## 4-BAND RESISTORS

100Ω ±5%

| BAND | 1 | 2 | 3 | 4 |
| --- | --- | --- | --- | --- |
| BLACK | | 0 | no zeros | |
| BROWN | 1 | 1 | 0 | ±1% |
| RED | 2 | 2 | 00 | ±2% |
| ORANGE | 3 | 3 | 000 | |
| YELLOW | 4 | 4 | 0000 | |
| GREEN | 5 | 5 | 00000 | ±.5%% |
| BLUE | 6 | 6 | 000000 | ±.25% |
| VIOLET | 7 | 7 | | ±.1% |
| GRAY | 8 | 8 | | |
| WHITE | 9 | 9 | | |
| GOLD | | | x.1 | ± 5% |
| SILVER | | | x.01 | ± 10% |
| | VALUE | VALUE | MULTIPLIER | TOLERANCE |

## 5-BAND RESISTORS

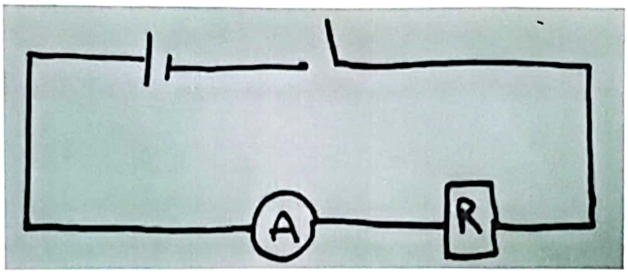
13.4KΩ ± 1%

| BAND | 1 | 2 | 3 | 4 | 5 |
| --- | --- | --- | --- | --- | --- |
| BLACK | | 0 | 0 | no zeros | |
| BROWN | 1 | 1 | 1 | 0 | ±1% |
| RED | 2 | 2 | 2 | 00 | ±2% |
| ORANGE | 3 | 3 | 3 | 000 | |
| YELLOW | 4 | 4 | 4 | 0000 | |
| GREEN | 5 | 5 | 5 | 00000 | ±.5% |
| BLUE | 6 | 6 | 6 | 000000 | ±.25% |
| VIOLET | 7 | 7 | 7 | | ±.1% |
| GRAY | 8 | 8 | 8 | | |
| WHITE | 9 | 9 | 9 | | |
| GOLD | | | | x.1 | ± 5% |
| SILVER | | | | x.01 | ± 10% |
| | VALUE | VALUE | VALUE | MULTIPLIER | TOLERANCE |

## Experiments: No: (1)

## A simple graphical method for determining both e.m.f and the internal resistance of a cell

**Apparatus: dry cell, ammeter reading to about 0.15 Ampere and whose resistance is known, resistance box, circuit key.**




**Method**

**Connect up the circuit as shown in the diagram. Take 1000 out of the resistance box and, if the current is measurable on the ammeter scale record both the current and the resistance box reading gradually reduce the resistance of the box until the current has risen to about 0.1 A. tabulate the results:**

$$R = E\frac{1}{I} - (R_C + R_A)$$

| Resistance box reading $R/\Omega$ | Ammeter reading $I/A$ | $\frac{1}{I} A^{-1}$ |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**Experimental details**

1- **The current through most resistance boxes should never exceed about 0.1 A.**
2- **Before taking any reading give all the plugs in the resistance box a half trun to ensure that they are properly in.**

3- If the resistance box possesses an infinity plug it may be used instead of a circuit key.
4- Check the ammeter for zero error and if necessary reset for zero reading by the adjusting screw provided.

**Theory and calculation**

Let E represent the e.m.f of the cell $R_C$ is internal resistance supposed constant R the resistance box reading $R_A$ the resistance of the ammeter and $I$ the current in the circuit.

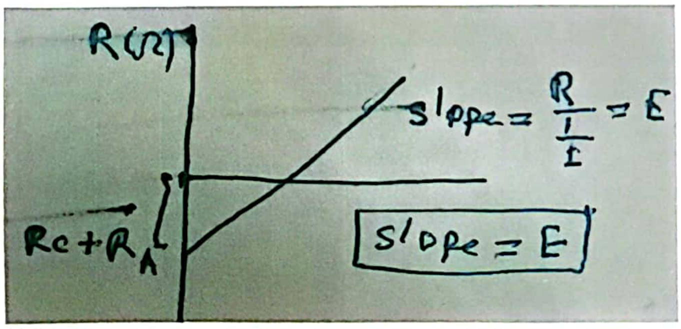
$$E = IR + IR_C + IR_A = I(R + R_C + R_A)$$

Then $I = \frac{E}{R+R_C+R_A}$ and $R + R_C + R_A = E\frac{1}{I}$

$R = E\frac{1}{I} - (R_C + R_A)$ Hence the graph of $R(\Omega)$ (ordinates against $\frac{1}{I}$ $(A^{-1})$ (abscissae is straight line whose slope is the magnitude of the $E$ and whose negative intercept of the $R$ axis is the magnitude of $(R_C + R_A)$.

Measure the slope from the co-ordinates of two convenient points on the straight line. Produce the line to cut the axis of $R$ and read off the intercept. Subtract the ammeter resistance to find the internal resistance $R_C$of the cell. : Errors and accuracy

From the graph estimate the likely errors in $E$ and $R_C$ from the difference between the values found from the chosen line and those obtained from other possible straight lines drown through the points.

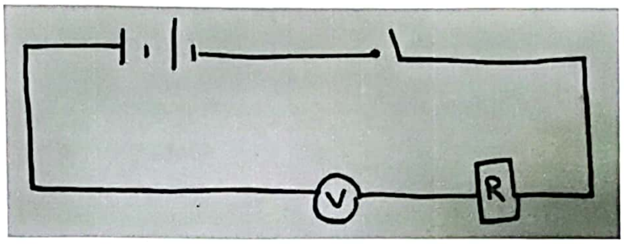


# Experiments No: (2)

## A simple graphical method for determining the resistance of the voltmeter and determine emf

### Apparatus

voltmeter reading to 1.5 or 3 $V$, two accumulators, resistance box of total resistance not less than 1000 Ω, circuit key




### Method

Connect up the circuit as shown in the diagram. Take out a large resistance from the resistance box $R$ and note whether any reading is obtained on the voltmeter scale. Decrease $R$ until the voltmeter reading is at its maximum on the scale. Record the resistance $R$ and the voltmeter reading $V$.

Increase $R$ in the suitable steps to make full use of the voltmeter scale.

Tabulate the results:

| Resistance box reading $R/\Omega$ | voltmeter reading $V/V$ | $\frac{1}{V}/V^{-1}$ |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

Plot a graph with the values of $R/\Omega$ as ordinates (Y axis) against the corresponding values of $\frac{1}{V}/V^{-1}$ as abscissae (X axis).

## Experimental details

**Theory and calculation**

**Let $E$ represent the total $e.m.f$ of the circuit.**

**$R$ the resistance box reading.**

**$V$ the voltmeter reading, and $R_V$ the resistance of the voltmeter.**

**Then the current $I$ in the circuit is $I = \frac{E}{R+R_V}$**

**Assuming the resistance of the accumulators in the circuit to be negligible.**

**The voltage across the voltmeter is**

$E = IR = IR + IR_V = I(R + R_V)$ $\qquad\qquad I = \frac{E}{R+R_V}$

**Hence** $V = IR_V = \frac{E}{R+R_V} R_V$

**Rearranging** $R + R_V = ER_V \frac{1}{V}$ **or**

$$R = ER_V \frac{1}{V} - R_V$$

**Thus, the graph of $R/\Omega$ (ordinates) against $\frac{1}{V}/V^{-1}$ (abscissae) is a straight line whose negative intercept on the $R$ axis is the magnitude of $R_V$**