Teacher's Choice Workshop - January 24, 2015

Chaminade College Preparatory School 8:00 a.m. - noon
425 S. Lindbergh Blvd. St. Louis 63131
Chaminade Hall -- Room 301 Further Directions at end of this document
Breakfast refreshments will be available

Focus will be on five topics:

1. Using water pressure as an analogy for electric potential, resistance and current.
2. Introductory Linear Motion Video Analysis using two methods
3. Rotational Motion Lab Practicums/Demonstrations
4. Ladder Problem with force plates, video and real time data synch.
5. Pasco Capstone software overview (Replacement to Pasco DataStudio)

Additional Details:

Electricity --- Rex Rice and Gabe de la Paz -- from Clayton High School

Rex and Gabe will be presenting a series of demonstrations that are used with ninth graders to teach about electric potential, resistance, and current.

First it is established that water pressure can easily be determined at a point in a container based on visualizing the height of the water above that point.

Then, using containers of various heights and diameters in combination with openings and tubes of different lengths and diameters, important concepts will be illustrated about why electrical charge moves and the factors that affect the rate of that movement.

Video Analysis --- Ryan King and Lee Johnson -- from Parkway Central

Two activities introducing motion analysis with video:

1. Using Quicktime, a smartphone, and a transparency, complete video analysis of a hover puck moving at a constant velocity. This activity will introduce the idea behind video analysis done on Vernier and the idea of scaling.
2. Use an iphone and Vernier software to complete video analysis of a hoverpuck accelerating down an inclined plane. This will introduce Vernier video analysis.

Each of these activities is meant to be a culminating lab experience to their respective units. A post-lab analysis template for use by honors freshman based on the claim, evidence, and reasoning model will be shared. We will also talk through how we introduce these labs and the type of activities students would have completed prior to them working through the lab.

Rotational Motion Lab Practicums/Demos --- Keith Henderson

1) CUP ON ROLLING WHEEL
Determine the minimum linear rolling speed required for the wheel in order for the marble to remain in the cup. (How much time should you allow for rolling it 3m?

2) CUP ON STATIONARY WHEEL
Determine the minimum number of rev/min required for the wheel in order for the marble to remain in the cup.

3) BALL and WASHERS
Determine the speed (rev/min) and angle below horizontal for the hand-spun ball balanced by washers.

4) MOTORIZED APPARATUS (or turntable) with friction
Determine the critical rotational speed at which the block will fly off the track.

5) MOTORIZED APPARATUS (or turntable) with lip
Determine the critical rotational speed at which the block will fly off the track. Notice that the block rotates about one corner as it flies.

6) LOOP the LOOP PENDULUM
Determine the maximum distance from the wall for releasing a pendulum that will successfully wrap around the faucet with no slack.

7) PAPER-BREAKING PENDULUM
Determine the minimum height above the floor for releasing a pendulum that will break a loop of paper during the swing.

Keith's discussion:

5-7 are my favorites, but they're all creative takes on $F=mv^2/r$, with the integral use of other concepts like friction, torque, converting rotational to linear quantities, etc.
I like them because

1. They're all real-world applications of theory
2. You have to break a complicated situation down into simple parts to analyze
3. You have to decide what to measure
4. You can easily see if your calculated results hold up
5. Error range is addressed explicitly
6. Students engage in group discussion
7. Students have to explain their thinking to me
8. Students start out unsure what to do, but finish up by being successful and feeling competent!

When I last did this with a class, I had groups of 3 choose any 4 of the stations around my large room and then show me:

• What values need to be measured on the setup? (is the top or middle the important point, etc.)

1 point earned by the group for determining the correct range (high-low) for each measured value.

• Show how you calculated the answer (Note: you don't get the lowest result, for instance, by just plugging all the lowest numbers into a formula!)

1 point for correctly determining the range (high-low) for each calculated value.

• Demonstrate with three trials that the calculated range is correct.

1 point for success! (Results consistent with prediction)

I did this over the course of 2 or 3 days, and gave almost everyone close to the full 12 points (which you could of course scale to any number —I just like using small numbers myself) I also had one extra station that was simply three challenging "book" problems for those students who would like a break from hands-on all the time!

Mike Johns - from Chaminade - Rotational Equilibrium and Pasco Capstone

1. Classic Ladder Problem in Rotational Equilibrium: Using a homebuilt ladder assembly, a 2-d force plate, a 1-d force plate, and Pasco Capstone software with a webcam, real time data is taken along with video synch'd with a person climbing a ladder against a wall. This is done as a class activity/demo with students in small whiteboard groups starting with free body diagrams in static, then with a student standing mid-ladder, then the student climbing the ladder, analyzing the changes as he/she moves to top. Following student discussion, the actual data collection is done with video, then before the students see them, they predict what the three Force vs. Time graphs are: Floor Normal, Floor Friction, and Wall Normal
2. Pasco Capstone and SparkVue Overview:

a. Pasco DataStudio was introduced about 16 years ago as a following on to their older ScienceWorkshop computer data collection system. DataStudio was superseded by Capstone two years ago. A short overview will be presented of Capstone's features and capabilities. If you have been using Pasco sensors and probes with DataStudio it is an easy transition to Capstone with DataStudio files directly importing into Capstone, plus it has Video analysis capability.
b. Also, to work into the smartphone and ipad future with easy sharing of data, Pasco has SparkVue software with associated apps that also work on PC and Pasco hand held devices.

Directions:
Chaminade College Preparatory School
425 S. Lindbergh Blvd.
St. Louis, MO 63131

On the west side of Lindbergh between Ladue Road and I-64

Park in front of Chaminade Hall which is the main, 4 story, older building. Come up the main front steps into the front door on the first floor. Go left (south) in the main hallway, then on the right is a stairwell to go up to the third floor. Room 301 is to the right at the top of the stairs. There is also an elevator to the right after you get in the main, first floor hallway. Mike Johns cell is 314-954-6724.