DATE	COURSE/YEAR/GROUP	NAME

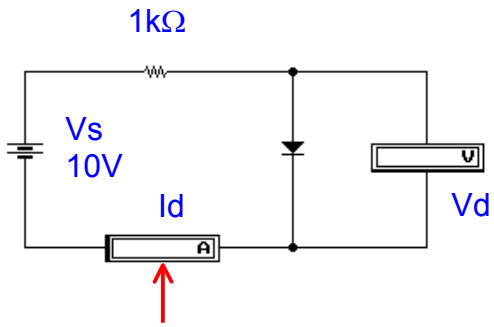
UNIVERSITY OF PLYMOUTH

Department of Communication & Electronic Engineering

DIODES AND RECTIFIER CIRCUITS

Part 1. Diode Forward Characteristic

Set up the diode circuit shown below and complete the table of results (NB if the model produces no reading at certain values, then ignore those points).



NB: rotate ammeter (before wiring) to give positive values of Id.

V_s(V)	V_d(V)	I_d(mA)
0		
0.2		
0.4		
0.6		
0.8		
1.0		
2.5		
4.0		
6.0		
8.0		

Use the measured values of diode voltage and current to plot the forward characteristic.

Which axis is which?

Hint: I depends on V.
Compare : Y depends on X

So I is the vertical axis (Y)

Part 2. Half-wave Rectifier Circuit

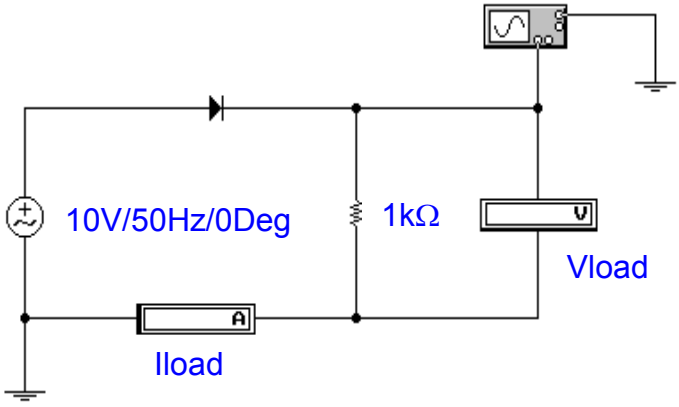
Simulate the rectifier circuit shown in the diagram. The meters should be set to dc.

Use a sinusoidal supply of 10 V peak at a frequency of 50 Hz.

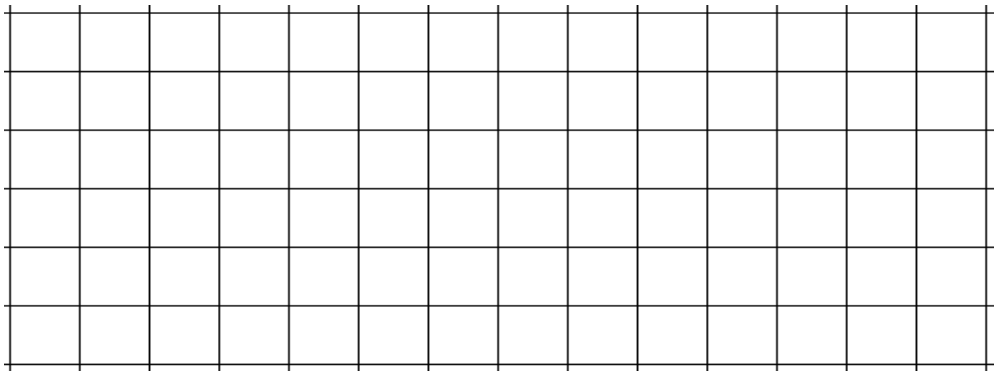
Suggested settings for the CRO are:

Time-base: 5 ms/div

Channel A: Vertical Deflection
5V/div
DC input



Sketch the voltage waveform across the load resistor on the "oscilloscope screen" below. Label the axes and number the scales.



What is the name of this wave shape?

Record the following values

D.C. load voltage V_{load} (from the meter) = V

D.C. load current I_{load} (from the meter) = mA

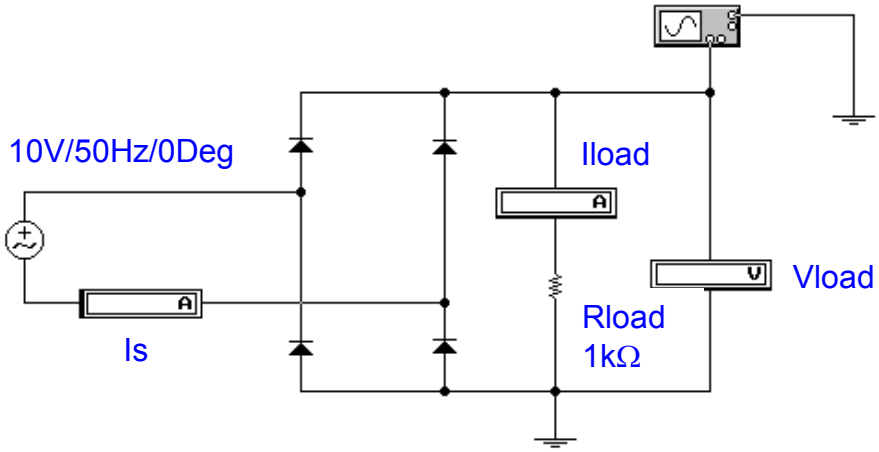
Peak D.C. voltage (from the graph) = V

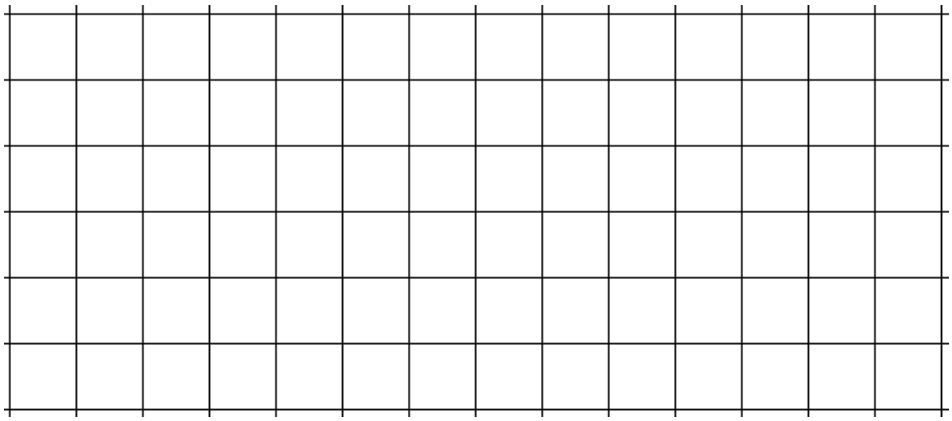
Why is V_{load} less than the peak voltage?

Calculate V_{load}/I_{load} Why is it this value?

Part 3. Full-wave Rectifier Circuit

Repeat the procedure of Part 2, but using the full-wave rectifier circuit shown below





Record the values of the d.c. load voltage and current (with the meters still set on dc).

V_{load} = V I_{load} = mA

and calculate the ratio V_{load}/I_{load} = Ω.

What is this resistance?

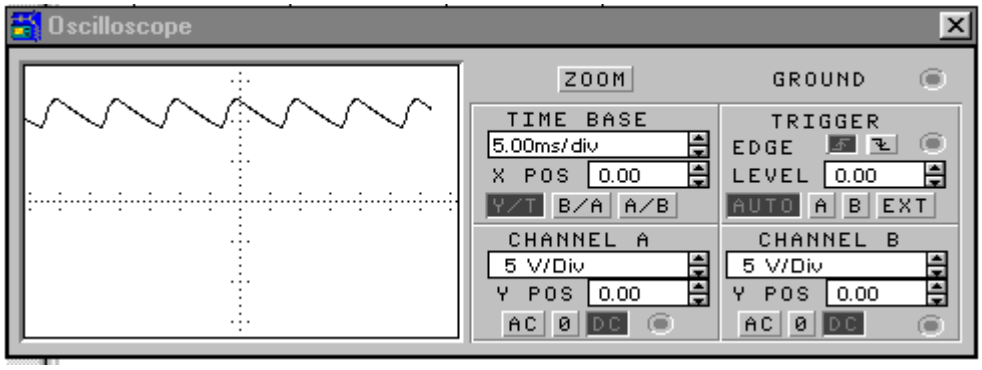
Account for the difference in the two ammeter readings.

Why is V_{load} greater than in Part 2?

Part 4. "Smoothing" The DC Output

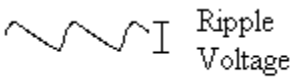
Add a smoothing capacitor across the load resistor (try 22μF, 100μF, 1000μF) and see the ripple being reduced.

NB. if there is an error reported by EWB: Under Circuit, Analysis Options, alter Tolerance to 10%. (Reset this to 1% when you start Part 4).



Which capacitor gives the above trace?

Record the value of the "ripple voltage" for each capacitor



22 μF

100 μF

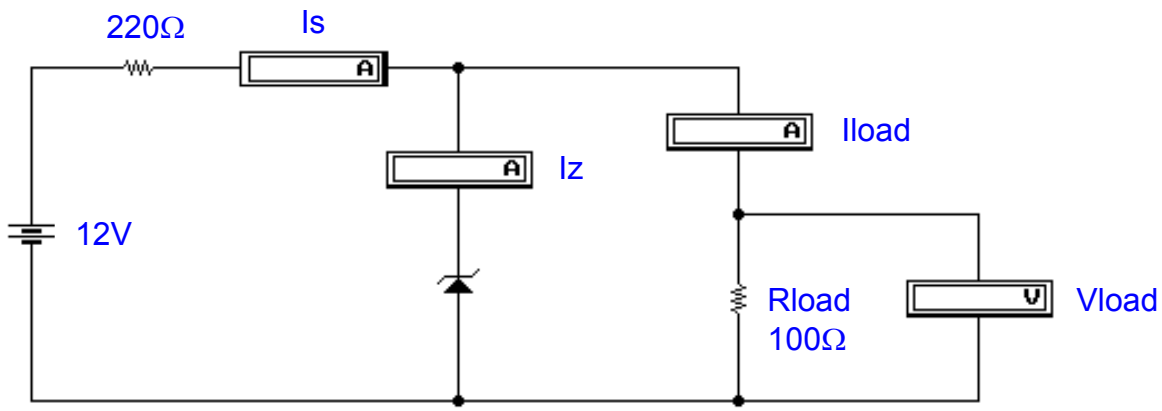
1000 μF

Explain the effect of increasing the capacitor value.

What would happen if you increased the load resistor value?

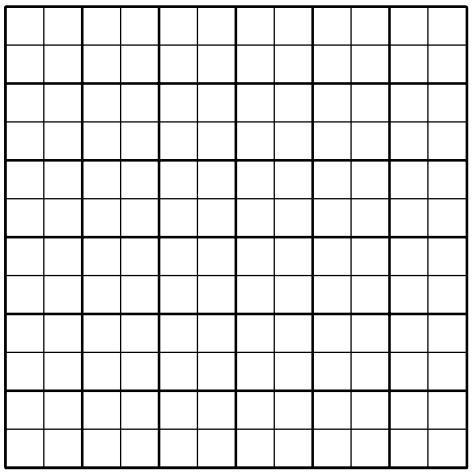
Part 5. Zener Diode Voltage Stabiliser Circuit

Simulate the Zener diode circuit shown in the circuit below.



Record values of the load voltage, load current, Zener current and supply current for the range of load resistances shown in the table. Plot a graph of load voltage/load current.
Which axis is the vertical one? Hint: The voltage depends on the load current.

R_{load} (Ω)	V_{load} (V)	I_s (mA)	I_z (mA)	I_{load} (mA)
50 k				
5 k				
1 k				
500				
250				
175				
100				
50				



Highlight the zener diode symbol, and double click to inspect the Zener Diode models. Click on Edit. What is the zener voltage in the model?

Comment on the characteristic obtained, ie, what is the circuit supposed to do? Does the circuit work and if so, how well?