Exp no:1

OHM'S LAW AND RESISTANCE

AIM:

To determine the resistivity of two wire by plotting a graph for potential difference versus current.

MATERIALS REQUIRED:

Two resistance wires; A voltmeter and an ammeter of appropriate range. A battery (battery eliminator), A rheostat, A metre scale, one way key, connecting wires, A piece of sand paper, screw guage.

THEORY:

i) Resistance per cm of the wire

$$R = \frac{V}{I} \text{ ohm}$$

$$R \text{ per cm} = \frac{R}{L} \text{ ohm/cm}$$

where R = resistance of the conductor in ohm.

V = potential difference in volt

I = current in ampere

L = length of the wire in cm.

ii) Specific resistance or resistivity of the wire

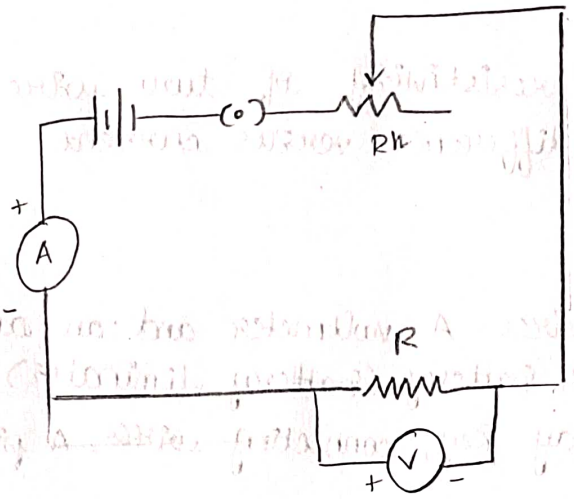
$$P = \frac{\pi r^2 R}{l}$$

P = resistivity of the material of the wire in ohm metre

r = radius of the cross-sectional area of the wire in mm.

l = length of the wire in cm.

CIRCUIT DIAGRAM



OBSERVATION:

Ammeter's Range = 0 - 5A

L.C = 0.1A

Zero error = 0

Voltmeter = 0 - 5V

L.C = 0.1V

Zero. Error = 0

TABULATION:

S.NO.	Ammeter Reading	Voltmeter Reading (V)		Calculated Reading $R = \frac{V}{I}$	
		Wire I	Wire II	Wire I (Ω)	Wire II (Ω)
			Average :	____ Ω	____ Ω

	length (m)	Radius (mm)	Area (A^2) (m^2)
Wire I			
Wire II.			

$A = \pi r^2$

CALCULATION

$$\rho = \frac{RA}{\ell}$$

WIRE I =

WIRE II =

RESULT

→ The graph between V & I is a straight line.

→ Resistance of the given wire are found to be

i) By using formula (wire 1) = _____ Ωm

(wire 2) = _____ Ωm

ii) By using graph (wire 1) = _____ Ω

(wire 2) = _____ Ω

iii) Resistivity of the given wires (wire 1) = _____ Ωm

(wire 2) = _____ Ωm

PRECAUTIONS:

i) The connections should be neat, clean and tight

ii) Care should be taken to connect the voltmeter and ammeter in proper polarities

SOURCES OF ERROR:

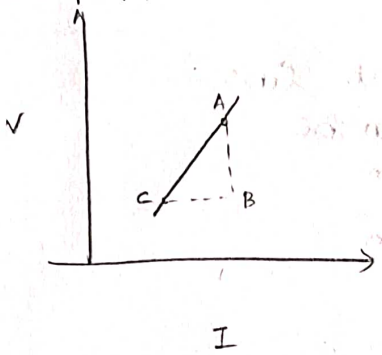
i) The instrument screws maybe loose.

ii) Thick connecting wire may not be available.

Include this under the theory.

Expected graph

(Wire I & Wire II)



Resistance (R) = $\frac{\Delta V}{\Delta I}$

= $\frac{AB}{BC}$ = _____ Ω

EXP-2

METRE BRIDGE
RESISTANCE OF THE WIRE

AIM

To find the resistance of the given wire using metre bridge

MATERIALS REQUIRED

Metre bridge, Battery eliminator, jockey, Galvanometer, Resistance box, one way key, unknown resistance and connecting wire.

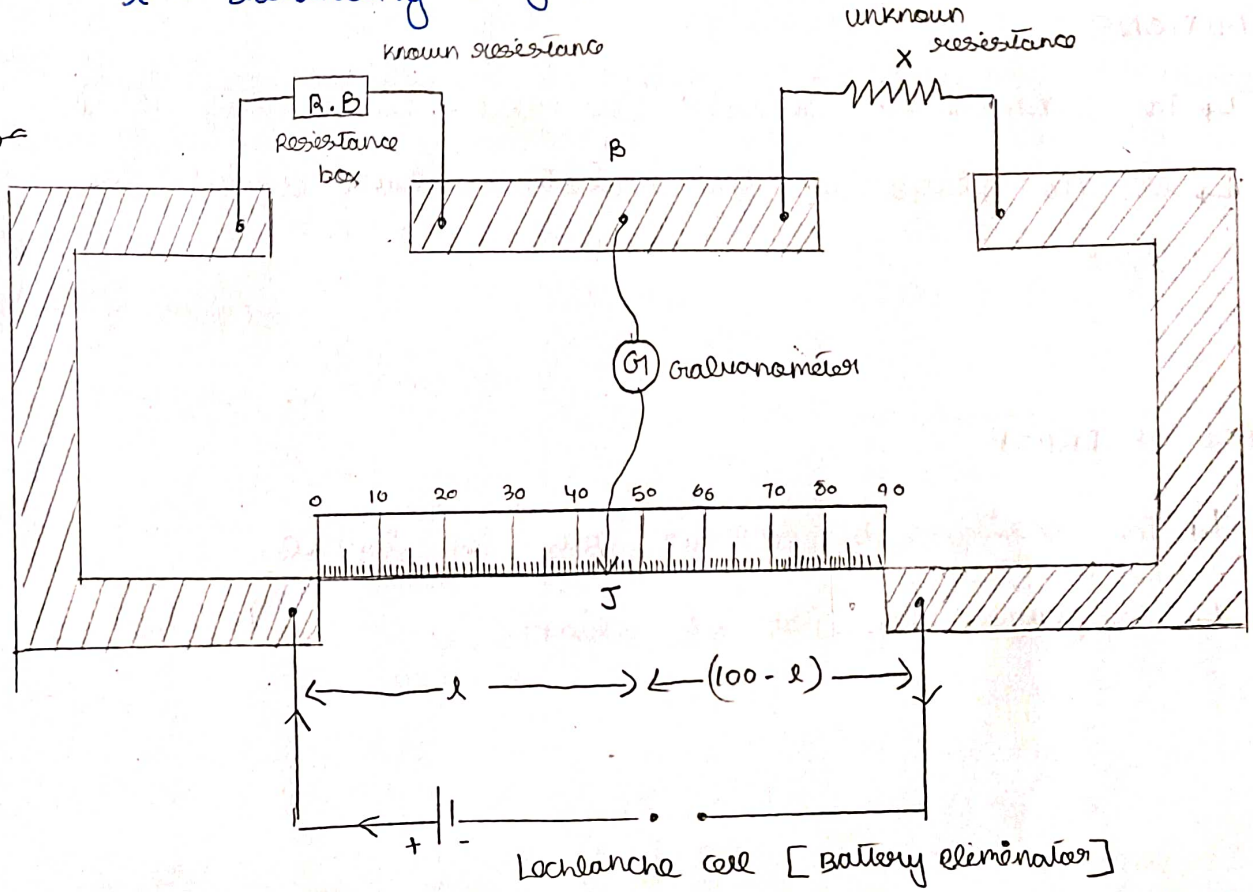
THEORY

The unknown resistance x is given by:

$$X = \frac{R(100-l)}{l}$$

where R - Resistance in the resistance box in ohm

l - Balancing length in cm



OBSERVATION

Least count of Metre Bridge Scale :

TABULATION

S.NO	Resistance from the resistance box 'R' ohm	Balancing length (from left) 'l' (cm)	Balancing length (100 - l) (cm)	Unknown Resistance $X = R\frac{(100-l)}{l}$ (Ω)
1				
2				
3				
4				
5				

Mean value x = _____ Ω

RESULT

The value of unknown resistance x is ____ Ω

PRECAUTIONS

↳ The connections should be neat, clean and tight

↳ All the plugs in the resistance box should be tight

SOURCE OF ERROR

↳ The instrument screws may be loose

↳ The plugs may not be clean

EXP-3

METRE BRIDGE - SERIES

AIM:

To verify the laws of combination (series) of resistance using a metre bridge.

APPARATUS:

A metre bridge, Battery eliminator, a galvanometer, a resistance box, a jockey, two resistance wires, a set square, sand paper and connecting wires.

THEORY:

(i) The resistance (r) of a resistance wire given by

$$r = \frac{(100-l)}{l} \times R$$

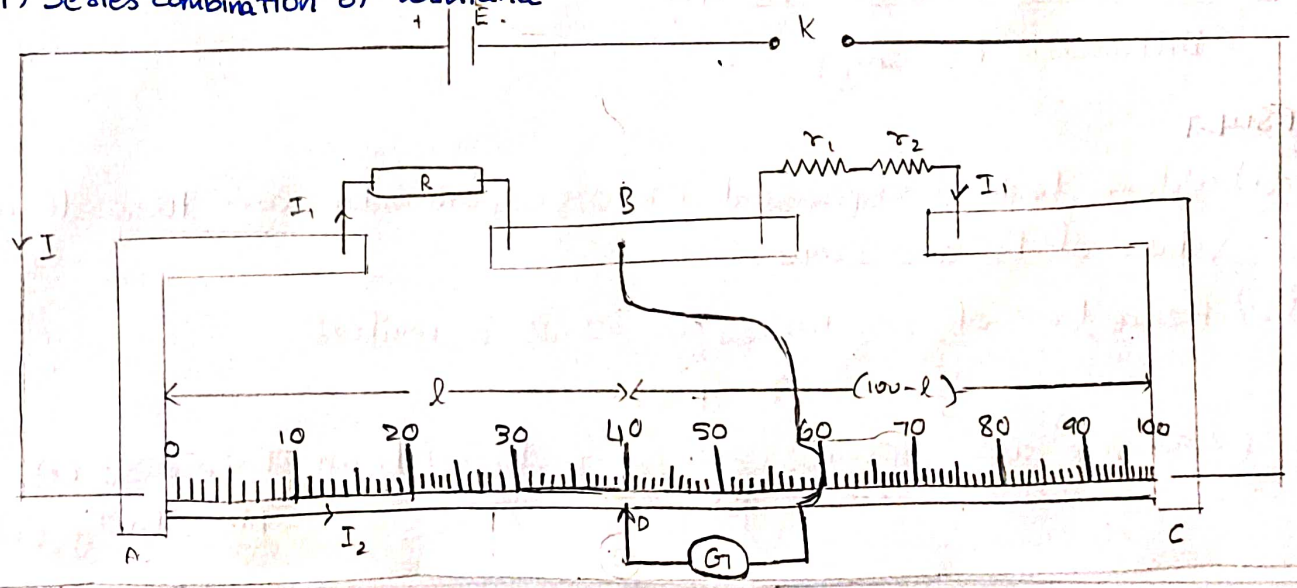
where, R is the resistance from the resistance box in the left gap and l is the length of the metre bridge wire from zero end up to balance point.

(ii) When two resistance r_1 and r_2 are connected in series, then their combined resistance,

$$R_S = r_1 + r_2$$

CIRCUIT DIAGRAM:

(i) Series combination of resistance



(ii) Resistance in Series

OBSERVATIONS

Resistance coil	S.No	Resistance from the resistance box R (ohm)	Length AD = l (cm)	Length DC = 100 − l (cm)	Resistance $r = \frac{(100-l)}{l} \times R$	Mean Resistance (ohm)
r_1 only	1					$r_1 =$
	2					
	3					
r_2 only	1					$r_2 =$
	2					
	3					
r_1 and r_2 in series	1					$r_3 =$
	2					
	3					

CALCULATIONS

(i) Calculation for r_1 only r_2 only, r_1 and r_2 in series

$$r = \frac{(100-l)}{l} \times R$$

(ii) Calculation for verification of laws

Experimental value of $R_s =$

Theoretical value of $R_s = r_1 + r_2$

Difference (if any) =

RESULT

(i) Within limits of experimental errors, experimental and theoretical values of R_s are same.

(ii) Hence, law of resistances in series is verified.

For precautions and sources of error learn from Experiment (2) – Meter Bridge (wire).

EXPERIMENT-4
CONVEX LENS-FOCAL LENGTH

AIM:

To find the focal length of a convex lens by plotting graphs between u and v.

APPARATUS:

An optical bench with three uprights, a convex lens with lens holder, two optical needles, a Knitting needle and a half metre scale.

THEORY:

The relation between u, v and f for a convex lens is,

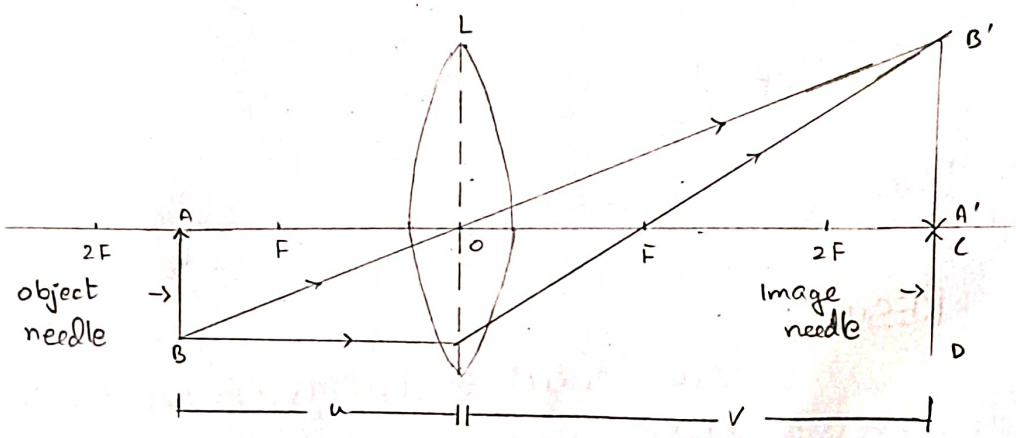
$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

Where, f = focal length of convex lens
u = distance of object needle from optical centre of the lens.
v = distance of the image needle from the optical centre of the lens.

Applying sign convention,

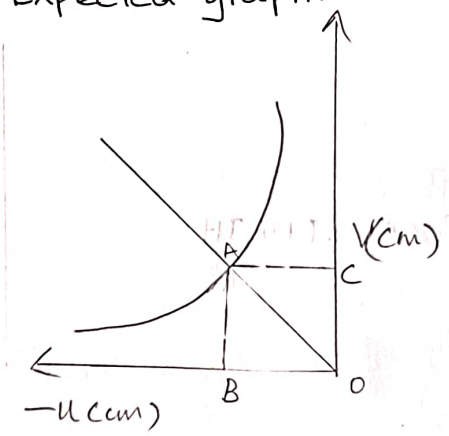
u is negative
v is positive

$$\Rightarrow f = \frac{uv}{u+v}$$



RAY DIAGRAM

Expected graph:



From graph

$$f = \frac{OB}{2} = \frac{OC}{2}$$

OBSERVATIONS:

Rough focal length of the given convex lens = ... cm

TABULATION:

S.No	Position of			Observed distance		$f = \frac{uv}{u+v}$
	Object needle A (cm)	Lens O (cm)	Image needle	OA=u (cm)	OC=v (cm)	(cm)
1.						
2.						

mean f = cm

CALCULATIONS:

focal length(f)= cm

from graph,

$$f = \frac{OB}{2} = \text{cm}$$

$$f = \frac{OC}{2} = \text{cm}$$

Mean f = cm

RESULT:

Focal length of the given convex lens:

i) focal length $f = \frac{uv}{u-v}$ = cm

ii) u-v graph = cm

RRECATIONS:

1. Tips of the object and image needles should lie at the same height as the centre of the lens.
2. Index correction for u and v should be applied.

SOURCES OF ERROR:

1. The uprights may not be the vertical
2. Parallax removal may not be perfect

EXP-5 FOCAL LENGTH OF CONVEX MIRROR USING CONVEX LENS.

AIM:

To find the focal length of a convex mirror, using convex lens

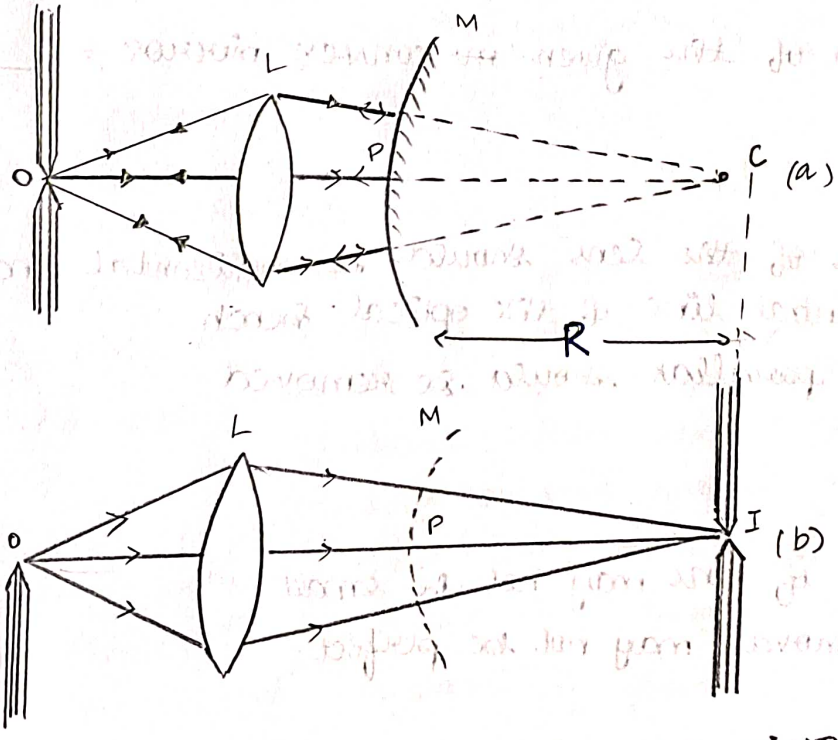
MATERIALS REQUIRED:

Metre scale, convex mirror, convex lens, candle, screen, lens holder, mirror holder.

THEORY:

Focal length of the convex mirror, $f = R/2$ where R is the radius of curvature of the mirror.

RAY DIAGRAM



Focal length of convex mirror.

OBSERVATION

Rough focal length of convex lens = ~~[illegible]~~ ____ cm.

Table for focal length of convex mirror.

S.NO.	Position of		Radius of curvature PI (cm)	Focal length $f = \frac{R}{2}$ (cm)
	Convex mirror P (cm)	Image needle I (cm)		

Mean focal length (f) = _____ cm.

RESULT :

The focal length of the given convex mirror = _____ cm.

PRECAUTIONS

i) Principal axis of the lens should be horizontal and parallel to the central line of the optical bench.

ii) Tip - to - tip parallax should be removed

SOURCES OF ERROR :

i) Focal length of lens may not be small.

ii) Parallax removal may not be perfect.

EXP-6

P-N JUNCTION - V-I CHARACTERISTICS

AIM:

To draw the V-I characteristic curve of a p-n junction in forward bias and reverse bias.

APPARATUS:

A p-n junction diode, 2 voltmeter of appropriate range, 2 ammeters of appropriate range, one-way key, connecting wires and piece of sand paper.

THEORY:

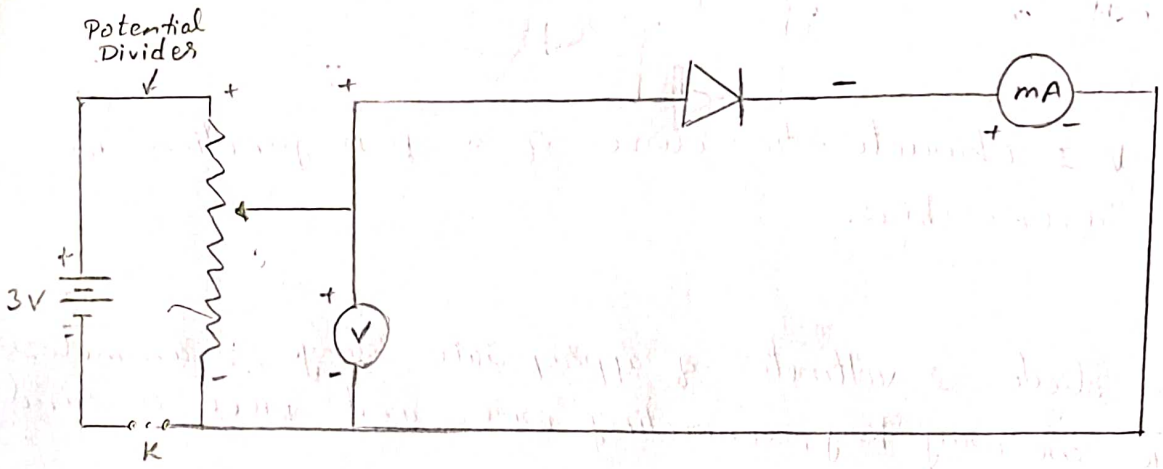
FORWARD - BIAS CHARACTERISTICS.

When the p-section of the diode is connected to positive terminal of a battery and n-section is connected to negative terminal of the battery then junction is said to be forward biased. With increase in bias voltage, the forward current increases slowly in the begining and then rapidly. The variation of forward current with respect to forward voltage is noted.

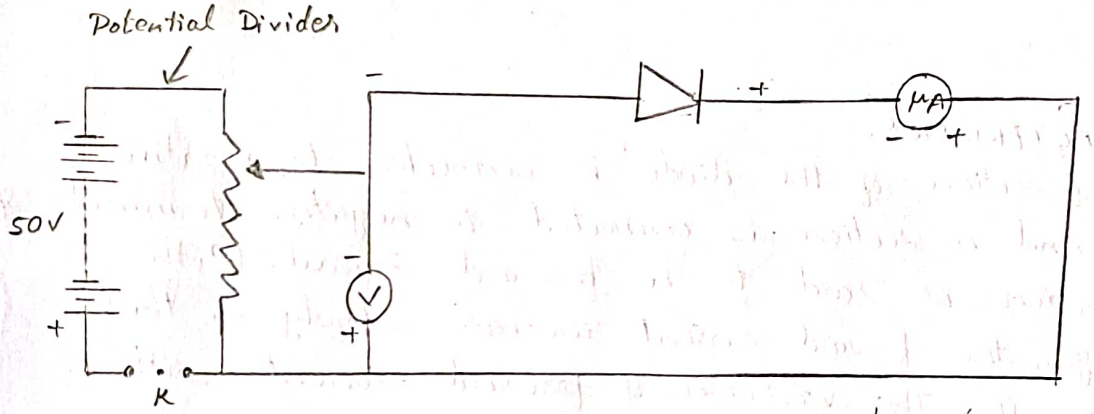
REVERSE - BIAS CHARACTERISTICS.

When the p-section of the diode is connected to negative terminal of high voltage battery and n-section of the diode is connected to positive terminal of the same battery, then junction is said to be reverse biased. When reverse bias voltage increases, initially there is a very small reverse current flow, which remains almost constant with bias. But when reverse bias voltage increases to significantly sufficient high value, the reverse current suddenly increase to a large value. The variation of reverse current with respect to reverse voltage is noted

DIAGRAM :

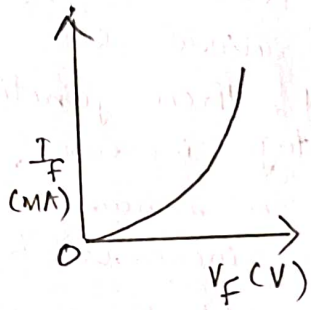


p-n junction diode - forward biased

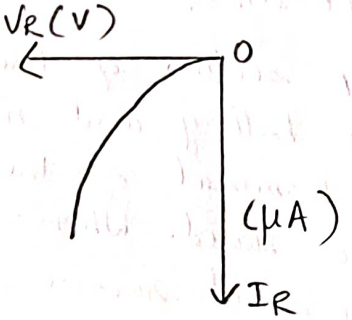


p-n junction diode - reverse biased

EXPECTED GRAPH :



Forward bias



Reverse bias

OBSERVATIONS :

FOR FORWARD-BIAS

Range of voltmeter = ... V

least count of voltmeter = ... V

Range of milli-ammeter = ... mA

least count of milli-ammetes = ... mA

ial No. of obs.	Forward - bias Voltage V_F (V)	Forward current I_F (mA
1.		
2.		
3.		

R REVERSE - BIAS

Range of voltmeter = ... V

least count of voltmeter = ... V

Range of micro - ammeter = ... μA

least count of micro - ameter = ... μA

Serial No. of obs.	Reverse - bias Votage V_R (V)	Reverse current I_R (μA)
1		
2		
3.		

CALCULATIONS:

Junction resistance for forward - bias.

$$r = \frac{\Delta V_F}{\Delta I_F} = \text{..... ohms.}$$

Junction resistance for reverse - bias.

$$r = \frac{\Delta V_R}{\Delta I_R} = \text{..... ohms.}$$

RESULT:

Junction resistance for forward - bias =

Junction resistance for reverse - bias =

PRECAUTIONS:

- All connections should be neat, clean, and tight.
- Forward - bias voltage beyond breakdown should not be applied.

SOURCE OF ERROR:

- Error may occur due to carelessness of the student.
  The terminals of battery may not be connected properly