Conversion of Galvanometer to Voltmeter

Object: To convert Weston galvanometer to a voltmeter of voltage range 0 to V volts.

Apparatus Used: battery, resistance box, galvanometer, voltmeter, rheostat, keys, connecting wires.

Formula Used: For the conversion of galvanometer to voltmeter (G→V) a high resistance 'R' is connected in series of galvanometer. The value of R is determined by following expression.

$$R = \frac{V}{I_g} - G$$

Here, V= maximum value of voltage range

G= galvanometer resistance

I_g =current for full scale deflection in galvanometer

$I_g = C_s$ N

N= total number of divisions in galvanometer

C_s =Current sensitivity of galvanometer or figure of merit

$$C_s = \frac{E}{n(R' + G)}$$

E= e.m.f. battery or cell

R'= resistance involved in galvanometer circuit (in determination of determination C_s / I_g)

n= deflection (number of division) in galvanometer on introducing the resistance R' in galvanometer circuit.

Circuit Diagram:

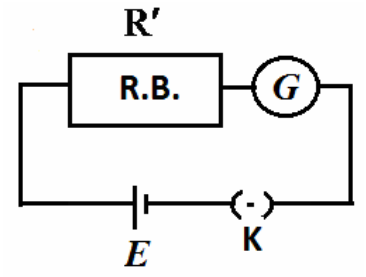

Figure (1)

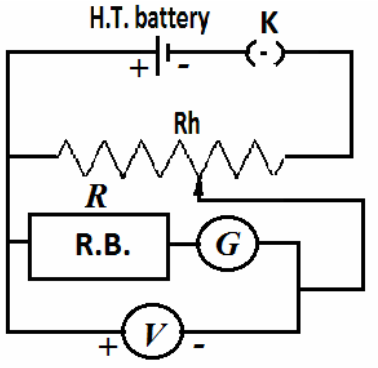

Figure (2)

Procedure:

1. Measure the e.m.f. of given cell/battery (E). Read the value of G written in galvanometer and total number of division (N) in galvanometer.
2. Make connections as shown in Figure (1).
3. Now close the key K . Note the value of deflection in galvanometer (n) with varying the resistance in resistance box (R').
4. Calculate the value of C_s for all set of $R'$and n using E and G. Now determine I_g with expression $I_g = C_s$ N and find the mean value of it.

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5. See in galvanometer, a value of current is written in it, this is I_g. If your calculated I_g is approximately same with this value then observation up to this point is correct. If it is not true then repeat/check the process 3→4.
6. After it, calculate the value of R with the formula $R = \frac{V}{I_g} - G$. Now make the circuit shown in Figure 2 and introduce the calculated resistance R in resistance box.
7. Now vary the deflection in galvanometer from 2→30 divisions in interval of 2 with help of rheostat and note the corresponding voltmeter readings (V).
8. If V is maximum voltage of given voltage range then voltage equal to one division on galvanometer is V/N. Using it convert galvanometer deflections in volt (V′).
9. Now calculate the difference of V and V′. If value of V and V′are approximately same or their difference is too much small then the conversion of G→V is correct.

Observation:

1. E= ……..volt
2. G= ……..**Ω**
3. N= ……..
4. Table for I_g

Sr.No.	R′(Ω)	n	C_s	I_g (A)	mean I_g (in A or μA)
1.	5000				
2.	6000				
3.	7000				
4.	8000				
5.	9000				
6.	10000				

5. Calibration of shunted galvanometer

Sr.No.	Galvanometer reading		Voltmeter reading V (in volt)	Error V′-V (in volts)
	In division	In volt (V′)		

Calculation: Show all calculations of C_s , I_g and R.

Result: The resistance required to convert the given galvanometer in to voltmeter of range of ….. volts is ……(Ω).

Precaution:

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1. Resistance in determination of figure of merit should be of high value.
2. Exact high resistance should be connected in series to galvanometer for conversion to voltmeter.
3. Voltmeter should be connected using sign convention.
4. Voltmeter used in calibration of shunted galvanometer should be of nearly same range.
5. In calibration process the readings should be noted from zero.

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