Experiment 9: Diodes

EQUIPMENT NEEDED:

– AC/DC Electronics Lab Board: 1 KΩ Resistor, 330 Ω Resistor, 1N4007 Diode, Wire Leads
– Digital Multimeter (DMM)
– (2) D-cell Batteries

Purpose

The purpose of this lab will be to experimentally determine some of the operating characteristics of semiconductor diodes.

Procedure

À Connect the circuit shown in Figure 9.1a using the 1N4007 diode you've been supplied and the 1 KΩ resistor. Use Figure 9.1b as a reference along with Figure 9.1a as you record your data. Note the direction that the diode is oriented, with the dark band closer to point **B**.

Á With the "switch" closed and the current flowing, adjust the potentiometer until there is a voltage of 0.05 volt between points **B** and **C** ($\mathbf{V}_{BC}$). Measure the voltage across the diode ($\mathbf{V}_{AB}$). Record your values in the left-hand side of Table 9.1 under "Forward Bias".

Â Adjust the potentiometer to attain the following values for $\mathbf{V}_{BC}$: 0.1, 0.2, 0.3,.....2.0 volts. Record the two voltages for each case.

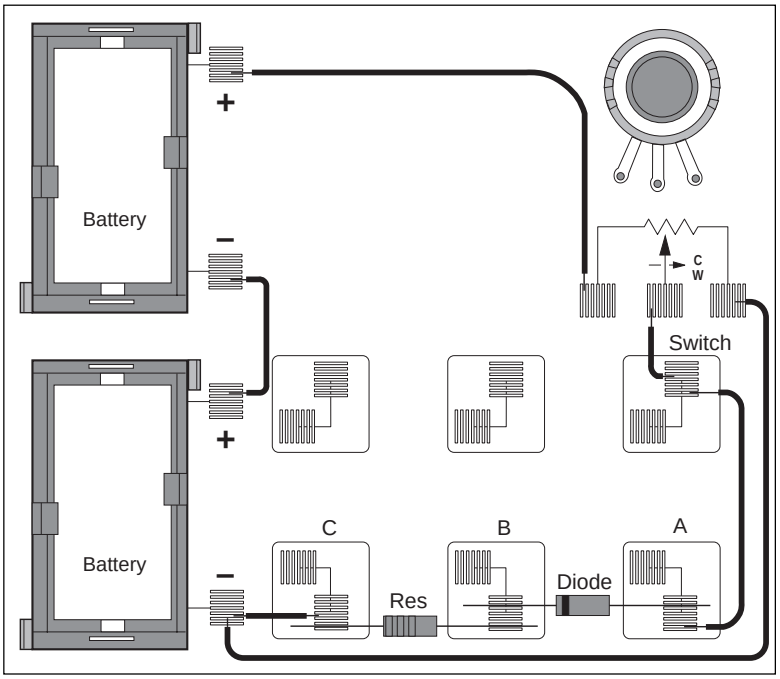

Figure 9.1a

Ã Remove the 1 KΩ resistor and replace it with a 330-Ω resistor. Repeat steps 3 & 4, going from a voltage of 0.3, 0.4,.....2.0 volts. Record $\mathbf{V}_{BC}$ and $\mathbf{V}_{AB}$ in each case.

Ä Reverse the orientation of the diode. Set the diode voltage ($\mathbf{V}_{AB}$) to the values 0.5, 1.0,....3.0 volts. Measure the resistor voltage ($\mathbf{V}_{BC}$) in each case. Record these values in the columns labeled "Reverse Bias".

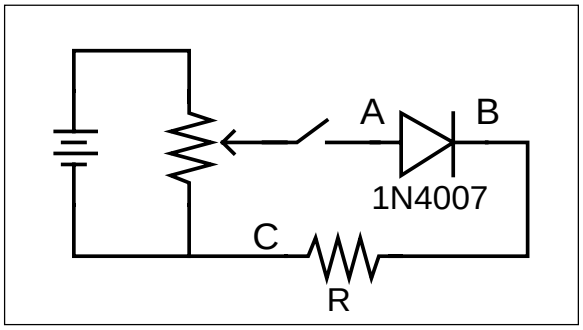

Figure 9.1b

Analysis

À Determine the current flow (**I**) in each setting by dividing the voltage across the resistor ($\mathbf{V}_{BC}$) by the resistance. Where you switched resistors, be sure to change the divisor.

Á Construct a graph of Current (vertical axis) vs the Voltage across the diode, with the graph extending into the 2nd quadrant to encompass the negative voltages on the diode.

Discussion

Discuss the shape of your graph and what it means for the operation of a semiconductor diode. Did the diode operate the same in steps 3 and 4 as it did in step 5? In steps 3 and 4 the diode was "Forward Biased", while it was "Reverse Biased" in step 5. Based on your data, what do you think these terms mean? What use might we have for diodes?

Sample Data Table

Diode Type _____

Forward Bias Reverse Bias

Table 9.1

R, Ω	V_{AB}, volts	V_{BC}, volts	I, mA	R, Ω	V_{AB}, volts	V_{BC}, volts	I, mA

Extensions

① If your instructor has a zener diode, carry out the same investigations that you did above. What differences are there in basic diodes and zener diodes?

② Use an LED (light emitting diode) to carry out the same investigations. What differences are there between basic diodes and LED's?