g-Force App Lab:

Name: _____

Date: _____

Your Smartphone Can Do Physics!

To explore the power of your phone, here's a simple physics experiment you can do at your local park. Simply by swinging on a swing and collecting a bit of data, you can measure the length of the swing without ever pulling out a ruler.

1. To get started, download the free g-Force Recorder app. Open it up and play around with it. Click the play button and the phone will start tracking acceleration over time. To stop recording, click the stop button again. Practice, practice and practice to get consistent readings.

2. Find a swing. (If it is too cold outside to find a swing, you can improvise by finding a bucket with strong string so you can hold it suspended from the string and "swing" it back and forth without breaking the string. Try spinning it all the way around to test the strength of the string. If it breaks, get a stronger string. The bucket needs to be deep enough to support your phone along the wall of the bucket.

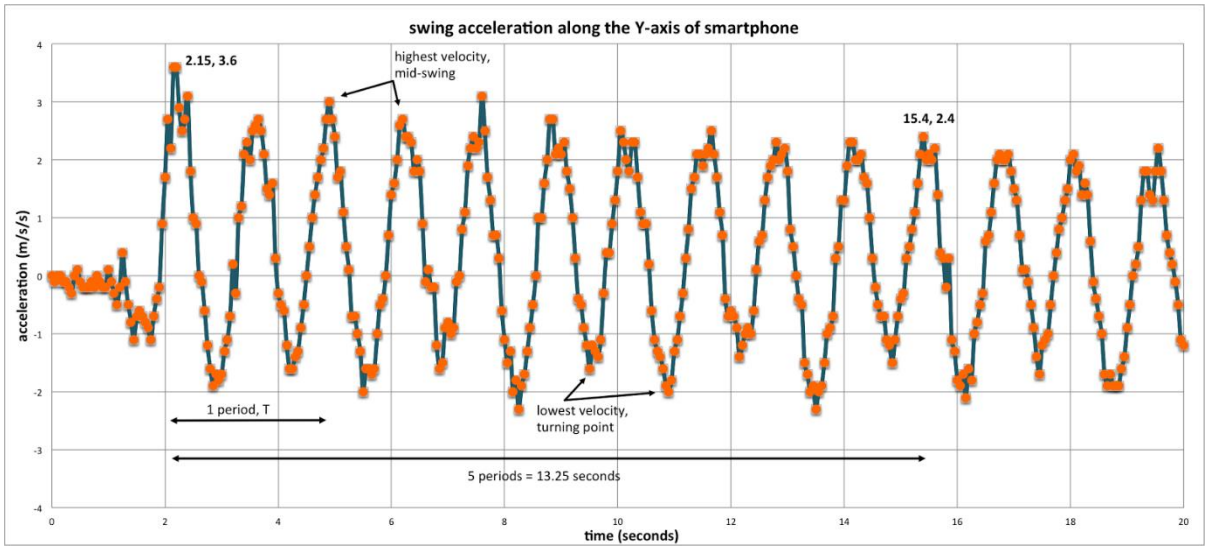
3. Fix your phone to the swing chain with tape or hold it really still against your chest in *portrait orientation* with the screen facing your body. You want portrait orientation in order to measure the acceleration along the direction of the swing chains. This will tell us how the centripetal acceleration also the Centripetal Force (g-Force) from the tension in the chains changes as you swing. If you don't have a swing available, use the bucket and tape or secure the phone vertically along the wall of the bucket. Make sure it is strapped in tight but you still have access to the screen to turn on the app.

4. Start swinging on the playground swing, without moving your legs or twisting your body. Collect data for about 20 seconds. If the swing is not available, duplicate this motion with the bucket and swing by securing the phone inside the bucket. Now turn on the app, and slowly begin swinging the bucket back and forth like you would on a swing set. Don't go all the way around (unless you dare) as the phone might come loose and fall out.

5. Stop recording and have a look at your lovely sinusoidal graph (see below for an example). Below are the first 20 seconds of my swing, plotting the centripetal (Y-axis) acceleration against time. You can immediately see the sine wave pattern of the swing, and the fact that the height of the peaks is decreasing over time. This is due to the swing slowing down due to some friction. Note the peaks are with higher g-Forces. And the valleys are near Zero g-Forces. Draw your graph in the graph provided (Graph 1) and label on the graph Maximum g's, zero g's.

Draw a picture (below the graphs) of what you were doing, swinging on a swing, or rotating a bucket. Show points where you feel zero g's and maximum g's, if you were in the bucket or on the swing.

(Graph 1)



Picture of your experiment:

Ideas for future experiments using this idea of discovering g-Forces. Come up with two other activities to measure g-Forces with your cell phone. Explain what you would do in each activity.

Activities:

1.

2.

Questions:

1. Describe what is a “g-Force”.

2. In the picture below of a rollercoaster, describe where the g-Forces are the greatest and the least. Imagine you are on the rollercoaster, describe what you might feel at each of the points (1.-6.) in relation to g-Forces.

1.

2.

3.

4.

5.

6.