Lab Report

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Plot the VI characteristics of the PN diode and Zener diode (Both forward and reverse bias plots)

EXPERIMENT-1

AIM :

Plot the VI characteristics of the PN diode for both forward and reverse bias.

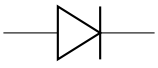
MATERIALS USED :

S.no.	Name of apparatus	Range	Quantity
1	DC power supply	0-30 V	1
2	Resistor	560Ω, 1KΩ	1
3	Breadboard	-	1
4	Connecting wires	-	4(accordingly)
5	Multimeter	-	1
6	Diode IN4007	-	1

THEORY :

A. ***PN junction diode :***

A p-n junction diode is a basic semiconductor device that controls the flow of electric current in a circuit. It has a positive (p) side and a negative (n) side created by adding impurities to each side of a silicon semiconductor. The symbol for a p-n junction diode is a triangle pointing to a line.



The triangle represents the positive or p side and the bar represents the negative or n side.

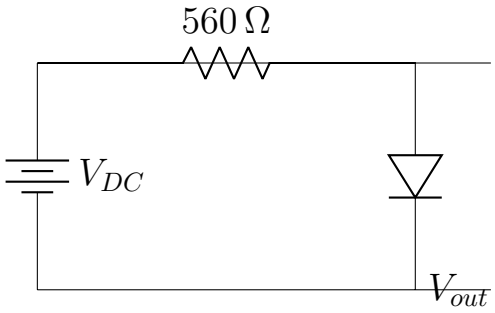
B. ***Forward and reverse biasing :***

A p-n junction diode conducts only in one direction. The V-I characteristics of the diode are curve between voltage across the diode and current through the diode. When external voltage is zero, circuit is open and the potential barrier does not allow the current to flow. Therefore, the circuit current is zero.

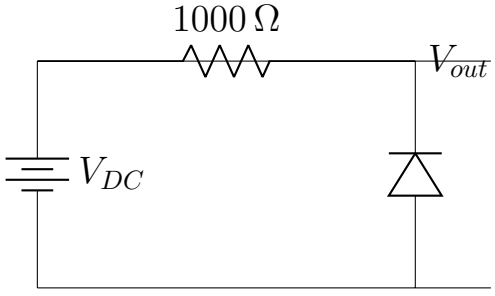
When P-type (Anode is connected to +ve terminal and n- type (cathode) is connected to –ve terminal of the supply voltage, is known as forward bias. The potential barrier is reduced when diode is in the forward biased condition. At some forward voltage, the potential barrier altogether eliminated and current starts flowing through the diode and also in the circuit. The diode is said to be in ON state. The current increases with increasing forward voltage.

When N-type (cathode) is connected to +ve terminal and P-type (Anode) is connected to –ve terminal of the supply voltage is known as reverse bias and the potential barrier across the junction increases. Therefore, the junction resistance becomes very high and a very small current (reverse saturation current) flows in the circuit. The diode is said to be in OFF state. The reverse bias current due to minority charge carriers.

C. ***Forward bias :***



D. ***Reverse bias :***



PROCEDURE :

E. ***Forward bias:***

1) Connections are made as per the circuit diagram.
2) Connect the positive terminal of the power supply to anode of the diode and negative terminal to the cathode of the diode.
3) Switch ON the power supply and increases the input voltage (supply voltage) in Steps.
4) Note down the corresponding current flowing through the diode and voltage across the diode for each and every step of the input voltage.
5) The readings of voltage and current are tabulated.
6) Graph is plotted between voltage on x-axis and current on y-axis.

F. ***Reverse bias:***

1) Do the same steps as in forward bias but reverse the polarity of the diode i.e, connect the positive terminal of the power supply to cathode of the diode and negative terminal to the anode of the diode.

OBSERVATION :

G. ***Forward bias***

S.no.	Applied voltage$(volts)$	Voltage across diode$(volts)$	Current through diode(mA)
1	0.2	0.188 V	0
2	0.95	0.57	0.7
3	1.3	0.6	1.25
4	2	0.637	2.55
5	2.4	0.65	3.15
6	2.8	0.661	3.87
7	3.1	0.664	4.42
8	3.5	0.67	5
9	4	0.68	5.91

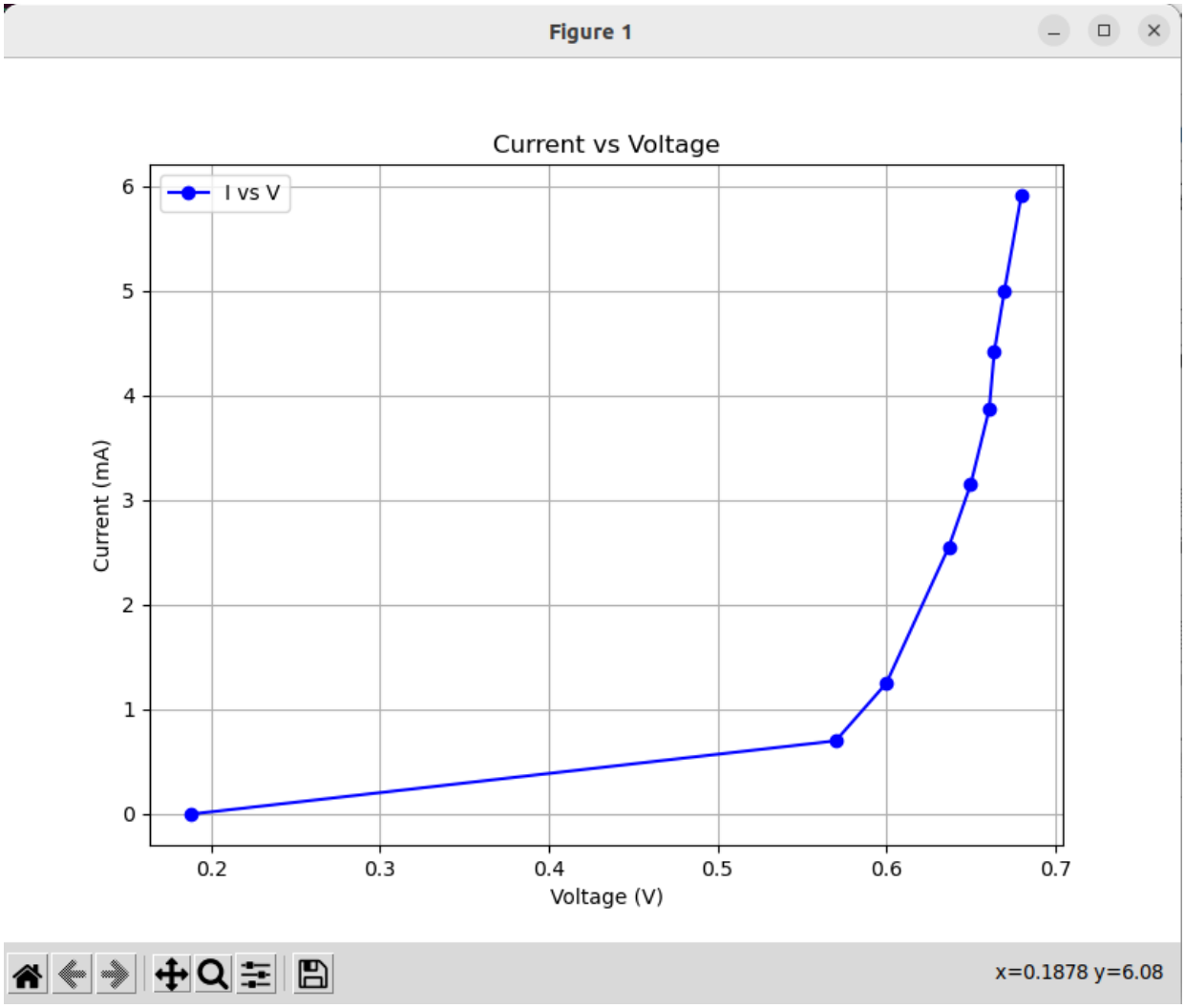


Fig. 1: Forward bias

The above graph shows that the knee or cut-in voltage of p-n junction diode is around 0.6 to 0.7 V.

H. ***Reverse bias***

S.no.	Applied voltage($volts$)	Voltage across diode($volts$)	Current through diode(μA)
1	0.1	0.165	0
2	1.7	1.77	0.1
3	2.5	2.56	0.2
4	4	4.09	0.3
5	5	5.08	0.4
6	6	6.06	0.5
7	7	7.04	0.6
8	8	8.05	0.7
9	10	10.06	1
10	13	13.07	1.2
11	15	15.07	1.4
12	18	18.09	1.7
13	21	21.07	2
14	25	25.09	2.4
15	30	30.07	2.9
16	32	32.06	3.1
17	35	35.06	3.4

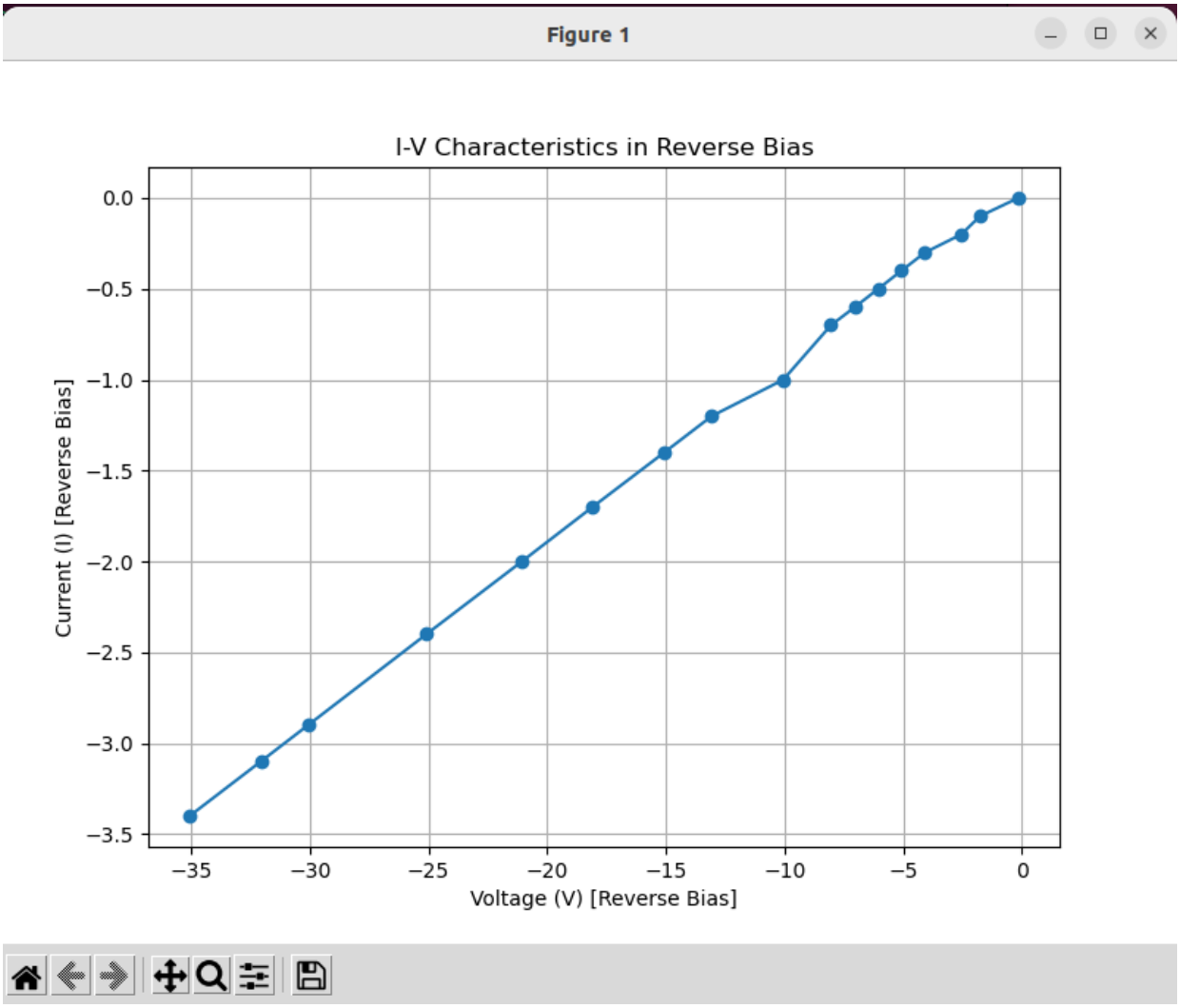


Fig. 1: Reverse bias

RESULT :

The Forward and Reverse Bias characteristics for a p-n diode are observed.

EXPERIMENT 2

AIM :

Plot the VI characteristics of the Zener diode.

MATERIALS USED :

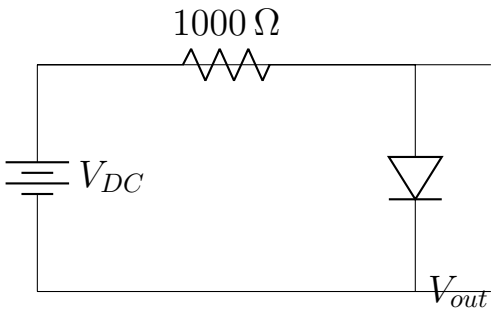
S.no.	Name of apparatus	Range	Quantity
1	DC power supply	0-30 V	1
2	Resistor	1000Ω	1
3	Breadboard	-	1
4	Connecting wires	-	4(accordingly)
5	Multimeter	-	1
6	Zener diode	-	1

THEORY :

A Zener diode is a heavily doped p-n junction diode specifically designed to operate in the breakdown region. Normally, a p-n junction diode does not conduct when reverse biased, but if the reverse bias is increased to a certain voltage, it begins to conduct heavily. This voltage is known as the breakdown voltage. Excessive current through the diode can cause permanent damage to the device, so a resistor is typically connected in series with the Zener diode to prevent this. Once the diode begins conducting, it maintains an almost constant voltage across its terminals, regardless of the current flowing through it, due to its very low dynamic resistance. This characteristic makes it useful in voltage regulation applications.

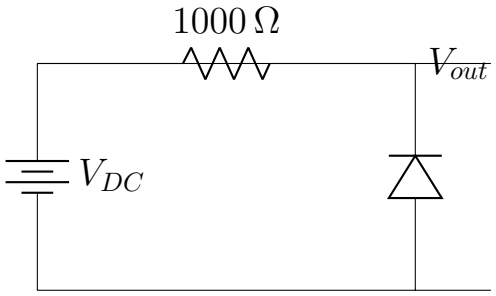
Forward bias :

A Zener diode in forward bias acts just like a P-N junction diode . If +ve terminal of the input supply is connected to anode (P-side) and –ve terminal of the input supply is connected the cathode. Then diode is said to be forward biased .



Reverse bias :

A Zener diode undergoes zener breakdown. The P-N junction supports uni-directional current flow. If negative terminal of the input supply is connected to anode (p-side) and –ve terminal of the input supply is connected to cathode (n-side) then the diode is said to be reverse biased



PROCEDURE :

Same as that of experiment 1.

OBSERVATION :

Forward bias

S.no.	Applied voltage($volts$)	Voltage across diode($volts$)	Current through diode(mA)
1	0.1	0.1	0
2	0.5	0.5	0
3	0.8	0.6	0.16
4	1	0.69	0.32
5	1.5	0.71	0.8
6	2	0.73	1.3
7	3	0.74	2.5
8	4	0.75	3.3
9	5	0.76	4.28
10	6	0.77	5.4
11	7	0.775	6.37
12	8	0.78	7.36
13	9	0.784	8.44
14	10	0.786	9.41
15	12	0.792	11.46
16	15	0.8	14.55
17	20	0.81	19.8
18	25	0.812	25.2
19	30	0.816	30.87

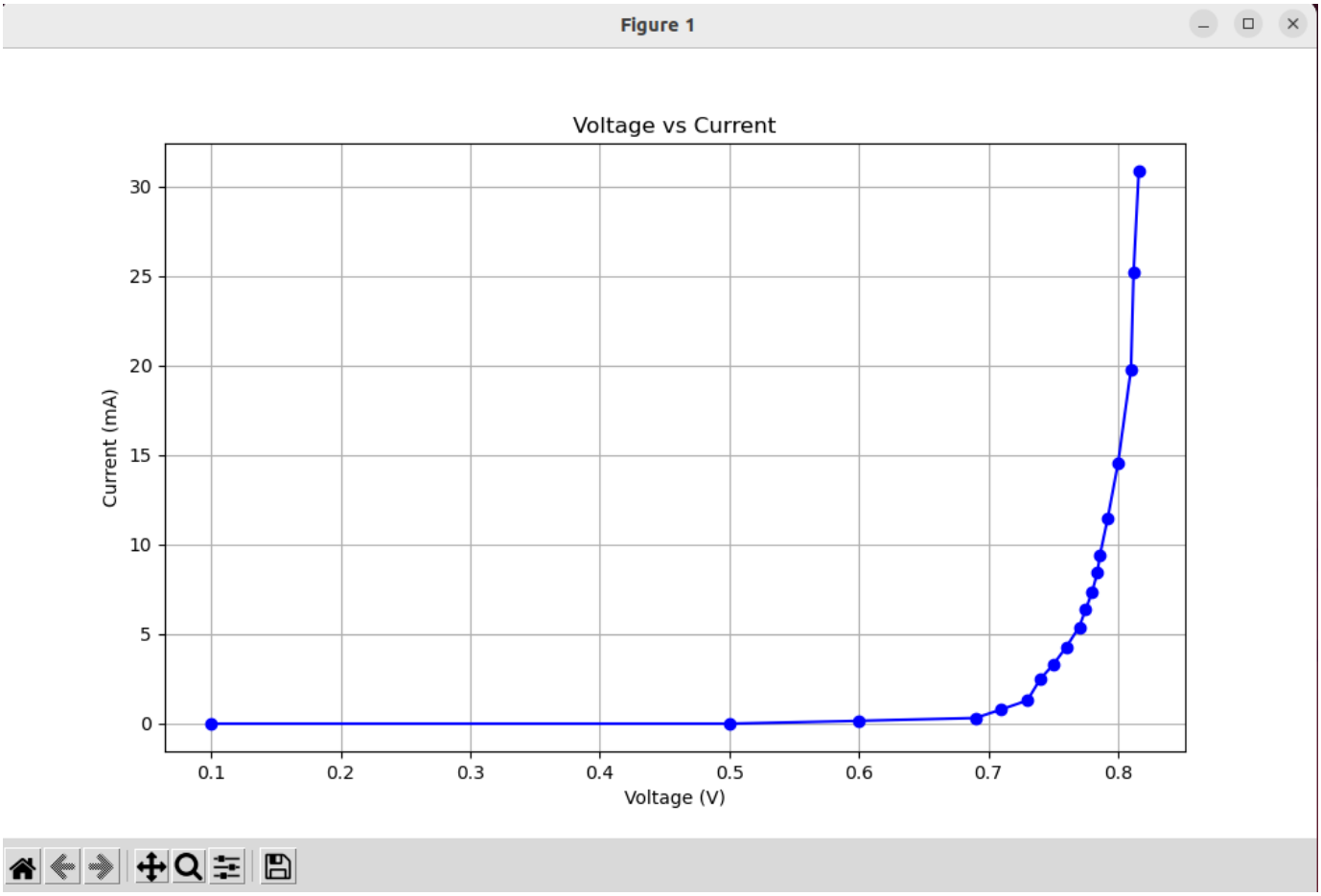


Fig. 1: Zener Forward bias

From the above graphs we can observe that the voltage at which the curve starts to increase is about 0.74V for forward bias.

Reverse bias

S.no.	Applied voltage($volts$)	Voltage across diode($volts$)	Current through diode(μA)
1	0.1	0.1	0
2	1.5	1.55	0.1
3	1.9	1.92	0.2
4	2.1	2.112	0.3
5	2.2	2.23	0.5
6	2.3	2.335	0.6
7	2.4	2.411	0.8
8	2.5	2.517	1.1
9	2.6	2.63	1.7
10	3.0	3.03	6.3
11	3.5	3.503	25.9
12	4	3.95	92.5
13	5	4.53	490
14	6	4.811	1250
15	10.9	5.1	6000
16	12	5.12	7000
17	13	5.13	8000
18	14	5.15	9000
19	15	5.16	10000

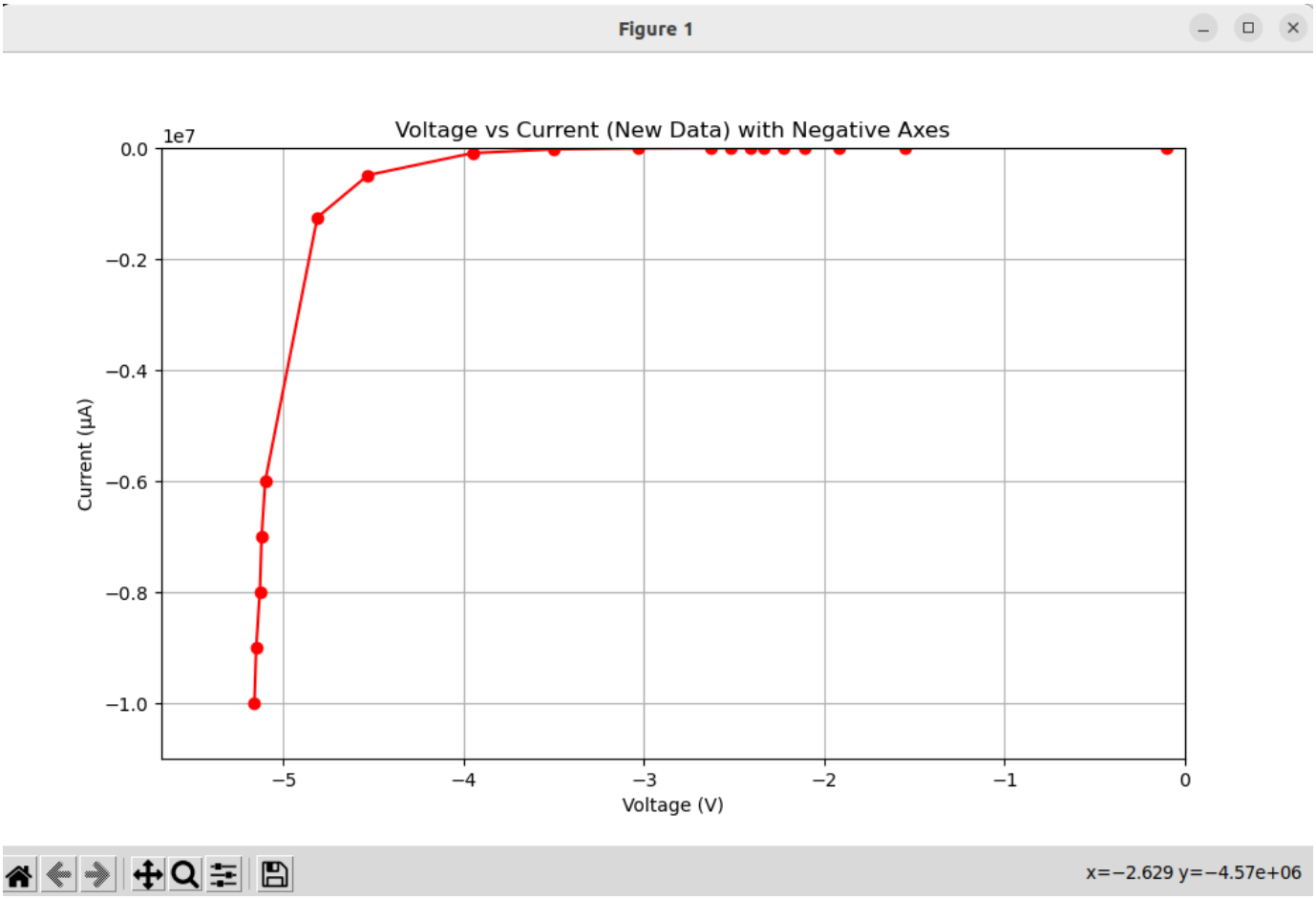


Fig. 1: Zener Reverse bias

From the above graph we can observe that the breakdown voltage of zener diode is around 4.53 V.

I. RESULT :

he V-I characteristic of Zener diode indicates that characteristic of Zener diode in forward bias is same as PN junction diode. In reverse bias, a negligible constant current flow through the zener diode but the current becomes abruptly large at certain voltage. This voltage is called as zener voltage. This sudden and sharp increase in zener current is called as zener.