Oaks Park

This assignment is like a final lab practical for this class. You are to complete a group research project and present it to the rest of the class. The presentation should be slides and will be presented to the class. Your peers and I will grade it. You will be working in groups of 3-4 – but we need to make sure that no class has more than 8 or so presentations, so we may have to adjust if there are more than 32 people in a class.

We will gather our data at Oaks Park – and we will spend some time the week of the Oaks Park field trip planning our data acquisition. As a class, we will try to gather data on **all** the rides, and as a group you need to investigate in some depth **3** rides. For the 3 rides your group chooses - you must choose:

>   **1: Vertical Circle ride**,
>   **1: Linear Acceleration ride**, and
>   **1: Energy or Wildcard ride.**

The Rides

Vertical Circle:	Linear Acceleration:	Energy Rides:
Ferris Wheel - Easy	Frog Hopper - Easy vertical	Big Pink Slide - Easy
Rock-O-Plane - Easy	Tree Top Drop - Easy vertical	Adrenaline Peak – Moderate
Zero Gravity - Moderate	Spider - Challenging vertical	Zoom Coaster - Easy
AtmosFEAR - Challenging	Scrambler - Challenging horizontal	

Wildcard:
Herschell-Spillman Carousel - Easy
Disk 'O - Challenging
Rock & Roll - Challenging
Go-Karts - Challenging
Bumper Cars - Challenging
Any ride with a unique analysis of your own.

Software: You will want to download the app *phyphox*. This app lets you gather acceleration data in three directions simultaneously, and share the data with Google apps, either by emailing a file to yourself, or possibly through Google drive integration. You can also save data to your Chrome downloads folder on your phone if your service is spotty.

The Lab: Your goal in the presentation is to compare the acceleration data from *phyphox* to calculations of the acceleration using either centripetal acceleration formulas, or video analysis on LoggerPro on one of the PCs or Macs we have. (You can also use the Video Analysis web app from Vernier) You should be able to interpret your graph and be able to compare the graph data you have from your Smartphone to your calculations. I have help videos to help you with this if you need them.

For each ride you could have literally three slides - Photos/Background, Calculations, and Graphs. Do not read words off the slides to us, rather put notes to yourself on notecards, and practice what you are going to say. Plan for your whole group to take about 10 minutes total for all three rides.

Take photos of the ride for your presentation, (Preferably of a team member on the ride!) and have a team member research the ride. For showing your calculations, I think the easiest thing is to write the calculations neatly on paper, and take a photo. (unless you want to figure out the equations editor in Google Docs and screenshot it into your slides) Show the formula you are using, list the quantities you are plugging in, and then show numbers in that formula. For the Linear Acceleration or Energy ride calculation slide put a screen shot of your video analysis with your formula visible.

For the graphs we will use the Chromebook app called Graphical Analysis or Google Sheets if you are more comfortable with that.

Required slides:

Vertical Circle ride:	Linear Acceleration ride:	Wildcard ride:
• Background info/Photos • Calculations of centripetal acceleration • Graph of data.	• Background info/Photos • Screenshot of Video Analysis with your formula showing • Graph of data.	• Background info/Photos • What your investigation is • What your results are

Energy ride:
• Background info/Photos • Calculations of the velocity at different points • Screenshots of the video analysis at those points with your formula showing

Using *phyphox*:

1. Run the app, and under Raw Sensors choose either Acceleration (without g) to ignore gravity, or Acceleration with g (Which I prefer personally). If it is in "Acceleration with g" mode, and you hold the screen vertically, the y axis will read 9.8 m/s/s, and the "without" mode will ignore gravity and read 0.0 m/s/s. Try both and decide which makes the most sense to you.
2. Try accelerating in each of the three directions indicated by the diagram to the right. Practice interpreting the graph you see on the screen. The x and y axes are intuitive to me, but the z axis seems backwards a bit.
3. Press "Pause" when you are done collecting data, either hit "Trash" to get rid of the data, or hit the three dots at the top right, and choose "Export Data". The most straightforward format to export to Google Drive is "Excel" IMO. I think the best thing to do is to email yourself an "Excel" file, that way you can include a subject line where you can identify the ride the data is for. On iOS I was able to "Save to Files", choose Chrome, and then in Chrome>Downloads I was able to rename the file, and export it, so if your service is spotty that could be a plan.
4. ***phyphox*** does not work on a locked screen, so adjust your phone settings so your phone does not Auto-Lock (iOS: Settings > Display & Brightness > Auto-Lock > Never), and hold it in your hand being careful not to hit the "Stop" button until you want it to stop. On rides like Adrenaline Peak where they don't let you hold anything in your hands, have it running in your pocket with the screen away from your skin (Or cut out a piece of cardboard to cover the screen so you don't butt dial it.)
5. Keep the phone oriented in the same direction on the ride, and make sure you note which way the phone was oriented as you rode the ride. <u>This should be part of your data table.</u>
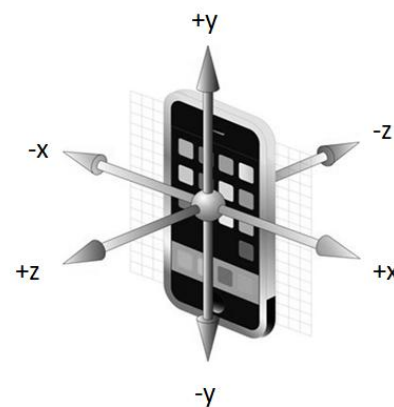
Videos:

1. If there is something in a video whose size we know, (like a meter stick), we can derive motion data. Go to the website, and look up what the distance reference is for your video. You may need to make your own reference and just put it in your video. (Especially for the Big Pink Slide) Make sure that you also capture your distance reference in your video. We already have quite a few good videos – so look at those before you go to Oaks Park.
2. For video analysis to work you need a steady unchanging framing of your shot. Use a tripod, or brace yourself against a sign or tree or stationary object, or just try to hold the phone stationary. Do the best you can.
3. You really only need to record the part of the ride you are analyzing. Make sure the video captures the motion that you are analyzing, and make sure the ride is up to full speed.

Data Gathering:

<u>Vertical Circle Rides:</u>
1. Ride the ride with the ***phyphox*** app running. (See directions above)
2. Time the period (Time to go around once) of the ride using your stopwatch app.
3. Get the radius (in meters) of the ride off the Physics Website
4. If you are doing the AtmosFEAR, get a **video** of the middle of the ride where the pendulum swing is the highest.

<u>Linear Acceleration Rides:</u>
1. Ride the ride with the ***phyphox*** app running. (See directions above)
2. Look up a distance reference to use from the website
3. Take a **video** of the ride. Be sure to capture the motion causing the acceleration.

<u>Energy Rides</u>
1. Take wide angle photos of the ride from 2 or 3 different perspectives. We are going to analyze these to determine the height of the ride at those points.
2. Take a **video** of the ride for one complete ride. You may want to take several videos to capture different angles. We are trying to capture **how fast** the ride is going for calculating kinetic energy.
3. Ride the ride with the ***phyphox*** app running (totally optional)

<u>Wildcard</u>
You design an investigation. You can do something creative with any of the rides. I have many ideas - and if you go to the Analysis website, I have videos with many ideas presented. You should make a clear plan before you go to Oaks Park, and you may want to pick several different Wildcard rides or ideas.

In General – One approach is to just write down all the known information prior to Oaks Park about their rides, and then measure everything you can think of when you are at the park. A carefully made data table made before you go really is the secret to success.