Internal Resistance of a Battery Lab

All sources of voltage have an internal resistance due to the wiring and physical makeup of the material. This internal resistance steals a little bit of the voltage that the battery creates depending on the amount of current being pulled from the battery. The overall voltage the battery supplies is termed the “**emf**” or electro motive force, written as **ε** in equations. Thus, for a circuit the equation for voltage is:

$$ε=V\_{internal}+\sum\_{}^{}V\_{resistors}$$

Your task today is to construct circuits with batteries, an ammeter, and different resistors in order to determine the internal resistance of an individual battery.

Data:

Number of batteries: \_\_\_\_\_\_\_\_\_\_\_\_

Stated emf on side of battery: \_\_\_\_\_\_\_\_\_\_\_\_

Circuit diagram of set up (Must include voltage source, internal resistor, added resistor, Ammeter)

|  |  |  |
| --- | --- | --- |
| Trial | Resistance added to circuit (Ω) | Resulting current drawn from battery (A) |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |

Using Kirchoff’s loop law, create an equation that relates the added resistance R to the current drawn I. (**Hint:** there will be ε and rinternal in your equation as well. Make sure to have the current I on one side of the equation and R on the other)

From that equation, what should you graph on your x and y axis? From your graph, what will tell you the internal resistance on the battery? This is your formal lab report. You MUST include a graph and determine your internal resistance from the trend line equation. The lab report will be due **Friday 11/12.**

Post Lab questions:

1. A 6 Ω flashlight bulb is powered by a 3 V battery having an internal resistance of 1 Ω.
	1. What is the power dissipation of the bulb? (**1.1 W**)
	2. What is the terminal voltage (useful voltage after internal resistor) of the battery in this scenario? (**2.6 V**)
2. The voltage across the terminals of a 9.0 V battery is 8.5 V when connected to a 20 Ω load. What is the internal resistance of the battery? (**1.18 Ω**)

ε = 12.0 V

r = 0.5 Ω

b

a

1. Look at the circuit diagram. Calculate:
	1. The current in the circuit

R = 65.0 Ω

* 1. The terminal voltage of the battery, Vab
	2. The power dissipate in the resistor R and the battery’s internal resistor r.