WJEC (Wales) Physics A-level

SP2.3a - Determination of the Internal Resistance of a Cell

Practical Flashcards

What is a source's internal resistance?

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A source's internal resistance is the resistance of the materials inside the source. It is equal to the lost volts per unit current in the source.

What is the emf of a power source?

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A power supply's emf is the work done by the source per unit charge. It is equal to the potential difference across the source when no current flows.

State the equation used to calculate a battery's emf from its current, load resistance and internal resistance.

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$$E = I (R + r)$$

R: Load Resistance

r: Internal Resistance

What is meant by the phrase ‘lost volts’?

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The lost volts of a battery is the difference between the battery’s emf and its terminal potential difference.

How do you calculate a battery's emf from its terminal potential difference, current and internal resistance?

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$$E = V + Ir$$

Demonstrate how the equation of a V-I graph, for a source with internal resistance ‘r’ can be obtained.

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$$E = I(R + r) \quad V = IR$$

$$E = V + Ir$$

$$V = E - Ir$$

$$V = -rI + E$$

Which is in the form $y = mx + c$

How can you find the internal resistance of a battery from a graph of V against I?

How can you find the internal resistance of a battery from a graph of V against I?

$$V = - rI + E$$

$$y = mx + c$$

The internal resistance is the positive equivalent of the gradient of the graph.

How can you find the emf of a battery from a graph of V against I?

How can you find the emf of a battery from a graph of V against I?

$$V = - rI + E$$

$$y = mx + c$$

The emf is the y-intercept of the graph.

Why should the battery be disconnected between readings?

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The temperature of the circuit should remain constant throughout the experiment, so that the resistance in the circuit remains constant. Disconnecting the battery when not needed mitigates heating.

Why should you avoid using a rechargeable battery/cell when carrying out this experiment?

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Rechargeable power sources have a very low internal resistance which would be hard to measure in this experiment.

Why should a new cell/battery be used when carrying out this experiment?

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Run-down cells and batteries have internal resistances that may fluctuate throughout the experiment. Using a new source will result in a more consistent value, that may therefore be more accurately calculated.

What safety precautions should be taken when carrying out this experiment?

What safety precautions should be taken when carrying out this experiment?

If connected for long periods of time, the battery and circuitry can become hot. Avoid touching bare metal contacts and disconnect the battery when readings are not being taken.

What device could be used to check your value for the cell's internal resistance?

What device could be used to check your value for the cell's internal resistance?

An Ohmmeter

Suggest why your value for the cell's emf may be slightly different to the true value.

Suggest why your value for the cell's emf may be slightly different to the true value.

Ideal voltmeters are assumed to have an infinite resistance. In reality, a small current may still flow through the voltmeter, resulting in there being an additional pd in parallel with the supply.

With reference to the supply's internal resistance, suggest why high voltage supplies are safe for use in a lab.

With reference to the supply's internal resistance, suggest why high voltage supplies are safe for use in a lab.

High voltage supplies have a very high internal resistance. This is much higher than the external resistance produced if a human were to handle the supply, and so the terminal potential is very low. So very little current flows in the circuit.

What equation can be used to calculate the load resistance from the emf, current and internal resistance?

What equation can be used to calculate the load resistance from the emf, current and internal resistance?

$$R = E/I - r$$

What should a graph of load resistance against the inverse of current look like?

What should a graph of load resistance against the inverse of current look like?

A graph of R against 1/I should form a straight line with a gradient equal to the emf and the y-intercept equal to the negative of the internal resistance.