

2011 Fall Demo Night

On Friday, October 7th, 2011 our SEPS AAPT held the annual demo night at Malvern Preparatory School in Malvern, PA. The event began with a delicious dinner held in the school cafeteria where members were able to converse and meet new members into the SEPS. There was a great turnout despite the fact the Phillies were playing in the divisional playoff game against the Cardinals that same evening.

We then moved into a classroom where a variety of demos were shared with the audience. Fran Poody opened the event with the mystery box she equated as a metaphor for science. Barry's demonstration was to show Ohm's Law in 10 seconds. An abstract of his demonstration is included below this summary.

Then we had four demonstrations illustrating motion. Then we saw a very clever demonstration on rotational motion using marbles contained within a hollow transparent plastic ball rotated on a coaster and also "a spill me not" apparatus where a cup was rotated, no flying coffee occurred at this event. There was a lab on one-dimensional kinematics using wooden boats, a rain gutter, sails in the form of index cards and washers to vary the mass of wooden boats. Here data such as velocity and distance as functions of time could be measured and analyzed. Two-dimensional motion was illustrated by using steel bars placed in a "+" set up and a ramp where θ was set below 25° and the acceleration of a marble moving down the ramp could be determined using $\tan \theta$.

Did you know a wandarama could be used as a portable Van der Graaf generator. These wandarama can be purchased at 5 and Below. Using these wandarama we were shown how the transfer of charges could be measured with a specialty scale measuring to the nearest milligram. Bill Berner completed the evening by telling the audience about the 15th Annual University of Pennsylvania Physics Demo Show, Physics for the Season of Lights: The Physics of Motion which will be held on Monday, December 12th and Tuesday, December 13, 2011. Bill then continued to give as a quick tour of the steps of linking multiple videos using Logger Pro.

Ohm's Law in Ten Seconds

Barry Feierman - Demo Night Oct 2011 Malvern Prep

Most of us teach Ohm's Law at some point in first-year physics.

Ohm's Law says that the current in a circuit depends directly on the applied voltage or electric potential, and depends inversely on the electrical resistance of the circuit: $I = V / R$

In order to test this idea, we typically use a variety of fixed voltages to apply to a resistor (wire) and measure the current through the circuit with some type of analog or digital ammeter. We can vary the voltage by using a

number of 1.5 volt batteries in series: 1.5, 3.0, 4.5, 6.0 volts. Plotting voltage (Y) vs. current (X) typically yields a linear graph with a slope equal to the resistance of the resistor in ohms.

One way to vary the voltage quickly across the resistor is to use a capacitor. First charge the capacitor to say 6 volts with a 6 volt battery.

Then discharge the capacitor into a 10-ohm wire resistor.

In my case, I used a Vernier voltage probe across the resistor and a current probe in series with the resistor. Collecting data at 10 or 20 samples/second for ten seconds with Logger Pro was all we needed to plot voltage vs. current and test for the linearity of the graph.

It only takes about ten seconds to produce the data for this run.

When repeated, but substituting a #46 lamp for the 10-ohm wire resistor, the lamp lights brightly at first, then dims and goes out in 10 seconds. The voltage vs. current graph turns out to be non-linear, with the greatest slope occurring where the current was greatest. We call such a device a "non-Ohmic" device since the resistance of the lamp's filament is not constant. In this case the resistance was greatest when the temperature was greatest, or when the current was greatest, just as the discharge first happens. Metals behave this way; cooling them lowers their resistance.

Normally this lab would take a whole lab period (40 minutes) using analog meters, multiple batteries and making graphs by hand. Using the Vernier Probes and Logger Pro software allows one to collect the data and show the graphs of both wire and lamp in only a few minutes.

