Elektroniske enheter og kretser
Lab 01

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0. Introduction

This is the first report in this course, detailing the completion of the first lab exercise.

Note: As always, the LaTeX file and all other assets, such as text, images, graphs and code made by me for this project is open source with the MIT licence, see my GitHub 

0.0. Table of Contents

0.1. List of Figures

0.2. List of Tables

1. Part 1 - Diode test

This Part is about testing a diode charachteristics with a multimeter. This means it is inherently not perfect, but it will function as a reference measurment.

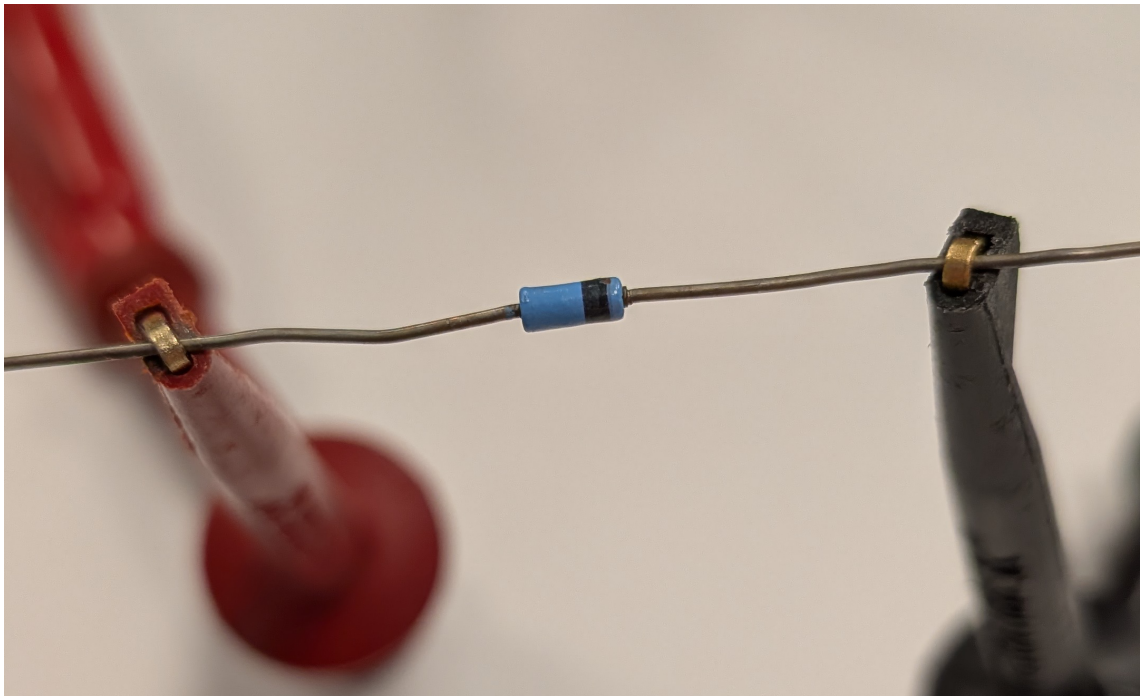


Figure 1.0: Diode being measured

Table 1.0: Diode measurments

Voltage forward	0.593 V	Resistance forward	225400 Ω
Voltage reverse	OL	Resistance reverse	OL

Interesting to note that the measured resistance in forward-bias of the diode fluctuated a lot. It went into high MΩ to low tens of kΩ. It was most stable around 200 kΩ and one of these measurmens was therfore noted down. This could be because the multimeter is acting as a powersupply in resistance measuring mode and depending on the voltage chosen by the autoranging multimeter the diode behaviour differs.

2. Part 2 - Forward-bias charachteristics

This Part is about testing the diode charachteristics for forward-bias. The values was stored in a table (RAW data like this is found on the GitHub) and then a plot was made to compare the current through the diode I_D with the voltage drop over the diode V_D.

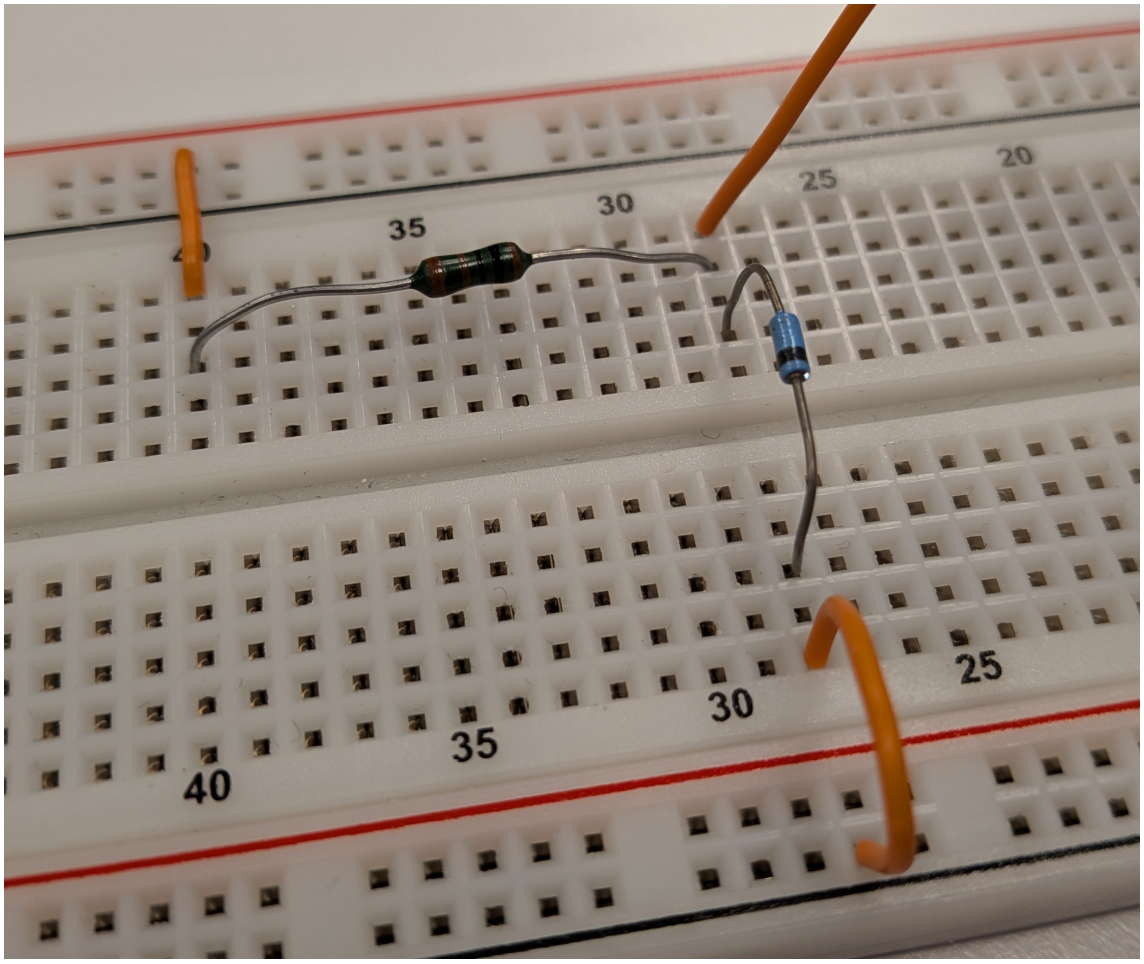


Figure 2.0: Part 2 circuit

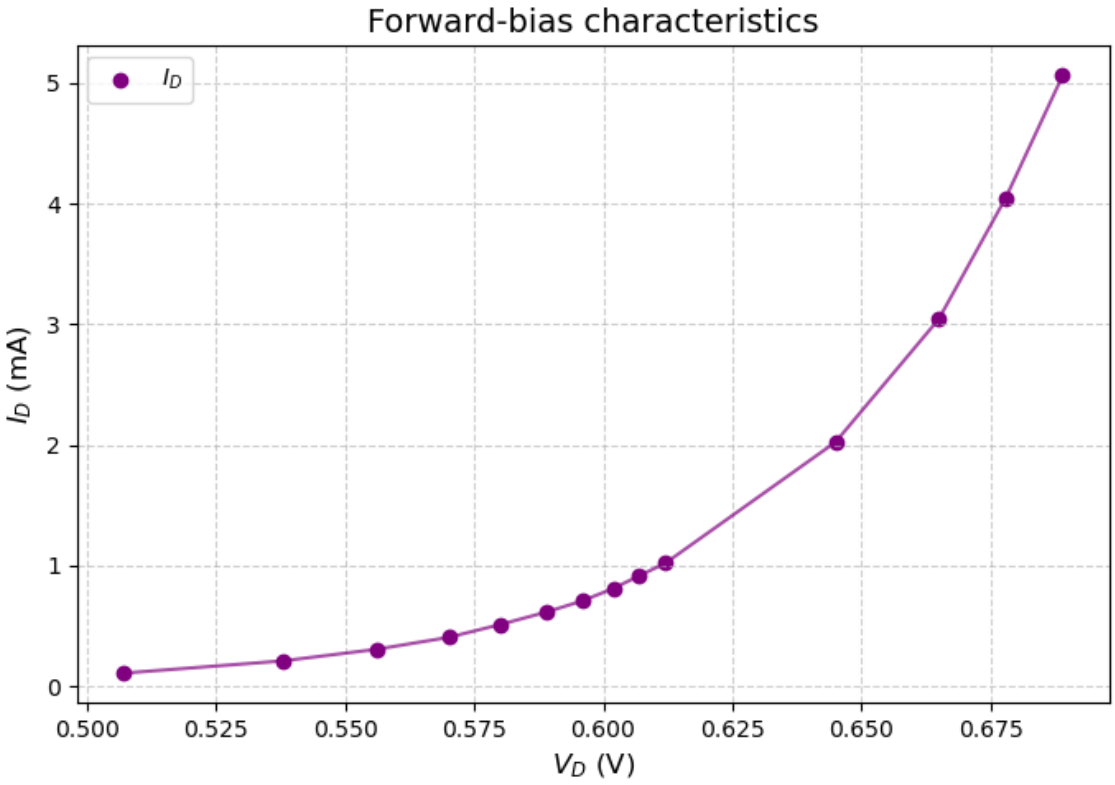


Figure 2.1: Plot of forward-bias charachteristics

Now when when extending the plot all the way to the origin it gets a charachteristic that looks a lot different. As seen in Figure 2.2 it looks like after the initial curve the value gets linear.

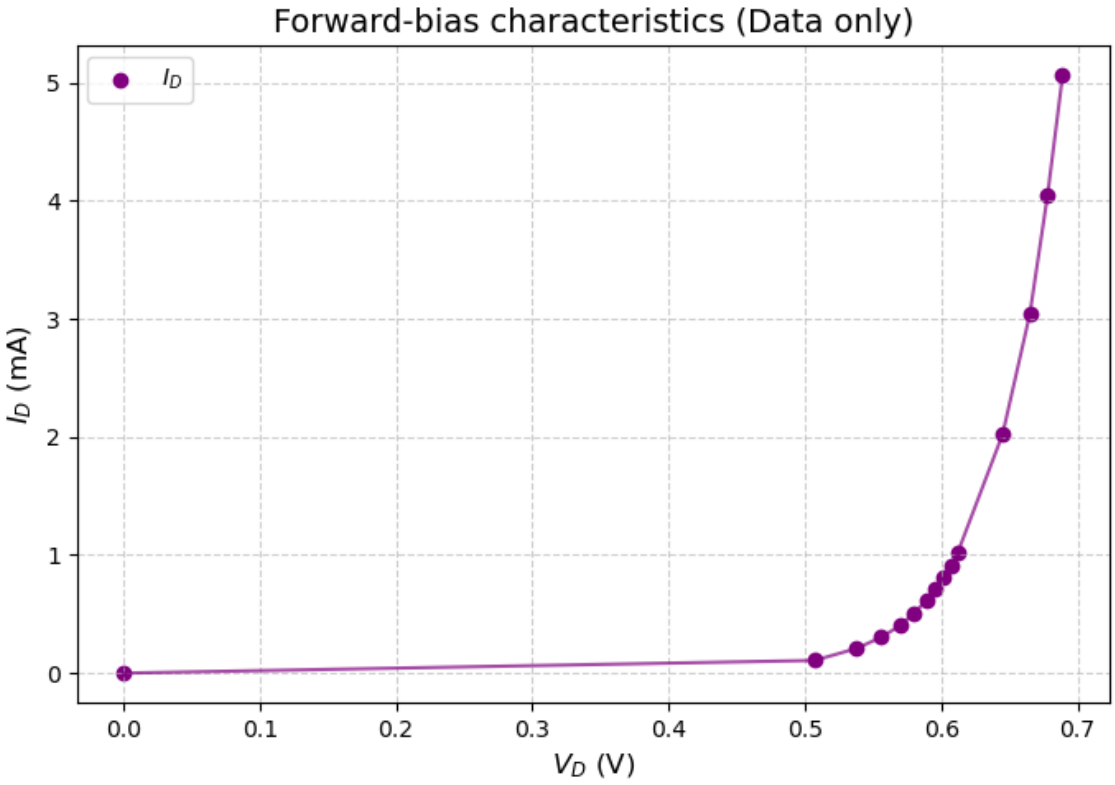


Figure 2.2: Extended plot of forward-bias charachteristics

This looks now very much like an exponential relationship, when checked, the end result is very similar to to this function. this shows that the behaviour can be very accuratly modeled easily using the exponential function.

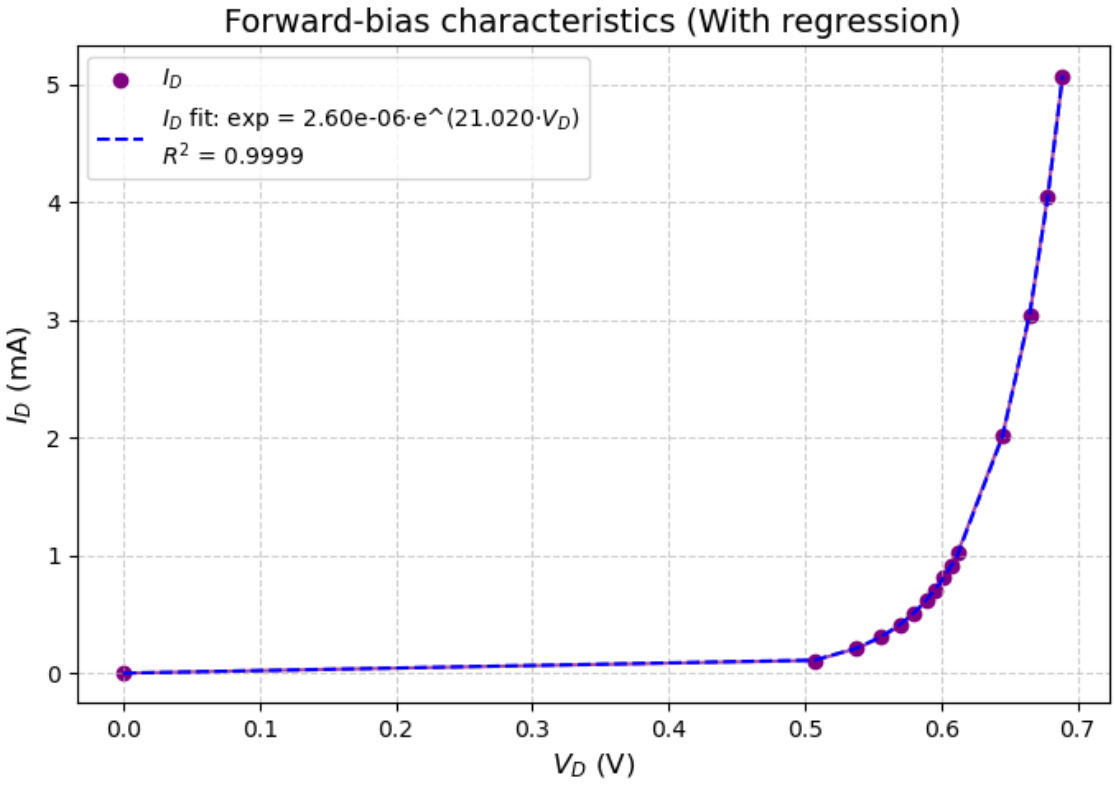


Figure 2.3: Extended plot with exponential regression

3. Part 3 - Reverse-bias

This Part is about testing the reverse-bias current. Measurments was made and noted in the table, note that the assumed resistive value of the voltmeter is specified by the assignment.

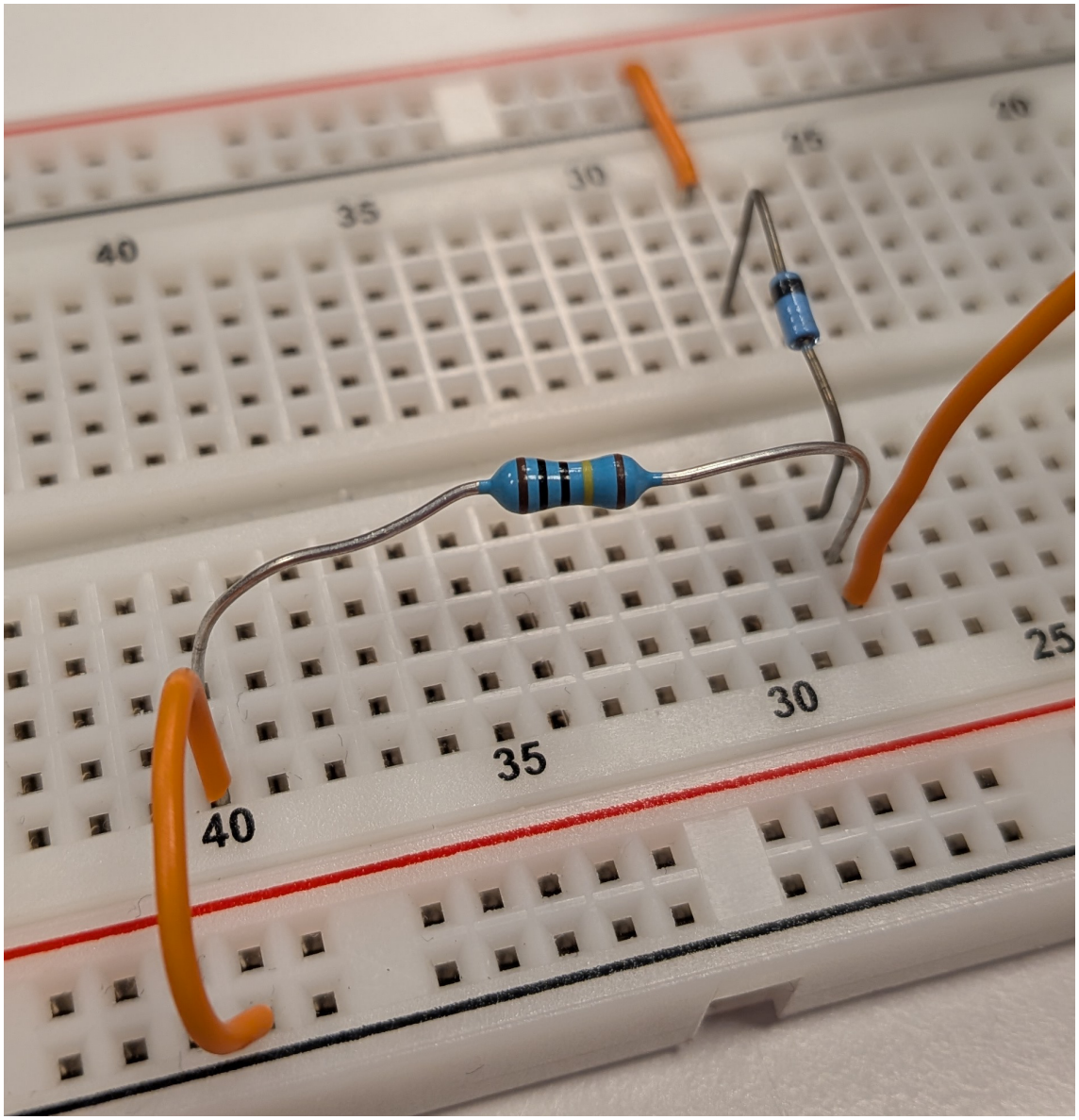


Figure 3.0: Part 3 circuit

Table 3.0: Reverse-bias measurments

E (Measured)	20.03 V
R_M (Assumed)	10 MΩ
R (Measured)	1002.5 kΩ
V_R (Measured)	6.2 mV
I_S (Calculated)	6.805 nA
R_{DC} (Calculated)	2942.71 MΩ

It looks as if the values for I_S and R_{DC} miss by an order of magnitude or two as the calculated reverse-bias resistance often leads to values between hunders of kΩ and up to a hundred MΩ. The inherent inaccuracies in the measurments are probably the cause of this magnitudinal error.

4. Part 4 - LED charachteristics

This part is about testing the charachteristics of LED's.

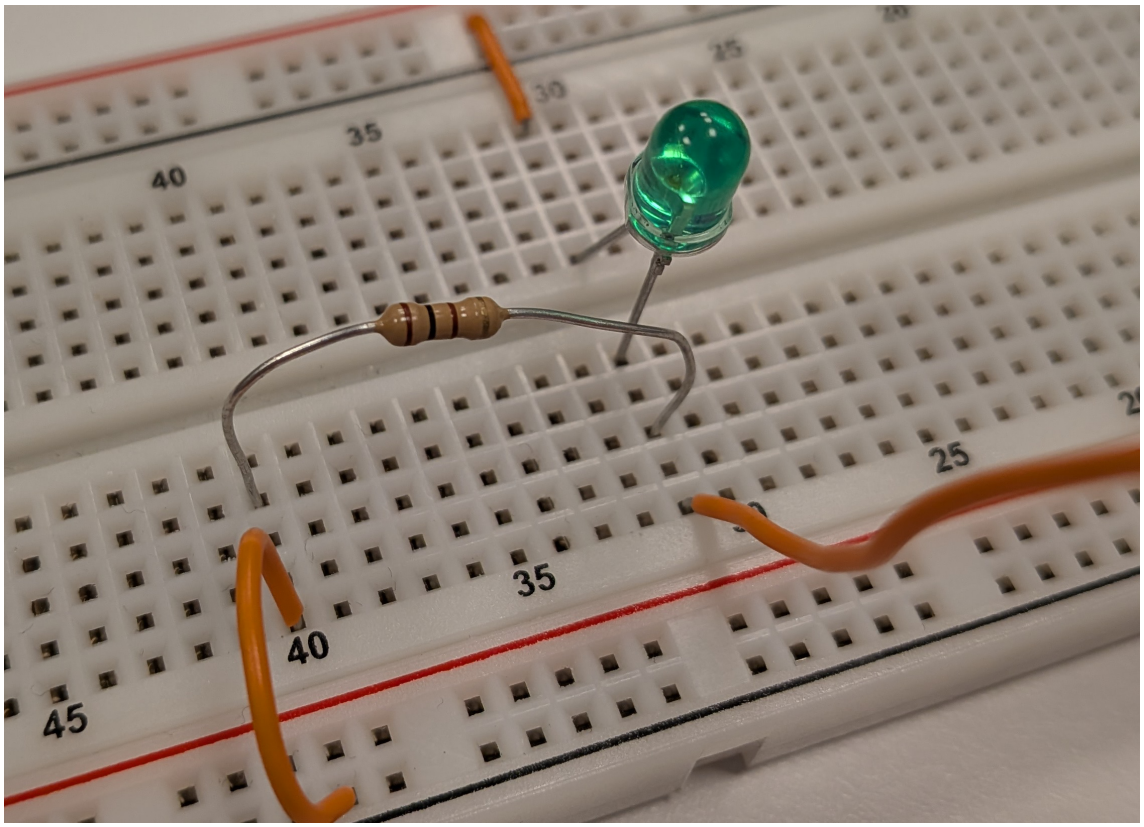
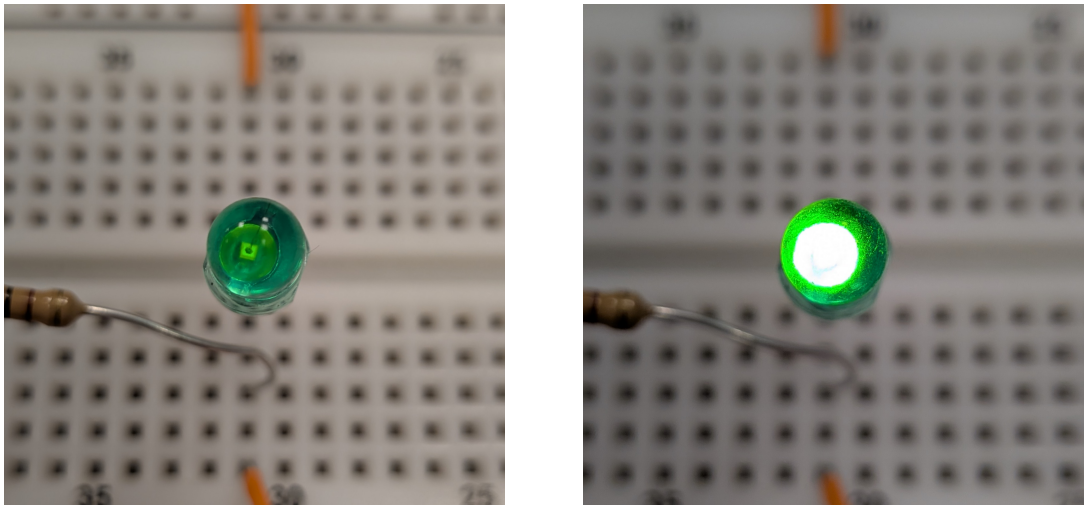


Figure 4.0: Part 4 circuit

First the circuit was connected and then the voltage supply was slowly ramped up. when first light appeared the value was recorded. Although hard to see, in Figure 4.1a there is a very faint sub-lumen light emitting from the diode. Then the supply was ramped up intill brightness leveled out at a bright level and values was recorded again.

Table 4.0: LED measurments

Measurments	First light	Bright
V_D (Measured)	1.787 V	2.185 V
V_R (Measured)	17.8 mV	3.632 V
I_D (Calculated)	179.980 µA	36.724 mA



(a) First light (b) Bright

Figure 4.1: Part 4 circuit

Then multiple data points was collected for differnt input voltages, and the results are listed below in Teble 4.1 and then graphed.

Table 4.1: LED values

E (V)	0.000	1.033	2.008	3.008	4.002	5.010	6.040
V_D (V)	0.000	1.032	1.860	1.987	2.066	2.135	2.201
V_R (V)	0.000	0.000	0.146	1.019	1.934	2.875	3.840
I_D (mA)	0.000	0.000	1.480	10.303	19.555	29.070	38.827

5. Part 5 - Zener charachteristics