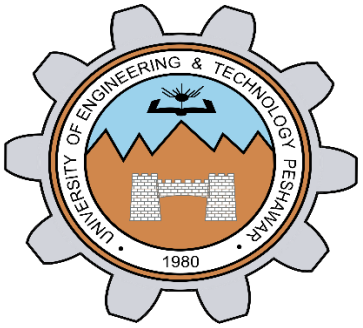
LAB REPORT



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Applied Physics Lab

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Experiment No.1

To determine the resistance of Galvanometer by Kelvin Method.

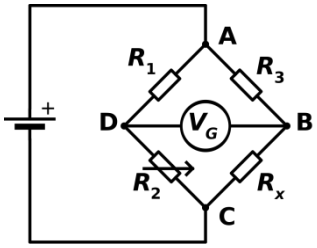
Introduction

Galvanometer

A device used to measure or detect small current is called Galvanometer. It is denoted by **G** in a circuit.

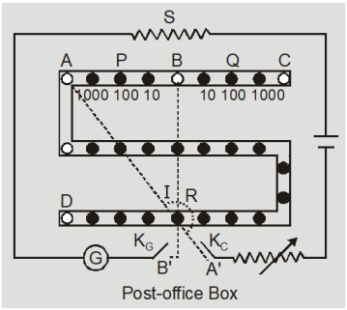
Wheat stone Bridge

It is a special type of electric circuit used to find the resistance of an unknown resistance. It is a balanced circuit in which the current in both wires is same which is the basics of many electrical circuits. Some of the examples are shown in the figure.



Apparatus Used

- **Galvanometer**
- **Battery**
- **High Resistance Box**
- **Post Office Box**
- **Connecting wires**



Principle and Formula Used

- **Wheat Stone Bridge**
- $\frac{P}{Q} = \frac{R}{G}$

Procedure

- ✓ Make connection according to figure No 1.
- ✓ Take resistance from **P** and **Q** and note in the table
- ✓ Then press K1 and remove resistance from **R.**
- ✓ Then start tapping the K2 and adjust the value of **R** such that No deflection is shown in the Galvanometer.
- ✓ Note the value of **R**.
- ✓ Then Repeat the same process for some other values of **P** and **Q.**

Observation Table

Sr. No.	P (ohm)	Q (ohm)	Value of R	G=R $\frac{P}{Q}$
1	10	10	100	103.5
2	100	10	125	104.2
3	100	100	150	106.6
4	1000	100	135	99.3
5	1000	1000	180	108.2
Mean Resistance				104.36

Precautions

- The wire should be tight accurately.

- K1 should be pressed after the K2.

Experiment No.2

To convert a Galvanometer into Ammeter.

Introduction

Galvanometer

A device used to measure or detect small current is called Galvanometer. It is denoted by **G** in a circuit.

Ammeter

It is a device which is used to find current in each circuit. It is denoted by **A** in a circuit.

Apparatus Used

1. **Ammeter**
2. **Battery**
3. **Galvanometer**
4. **High Resistance Box**
5. **Post Office Box**
6. **Connecting wires**

Principle and Formula Used

- **Ig=E/R+Rg**
- **Rs=Ig+Rg/I-Ig**

Procedure

- To convert a galvanometer first we find the resistance of galvanometer using half deflection method
    1. Connect the galvanometer according to the circuit diagram as in figure.
    2. Note the reading in the galvanometer as **A**
    3. Now remove some resistance as the reading of galvanometer is half as **A/2**.

S.no	H.R.B	A	A/2	Rg=S
1	5000	19	9.5	100
2	7000	15	7.5	100
3	8000	13	6.5	100
4	15000	8	4	100

- Then find the current in galvanometer using above equation 1.
- Then find the Rs using the above equation 2.

S.no	Ig	Rg	I	Rs
1	0.3mA	100	60mA	5.0

Verification

- For verification set the circuit according to the given circuit in the figure.
- Then note the value in both galvanometer and standard ammeter.

S. No	T (mA)	A (division)	Ig=AxL.C	Error
1	80	4	2x4=8	72
2	34	1.5	2x1.5=3	31
3	54	3	2x3=6	48
4	38	2	2x2=4	34

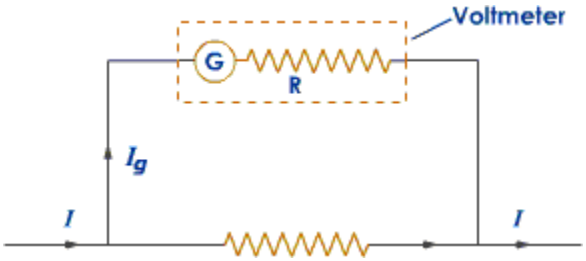
Precautions

- The wire should be tight accurately.
- The reading should be taken accurately.

Experiment No. 3

To convert Galvanometer into Voltmeter.

Circuit Diagram



Apparatus:

1. Galvanometer
2. DC E.M.F source
3. High resistance box
4. Low resistance box
5. Key switches
6. Rheostat
7. Connecting Wires
8. Voltmeter

Procedure

1. Find the resistance of the galvanometer by half scale deflection method.
2. Measure the voltage by battery or cell by voltmeter.
3. To measure Rg, the high resistance R, galvanometer, Key K and battery should be connected in series.
4. Plug the key K and adjust the resistance of H.R.B., to get the full scale deflection of galvanometer.

Calculation:

Let the full scale deflection be the current of Ig.

From Ohm's Law,

$$V = V_g + V_{H.R.B}$$

$$V = IgRg + IgR$$

$$E = Ig(R + Rg)$$

$$Ig = E/R + Rg$$

For calculating value of R(H.R.B.)

$Ig = E/R + Rg$

$R = E/Ig - Rg$

S.No.	R	Readings of converted voltmeter in (θ)	Reading of converted voltmeter (v')	Reading of standard voltmeter(V)	Difference V-V'
1	20	10	3/30 x 10= 1V	0.8 V	1-0.8=0.2V
2	40	12	3/30 x 10 = 1.2V	1.1 V	1.2-1.1=0.1V
3	50	11	3/30 x 11= 1.1 V	0.9 V	1.1-0.9=0.2 V
4	100	14	3/10 x 14 = 1.4 V	1.1 V	1.4-1.1=0.3 V

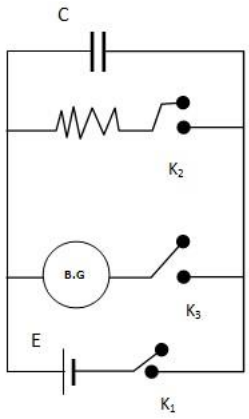
Precautions:

1. Connections should be clean.
2. Voltage of the E.M.F. source should be constant during the experiment.
3. Error of galvanometer and voltmeter should be removed.
4. The terminal of battery should be connected to the positive terminal of battery.

Experiment No.4

To determine the given High Resistance by Leakage Method.

Circuit Diagram



Apparatus

- Ballistic Galvanometer
- 3 Keys
- High Resistance
- Battery
- Capacitor
- Stopwatch

Procedure

1. First, we set the Ballistic Galvanometer at zero point, then we pull out the damping key so that the current should pass through the galvanometer.
2. Press Key 1, the capacitor will charge for some time. Now release key 1 so that the charge will leak to the galvanometer, and it will show reading.
3. We will note the deflection θ_0, for the first deflection.
4. Now put the damping key again and press key 1 to charge capacitor again. Now release key 1 and press key 3 for a known time 't'.
5. I note the time and release key 3 and again press key 2, the galvanometer will show deflection again and note that reading as θ_t.
6. This deflection will be less than θ_0 because some charge is leaked by pressing key 3 and remaining key 2 again.
7. Use this formula
   $R = t / c \ln \theta_0/\theta_t$.

Where C is capacitance, t is the time and ln is the natural log.

Table and Observations

$\square_0$	$\square_t$	Time 't'	$R = \frac{t}{c \ln \square 0/\square t}$
40	**30**	**4**	**$1.3\times10^7\Omega$**
40	**30**	**3**	**$2.246\times10^7\Omega$**
42	**35**	**5**	**$2.74\times10^7\Omega$**
40	**36**	**5**	**$4.745\times10^7\Omega$**
45	**37**	**7**	**$3.576\times10^7\Omega$**
45	**35**	**7**	**$2.785\times10^7\Omega$**

Precautions

1. The galvanometer should be set at zero point.
2. The $\square_0$ must be greater than $\square_t$.
3. The capacitor should be charge for a less time.

Experiment No.5

To study the earth dip angle.

Apparatus

- Earth inductor
- Ballistic Galvanometer
- Damping key

Circuit Diagram

Procedure

1. First, we will check that galvanometer is at zero point.
2. Then will release the key and rotate the earth inductor in vertical position to find H_v.
3. Now we will place the Earth Inductor at its horizontal position and rotate to find H_H.
4. By rotation the galvanometer will show deflection both in horizontal and vertical positions.
5. We will use the following formula for Earth dip angle

$\theta = \tan^{-1} H_v/H_H$

Table and Observations

H_V	H_H	H_V/H_H	$\theta = \tan^{-1} H_v/H_H$
40	35	1.14	48.7
42	33	1.27	51.7
38	30	1.26	51.5
45	40	1.125	48.36
45	36	1.85	51.34

Precautions

1. The galvanometer must be at zero point before starting the experiment.

2. The Earth Inductor should be handled with care.

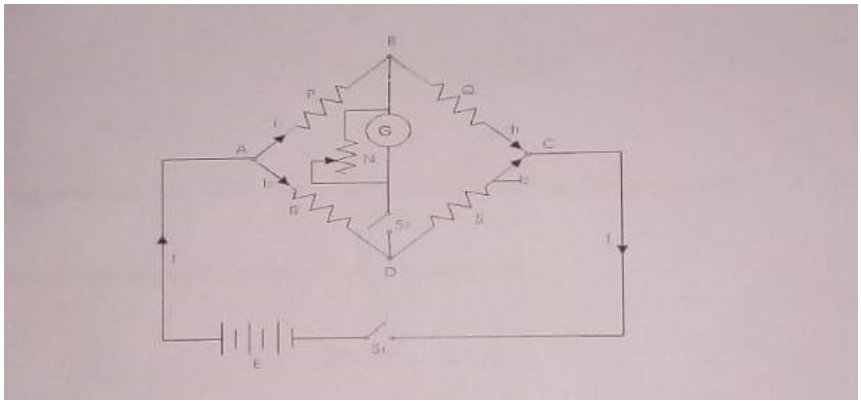
Experiment No.6

To find the value of coefficient of resistance using post office box

Apparatus

- Post Office box
- High resistance box
- Galvanometer
- Connecting wires

Circuit Diagram



Procedure

1. Join negative terminal of the battery with resistance box at one end and second end with point c of post box.
2. Connect the galvanometer between point C and D.
3. Connect positive terminal of battery with key 1. (This key is internally connected with point A of PO box).
4. Tap key 1 if needle of galvanometer goes out of scale and remove one key to add resistance from HRB.
5. As now needle of galvanometer is in range of measurable value, now remove two keys from point P and Q.
6. Tap key 1 again, it will show deflection and hold it permanently. Now tap key 2 again and again and remove keys from point A to D till deflection of galvanometer comes to zero.
7. Now note the readings of point P and Q and from points A to D. Put the readings in formula to calculate the unknown resistance.

Table and Observations

P	Q	R	R_t=QR/P	$Tc^0$1	**T^0c2**	$\alpha=Rt_2-Rt_1/Rt_1t_2-Rt_2t_1$
1000	100	190	19	20	35	0.0081
100	10	220	22	27	51	0.00445
100	10	190	19	18	39	0.00327

Precautions

1. The value of P should be greater than Q.

2. Do not let off Galvanometer go off scale, that will damage the instrument.

3. The value of Galvanometer should be from H.R.B.

Experiment NO #7

Finding Resistance by Color Coding Method:

Apparatus:

Following apparatus are needed to carry out this verification:

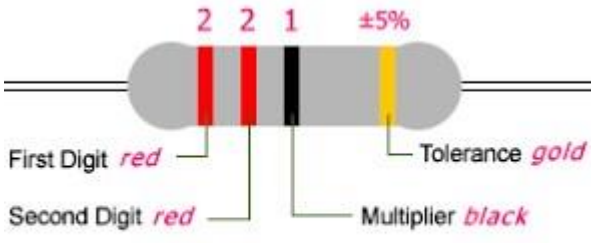
1. Different resistors with color bands.
2. Ohm meter i.e. Multimeter.

Procedure:

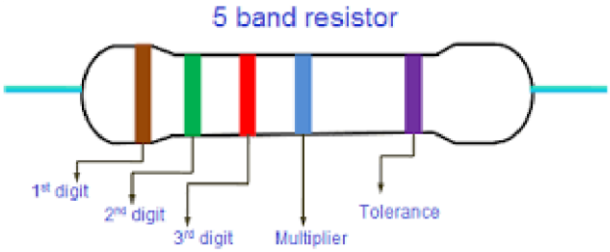
The resistance of a given resistor can be found by following method:

1. First band will give tens number in numerical value of the resistance.
2. Second band will give unit number in numerical value of resistance.
3. Third band gives the value of in numerical multiple of ten for the first value.
4. Fourth band gives the resistance tolerance.

Colour	Digit	Multiplier	Tolerance
Black	0	1	
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1,000	
Yellow	4	10,000	
Green	5	100,000	± 0.5%
Blue	6	1,000,000	± 0.25%
Violet	7	10,000,000	± 0.1%
Grey	8		± 0.05%
White	9		
Gold		0.1	± 5%
Silver		0.01	± 10%
None			± 20%



A 22Ω Resistor
22×1 Ohms with a tolerance rating of ±5%



Readings:

S. No.	1st Band	2nd Band	3rd Band	4th Band	Resistance in Ohms Ω	Readings of Ohm meter	Error
1.	2	2	10^1	±5%	22x 10^1 ±5%	21.7x 10^1 Ω	0
2.	1	5	10^3	±5%	15x 10^3 ±5%	14.3x 10^3Ω	0
3	4	7	10^3	±5%	47x 10^3 ±5%	0.7 Ω	0.206
4.	6	8	10^{-1}	±5%	68x 10^{-1} ±5%	6.9 Ω	0
5.	4	3	10^2	±5%	43x 10^2 ±5%	4.25K Ω	0
6.	1	0	10^7	±5%	1x 10^7 ±5%	9.62M Ω	0
7.	1	0	10^5	±5%	1x 10^5 ±5%	0.956M Ω	0

Experiment No #8

CALIBRATION OF THERMOCOUPLE

AIM OF EXPERIMENT:

. A thermocouple has two dissimilar wires welded at one end and free at the other. When these wires experience a temperature difference, a voltage is produced, creating a potential difference at the junction. This voltage at the junction is measured and correlated with the temperature. Thermocouples are made rugged and robust. They can withstand a wide range of temperatures. However, since the temperature measurement depends on the voltage, thermocouple calibration at regular intervals is necessary to ensure that the device can successfully recognize the voltage. The process of calibration involves comparing the thermocouple's measurement accuracy against a known and standard reference.

APPARATUS USED:

- Stand
- Water
- Mercury
- Two beakers
- Two test tubes
- Two thermometer
- Spirit lamp / electric rod
- Wires (Eureka and copper)
- Galvanometer / multi meter

ARRANGEMENT OF APPARATUS:

1. Take two test tubes containing some mercury
2. Dipped these test tubes in different beakers containing some water
3. Water in both beaker should be at same temperature in the start
4. Dip one thermometer in each test tube to measure temperature of water
5. Join two wires end to end and dipped it’s both ends in different test tubes
6. Connect galvanometer with only one wire of both beakers to measure thermoelectric e.m.f. Or use multi meter to get accurate result

PROCEDURE:

I. Note the initial reading of thermometer and multi meter. Initial reading of thermometer depends water temperature but the multi meter show zero deflection.

II. Increase the temperature of one beaker slowly and gradually. By increasing temperature of one beaker there is change in temperature occur between both beakers.

III. To find change in temperature, use following equation

IV. $\Delta T = T_f - T_i$

V. As the temperature increase multi meter reading is also increase, because of value of change in temperature increase.

VI. Now note the readings of multi meter.

OBSERVATION AND CALCULATION: S. no	Ti (0C)	Tf (0C)	ΔT=Tf-Ti	Voltage at 200mm
1.	20	20	0	0.1
2.	20	26	6	0.2
3.	20	37	17	0.3
4.	20	45	25	0.4
5.	20	54	34	0.4
6.	20	60	40	0.5
7.	20	70	50	0.6

Experiment No # 9

TO FIND OUT THE FREQUENCY OF ALTERNATING CURRENT

AIM IF THE EXPERIMENT:

The aim of this experiment is to find out the frequency of alternating current. Frequency is the numbers of cycle completed in one second. So the number of cycles completed by alternating current in one second is known as A.C frequency.

APPARATUS:

- Sonometer
- Slotted weight
- U shaped magnet
- Digital balance
- Step down transformer
- Ammeter wires made of non-magnetic material
- Rheostat

The word sonometer is the combination of two words, sono means sound and meter is measurement. Thus sonometer is the device used to measure frequency of sound. It is composed of wooden board and a sca This type of magnet is shaped like English alphabet U,hence the name. It is used to provide a uniform magnetic field across the wire.

3. SLOTTED WEIGHT: These are weights which have narrow openings or grooves which allows us ti create any desire value of the mass. It is used to create tension in the wire.

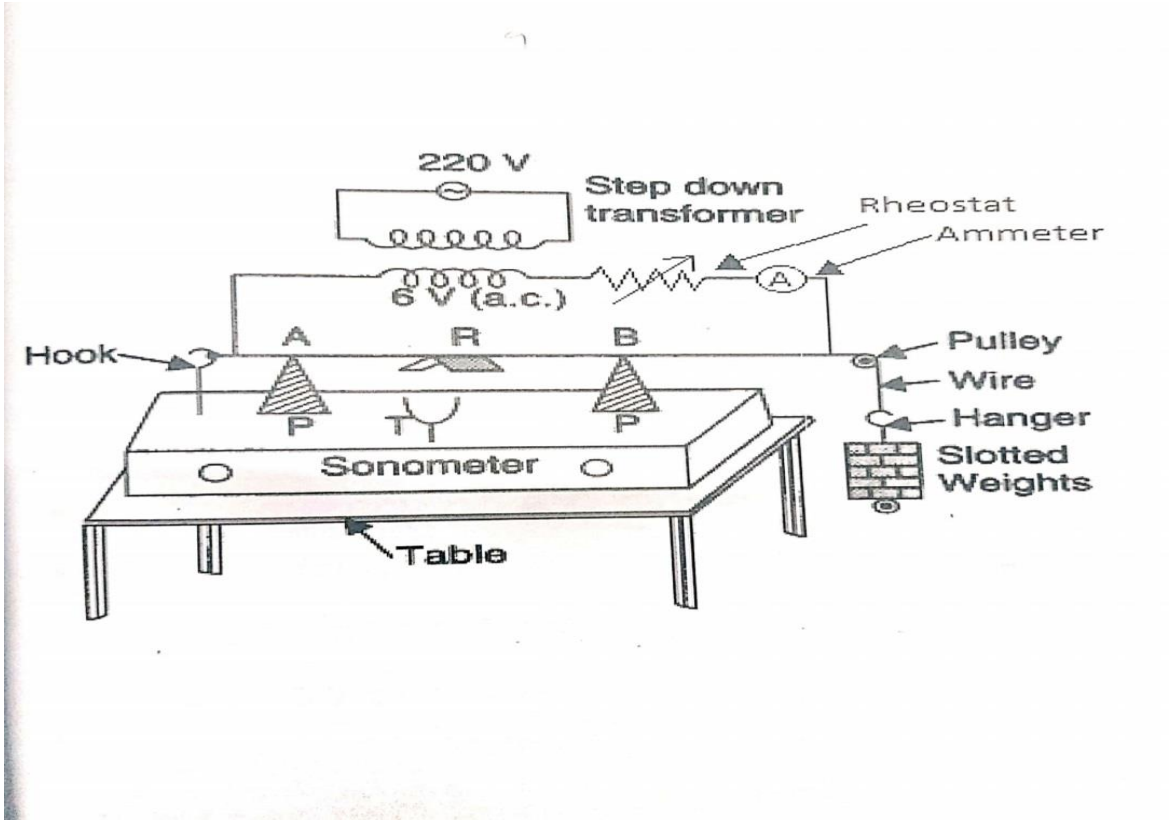
4. RHEOSTAT:

Rheostat is a type of variable resistor which is used to increase or decrease the current in the wire due to which amplitude of vibration in the wire change.

5. STEP DOWN TRANSFORMER:

This device decrease the A.C voltage from 220V to 6V we need to decrease voltage because if high voltage is applied to a conductor, it heat up and more heat could increase the resistance or even damage the conductor. Another reason is our own safety.

CIRCUIT DAIGRAM:



FORMULA USED:

$$f = 1/2L\ (\sqrt{T}/\mu)$$

- f= frequency of A.C

- L= length of wire
- T= tension in sonometer wire
- μ= Linear density of sonometer wire i.e. mass per unit length

EXPERIMENTAL PROCEDURE:

1. First of all we are require to find out linear density of sonometer wire. For this we will take wire of known length and find its mass by digital balance and put in the following formula

$$\mu = m/L$$

2. Find tension in the wire by multiplying mass "m" with gravitational acceleration "g".
3. Switch on the power supply
4. Now start increasing distance between wedges place next to each other
5. At specific position of wedge the wire will start vibration with maximum amplitude
6. Put values in the following table to find out the frequency of A.C

OBSERVATION AND CALCULATION:

S. no	μ	m_g	g	T=mg	L1	L2	I=L2-L1	F
1.	0.052	1000	9.8	980,000	5	45	40	47.1
2.	0.052	1500	9.8	14700	5	58	53	50.1
3.	0.052	2000	9.8	19600	5	64	59	50.8
4.	0.052	2500	9.8	24500	5	72	67	52.5
5.	0.052	3000	9.8	29400	5	80	75	51.57

PRECAUTIONS:

A. Move the wedge by a small distance interval so that the fundamental node of resonance is not skipped.

B. Length of sonometer wire should be noted when amplitude of vibration is maximum.
C. U shaped magnet should be in between center of position of wedges.
D. Increase the weight stepwise and do not put large weight at once.

Experiment No #10

TO STUDY THE VARIATION OF PHOTOELECTRIC CURRENT WITH INTENSITY OF LIGHT

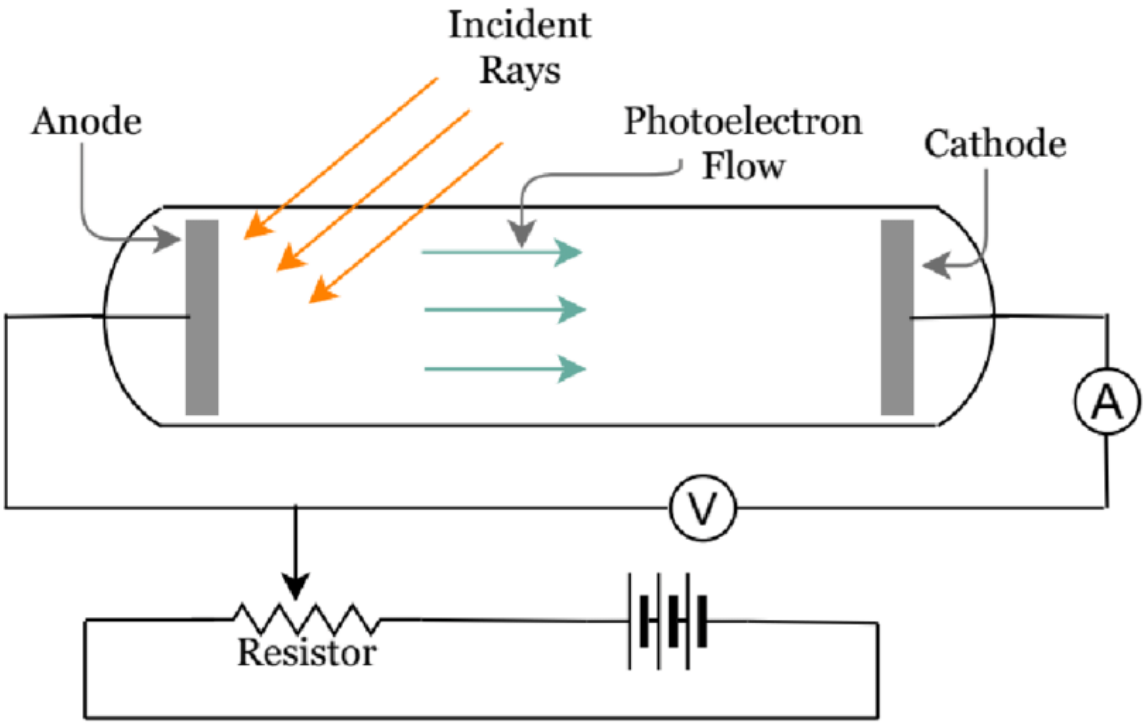
Aim of experiment:

The aim of performing this experiment was to check the impact of change in intensity of light on photoelectric current. Apart from that, it has also proved that the photoelectric phenomenon, which has been commonly used in various application of daily life is a simple phenomenon.

Apparatus:

- Voltmeter
- Micrometer
- Power supply
- Meter rod
- Photoelectric effect
- Electric bulb

Circuit diagram:


Incident
Rays
Anode
Photoelectron
Flow
Cathode
A
V
Resistor

Procedure:

1. Light from a source fall on the metal surface at some particular surface measured with the meter rod.
2. Electrons are emitted from the metal surface due to incident beam called photons and current produced due to photons is called photoelectric current.
3. The micrometer will show little current reading and deflection.
4. The circuit figure show cathode and anode. The diode tube cathode is connected to the negative terminal of the battery.
5. The micrometer is connected in series with the circuit.
6. The light from the source is incident on the cathode in the bulb.
7. If we increase or decrease the distance between the bulb and cathode.

The micrometer will show deflection.
8. The intensity of the beam depends upon the distance of the source from the tube.

Formula used:

$I = 1/d^2$

- d is the distance between the electric bulb of incident light and the cathode.
- It shows that greater the distance lesser will be the photoelectric current.

Readings and observations: S. no	Distance (cm)	Angle (dA) of micrometer	d2	I = 1/d2
1.	50	2.5	2500	0.0004 A
2.	40	2	1600	0.000625 A
3.	30	3	900	0.00111 A
4.	20	6	400	0.0025 A
5.	15	13	225	0.0031 A
6.	10	22	100	0.01 A
7.	5	30	25	0.04 A

Precautions:

- The connections be neat and clean.
- Wire ends should be cleaned with sandpaper.
- Shunt the ammeter to prevent from damage.