Pre-Lab Report

Lab section:

Name & Surname:

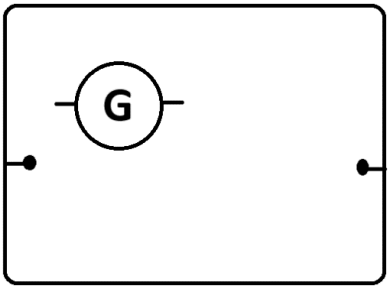
Table #:

***Before the Lab** complete this page YOURSELF! Hand it in in the first 5 min. of the session PERSONALLY!*

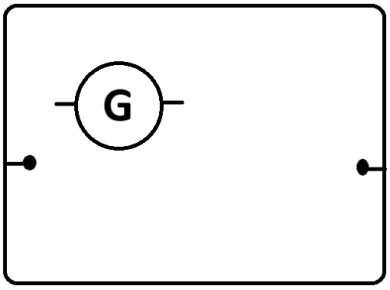
You MUST justify your answers and show all steps. NO COPYCAT answers, or NO credits!

Please read the relevant presentation on PHYS LAB Website.

Q1. You are given 3 circuit elements: A galvanometer (G) whose internal resistance is R_G, and two resistors R_L and R_S. Their resistance values are related by the following inequality: $\mathbf{R_L >> R_G >> R_S}$. Using all or some of these circuit elements draw the internal structure of a Voltmeter and an Ammeter respectively.



Inside of a Voltmeter



Inside of an Ammeter

(2nd Question is on the next page!)

Q2. A certain DC voltmeter has an internal resistance of 1000 Ohms per volt. What current in milliamperes is required for full scale deflection? . **Justify your answers, show calculations if needed or no credits!**

Q3. An ammeter and a voltmeter will be used to measure the current and the voltage across an electric lamp, respectively. If the voltmeter is connected as an ammeter and the ammeter as a voltmeter, what will happen? **Justify your answers, no credits!**

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Lab Report

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***Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest!* Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To convert a galvanometer into an ammeter and a voltmeter of a given range.

THEORY : Ammeters are instruments for measuring the current passing through them. Ideally they should have zero internal resistance so that the voltage across them will be zero without changing the circuit characteristics that they are connected. However, the real ammeters have some resistance even though it is very small.

Voltmeters are instruments to measure the potential difference between the two points they are connected in a specific circuit. Ideal voltmeters should have infinite internal resistance so that they do not draw current from the circuit that they are connected. But the real voltmeters have some finite internal resistance.

To build a voltmeter we could use a sensitive galvanometer with a very high internal resistance to start with. Since we will be connecting the voltmeter in parallel to any circuit section with a voltage difference up to a maximum value, we should connect a series resistance to the galvanometer. If the full scale deflection is desired to be V, then equating the voltage across the voltmeter to V would give us:

$$I_G R_G + I_G R_{series} = V$$

where IG and RG are the galvanometer current and internal resistance, respectively. We can determine the series resistance from this expression.

We can also use the same galvanometer to construct an ammeter. This time we should connect a parallel resistance to the galvanometer to shunt the excess current from the galvanometer. In this case the voltage difference across the galvanometer and the shunt resistance will be the same:

$$I_G R_G = (I - I_G) R_{paralel}$$

where I is the current at which the galvanometer shows full scale deflection. We can determine the parallel resistance from this expression for our ammeter.

APPARATUS : Galvanometer, various wires and resistance boxes, switch, voltmeter, ammeter, and a 2-V power supply.

PART – 1: DETERMINATION OF THE CONSTANTS OF A GALVANOMETER

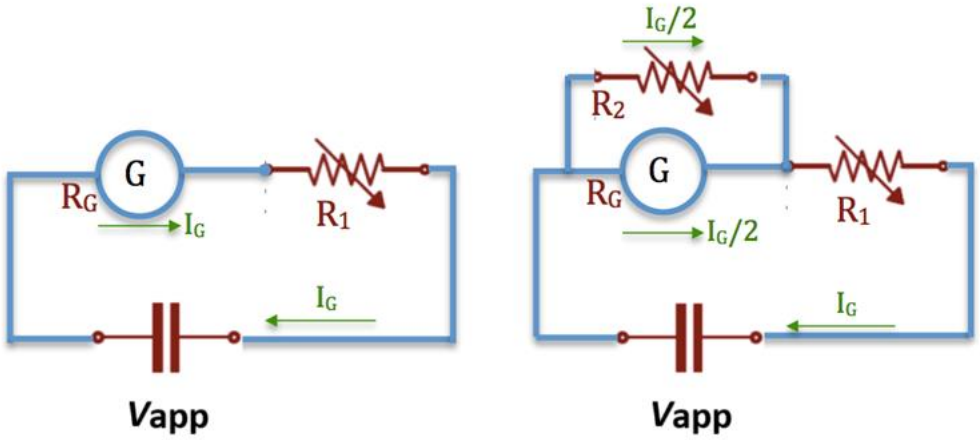
The values below will be given by your Lab Instructor during DEMO

Resistance to set for **FSD** R_1 = ...

Applied Potential V_{app}=. . . . . .

Resistance to set for **HSD** R_2 = ...

CONSTANTS OF THE GALVANOMETER:



Description / Symbol	Formula-Calculation / Value & Unit

Calculate Internal resistance of the Galvanometer R_G = ...

Calculate Max. Galvanometer Current I_G = ...

. . . . . .

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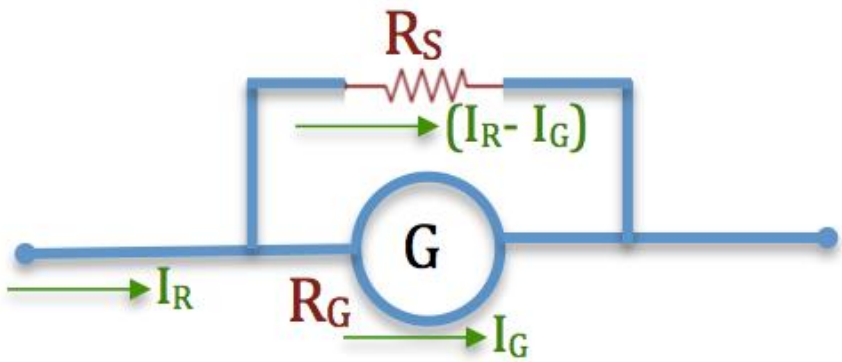
PART – 2: CONSTRUCTION OF AN AMMETER

Circuit for ammeter (theoretical):



Range for the Constructed Ammeter *(given)* I_R = . **1.0 A**

Given Resistance per unit length of the Copper Wire ρ_{cw} = **1.34 x 10^{-3} Ω/cm**

Description / Symbol	Formlula / Calculation	Value & Unit
Shunt Resistance R_S =	. . . .	
	. . . .	. . . .
Length of the Copper Wire L =	. . . .	. . . .
	. . . .	

4 Draw the circuit in which the constructed ammeter is used:

Description / Symbol	Value / Calculation	Result

Value read from the Galvanometer G_x = ...

Value read from the Constructed Ammeter I_{EV} = ...

. . . . . .

Value read from a Real Ammeter I_{TV} = ...

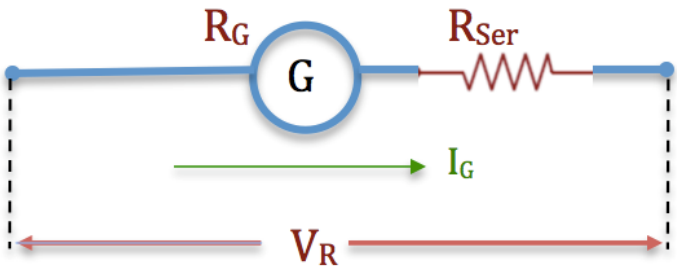
. . . . . .

% Error for *I*:

5

PART – 3: CONSTRUCTION OF A VOLTMETER

Circuit of voltmeter (theoretical):



Description / Symbol	Fomula / Calculation	Value / Result

Range for the

Constructed Voltmeter $\mathbf{V_R}$ = **2.3 V + Table # / 10**

Series Resistance $\mathbf{R_{Ser}}$ = ...

. . . . . .

. . . . . .

Draw the circuit in which the constructed voltmeter is used:

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Description/Symbol	Value / Calculation	Result

Value read from the Galvanometer G_Y = ...

Value read from the Constructed Voltmeter V_{EV} = ...

Value read from a Real Voltmeter V_{TV} = ...

% Error for *V*:

Consult to the resources for this experiment from PHYS LAB Website:

PHYL201 Intro

Presentation #3

PHYL201 Lab Book