Experiment - 3

Diode Circuits

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EE102: Basic Electronics Laboratory

Expt. No. 3: Diode Circuits

Objectives:

1. To study half wave rectifier circuits with and without capacitor filter.
2. To study the behaviour of clipping circuits.

Materials Required:

1. Equipment: Breadboard, Multimeter, Function Generator, Oscilloscope
2. Components: 1N4007 Diode (1 unit with V_D = 0.7V), Zener Diode (1 unit with V_Z = 5.1V), 1 kΩ (1), 10 kΩ (1), 1 µF (1)

Pre-Lab Work:

1. How the cathode and anode are generally indicated on a diode?
2. Draw the expected waveforms at step 3 of Part B.
3. Draw the expected waveforms at step 2 of Part C.
4. Draw the expected waveforms at step 3 of Part D.

Part A: Test a Diode

1. Bias a diode as shown in Fig. 1.
2. Set the DC supply voltages as given in Table-1. For each input value, measure the voltages across the diode in forward and reverse biased conditions using a multimeter.

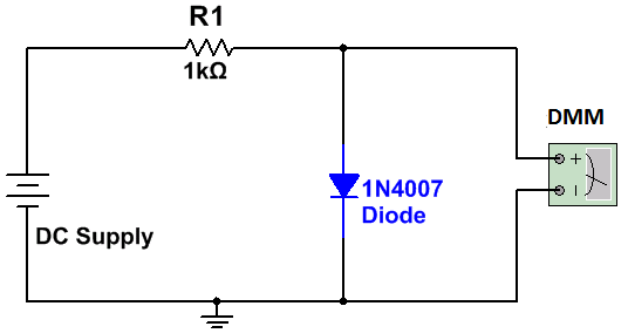


Fig. 1

DC Supply (Volt)	Voltage across diode (in Volt)	
	Forward biased	Reverse biased
5		
10		
15		

Part B: Half Wave Rectifier

1. Set the function generator to obtain a 10 V peak-to-peak sine wave at 500 Hz frequency. Ensure that the dc offset of the function generator is set to 0. Observe the function generator output on the oscilloscope and verify sine wave generation.
2. Set up the circuit as shown in Fig. 2, taking R_L = 1 kΩ and the function generator connected at points F_1 & F_2.
3. Display V_i and V_o simultaneously on the oscilloscope on Channel 1 and Channel 2 respectively. Sketch V_i and V_o, one below the other with identical time and amplitude axes. Alternatively, take screen shots of the oscilloscope.

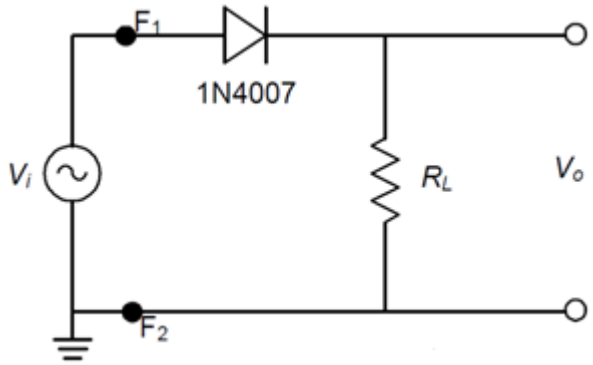


Fig. 2

Part C: Half Wave Rectifier with Capacitor Filter

1. Connect a capacitor with C=1 μF in the circuit with correct polarity as shown in Fig. 3.
2. Display V_i and V_o simultaneously on the oscilloscope on Channel 1 and Channel 2 respectively. Sketch V_i and V_o, one below the other with identical time and amplitude axes.
3. Measure peak-to-peak ripple voltage on oscilloscope by enlarging Vo to the maximum extent. You may have to put the input coupling in AC mode while doing this measurement.
4. Repeat steps 2 and 3 for R_L = 10 kΩ. Comment on the output waveforms and ripple voltages.

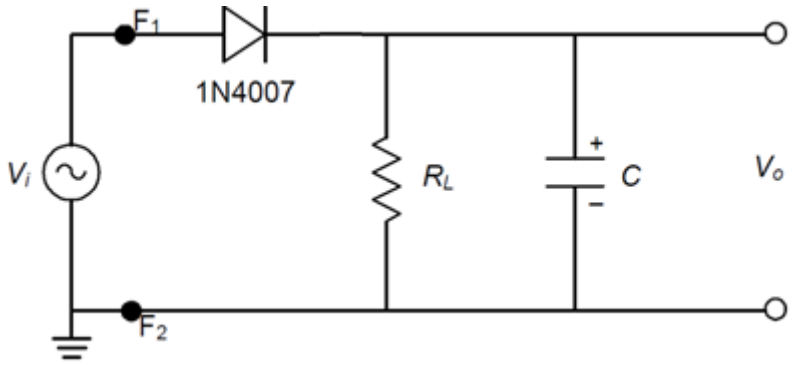


Fig.3

Part D: Clipping Circuit - Positive Clipper

1. Connect the circuit as shown in Fig. 4 with R = 1 kΩ.
2. Set the function generator to 10 V peak-to-peak sine wave at 500 Hz frequency. Observe the function generator output on the oscilloscope and verify sine wave generation. Connect the function generator output to the circuit as shown in Fig. 4.
3. Display V_i and V_o simultaneously on the oscilloscope on Channel 1 and Channel 2 respectively. Sketch V_i and V_o, one below the other with identical time and amplitude axes.
4. Set the oscilloscope in X-Y mode (V_i to Channel 2: X- input and V_o to Channel 1: Y-input) and sketch V_o versus V_i with equal x and y scales. Label the graph and ticks on the axes.

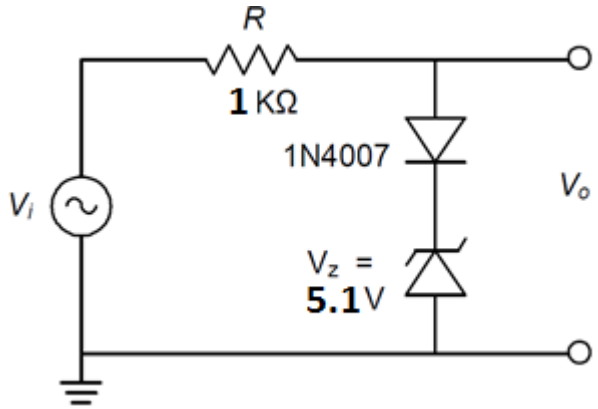


Fig. 4

Part D: Lab Report

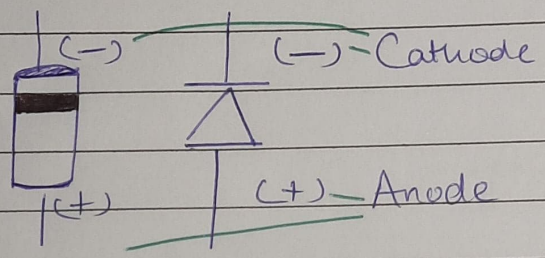
Prepare and submit a lab report as specified in the general instructions regarding the lab. Include the answers to the following questions in the report:

1. Draw circuit diagrams for: (a) –ve clipper (b) +ve and –ve clipper

Prelab-#3

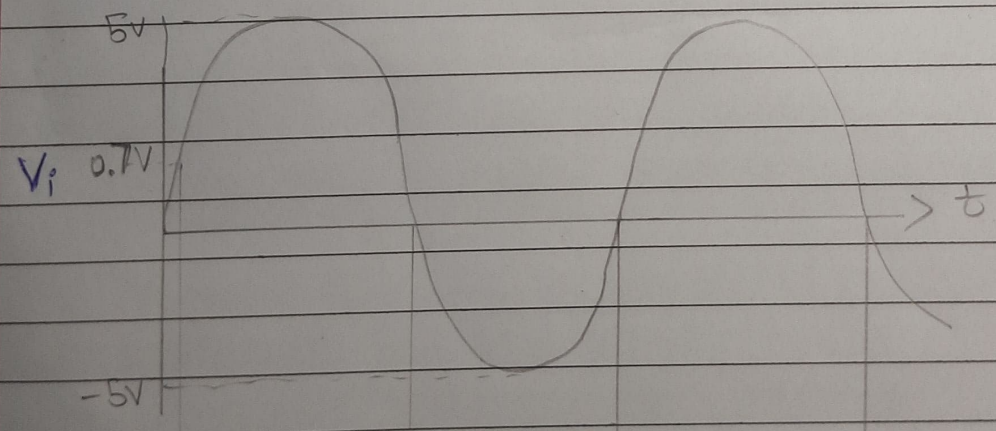
Ans1

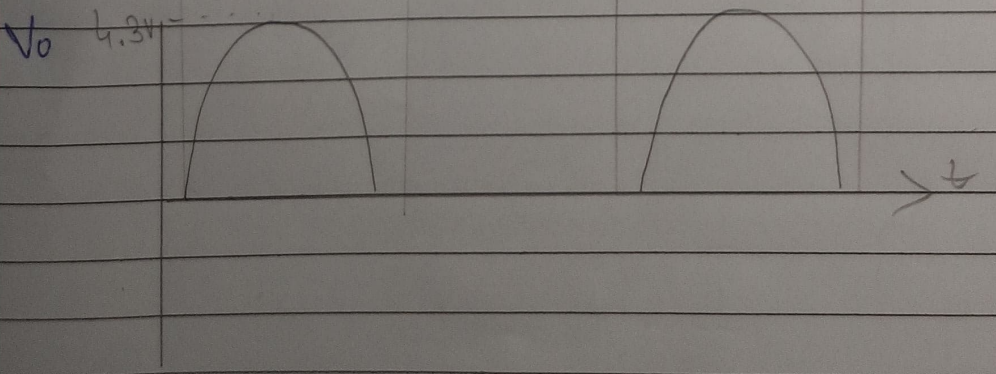
Generally a white/black ring on one side of a diode indicates its cathode, other being anode. #



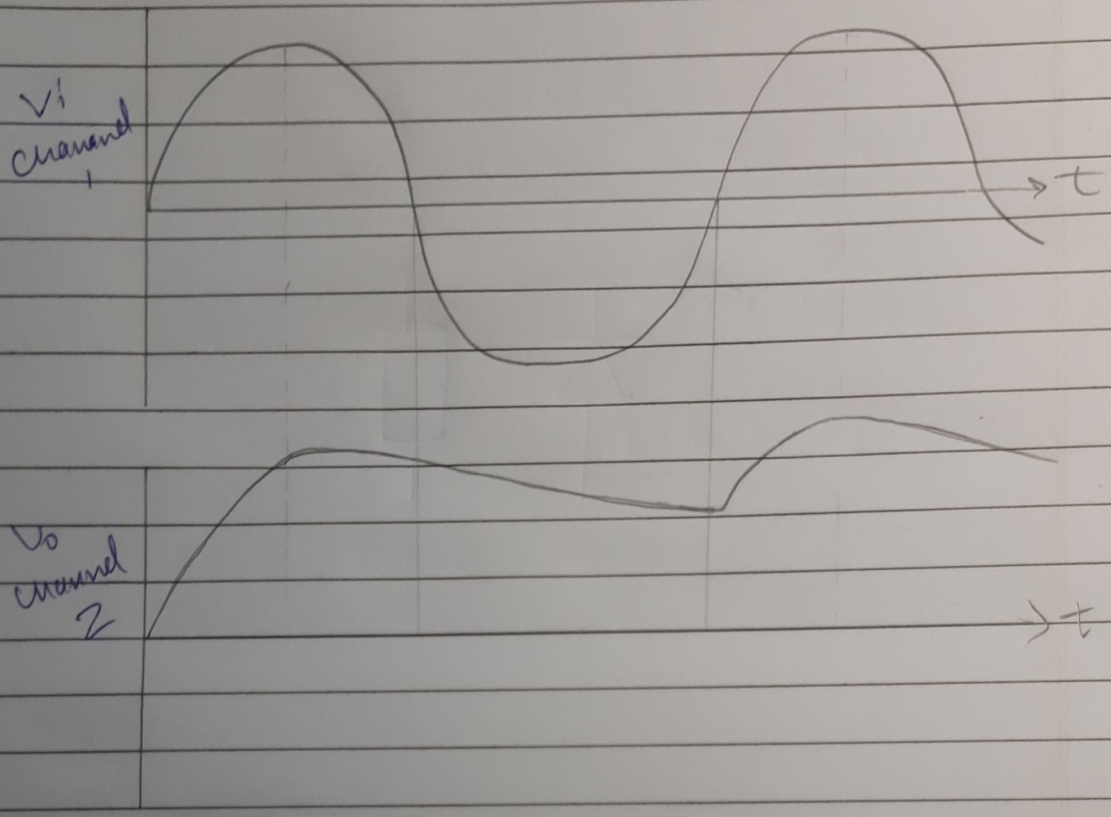
Physical diode Symbolic representation

Ans2



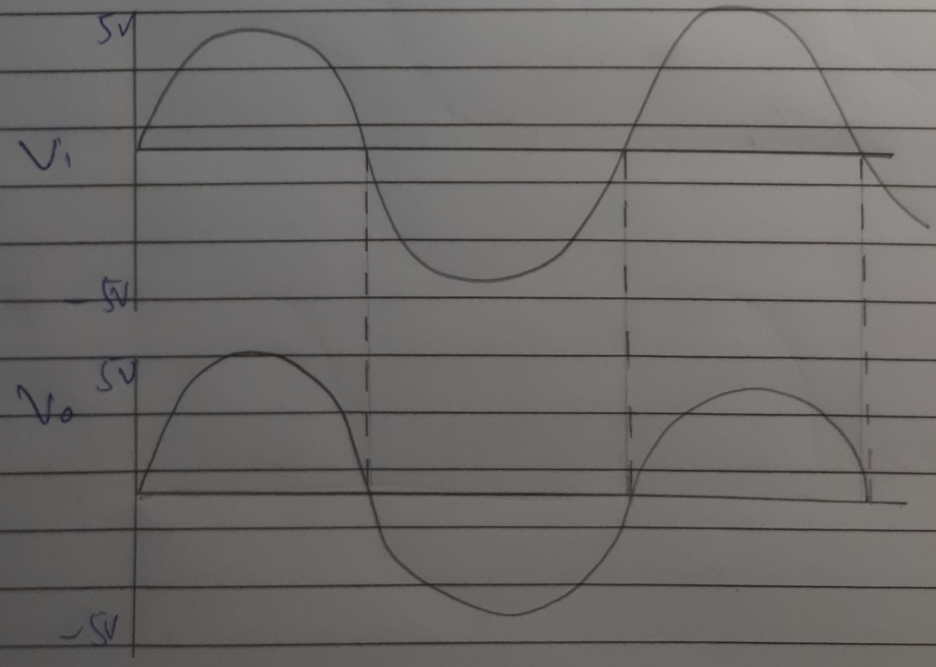


Ans 3



Ans 4

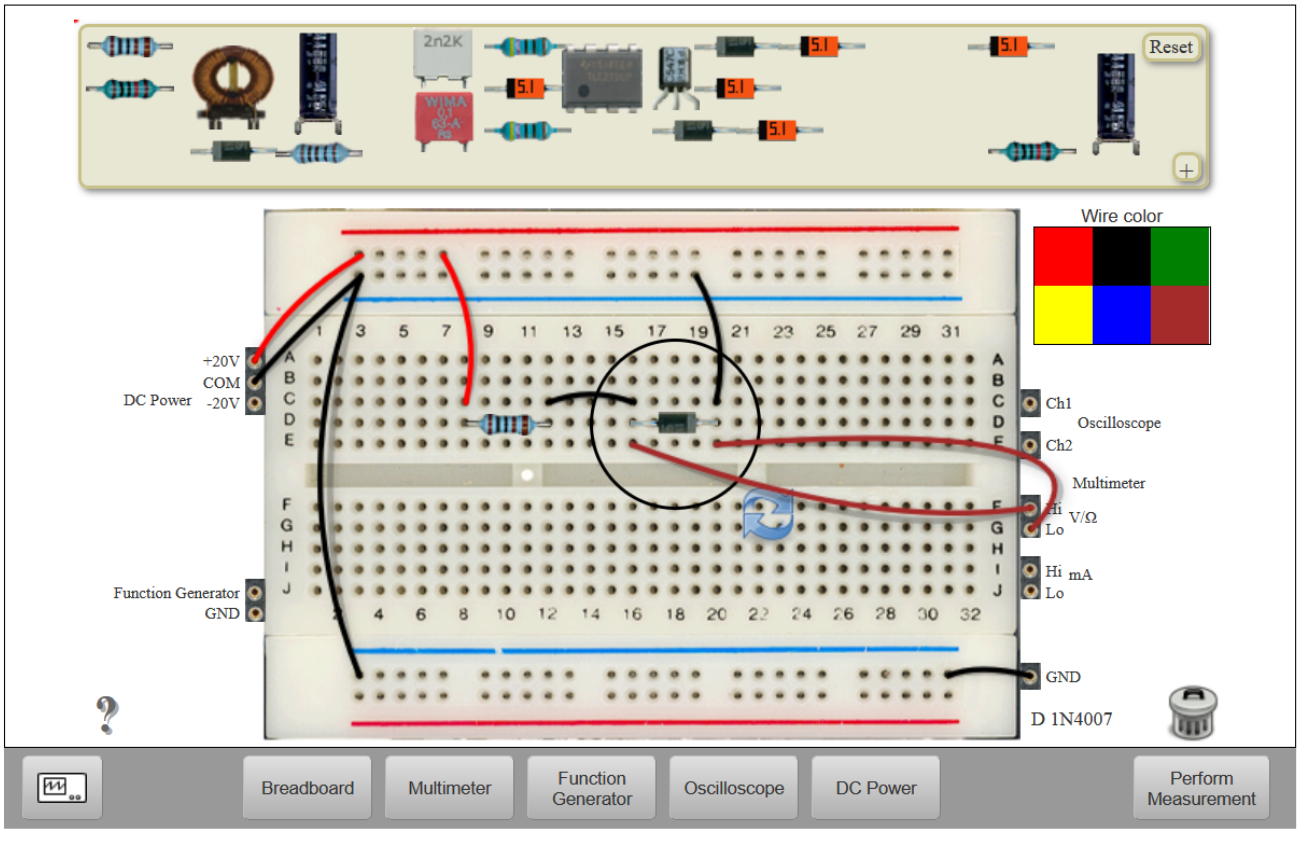
Since the voltage should be minimum of 5.8 volt to get clipping, there won't be any clipping.



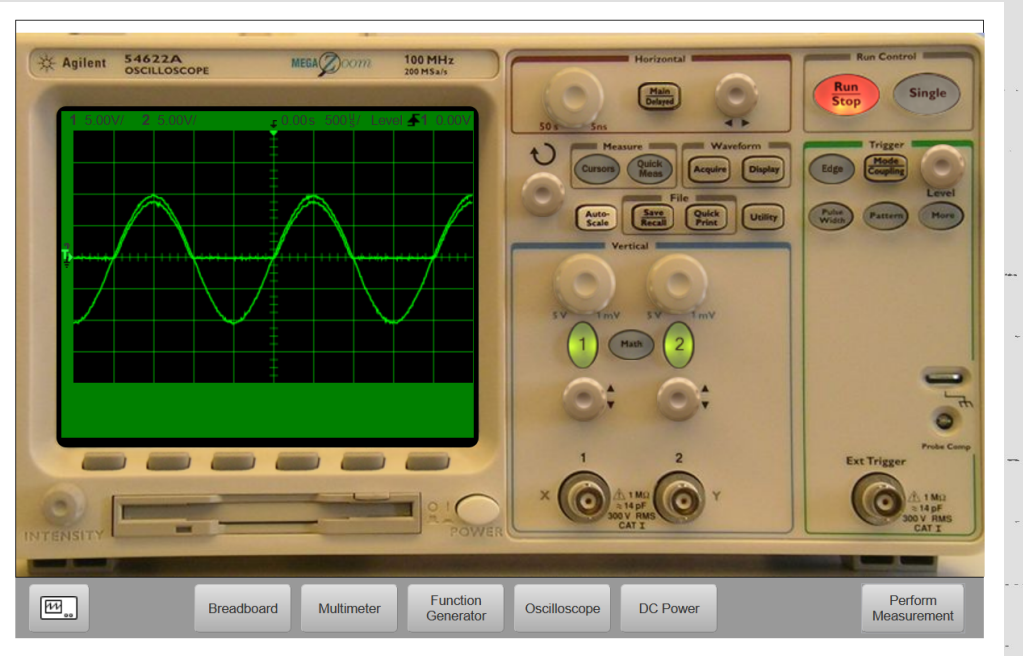
Observations

Part : A

DC Supply (Volt)	Voltage across diode (in Volt)	
	Forward Biased	Reverse Biased
5	0.6303	5.001
10	0.6654	10.00
15	0.6956	15.00

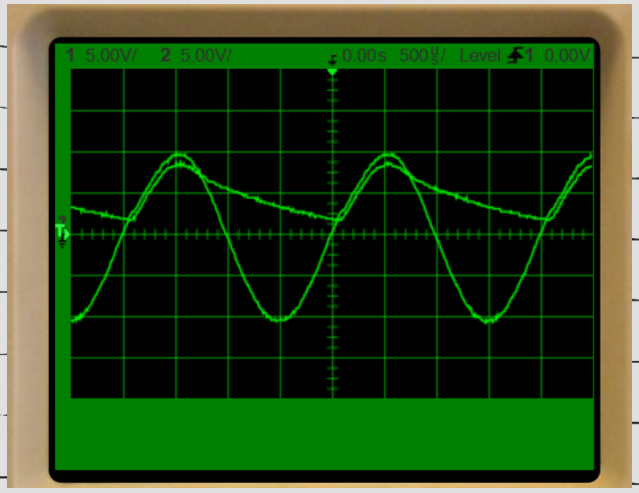


Part B

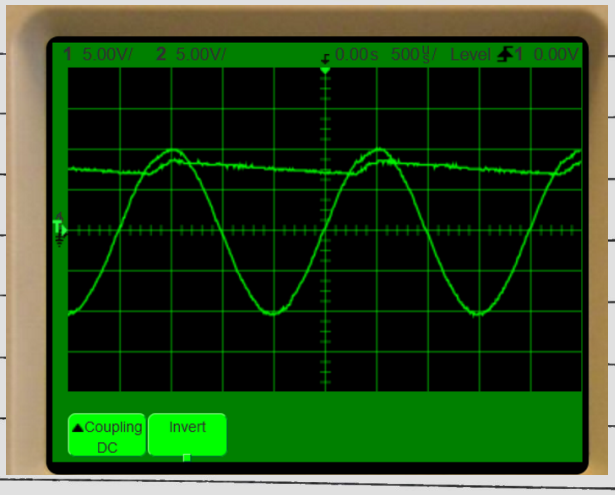


Part C

$R = 1k\ \Omega$



$R = 10k\ \Omega$



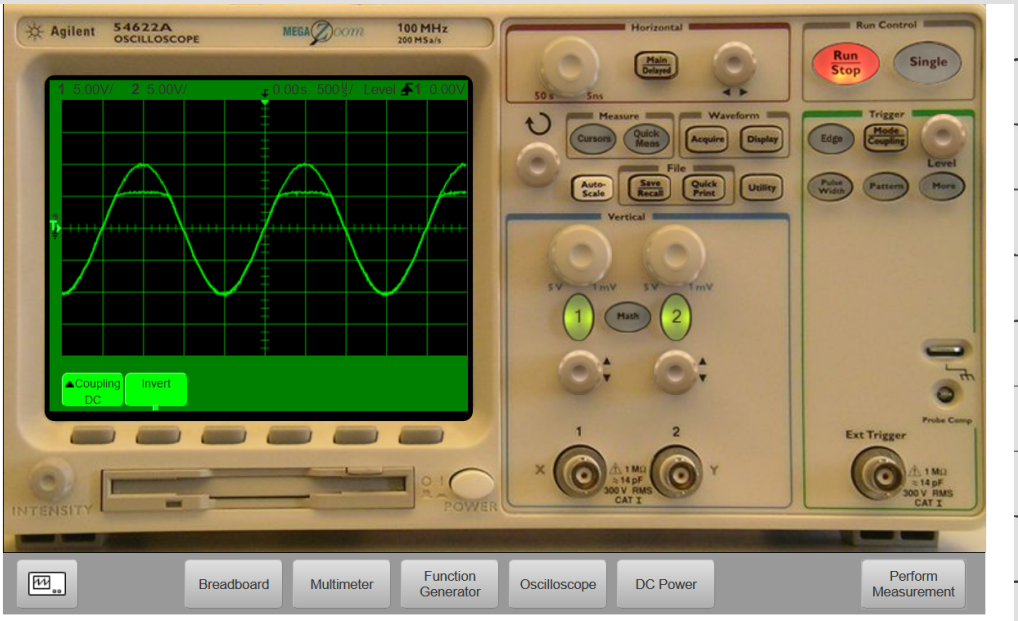
Peak-to-Peak Ripple Voltage

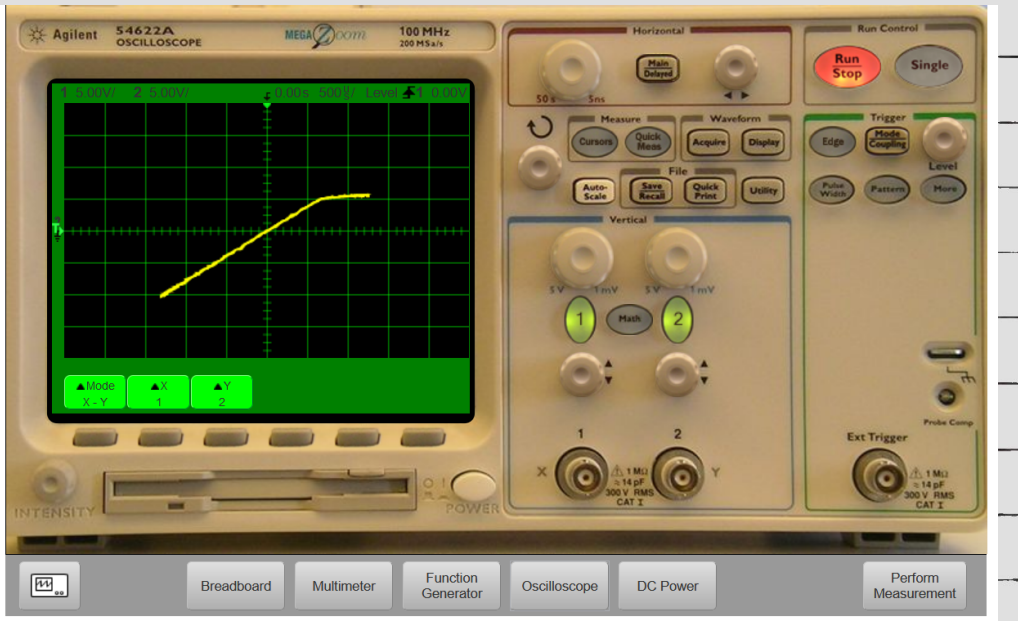
for $1k\Omega$ → 6.596 V

for $10k\Omega$ → 1.593 V

On comparing the output waveforms of the 2 values of R_L, we clearly get that for $R_L = 10k\Omega$, the output voltage V_o is more stable and has smaller ripple voltage. Thus we see, more resistance gives lower ripple voltage and straighten the curve.

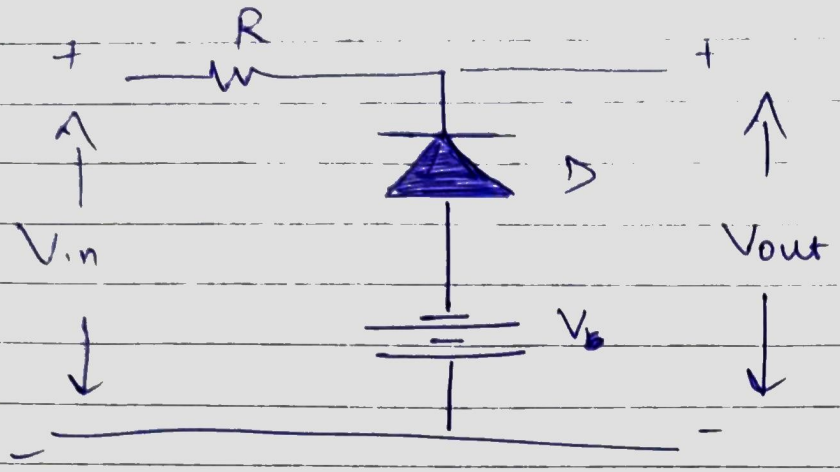
Part D





Answers

(a) -ve clipper



(b) +ve & -ve clipper