

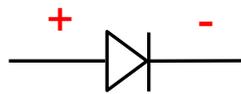
Laboratory 2: Diodes and DC Regulation (5%)

A) Objectives

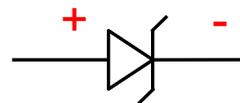
- To get familiar with circuit diagram and circuit construction on breadboard.
- To construct a regulator to transform DC voltages.

B) Prelab (solution included)

- Q1 Indicate the polarity of the diodes below.



Diode



Zener Diode

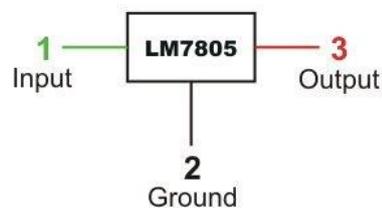
- Q2 What is the difference between a Zener diode and a diode?

Zener diode allows current to flow when the reverse voltage is larger than a certain value.

- Q3 How to identify each pin function of LM7805?

Let the number side of LM7805 face to you, from its left to right are pin 1 (Input), 2 (Ground) and 3 (Output) as shown below.

LM7805 PINOUT DIAGRAM



- Review all the techniques in connecting components and measurement in Lab#01.
- Unless otherwise specified, all the negative terminals of equipment used in experiment should connect to the GND connection of a circuit.

C) Tinkercad Simulation Part

Simulation 1: Review of Generating Sine Wave

[Lab#02_S1]

Step 1: Create a new circuit in **Tinkercad** and change the circuit name. Find the function generator and oscilloscope in instrument list.

Step 2: Set the function to **Sine**, and the amplitude to **5V**.

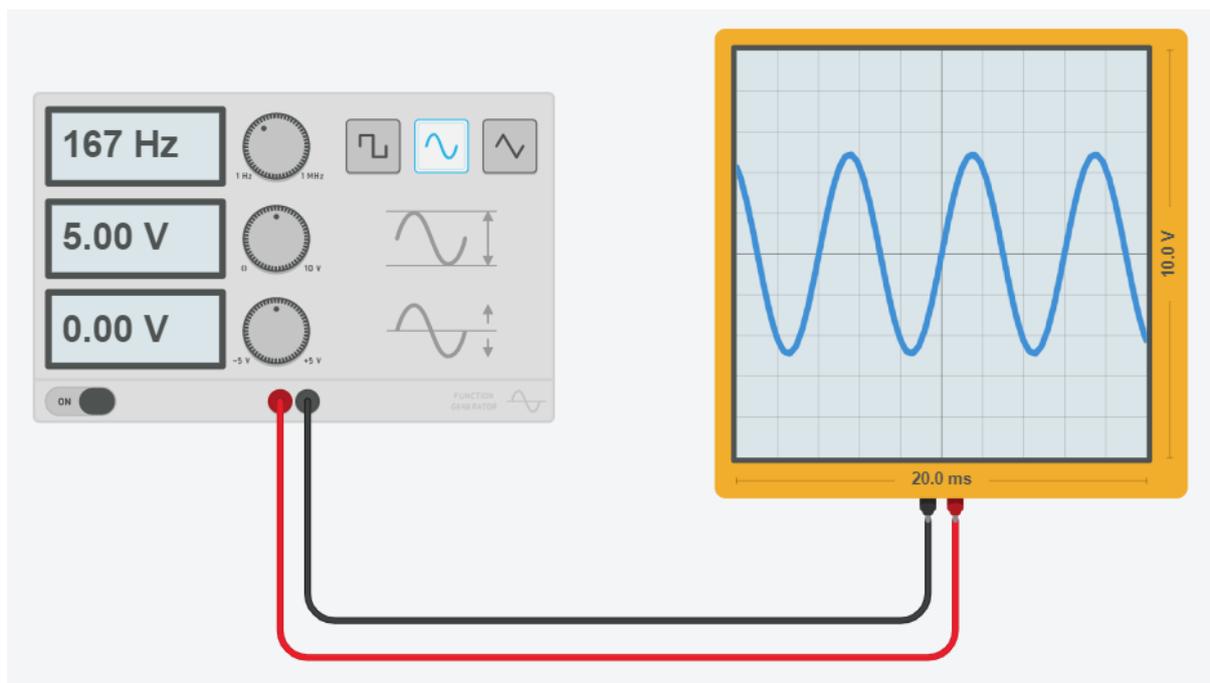
Step 3: Set the frequency to **(100+x) Hz**.

Note: In this lab, let x be the number represented by the 6th and 7th digits of your student ID. For example, if your student ID is 12345678, then x = 67.

Step 4: Connect the oscilloscope to the function generator.

Step 5: Start simulation and you should see a sine wave displayed on the oscilloscope.

Step 6: Change the setting "Time Per Division" of the oscilloscope, if needed, to show at least two completed periods. *This requirement shall be applied to all of experiment.*



****** TA Check 1: Show your generated sine wave (at least two completed periods) to TA. Using your own student ID for x.**

Simulation 2: Diode Circuit

[Lab#02_S2]

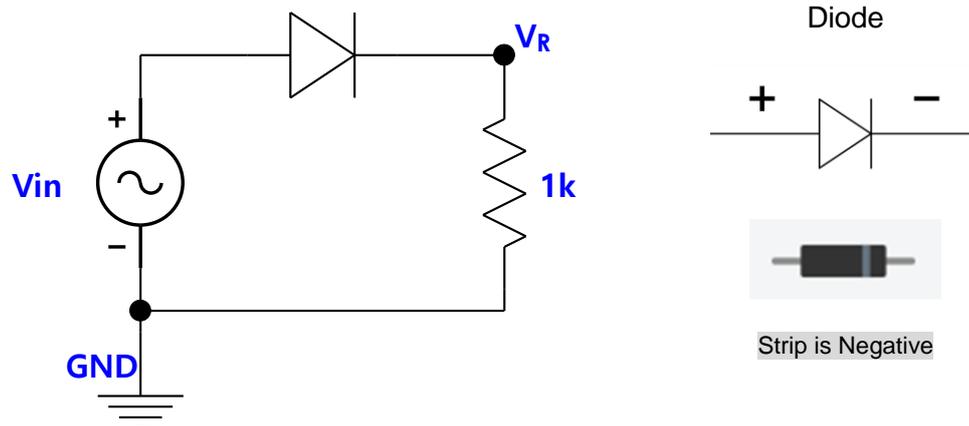
Step 1: Create a new circuit in **Tinkercad** and change the circuit name.

Step 2: Find "Breadboard Small" in the instrument list.

Note: there are 3 types of breadboard in Tinkercad, using "Breadboard Small" is for the lab content consistency.

Step 3: Find "Diode" in the instrument list. Construct the following circuit on breadboard. (You may refer to Tutorial notes for the breadboard arrangement)

Notice the polarity of the diode.



Step 4: Use the generated sine wave in **Review** part as V_{in} .

Step 5: In this experiment, you need two oscilloscopes. Use Oscilloscope 1 to measure V_{in} and Oscilloscope 2 to measure V_R (voltage across the $1k\Omega$ resistor).

**** **TA Check 2: Show your measured waveforms to your TA.**

Step 6: Notice the difference between the waveforms on Oscilloscope 1 and Oscilloscope 2. Answer below question in your summary sheet.

Q1: What is the difference between the two waveforms? Briefly explain your answer (the feature of a diode).

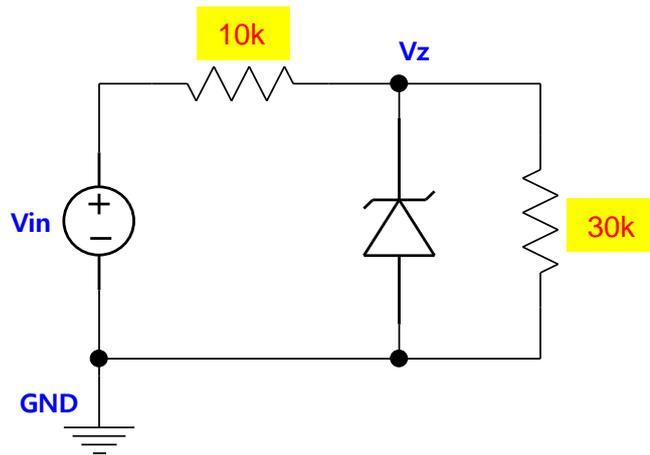
Simulation 3: Zener Diode in Voltage Regulation

[Lab#02_S3]

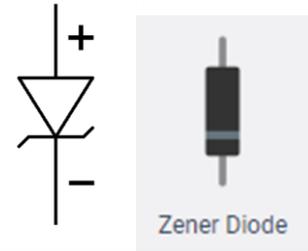
Step 1: Create a new circuit in **Tinkercad** and change the circuit name.

Step 2: Find "Breadboard Small" and "Zener Diode" in the instrument list. Construct the following circuit on breadboard. (You may refer to Tutorial notes for the breadboard arrangement)

Notice that polarity of Zener diode.



Zener Diode



Strip is Negative

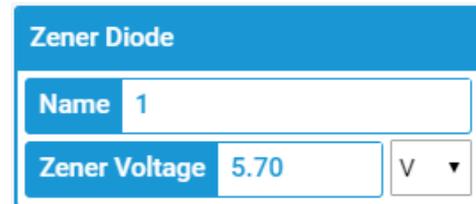
Step 3: Click on Zener diode, set its “Zener voltage” to be 5.7V.

Step 4: Find the power supply, set V_{in} to 1V.

Step 5: Use the multimeter to measure V_Z and record the reading in summary sheet.

Step 6: Increase V_{in} by 1V and record V_Z again.

Step 7: Repeat step 6 until $V_{in} = 16V$.



Q2: Complete the table of experiment result in your summary sheet.

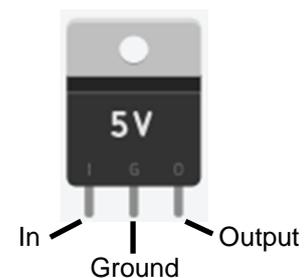
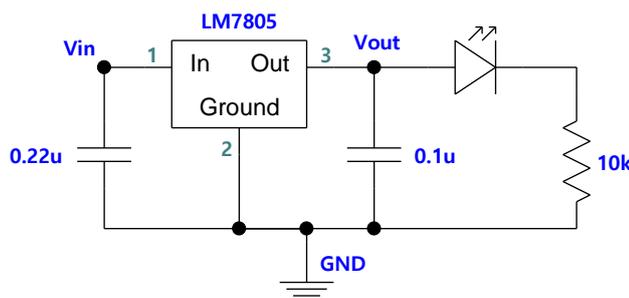
Q3: From your record in Q2, what is the breakdown voltage of the Zener diode? (give a rough number)

Simulation 4: LM7805 Voltage Regulator

[Lab#02_S4]

Step 1: Create a new circuit in **Tinkercad** and change the circuit name.

Step 2: Find “Breadboard Small” and “5V Regulator [LM7805]” in the instrument list. Construct the following circuit on breadboard. (You may refer to Tutorial notes for the breadboard arrangement)



Step 3: Set the power supply to 12V and connect to V_{in} .

Step 4: Use the multimeter to measure the voltage at V_{out} . You should see a 5V as the multimeter reading.

****** TA Check 3: Show your TA that you have finished the circuit and obtained 5V output from 12V.**

Remember to change the circuit names and copy share links of your [Simulations 1-4](#) to the table in your summary sheet.