Determining the maximum power available from a cell

Introduction

In this experiment you will be determining the e.m.f. of a cell, its internal resistance and considering the maximum power available from the cell.

Aim

- To set up the circuit correctly
- To obtain an appropriate set of data
- To interpret the data to give values for e.m.f. and internal resistance
- To plot a graph and comment on the conditions for the transfer of maximum power from the cell.

Intended class time

- 60 to 90 minutes

Equipment (per group)

- 1.5 V D standard cell
- 6 low voltage lamps (1.25 to 2.5 V torch bulbs)
- ammeter
- voltmeter
- leads

Health and safety

Ensure the safe use of electrical circuits at all times.

Work within the limits of voltage and current provided by your teacher.

Procedure

1. With no load connected to the cell, measure the potential difference across the terminals.
2. Add a single lamp bulb and record the potential difference across the cell and total current flowing from the cell.
3. Continue to add additional lamps in parallel and record p.d. of the cell and total current from the cell in each situation. Note that you will require two additional columns in your data table later in the task.
4. Plot a graph of potential difference, V, against current, I.
5. What is the e.m.f. of the cell? Justify your response.
6. What is the maximum current that the cell can provide?
7. What is the power delivered in points 5 and 6 above?

8. The value of the internal resistance is given by the value of the gradient of the graph, calculate this value.
9. An alternative way to calculate the internal resistance is to use two sets of values from the table, normally that with no load and that with a load, calculate this and compare.
10. Add load resistance and power as the two additional columns in your table.
11. Plot a graph of power (*y*-axis) against resistance (*x*-axis)
12. Identify the value of resistance at which maximum power is transferred.

Recording

As evidence for the Practical Endorsement you should have the data collected from your group in a clear and logical format. All work should be clearly dated.

Additionally, plotting the graph and completing the calculations will support your preparation for the written examination.