Light Flicker

Math / Physics / Biology
Middle / High
Sine Regressions / Data Collection
AC Power/Human Vision

Introduction: All the electricity that comes into your home and school runs on alternating current. Alternating current is so named because it alternates or changes direction 60 times per second, the electrons flow into the building, stop for a fraction of a second, and then flow out. In the process of moving, the electrons can do work. They light the light bulbs, turn vans, power CD players, etc. The frequency of sixty times per second is related to the structure of the power station generators that put out the electricity.
As the electrons make their transition from one direction to another, simple appliances, like lights, momentarily turn off, then back on. However, we never notice that "flicker" or transition. The nerves in our eyes are not able to react fast enough to detect that change. The delay in registering the change in light is called persistence of vision.

Objectives: Students will be able to…

1. Collect data by following an experimental procedure.
2. Input data in a graphing calculator.
3. Compare results.
4. Draw conclusions.
5. Determine the governing math model
6. Discuss applications of results.

Related Key Words:

persistence of vision	AC	DC	period
frequency	cornea	rods	cones

Materials:
Fluorescent Ceiling Light
CASIO CFX9850-Ga Plus COLOR GRAPHING CACLAULTOR
CASIO EA-100 CASIO Data Collector (CDA)
Light Probe (Included with the CDA)
Link Cord (Included with the CDA)

Purpose: To demonstrate the flicker found in household fluorescent lights by using the CASIO CDA and the included Light Probe.

STEP 1— With the CDA turned off, insert the Light Probe into the Channel One port on the top of the CDA and turn on the CDA.

STEP 2-- Press the Yellow SHIFT key followed by the mode key on the CDA. This enables you to set up the parameters of the experiment. The first thing that appears is a choice to set the time between when the data points can be collected. To view these different times press the DATALOG key to scroll through the times; these range from 10 m-sec to 60 seconds. There is also a choice of .000, this allows you to record a data point whenever you press the trigger key, and this is not dependent on time. **Set this parameter for 10.0 m-sec and press the TRIGGER key to fix the setting.**

STEP 3-- The next parameter you will need to set is the total number of samples you will be collecting. By pressing the DATALOG key you will scroll through the values, these vary from 10 to 200, **set the parameter to 30 and press the TRIGGER key to fix the choice.**

STEP 4-- The last parameter you will need to set is the time setting. This setting has three choices. The first choice is ZERO (0); this is used for real time data collecting and should only be used in conjunction with a program in the calculator. The second choice is ONE (1), this is the choice that you should use whenever you are collecting data and the CDA does not have to be collected to the calculator. This will give you the time readings in relative time. The third choice is two (2); this is the absolute time setting and is used in conjunction with a program from the calculator.

STEP 5-- At this point you should have either a light reading or three dashes [---] on your CDA. If you do not repeat steps 1-4. If you do have a reading and the word "READY" appears on the left side of the screen, hold the light probe so that it is facing a fluorescent light source. Now press the trigger key. At this point, the word "sampling" will be flashing on the left side of the screen; this will only last for a very short time. Hold the probe as still as possible until the word "DONE" appears on the screen. You have now collected one light reading every 10 m-sec for 30 seconds, and it is stored in the CDA. To repeat the experiment using the same parameters press the SHIFT RESTART key. (NOTE: This will delete the data from the previous sampling.)

STEP 6-- This section can be used with either the cfx-9850G or the fx-7400G by manually entering the data recorded in the EA-100 into the STAT MENU on the calculators.

To view the data that has been collected in the EA-100 press the DATALOG key on the EA-100. This will scroll you through the data samples. You will need to record these samples as the "Y" value and the TIME as the "X" values. Now you can have your students graph these data points on a piece of graph paper.

Dave Barron of Casio, Inc. developed this activity.

Questions and Problems:

Level 1: Answer the following questions in complete, well-structured sentences.

1. Explain the difference between Ac and DC currents.
2. Discuss real world applications of persistence of vision.
3. Why do see a dot after someone takes a flash picture of you?
4. Define frequency.
5. What are the rods and cones of our eyes? What is the function of each?

Level 2:

1. How does the frequency relate to period?
2. Explain why humans do not detect color well in low light.
3. It is possible to get very good data that shows the alternating current through a light with these procedures. What factors may produce data that is not "nice" and what can been done to improve the results?
4. Discuss if the data will be different for different lights. What are the results if an incandescent light is used? Explain what the results are will for a flashlight.

Extension:

Students can experiment with flipcard cartoons, stop action photography, and / or research the art of animation and movie making.