GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES TIME: 2HRS GRADE 12

PHYSICS EXPERIMENT: TERM 3 2024 TOTAL MARKS : 50

ELECTRICITY AND MAGNETISM - INTERNAL RESISTANCE

INTRODUCTION

The term "lost volts" refers to the difference between the emf and the terminal voltage.
The voltage is not "lost". It is the voltage across the internal resistance of the battery, but "lost" for use in the external circuit.
The internal resistance of the battery can be treated just like another resistor in series in the circuit.
The sum of the voltages across the external circuit plus the voltage across the internal resistance is equal to the emf:

$$\varepsilon = V_{load} + V_{internal\ resistance} \quad \text{or} \quad \varepsilon = IR_{external} + Ir$$

$$\text{REARRANGE TO GET: } V = -rI + \varepsilon$$

$$\text{WHICH IS IN THE FORM OF } y = mx = c \text{ WHERE } m = -r$$

PART 1

AIM

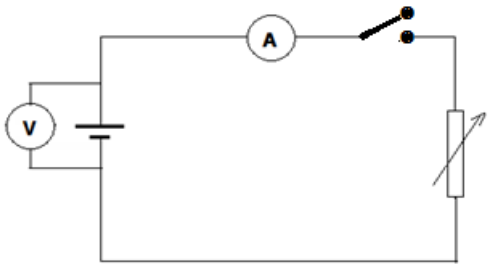
To determine the internal resistance of a battery.

APPARATUS

Voltmeter (or Multi meter).
Ammeter (or Multi meter).
Any size carbon zinc battery (Choose voltage in relation to the values of the resistors).
Battery holder.
Rheostat.
Connecting wires.
Switch.

METHOD

Set up the apparatus as shown in the diagram below and **determine** the **ammeter** and **voltmeter** readings for five different rheostat settings.



PRECAUTION: **DO NOT KEEP ON TOO LONG.**
IT WILL HEAT THE BATTERY AND CAUSE IT TO RUN DOWN.

RESULTS

1 **Tabulate** the **Terminal Potential Difference (volts)** and **Electric Current (amperes)** readings obtained from the experiment. (10)

RESULTS

1. Table for results obtained during experiment

	TERMINAL POTENTIAL DIFFERENCE (VOLTS)	ELECTRIC CURRENT (AMPERES)
1	6	0
2	5,76	0,6
3	5,52	1,2
4	5,28	1,8
5	5,04	2,4

INTERPRETATION AND DISCUSSION OF RESULTS

2 **Identify** the

2.1 Independent variable.
2.2 Dependent variable.
2.3 Controlled variable. 3 x 2 (6)

3 Why do we include a **rheostat** in the circuit? (2)

4 Draw a graph of the **voltmeter readings** versus **ammeter readings**. (8)

5 Is the gradient of the graph **positive** or **negative**? Explain. (4)

6 Use the graph to determine the **internal resistance** of the battery. (4)

7 Which point on your graph represents the **EMF** of the battery? Explain. (4)

CONCLUSION

8 Draw a **conclusion** from the results obtained. (2)

PART 2

AIM

To determine the equivalent resistance of a series-parallel network and compare it with the calculated theoretical value.

APPARATUS

3 fixed resistors with known values (not to high values).
Voltmeter (or Multi meter).
Ammeter (or Multi meter).
Battery (Choose voltage in relation to the values of the resistors).
Battery holder.
Connecting wires.
Switch.

METHOD

Set up the circuit as shown in the diagram below.
Record the voltmeter and ammeter readings obtained.

R_1 = 11,5Ω R_2 = 7Ω R_3 = 25Ω

Table of Results:

emf (V)	*Terminal Voltage (V)*	*Current (A)*

INTERPRETATION AND DISCUSSION OF RESULTS

1 From your **readings obtained in the experiment**, determine the equivalent resistance of the circuit. (4)

2 By using the values of R_1, R_2, R_3, calculate the **theoretical value** of the equivalent resistance. (5)

CONCLUSION

3 Compare and evaluate the **values** obtained in questions 1 and 2. (2)