Alternating current is important to study since it is how we get electricity from the power plant to our homes. Most appliances use direct current to run. In this experiment we will watch how resistors, capacitors, and diodes affect current from an AC source.

Equipment:
- Electronics Trainer
- Vernier interface
- (2) voltage probes
- iBook computer
- Multimeter
- Components box

Cautions:
This equipment is very delicate. Never, never, never short-circuit the power supply! Doing so will (if you are lucky) blow the fuse. If you're not lucky it will blow the whole $200 trainer unit! Don’t plug in a wire into the trainer unless you are told to do so. Do not apply power until you are instructed to do so!!

Be very cautious when using the meter to read current! If you put the meter across a voltage source without a series resistance you will blow a fuse in the meter. The meter will have to be disassembled to replace this fuse, which will not please your teacher in the least! As a rule of thumb, never leave the red lead plugged into the “μAmA” socket. Always move the red lead to the “VΩ” socket when done taking a current measurement.

Procedures:

Part A

1. Open the trainer, make sure the rocker switch is toward “OFF” and plug the line cord into a wall outlet.
2. Using a medium black jumper, connect one of the “GND” sockets on the power supply with the leftmost socket just below the blue line on the upper edge of the upper breadboard.
3. Using a medium red jumper, connect one of the “FREQ” sockets with the leftmost socket just above the red line on the upper breadboard.
4. Locate a 10000Ω resistor and use it to connect sockets 25f and 30f.
5. Use a short red jumper to connect 30g with the positive power bus.
6. Use a short black jumper to connect 25g with the negative power bus.

One of the basic realities of life is that resistors seldom have exactly the values they say. That’s why they have a tolerance band! Now you will use the meter to measure the actual resistance of the resistor:
7. Plug the socket end (90° bend) of the black test lead into the “COM” terminal of the meter and the socket end of the red test lead into the “VΩ” terminal of the meter.
8. Turn the meter’s dial to “20K” on the “Ω” scale.
9. Make sure that the power switch on the trainer is in the “OFF” position. Taking resistance readings from a powered circuit will ruin the meter! Even though these
resistors aren’t hooked to anything yet, it is good practice to make sure that there is no chance of accidentally measuring a powered circuit.

10. Touch each of the meter leads to opposite metal leads of the 10000Ω resistor. The meter is reading in thousands of ohms, so multiply the meter reading by 1000 and record the true value here under the nominal value:

NOMINAL VALUE: 10000Ω

TRUE VALUE: __________ Ω

11. If it isn’t already there, plug a voltage probe into CH1 of the Vernier interface.
12. Attach the red end of the voltage probe to the resistor lead that goes into socket 30f.
13. Attach the black end of the voltage probe to the resistor lead that goes into socket 25f.
14. If it hasn’t already been done, plug the USB connector into the iBook and turn the iBook on. Login as Student; the password is “student”.
15. From the “Student” folder, start the “Buxman’s Cap” item.
16. Turn the rocker switch on.
17. Click on the “Collect” button on the iBook.
18. Set the wave form knob to sine wave (the curvy one).
19. Set the course frequency knob to 10.
20. Adjust the Amplitude and DC Offset knobs until the sine wave is centered on zero and has an amplitude of ±5.

Q#1: Describe what you see (sketch the graph).

Part B

1. Turn the rocker switch toward “OFF”.
2. Remove one end of the black jumper from 25g and connect it to 20f.
3. Locate a diode and use it to connect sockets 20g and 25g.
   Caution: you will blow a diode if you put it in the wrong way. Make sure the lead on the flat side of the diode is in socket 20g.
4. Turn the rocker switch on.
5. Click on the “Collect” button on the iBook.

Q#2: Describe what you see (sketch the graph).
Q#3: How is it the Part B graph different from the Part A graph?

Q#4: What caused the change?

Q#5: What do you think is a function of a diode?

**Part C**

1. Turn rocker switch off.
2. Find the 100µf capacitor. Plug the negative end (black stripe) into 25j and the positive end in 30j.
3. Turn rocker switch on.
4. Click on the “Collect” button on the iBook.

Q#6: Describe what you see (sketch the graph).

Q#7: How is the Part C graph different from the Part B graph?

Q#8: What caused the change?

Q#9: What is a function of a diode/capacitor combination?

5. Turn the rocker switch off.
6. Replace the 100µf capacitor with a 1000µf capacitor.
7. Turn the rocker switch on.
8. Press the collect button on the iBook.

Q#10: How has changing the capacitance changed the graph?

Q#11: Why would this happen?