Iona Physics Experiment
Title: Exploring the acceleration function in Phyphox

Br. R.W.Harris

Introduction: It is important to be aware of the limits placed on our measurements by the instruments we are using. For example, using a standard meter stick you can measure to the nearest millimeter if you are careful. However you cannot measure much more accurately than that given the limitations of the stick and your eyes.
Even more complex instruments (like those employed by your phone) have limitations.

In this experiment we will explore the limitations placed on our measurement of acceleration by the detector in our phone.

First, different phones will have different kinds of detectors, and they will present their results to the operating system in different ways. Therefore, different students will probably come up with different answers, depending upon the model phone they are using.

That having been said, set up Phyphox to measure acceleration. Right here is where we will note a difference. Some phones will have only "Acceleration with g" and others will have that, as well as "Acceleration without g." The reason for the discrepancy is how the measurement is made. My phone has only the "Acceleration with g" so that is what we will use.

Procedure:

1. Choose the "Acceleration with g" function of Phyphox.
2. Place the phone flat on a table or desk so that you can move it in the direction you have already determined to be the x-axis of your phone.
3. Use the GRAPH tab.
4. Start collecting data. Stop collecting data after a couple of seconds and examine the traces. *Question 1: Do the three traces (x,y,z) make perfectly straight lines, or do they "jiggle around"?* -- If they jiggle around, it is not completely clear whether there actually is a slight acceleration (the table could be trembling because of a truck moving on the street outside, for example) or whether it is what we would call noise in the signal (like static in a radio signal). In any case, we need to know that the measurement is complicated.
5. Before you answer this question, note the scales on the sides of the three graphs. They are not necessarily the same! For example, one scale might vary from +1 to -1 and another might vary from +10 to -10. *Question 2: Which of the three signals (x,y,z) has*

the greatest variation (top to bottom) or do they have pretty much the same variation when there is no discernable disturbance?

6. Clear the data.
7. Start collecting data again.
8. Now strike the desk vertically with your closed fist about 6 inches away from the phone and observe how it reacts. Stop collecting data.
9. *Question 3: When you struck the table vertically, which of the three signals has the greatest variation (top of trace to bottom of trace) or do they have essentially the same variation?*
10. Clear the data
11. Start collecting data again.
12. Now strike the desk horizontally a few inches away from the phone and parallel to the direction you have identified as the x direction of your phone. *Question4: When you strike the table horizontally parallel to the x direction, which of the three signals has the greatest variation, or do they have essentially the same variation?* Stop collecting data.
13. Clear the data.
14. Start Collecting data.
15. Now strike the desk horizontally a few inches away from the phone and parallel to the direction you have identified as the Y direction of your phone. *Question5: When you strike the table horizontally parallel to the Y direction, which of the three signals has the greatest variation, or do they have essentially the same variation?* Stop collecting data.

Lab Report:

1. Answer these questions in complete sentences.
   Question 1: When the phone is at rest, do the three traces (x,y,z) make perfectly straight lines, or do they "jiggle around"?

   Question 2. Which of the three signals (x,y,z) has the greatest variation (top to bottom) or do they have pretty much the same variation when there is no discernable disturbance?

   Question 3: When you struck the table vertically, which of the three signals has the greatest variation (top of trace to bottom of trace) or do they have essentially the same variation?

   Question4: When you strike the table horizontally parallel to the x direction, which of the three signals has the greatest variation, or do they have essentially the same variation?

   Question5: When you strike the table horizontally parallel to the Y direction, which of the three signals has the greatest variation, or do they have essentially the same variation?

2. Write at least one paragraph explaining what you learned about measuring acceleration in this way