PHYSICS INVESTIGATION : Finding the internal resistance of a power supply.

A range of resistors were used -- different ones were used in the actual experiment than planned -- doesn't matter though as still good range obtained. --

Aim:

The aim of this investigation is to find the internal resistance of a solar cell. This will not be measured directly but must be obtained by calculation from values of current and voltage in a circuit incorporating a solar cell.

Equipment:

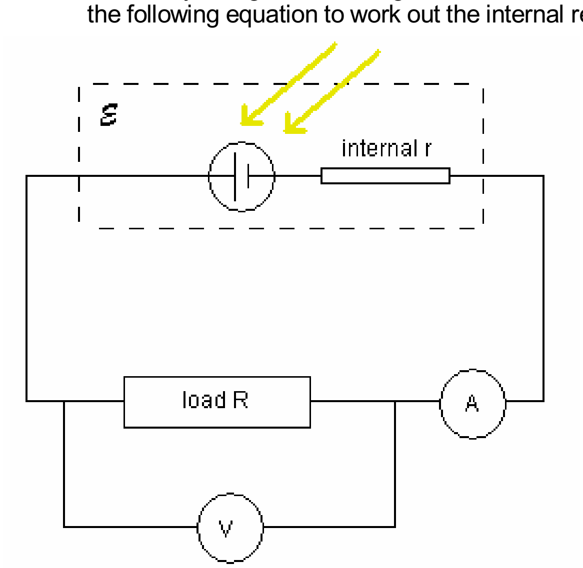
- Solar cell (emf about 2V)
- Lamp (and power pack)
- Several resistors - 100Ω, 70Ω, 50Ω, 25Ω, 10Ω, 5Ω and 1Ω.
- Voltmeter
- Ammeter
- Clips and connecting leads

The equipment will be set up as shown in the diagram. Multimeters will be used as the voltmeter and ammeter. The lamp will be used to provide light for the solar cell. Various resistors will be used to provide a load resistance, values as above. The experiment will take place in a darkened room.

Method:

The equipment will be set up as described. To check the accuracy of the ammeter and voltmeter, it will be checked that they both read zero when no current is flowing. If it does not, the faulty equipment will be replaced. A resistor of 100Ω will be used as the external load resistance, and the lamp shone onto the solar cell. Values of current and voltage will be recorded. This will then be repeated twice. The readings will be checked to see if they are of similar values. If there are any extreme inconsistent results the reading will be repeated. The resistor will be replaced with one of 70Ω and three values of current and voltage recorded, with inconsistent results discarded and repeated. This will then also be carried out with all the other resistors.

Once the values for each resistor are recorded, they should be added together and divided by 3 to give an average value each for current and voltage. These can then be applied to the following equation to work out the internal resistance of the solar cell.



= I (R+r) and V = I R rearranged to give

V = -rI +

This corresponds to the equation y = mx + C. When V is plotted against I and the corresponding equations y = mx + C and V = -rI + , then gradient m = - r and C =

Safety:

The equipment used is not inherently dangerous but care should be taken not to over heat the circuit. The work area should be clear.

Fair Test & Reliability:

To make this as fair as possible, accuracy, precision and reliability should all be taken into account. The conditions in which the experiment will take place should be kept constant, i.e. the amount of light shone on the solar cell, the set up of the circuit and the equipment used and the temperature. Resistance may change if the temperature of the solar cell increases or decreases significantly. The environment in which this experiment will be carried out in is not prone to extreme changes in temperature so I do not think this will be a problem. During the experiment however, a lamp will be shone on the solar panel, which will cause it to heat up. This will not be a problem either as the length of time required to obtain the results needed is not long enough for the solar cell to heat up sufficiently to cause a significant change in any component of the circuit. Only the current, voltage and resistance in the circuit should vary as stated.

In order to make the results from this experiment as accurate as possible the equipment and method must be checked. The multimeters will be checked to avoid systematic error as outlined in the method. If inconstant results are recorded, they will be repeated. If this does not yield more regular results or there is something obviously wrong with either the equipment used or the method, they will be altered appropriately. Parallax error is avoided by using multimeters as these meters digital.

Precision in this experiment is improved by using a wide range of values of resistance. This means that the dependant variable changes significantly so that any trends are more obvious and can be identified easily. Precision will also be improved as the uncertainty value will be calculated. This can be used to gauge the reliability of the results. Repeating the experiment and taking averages increases the likelihood of having results near to the ‘true’ value of what is being measured.

If all these points are considered and the results show a pattern or trend as expected, it can be assumed that the results are quite reliable. Any obviously anomalous results would decrease the reliability as they are not expected and probably the result of an error in the method or equipment.