NAME- PRATIK RAJESH JADE

DIV- A

ROLL NO- A72

PHYSICS PRACTICAL

SR.NO	NAME OF EXPERIMENT
1	APPLICATION OF CRO
2	NEWTON'S RING (RADIUS)
3	NEWTON'S RING (R.I OF LIQUID)
4	NEWTON'S RING (WAVELENGTH OF LASER)
5	ENERGY BAND GAP OF SEMICONDUCTOR
6	I-V CHARACTERISTICS OF DIODE
7	PN JUNCTION DIODE AS RECTIFIERS
8	APPLICATION OF DIODE VOLTAGE REGULATION BY ZENER DIODE

Experiment no. 1

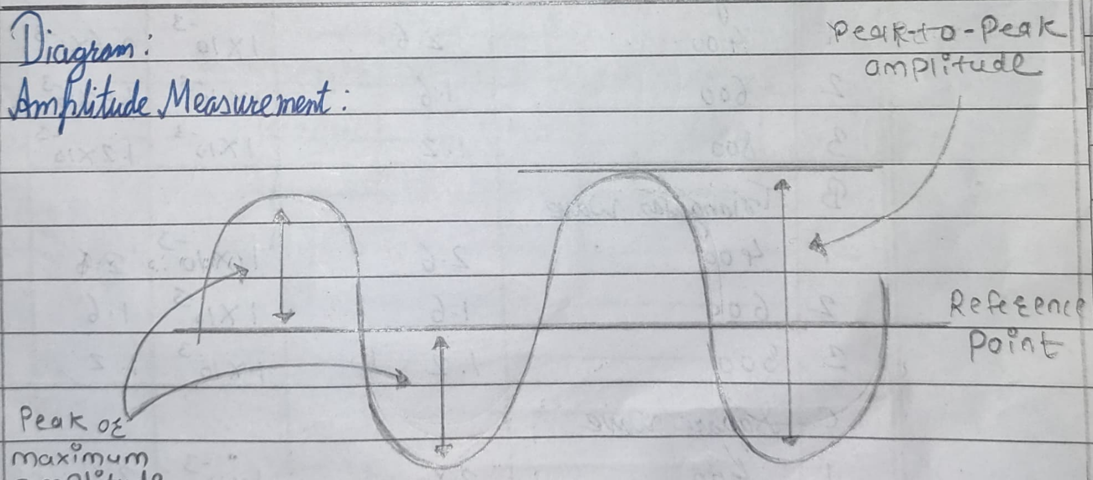
Name - Pratik Jade
Roll no.- A72

Name of Experiment: Application of CRO
Date of Performance:

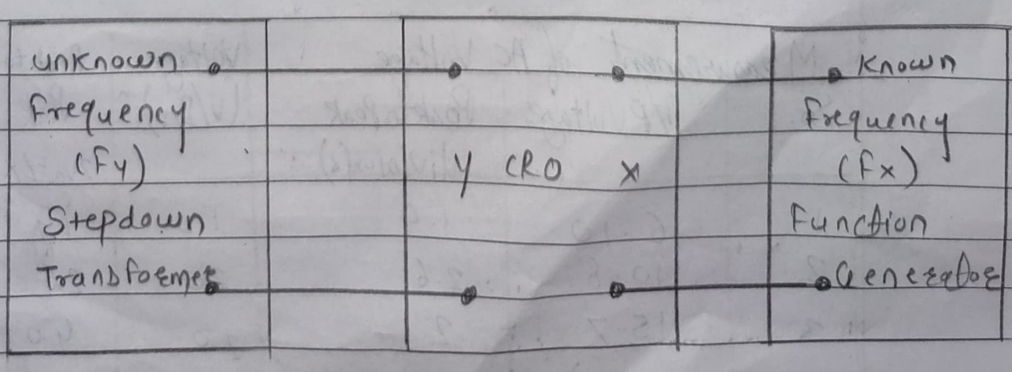
Aim - To measure amplitude of AC Voltage and determine unknown frequency using CRO.

Apparatus: Cathode Ray Oscilloscope (CRO), Function generator, Lissajou's figure kit, connecting wires.

Diagram:
Amplitude Measurement:



Unknown Frequency:



Formula:

Unknown frequency = $F_y = \frac{n_x}{n_y} f_x$

where, F_y = unknown frequency to transformer

Observation table:-

A] For measurement of frequency

obs	i/p Freq^n (Hz)	Peak to Peak Horizontal length (L)	Time Base (t)	Period. $T = t \times l$	Frequency $F = 1/T$ (Hz)
A	Signal wave				
1	400	2.6	1×10^{-3}	2.6×10^{-3}	3.846×10^{-4}
2	600	1.6	1×10^{-3}	1.6×10^{-3}	6.25×10^{-4}
3	800	1.2	1×10^{-3}	1.2×10^{-3}	8.33×10^{-4}
B	Triangular wave				
1	400	2.6	1×10^{-3}	2.6	0.38
2	600	1.6	1×10^{-3}	1.6	0.625
3	800	1.2	1×10^{-3}	1.2	0.833
C	Square wave				
1	400	2.6	1×10^{-3}	2.6	0.384
2	600	1.6	1×10^{-3}	1.6	0.625
3	800	1.2	1×10^{-3}	1.2	0.333

Measurement of AC Voltage

Sr.	i/P Voltage	Peak to Peak division (L)	Voltage (V/Div)$^{\cdot n}$	Peak to Peak $2V_0 = L \times n$	Output Voltage $V = \frac{2V_0}{2\sqrt{2}}$
1	6.10	1.4	10	14	7
2	10.8	2.6	20	26	13
3	15.7	2	20	40	20

Unknown $freq^n$

Sr.	Known freq F_x (Hz)	No of loops horizontal direction n_x	No of loops vertical direction n_y	Unknown freq F_y (Hz)
1	200	1	1	200
2	300	2	1	600
3	400	3	2	600
4	600	4	3	800

Avg. freq. = 550 Hz

Formula:

$$\text{Unknown } freq^n (F_y) = \frac{n_x}{n_y} \times F(x)$$

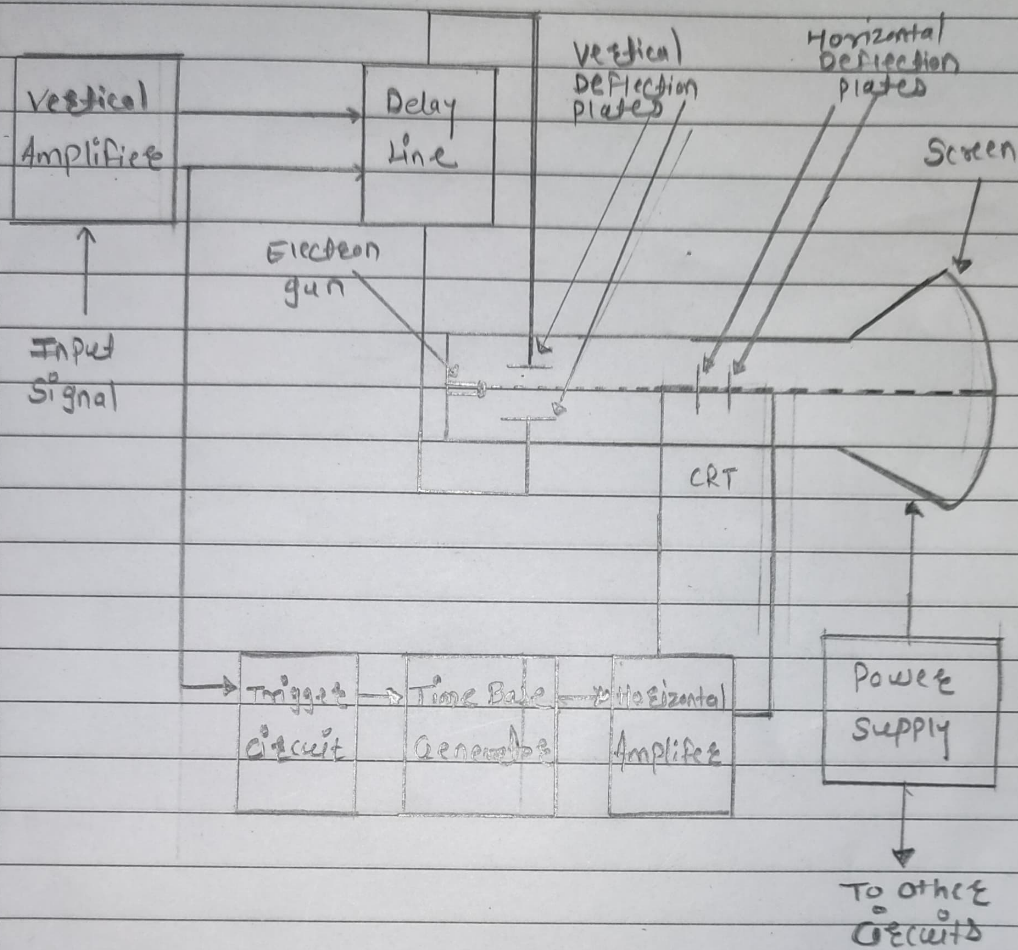
Q1 Function of CRO

→ The cathode-ray oscilloscope (CRO) is a common laboratory instrument that provides accurate time & amplitude measurements of voltage signals over a wide range of frequencies. Its reliability, stability and ease of operation make it suitable as a general purpose laboratory. It purpose is to generate the electron beam & control its intensity & focus, between the electron gun & the fluoresenent screen are two pair of metal plates.

Q2 What ~~are~~ are different block of CRO

→ Cathode Ray oscilloscope (CRO) consists a set of blocks, Those are vertical amplifier, delay line, trigger circuit, time base generator, horizontal, amplifier cathode Ray tube (CRT), power supply.

Q3 Block diagram of CRO.



Experiment no. 2

Name of Experiment - Application of Interference

Date -

Aim - Determination of radius of curvature of plano-convex lens using Newton's ring setup.

Apparatus : ① Newton rings apparatus consisting of

a. Plano-convex lens

b. Optically flat glass plate

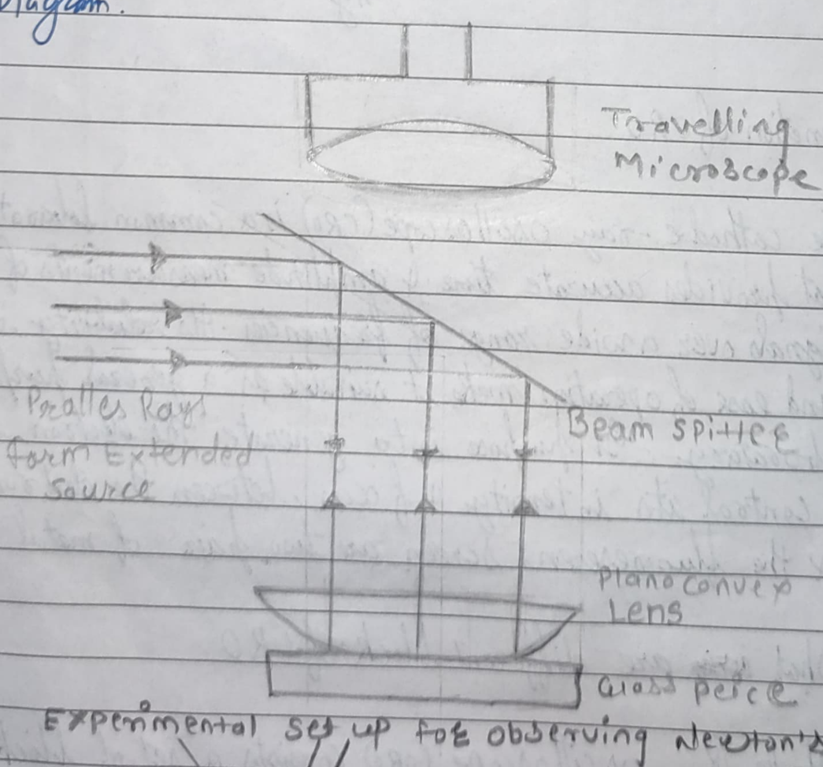
c. Beam Splitter

d. T-Type traveling microscope with scale with L.C = 0.001 cm

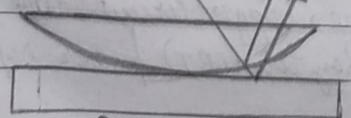
② Monochromatic source of light of known wavelength (eg. sodium)

③ Reading lamp & reading lens.

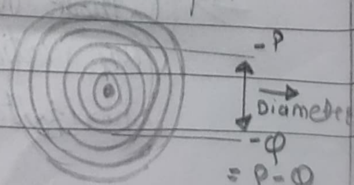
Diagram:



Experimental set up for observing Newton's rings



The Ray diagram for Newton's Rings



Newton's Rings

Formula:

$$R = [(D_m^2 - D_n^2)] / [4(m-n)]\lambda$$

Where

R = Radius of curvature of planoconvex lens

D_m = Diameter of m^{th} dark ring

D_n = Diameter of n^{th} dark ring.

Newton Ring to final Radius:

No of Ring	Microscopic Reading		Diameter	D^2 in cm
	Left side (a) cm	Right side (b) cm	D = (a-b) cm	
1	9.989	10.021	0.032	0.001
3	9.984	10.037	0.053	0.003
4	9.973	10.046	0.073	0.005
6	9.937	10.086	0.149	0.022
7	9.883	10.118	0.235	0.055
8	9.871	10.127	0.256	0.066
9	9.861	10.075	0.214	0.046

Formula $R = \frac{D_{n+p}^2 - D_n^2}{4P\lambda}$

$P = 10$, $n = 1$

$$R = \frac{0.046 - 0.001}{4 \times 10 \times 5890 \times 10^{-8}}$$

$R = 0.0459$

$R = \approx 130cm$

Q1 How netwon's Ring forms?

New ton's rings are formed as result of interference between the light waves reflected from the top & bottom surface of the air film formed between lens & glass sheet

The phenomenon of the formation of newton's ring can be explained on the basis of wave theory of light, An air film of varying thickness is formed between lens & the glass sheet.

Q 2 Why fringes are circular in new tons ~~ki~~ ring expt.

-> The path difference between the reflected ray & incident ray depends upon the thickness of air gap between lens & the base. As the lens is symmentric along its axis the thickness is constant along circumference of a ring of given radius, Hence Newton's rings are circular

Q3 What is interference? Define its types.

-> The effect of combination of two or more wave trains moving on intersecting or coincident paths. The effect is that of additional of the amplitudes of the individual waves at each point affected by more than one wave

There are two types of interference

① Constructive interference

② Destructive interference.

Experiment 3

Name of exp. - Application of interference

Date

Aim - Determination of refractive index using Newton's ring set up.

Apparatus - (1) Newton's ring apparatus consisting of

a. Plano - convex lens

b. Optically flat glass plate.

c. Beam splitter

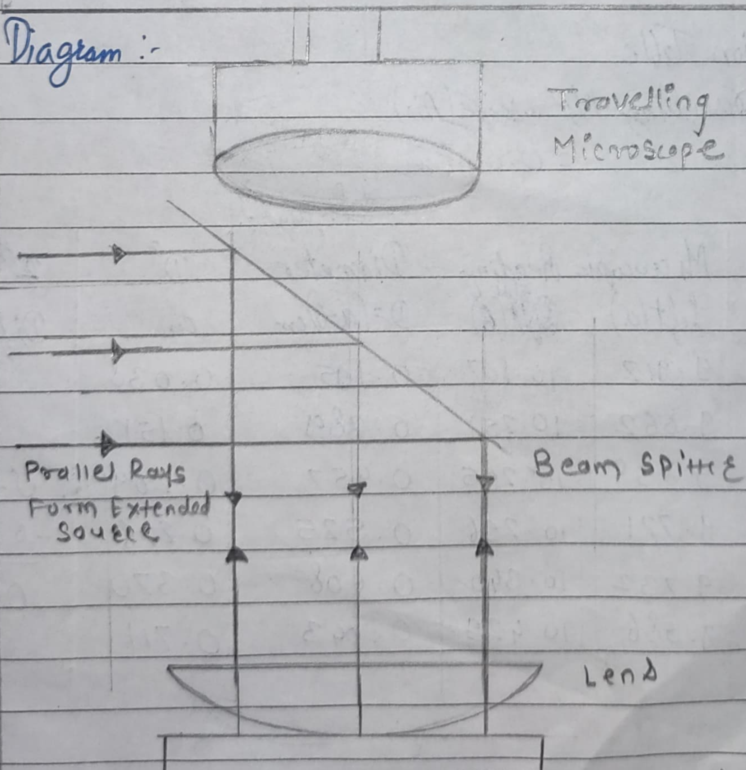
d. T type travelling microscope with scale with $LC = 0.001cm$

(2) Monochromatic source of light at known wavelength (eg - Sodium

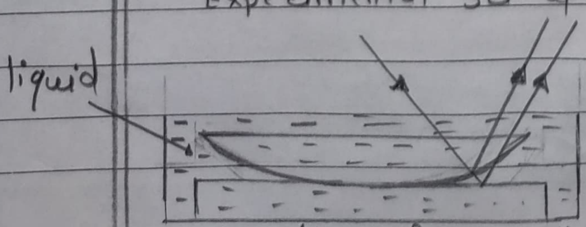
(3) Reading lamp & reading lens

(4) Liquid.

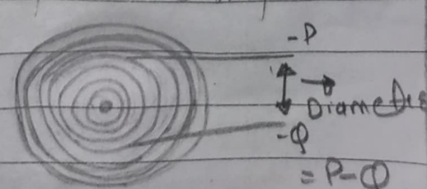
Diagram :-



Experimental set up for obseving Newton's rings.



The Ray diagram for Newton's Rings



Newton's Rings

Formula.

$$R = [(D_m^2 - D_n^2)] / [4(m-n).\lambda]$$

Where

R = Radius of curvature of planoconvex lens

D_m = Diameter of m^{th} dark rings

D_n = Diameter of n^{th} dark rings

λ = wavelength

μ = Refractive index of the medium in between planoconvex lens & glass plate

$$\mu = \frac{(D^2_{n+p} - D_n^2)_{air}}{(D^2_{n+p} - D_n^3)_{liquid}}$$

Observation Table.

L.C of travelling Microscope (Air)

= 0.001cm

(Liquiad.)

No of Ring	Microscopic Reading Left (a)	Right (b)	Diameter $D=(a-b)$ cm	D^2 cm	p^{th} Ring Difference.
1	9.912	10.107	0.195	0.038	
3	9.862	10.251	0.389	0.151	
4	9.838	10.295	0.457	0.209	0.157
6	9.771	10.296	0.525	0.276	-0.038
7	9.732	10.340	0.608	0.370	0.123
9	9.586	10.429	0.843	0.711	

(Air)

No of Ring	Microscopic Reading		Diameter $D = (a-b)$ cm	D^2 cm	n^{th} Ring Diameter
	Left	Right			
1	9.959	10.021	0.032	0.001	
3	9.984	10.037	0.053	0.003	0.003
4	9.973	10.046	0.073	0.005	-0.001
6	9.937	10.086	0.149	0.022	0.002
7	9.883	10.18	0.235	0.055	
8	9.871	10.127	0.256	0.066	
9	9.861	10.075	0.214	0.046	

When R = Same

$$R = \frac{D_m^2 - D_n^2}{4(m-n)\lambda} \text{ air}$$

$$R = \frac{D_m^2 - D_n^2}{4(m-n)} \text{ liquid.}$$

By Formula

μ = R.I of liquid

$$\mu = \frac{(D_m^2 - D_n^2)\text{air}}{(D_m^2 - D_n^2)\text{ liquid.}}$$

$$= \frac{0.113}{0.002}$$

$$= 0.05$$

Result: $\mu = 0.05$

RI = given liquid.

Name of experiment - 4
Newton Ring experiment for laser light wavelength.

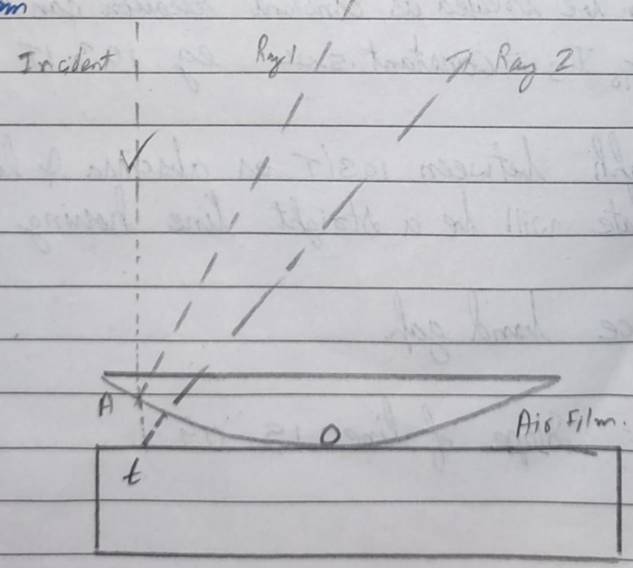
Aim - Newtons Ring Experiment for Laser Light wavelength.

Formula

$$\lambda = \frac{D_{m+p}^2 - D_m^2}{4pR}$$

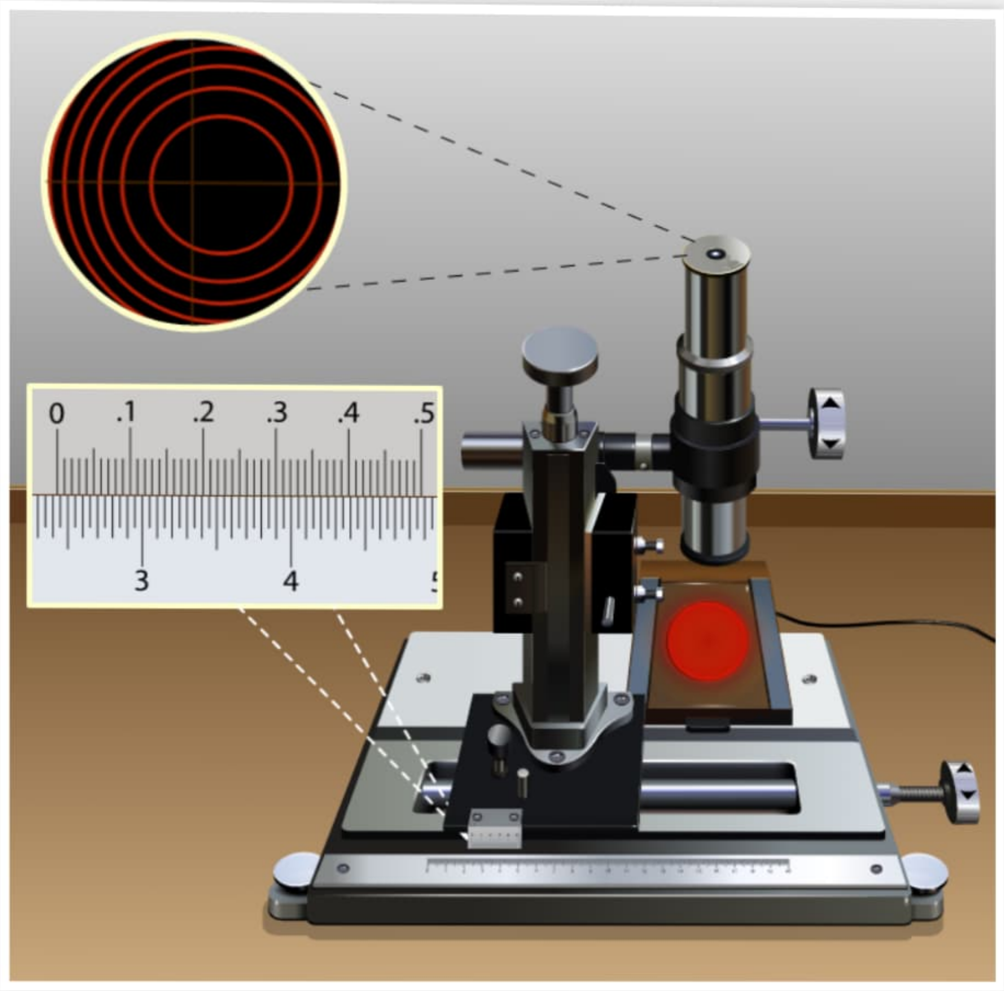
where D_{m+p} is the diameter of th $(m+p)^{th}$ dark ring.
&
D_m = Diameter of the m^{th} ring.

Diagram



Result - Wave length of light from the given source is found to be 6700 Å

Newton's Rings-Wavelength of light



VARIABLES

Select Medium:

Air

Light Source

Red Light

LIGHT OFF

Radius Of Lense : 65 cm

Microscope Position

Microscope Focus : 7.5 cm

RESET

Show result

RESULT

Wavelength : 6700 Å

Experiment - 5

Energy Band Gap of Semiconductor.

Aim- To determine energy band gap of the semi conductor.

Theory:- In the reverse bias, the saturated value of reverse current for a PN junction diode is given by

$$I_s = A.T^{3/2} e^{-E_g/KT} \quad \text{--- (1)}$$

where

A = constant term

I_s = Saturated current in micro ampere

T = Temperature of junction diode in kelvin

E_g = band gap in eV

K = ~~band gap in eV~~ boltzman constant in eV per kelvin

for small changes in Temperature where log T can be treated as constant relation can be written as

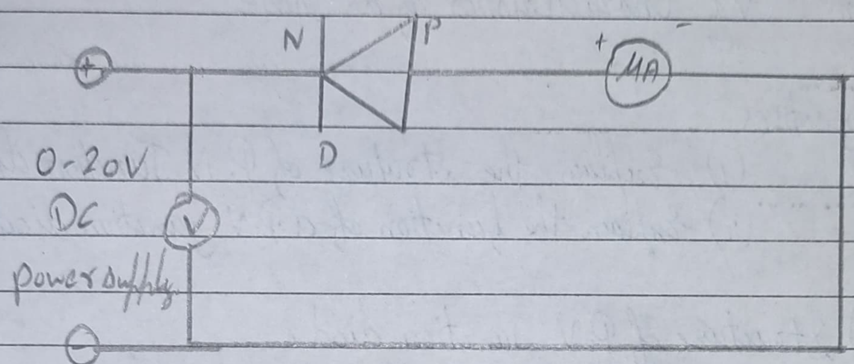
$$\log_{10} I_s = \text{constant} - 5.04\, E_g \cdot 10^3/T \quad \text{--- (2)}$$

Graph between $10^3/T$ as abscissa & $\log_{10} I_s$ as ordinate will be a straight line having a slope $= 5.04\, E_g$

Hence band gap

E_g = Slope of line / 5.04

Diagram



Result :- energy band gap $E_g = \frac{-0.746}{5.04}$

$= -0.148$

Observed energy band gap is -0.148

ENERGY BAND GAP SIMULATION

DISABLE POWER

Place Container

P-N Diode | Battery

Ammeter | Voltmeter

Point | Connect

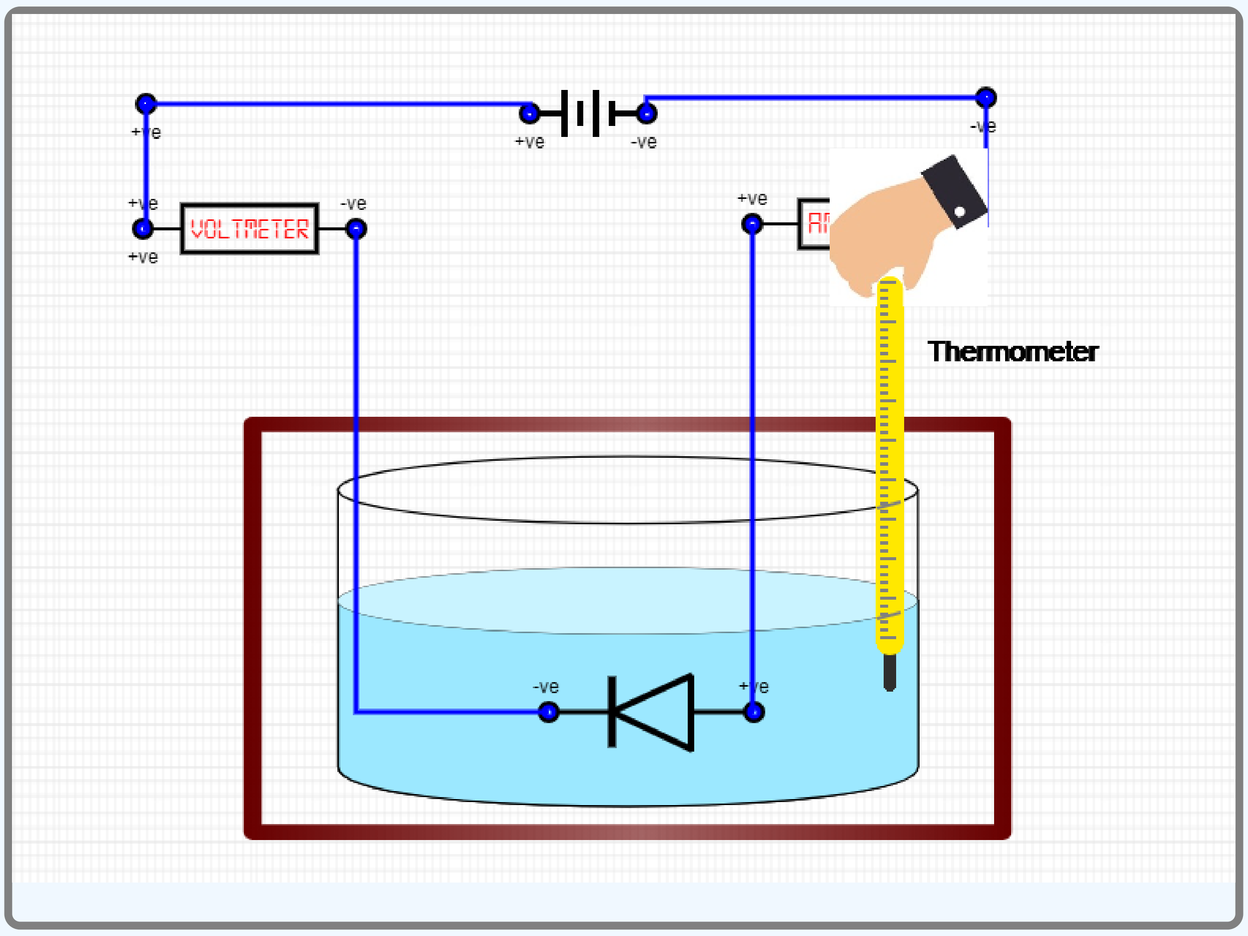
Place Thermometer

Undo | Redo

Reset

Message

>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>Undo Done..
>>



04 | Click

Selected Voltage is **04** Volt

Slide to choose Temprature

0 100

Selected Temprature is **20** °C

Get Reverse Saturation Current

Find Here

Respected value is **5.346** μA

FORMULAS

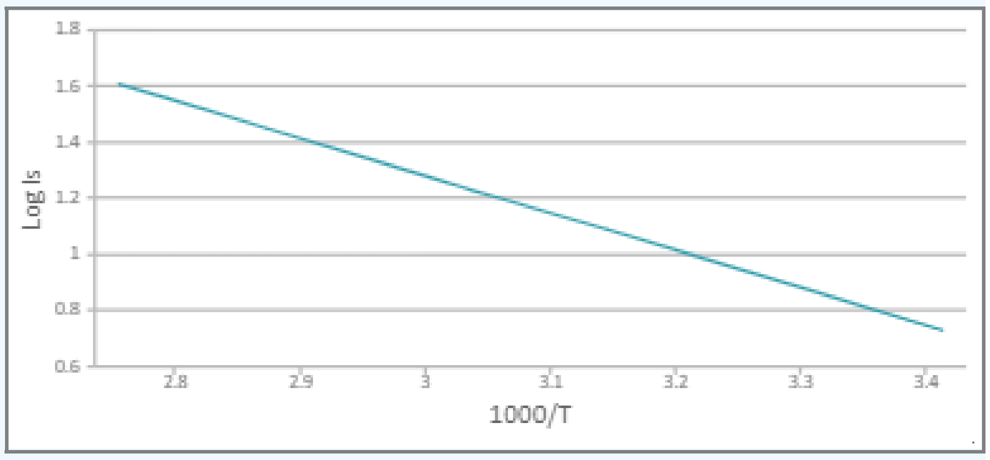
$I_s = A * T^{3/2} e^{\frac{Eg}{KT}}$

$\log_{10} I_s = \text{Constant} - 5.04 * E_g * 10^3 * \frac{1}{T}$

$E_g = \frac{\text{Slope of the line}}{5.04}$

TABLE : OBSERVATIONS

S.No.	Temperature(°C)	Current I_s (μA)	Temperature(°K)	$10^3/T$	$Log_{10}\ I_s$
01	90	40.711	363	2.75	1.610
02	85	36.155	358	2.79	1.558
03	75	28.226	348	2.87	1.451
04	60	18.934	333	3.00	1.277
05	55	16.441	328	3.05	1.216
06	45	12.232	318	3.14	1.087
07	30	7.568	303	3.30	0.879
08	20	5.346	293	3.41	0.728



Calculate Data | Draw Graph

NOTE : Enter value of X coordinate and Y coordinate seperated with comma(,)

2.7548,1.6097 | 3.4129,0.7280 | Find Slope | Calculated Slope is **-0.746**

NOTE : Enter value of Slope calculated above in the below box

Energy Band Gap (E_g) = -0.746 /5.04 Calculate

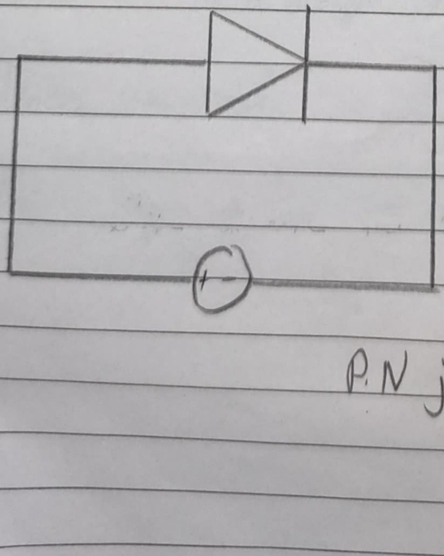
Observed Energy Band Gap is **-0.148**

Experiment - 6
Characteristics of Diode

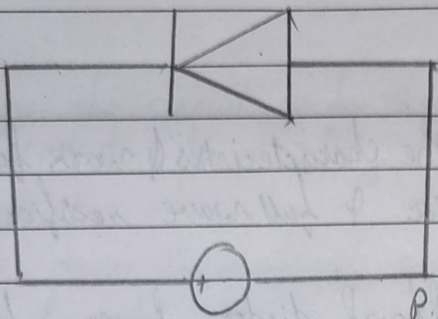
Aim - VI Characteristics of a Diode

Objectives
(i) Explain the structure of P.N Junction diode
(ii) Explain the function of a P.N junction diode.

(i) Structure of P.N Junction diode.
The diode is a device formed from a junction of n type and p-type semiconductor material the lead connected to the p type material is called the anode & the lead connected to n type material is called cathode. In general the cathode of a diode is marked by a solid line on the diode.
(ii) Function of P.N junction diode.
First a pn junction resist current flow when the voltage applied in a reverse bias polarity & allows current flow when voltage is applied in the forward bias polarity. This is why a diode can function as a one way value for electric circuit.



P.N junction diode in forward bias.



P.N junction diode in
Reverse bias.

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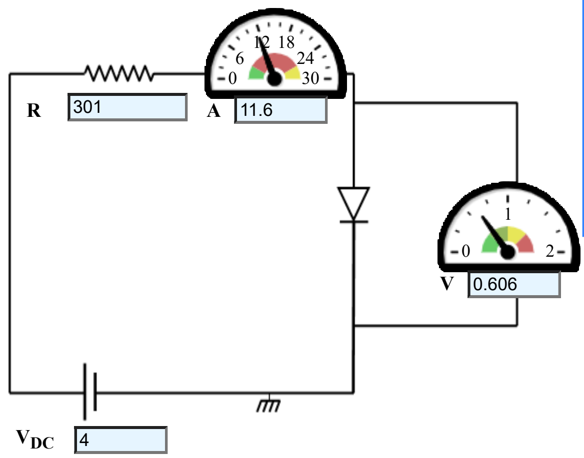
Forward Bias Silicon Diode

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Forward Voltage(Volt)	Forward Current(mAmp)
1	0.570	1.66
2	0.582	3.65
3	0.593	6.31
4	0.599	8.30
5	0.606	11.6



CONTROLS

Select Diode: 1N4148 V_F 0.5

DC volt : Volt

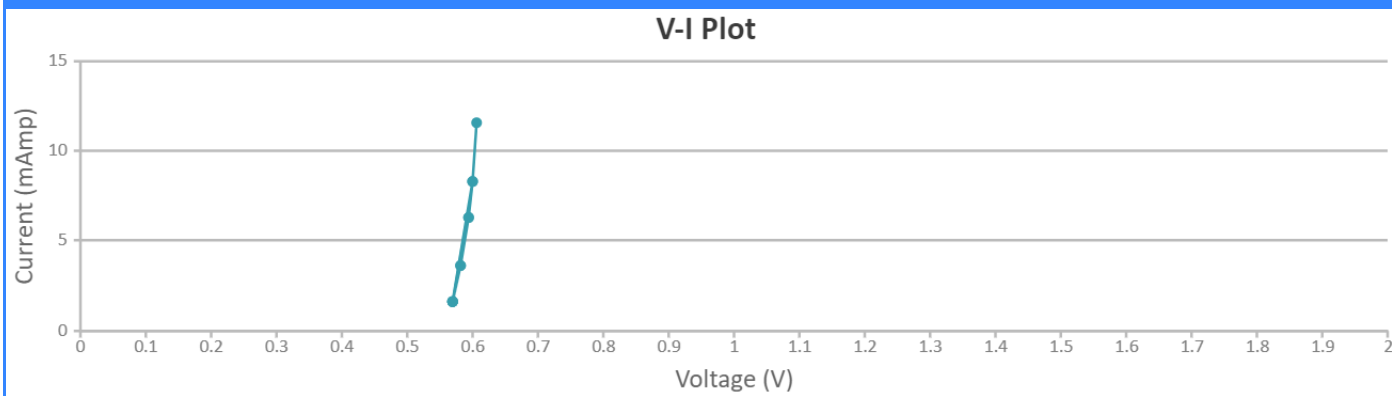
Resistance : ohms

Add to Table Plot Clear

Print It

Check for Reverse Bias

GRAPH PLOT



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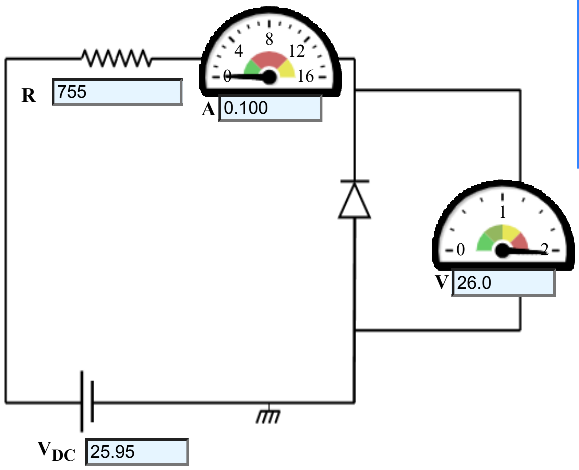
Reverse Bias – Silicon Diode

INSTRUCTION

EXPERIMENTAL TABLE

Serial No.	Reverse Voltage(Volt)	Reverse Current(µAmp)
1	6.92	0.100
2	9.41	0.100
3	12.2	0.100
4	15.5	0.100
5	19.8	0.100
6	26.0	0.100



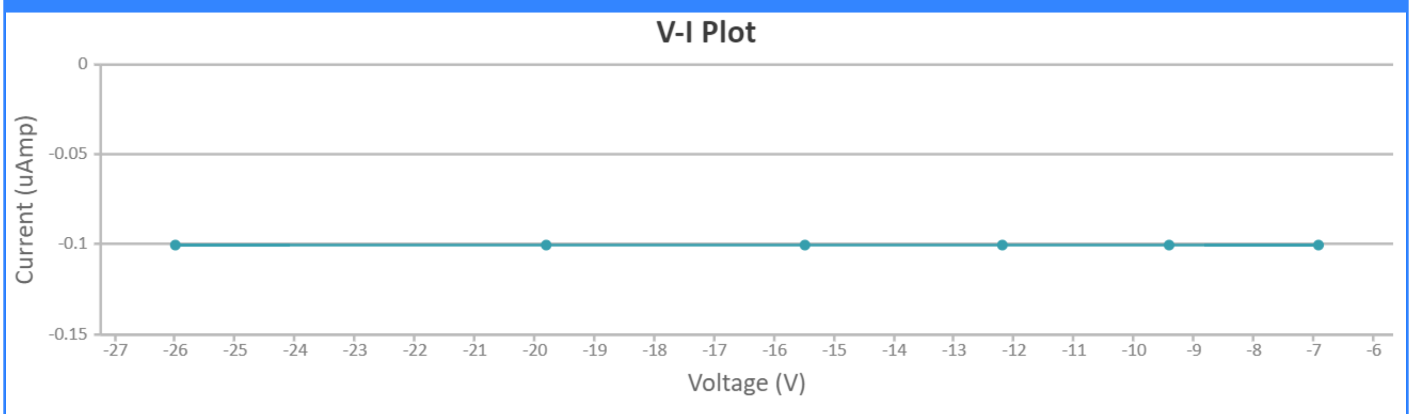
CONTROLS

Select Diode: Choose Diode V_R Value
DC volt : Volt
Resistance : ohms

Add to Table Plot Clear

Print It

GRAPH PLOT



Experiment - 7

Aim - To Study the characteristics & work function of half wave rectifier & full wave rectifier

Equipment: Breadboard, diodes, power supply, connecting wires, multimeter, etc.

Theory:

(i) In half wave rectification, either the positive or negative half of AC wave is passed, while the other half is blocked.

(ii) A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output.

(iii) While half wave & full wave rectifiers deliver a form of DC output.

(iv) In order to produce steady DC from a rectified AC supply. a filter circuit is required. In its simplest form this is achieved by shunting the resistor with a compacitor.

(v) Full wave rectification rectifies the negative components of the input voltage to a positive voltage, then converts it into DC utillizing a diode bridge configuration.

(vi) In contrast, half wave rectification removes just the negative voltage components using a single diode before converting to DC.

Procedure:

(i) Design the circuit as per the diagram on bread board.

(ii) Connect diodes, power supply, wires multimeters, etc as per the circuit

(iii) Note down the graphical information after observing the wave formed

Conclusion:-

(i) Half & full wave rectifiers are used to converts AC into DC Voltage

(ii) This is the primary function of the rectifier in industrial applications

(iii) From the graph.

(A) In half wave rectifier,

$V = 549.52\,mV$

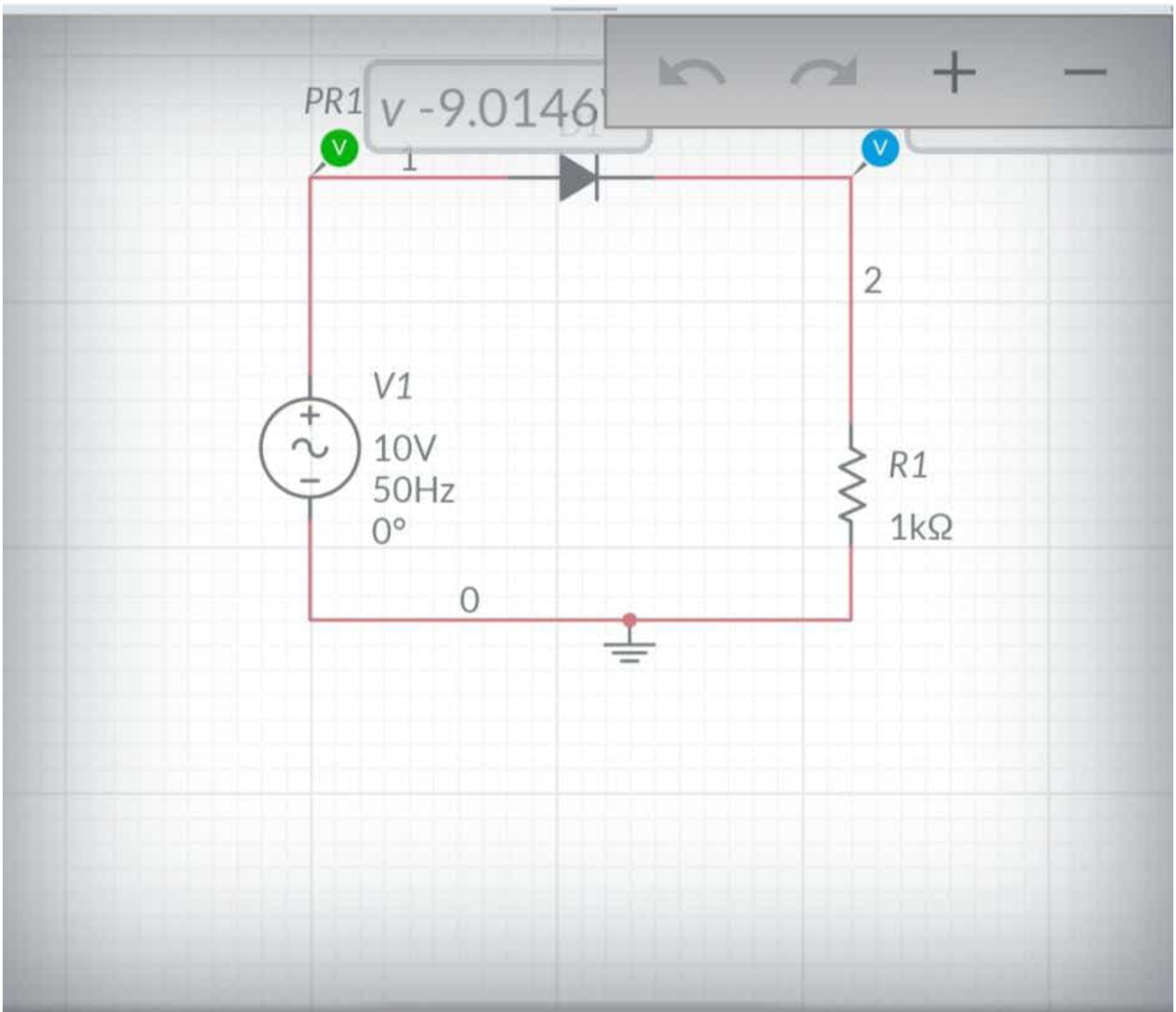
$i = -549.522$

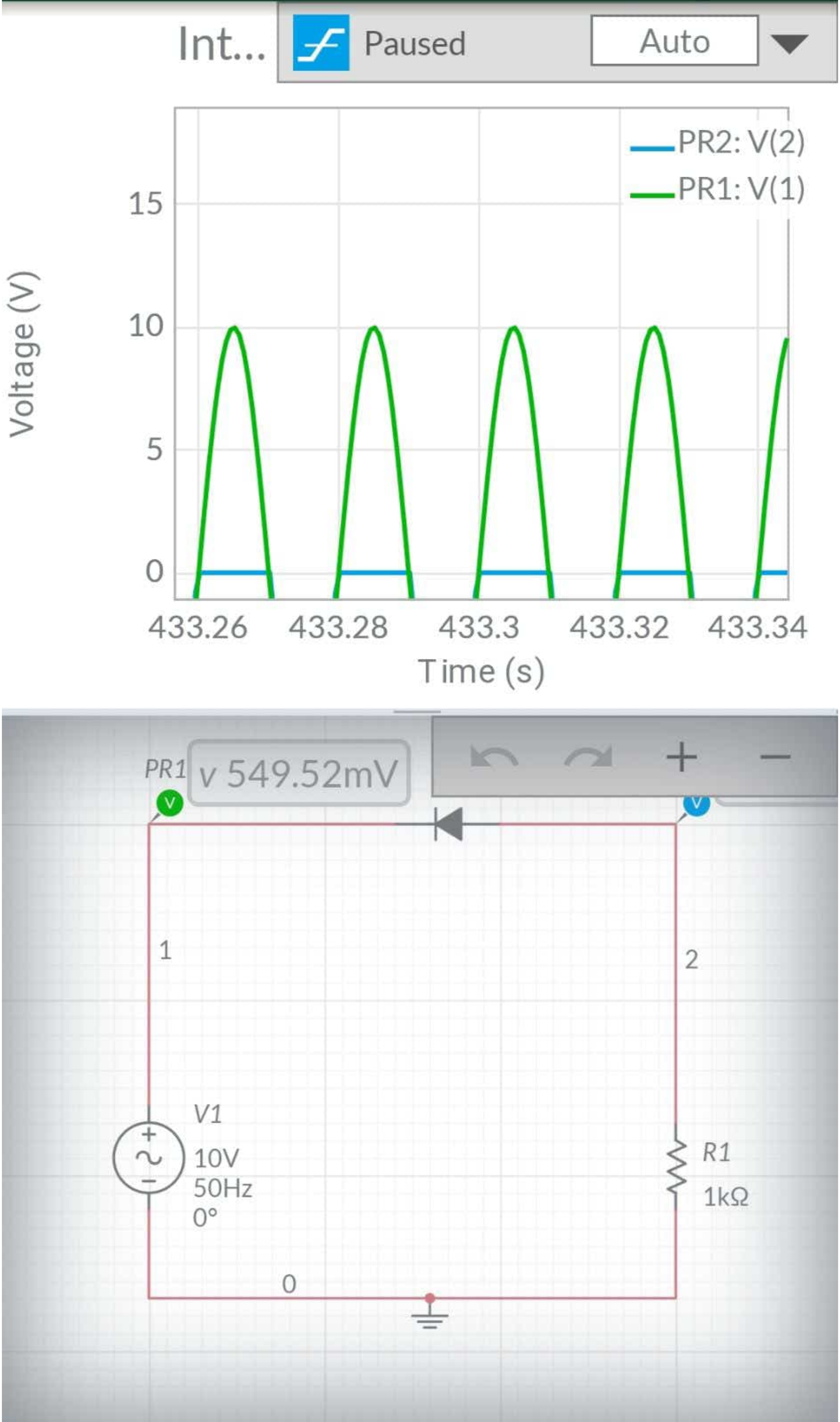
(B) In full wave rectifier

$V = -9.0146\,V$

$i = -9.0146\,nV$


Int...
Paused
Single
PR1: V(1)
PR2: V(2)
Voltage (V)
Time (s)
56.24
56.26
56.28
56.3
56.32


PR1
V -9.0146
1
2
V1
10V
50Hz
0°
R1
1kΩ
0



Int...
Paused
Auto
PR2: V(2)
PR1: V(1)
Voltage (V)
15
10
5
0
433.26
433.28
433.3
433.32
433.34
Time (s)
PR1
v 549.52mV
1
2
V1
10V
50Hz
0°
R1
1kΩ
0

Experiment - 8

Aim - To study the charecteristics of zener diode & its work function

Equipment - Breadboard, zener diode, power supply, multimeter, connecting wires, etc

Theory : (i) The zener diode mainly operates in reverse biased condition.
(ii) We use zener diodes for voltage regulation & voltage stabilisation. They provide a low cost and no frill method for voltage regulation.
(iii) The critical parameter of this type of diodes is the zener breakdown voltage
(iv) The zener breakdown voltage is ~~a~~ minimum reverse biased voltage below which the diode blocks the biased voltage below which the diode blocks the reverse current through it and above which it causes a significant amount of reverse bias current to flow through it
(v) Once, the reverse voltage reaches the zener breakdown voltage the voltage across the device remains constant at that level.
(vi) Hence, we can use zener diode for voltage regulation.

Procedure
(i) Design the circuit as per the diagram on bread board.
(ii) Connect the chower supply as per the circuit diagram
(iii) Observe the wave formed.

Conclusion:-

(i) The zener diode, with its accurate & specific reverse break down voltage allows for a simple, inexpensive voltage regulator.

(ii) The low power rating of standard zener diodes and resistors make this solution impractical for high power devices

(iii) From the graph.

(A) In forward zener diode

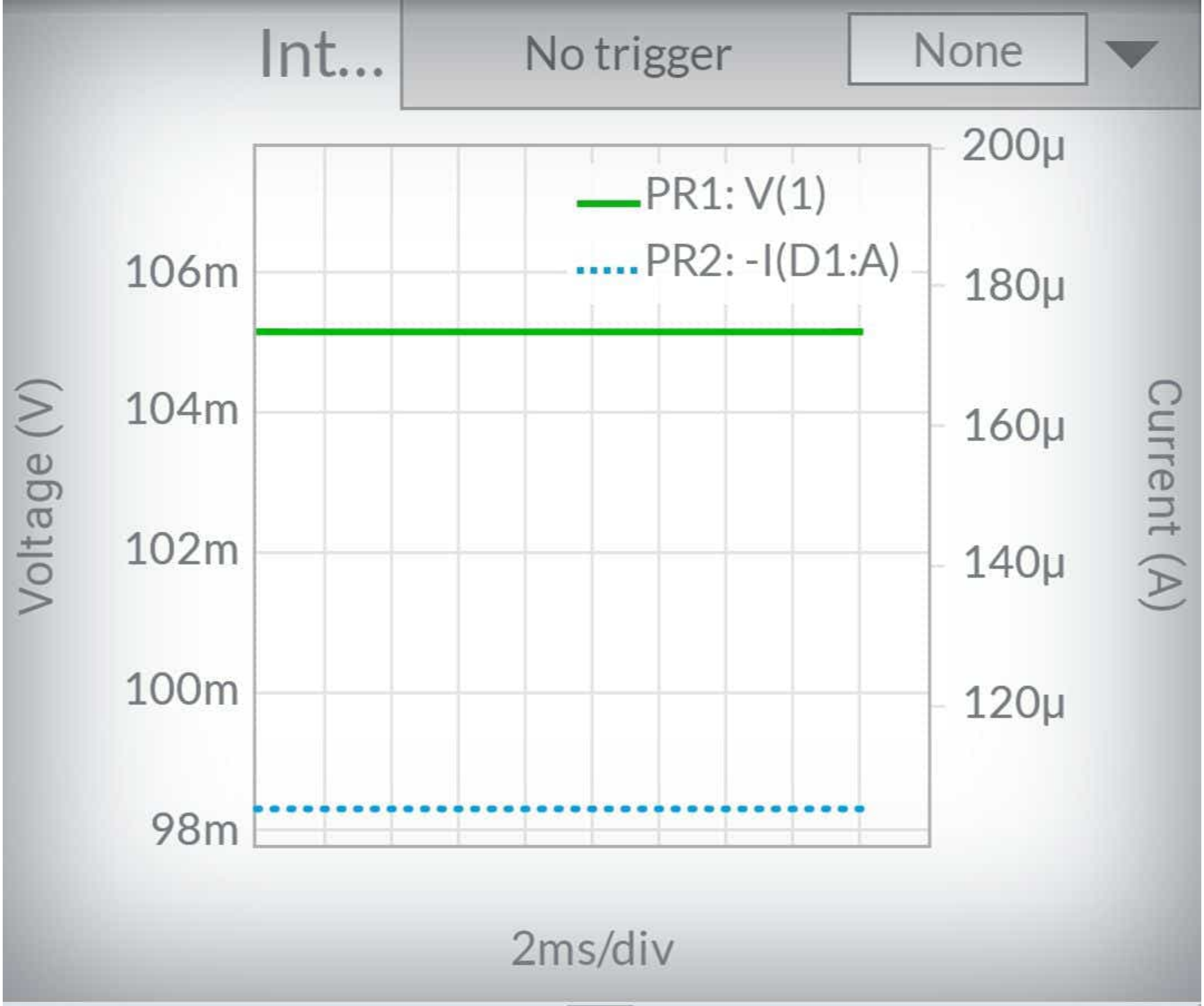
$V = 4.4225 V$

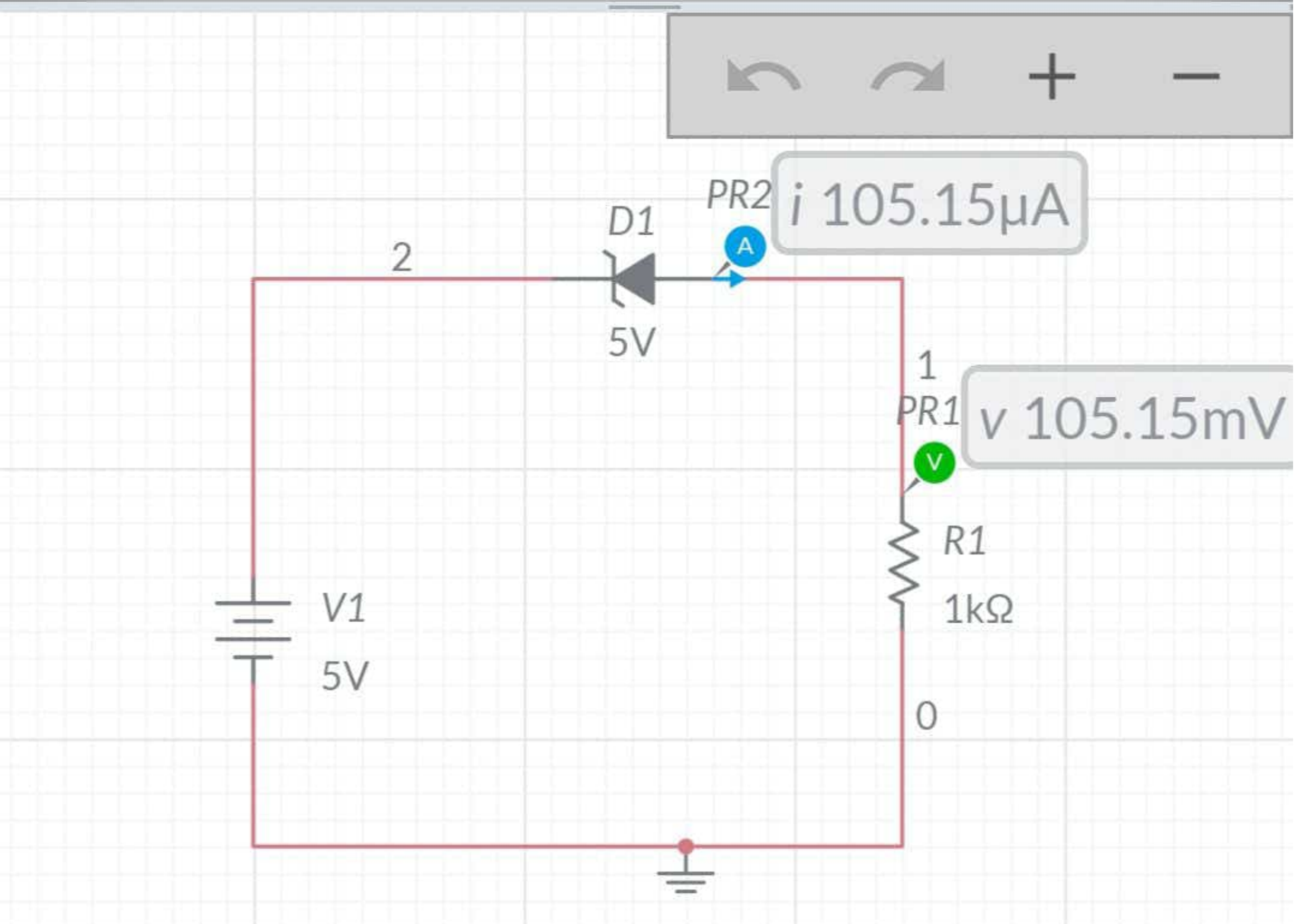
$i = 4.4225 mA$.

(B) In reversed zener diode

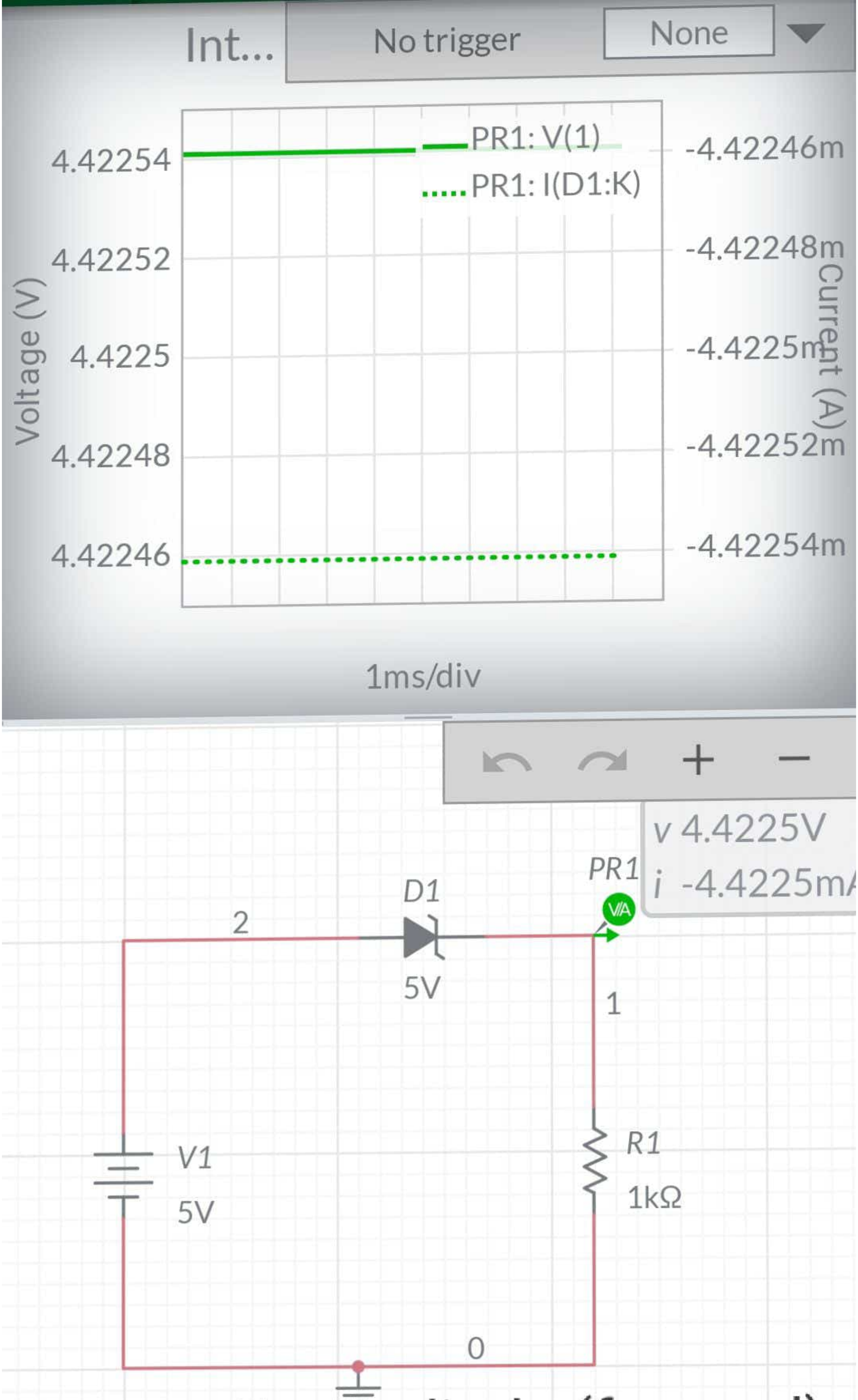
$V = 105.15 mV$

$i = 105.15 \mu A$





Zener diode (reverse)



Zener diode (forward)