every electrical instrument is made up of a conductor that has some resistance (but very small). The **internal resistance** of a cell is normally given the symbol r and is a very small resistance. This doesn't mean, however, that it's always small. The resistance of a miniature watch battery might be 100 ohms or so. A torch battery has an internal resistance of around 0.1 ohms and a car battery about 0.001 ohms.
Our imaginary internal resistor obeys Ohm's law just like any other resistor. The only difference is that it's hidden inside the battery.

You can measure the EMF of a battery by simply measuring the voltage across the terminals when it's not connected to anything. This is called measuring the voltage in 'open circuit'.You can't just measure the internal resistance directly because you can't get inside the battery. So you have to do an experiment where you change the current drawn from the battery (by changing the load resistance) and measuring the p.d. across the terminals.

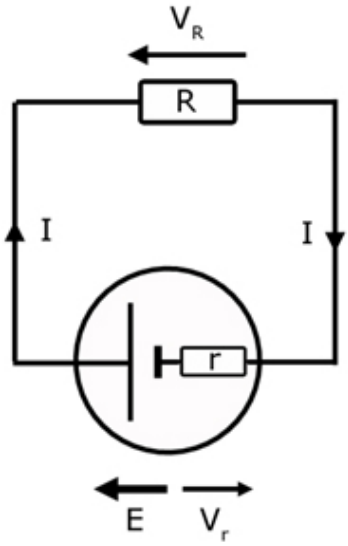
A battery's internal resistance=r external resistance=R

Usually voltmeters are made such that they draw very negligible current,
so the overall current in circuit is I, and current through voltmeter=0.The EMF of battery(E) will then drop across each resistance



Internal resistance is a feature of all practical power supplies. Different battery designs will have different internal resistances, and the manufacturers will often take steps to minimize the internal resistance.

A representation of a battery with internal resistance.



We can obtain important equations for E and r by considering a cell with resistance in a circuit.

The total resistance R_{total} is the sum of the series resistor and the internal resistance of the cell.

$$R_{total} = R + r$$

by summing p.d. around the circuit,

$$E = IR_{total}$$

by substituting for R_{total},

$$E = IR + Ir$$

by Ohm's law, substituting $IR = V_R$

$$E = V_R + Ir$$

Note, V_R is called the **terminal p.d.** . That is the p.d. across the cell when it is delivering current.

Want to know more about EMFs and internal resistance? Click here to schedule a live session with an eAge eTutor!

About eAge Tutoring:

eAgeTutor.com is the premium online tutoring provider. Using materials developed by highly qualified educators and leading content developers, a team of top-notch software experts, and a group of passionate educators, eAgeTutor works to ensure the

success and satisfaction of all of its students.

Contact us today to learn more about our guaranteed results and discuss how we can help make the dreams of the student in your life come true!

Reference links:

- http://wwww.hyperphysics.phy-astr.gsu.edu/hbase/electric/conins.html
- http://www.en.wikipedia.org/wiki/Electric_current
- http://www.coursework.info/.../Measuring_the_e_m_f__And_Internal_Resist_ L4195.html

Category:ROOT