In this online simulation, you will create standing waves in both open and closed tubes.

The purpose of this lab will be two-fold:

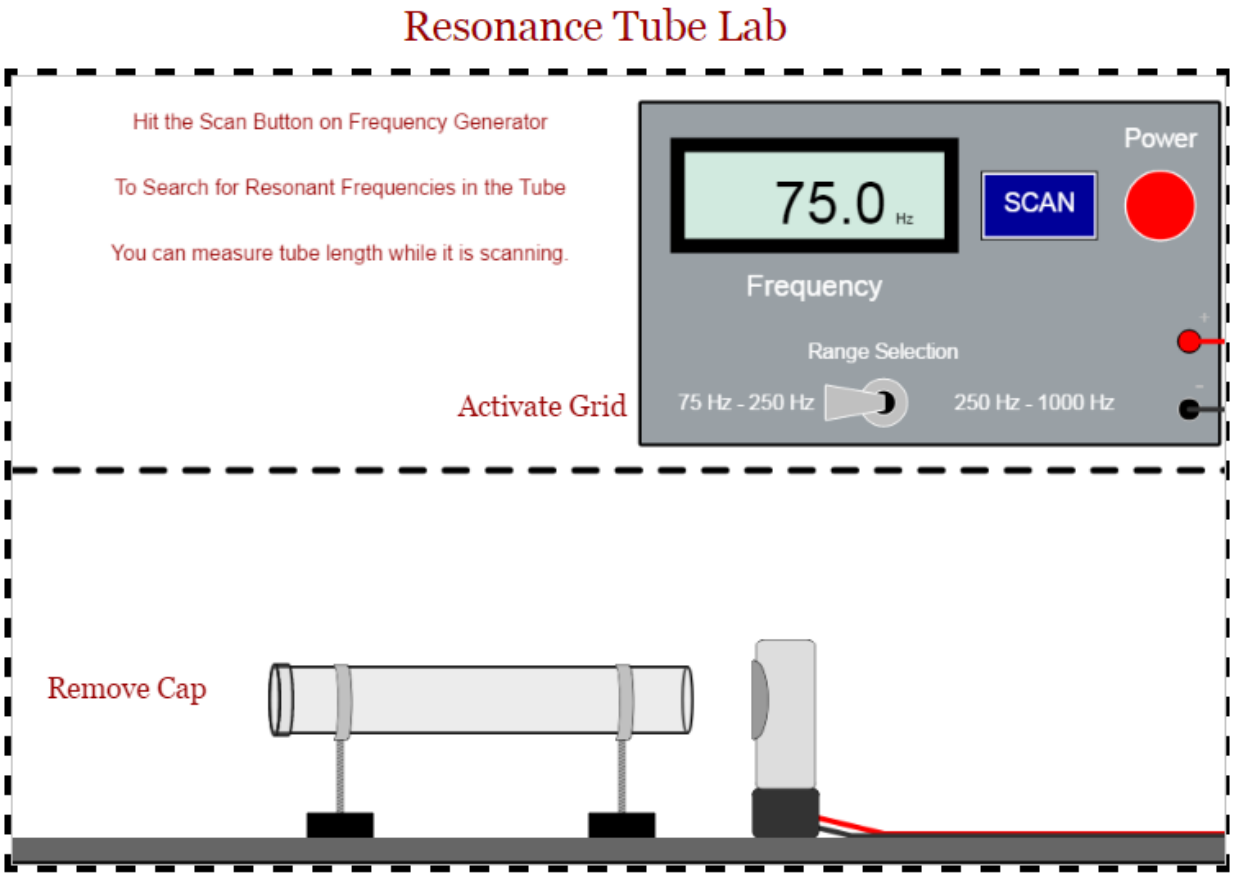
First, students will determine a mathematical relationship between the length of the tube and the fundamental frequency of the standing wave in that tube. They will do this for both open and closed tubes.

Second, students will make predictions about higher harmonics and use the simulator to collect data to verify their predictions. Again, this purpose will be determined for both open and closed tubes.

The lab simulator to be used:
http://www.thephysicsaviary.com/Physics/Programs/Labs/ResonanceTubeLab/index.html

The Physics Aviary>>>Lab Simulations>>>Oscillations (Waves and Optics)>>>Resonance Tubes>>>Begin

At this point, your screen should look like the image below. Click "Activate Grid" so you can measure the length of your tube.



You can scan for the fundamental frequency by pressing the scan button. You may have to change the range selection to the 250 Hz – 1000 Hz position. When a standing wave is found, you will see it appear in the tube. The default setting for the tube is as a "Closed Tube". You can change this to an "Open Tube" by clicking the text that says, "Remove Cap".

1. Perform an experiment that will allow you to compare the length of the tube to the fundamental frequency for a CLOSED TUBE.

A) Identify the variables to be tested and controlled in the space below:

IV:

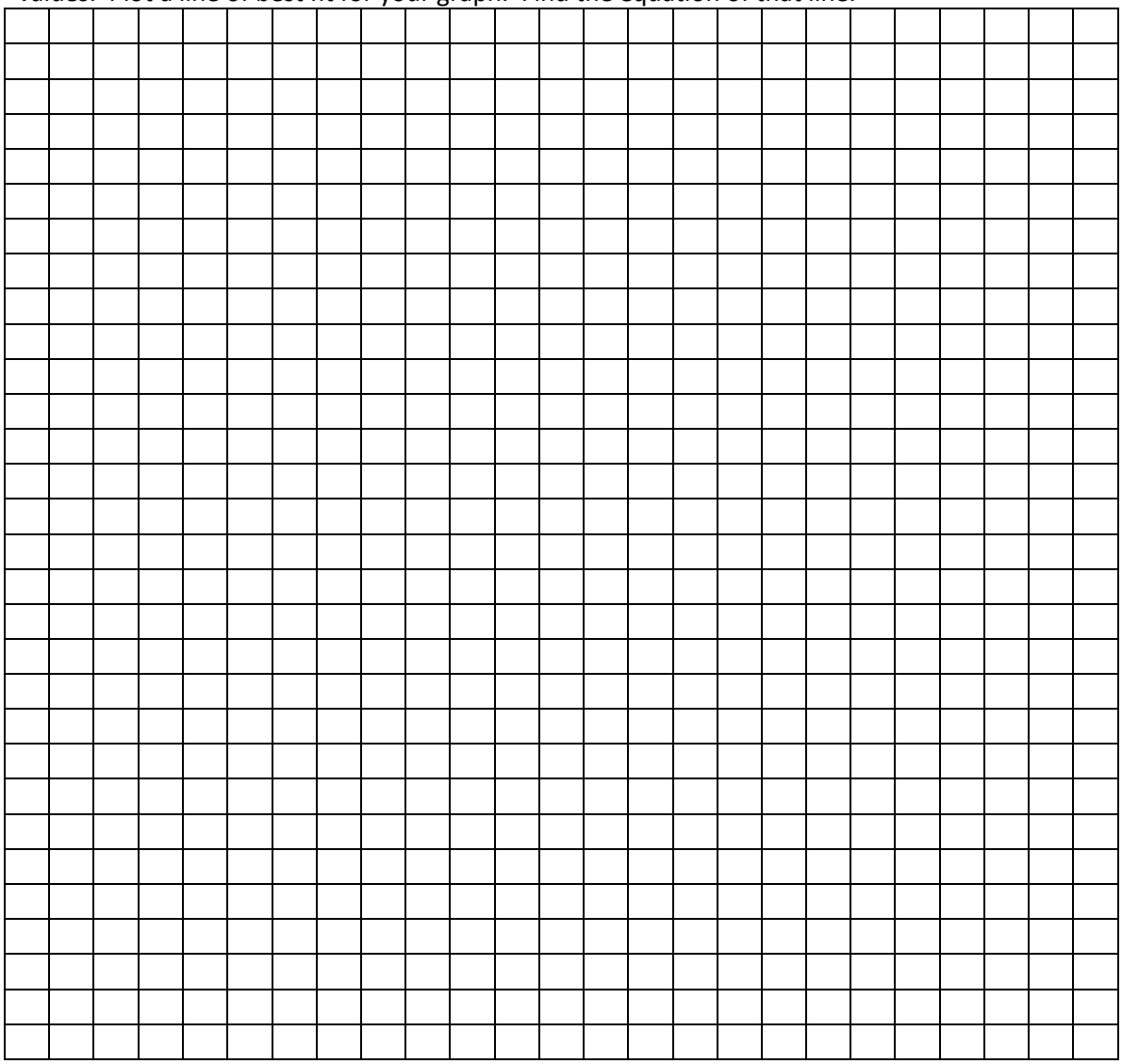
DV:

Controlled Variables:

B) Describe the process you will use for this experiment in the space below:

C) Create a data table of your independent and dependent variables:

D) Create a graph of your variables below. Be sure to label your axes with titles, variables, and values. Plot a line of best fit for your graph. Find the equation of that line.



E) Use the graph you have created to explain the relationship between the length of the tube and the fundamental frequency of the tube for CLOSED TUBES.

2. Perform an experiment that will allow you to compare the length of the tube to the fundamental frequency for an OPEN TUBE. (Select "Remove Cap.")

A) Identify the variables to be tested and controlled in the space below:

IV:

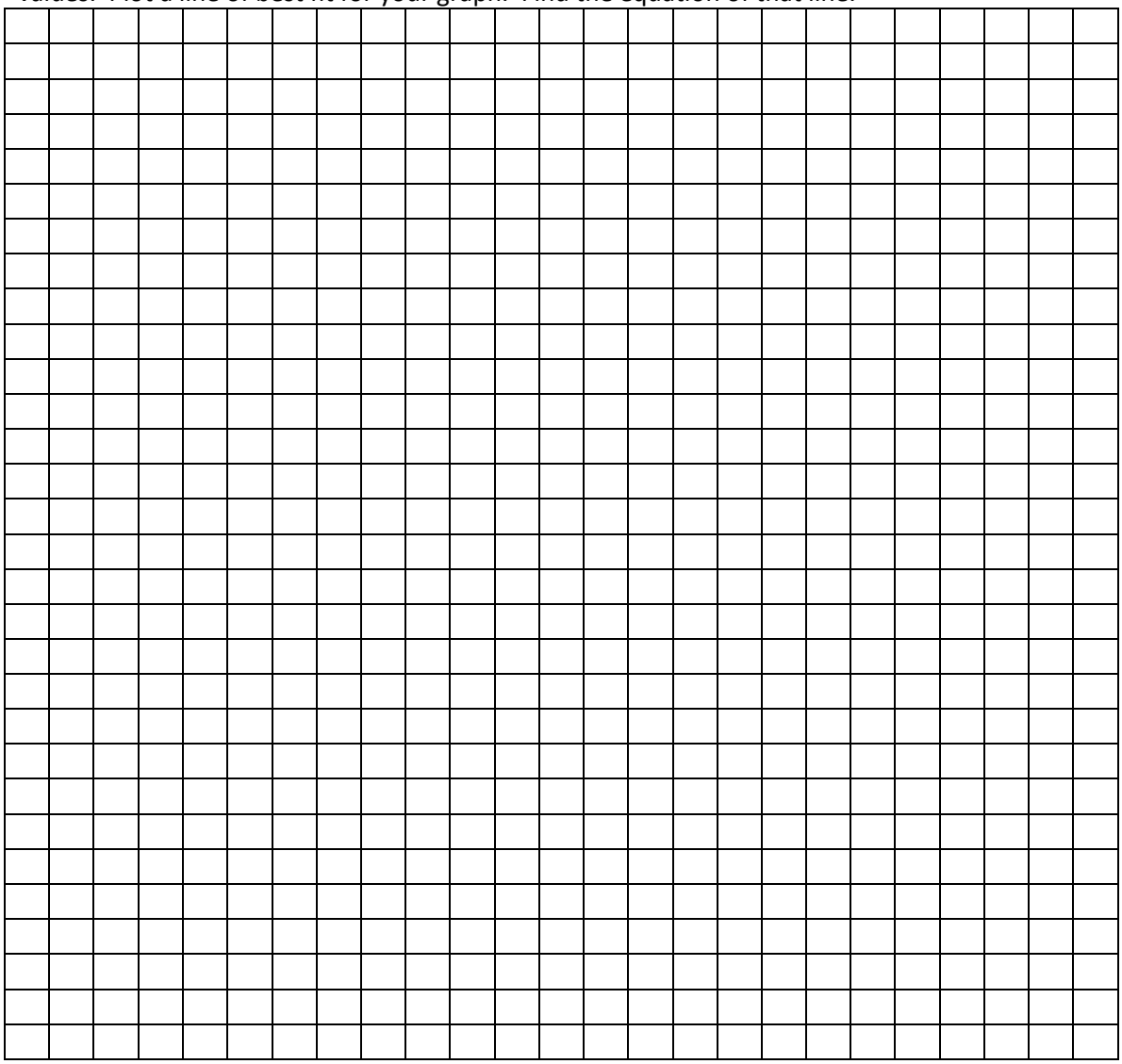
DV:

Controlled Variables:

B) Describe the process you will use for this experiment in the space below:

C) Create a data table of your independent and dependent variables:

D) Create a graph of your variables below. Be sure to label your axes with titles, variables, and values. Plot a line of best fit for your graph. Find the equation of that line.



E) Use the graph you have created to explain the relationship between the length of the tube and the fundamental frequency of the tube for OPEN TUBES.

3. In the space below, summarize your experiment, including the results you have determined regarding OPEN and CLOSED Tubes and the relationship between their lengths and fundamental frequencies. How do you know the information you found was regarding the fundamental frequencies (as opposed to some other harmonic)? How were the graphs relevant to making these conclusions? Do your conclusions correspond to the information in the notes? Explain why or why not.

4. Use the simulation to find as many harmonics as you can for each tube length you tested earlier, both closed and open. Identify which harmonic(s) you have found for each length of tube, what frequency they occur at, and how these frequencies correspond to the fundamental frequency for the open or closed tube of that length. Create a data table to organize all of this information in the space below.