TechLab: Jewels of Joule

an investigation of electric power

PERIOD	1.		
	2.		
GROUP	3.		
	4.		

• Prerequisite •

Successful completion of *PhyzLab: Ohm, Ohm on the Digital Range.*

• Purpose •

In this activity, you will use data sets acquired in the Ohm, Ohm on the Digital Range activity to investigate the relationship between electric power and voltage, and the relationship between electric power and current.

• Apparatus •

___ computer (PhyzMac iBook or equivalent)
___ data analysis software (DataStudio or equivalent)
___ data sets from PhyzLab: Ohm, Ohm on the Digital Range

• Procedure •

1. PREPARE THE FILE

a. Turn the computer on and allow it to complete its start-up cycle.

b. Launch DataStudio. When DataStudio asks what you would like to do, select "Open Activity."

c. Navigate to and open your saved Ohm, Ohm on the Digital Range data file (X PhyzMac X / Student Work / Teachername / Periodname / X.yy Ohm on the Range PG).

d. From the File menu, select "Save Activity As..." and rename the file "X.yy Jewel of Joule PG," Where X is the level of physics, yy is the two-digit unit number, P is the period, and G is the group letter. For example, "2.08 Jewel of Joule 3C."

e. Delete the data set corresponding to the mini lightbulb.

f. i. Delete the graph window.
ii. From the Data window, delete the Voltage vs. Current data, and all Linear Fits.

2. CALCULATE THE POWER

a. From the main toolbar, click the "Calculate" button. If the Calculate button is not visible, ask the instructor for assistance. A new Calculator window should appear.

b. In the equation field, delete "y = x" and type in "Power = I*V" (without the quotation marks).

c. Click the "Accept" button. Below the equation field, DataStudio will ask you to "Please define variable I" and to "Please define variable V."

d. i. Define "I" as the Data measurement of Current (A).
ii. Define "V" as the Data measurement of Voltage (V).

f. Click the "Properties" button.
i. In the Label field, change "Y" to "Power."
ii. In the Units field, type "W" (without the quotation marks).

g. Approve the settings and close the Calculation window.

3. POWER VS. CURRENT PLOT

a. Create a new graph of Power vs. Time.

b. i. Change the Power vs. Time graph to a Power vs. Current graph.
ii. Under the Graph heading of the Displays window, change the name of the graph from "Graph" to "Power vs. Current."
iii. From among the graph tools, use the Settings Tool to deselect "Connected Lines" or "Connected Data Points" for each plot. Resave the file.

c. i. Fit each curve to a Quadratic function then resave the file.
ii. Recall that a quadratic takes the form $y = Ax^2 + Bx^1 + Cx^0$. Given that this is a P vs. I graph, not a y vs. x graph, rewrite the quadratic function using P and I instead of y and x (you may still use A, B, and C).

d. What do you notice about the values of variables B and C?

e. Simplify the quadratic expression you wrote in step 3.c. above, taking into account your finding in step 3.d.

f. The resistance of the resistor is "hidden" in the function of its P vs. I plot. Where is it?

g. Rewrite the equation you wrote in step 3.e., taking into account your finding in step 3.f.

4. POWER VS. VOLTAGE PLOT

a. Create a new graph of Power vs. Time in a new window (not tiled with the previous graph).

b. i. Change the Power vs. Time graph to a Power vs. Voltage graph.
ii. Under the Graph heading of the Displays window, change the name of the graph from "Graph" to "Power vs. Voltage."
iii. From among the graph tools, use the Settings Tool to deselect "Connected Lines" or "Connected Data Points" for each plot. Resave the file.

c. i. Fit each curve to a Quadratic function then resave the file.
ii. Write the quadratic function using P and V (you may still use A, B, and C).

d. What do you notice about the values of variables B and C?

e. Simplify the quadratic expression you wrote in step 4.c. above, taking into account your finding in step 4.d.

f. The resistance of the resistor is "hidden" in the function of its P vs. V plot. Where is it?

g. Rewrite the equation you wrote in step 4.e., taking into account your finding in step 4.f.