Unit 4 Homework Problems

- *Complete HOMEWORK FOR UNIT* 4: *CHANGING MOTION II,* a .pdf file included on the homework web page with this assignment.

4-1)   Three digital movies depicting the motions of **four** single objects have been selected for you to examine using the Logger Pro Software. They are as follows:

     PASCO 004: A cart moves on the top track while another moves on the bottom track below. (Ignore the cart on the middle track.)
     PASCO 153: A metal ball attached to a string swings gently.
     DSON002: The Cedar Point Amusement Park Demon Drop Cage with 4 people in it slows down on a horizontal track and almost comes to rest.

     Please examine the horizontal motion of each object carefully by viewing the digital movies using the Logger Pro files. In other words just examine the motion in the *x*-direction (and ignore any slight motions in the *y*-direction). You may use the Logger Pro software and a spreadsheet to analyze the motion in more detail if needed. Based on what you have learned so far, there is more than one analysis method that can be used to answer the questions that follow.

(a)   Which of these four objects (PASCO 004–top cart, PASCO 004–bottom cart, PASCO 153–metal ball, or DSON 002–cage), if any, move at a constant horizontal velocity? Cite the **evidence** for your conclusions.

(b)   Which of these four objects, if any, move at a constant, non-zero, horizontal acceleration? Cite the **evidence** for your conclusions.

(c)   Which of these four objects, if any, move at neither a constant horizontal velocity or acceleration? Cite the **evidence** for your conclusions.

(d)   The kinematic equations are very useful for describing motions. Which one of the four motions cannot be described using the kinematic equations? Explain the reasons for your answer.

4-2)   Problem 4.7.1 from the Activity Guide.

(a)   Watch the movie first without opening it in Logger Pro. If you do watch the movie using Logger Pro, you will want to quit Logger Pro and reopen it for parts (b) – (d) below.

(b)   I have already set the origin and the scale for you. Change either one of them at your own peril.

(c)   The video opens in Logger Pro at the frame where John Young just leaves the ground (frame 240, $t = 8.0$ s). Collect data from frames 240 through 279 ($t = 8.0$ s to $t = 9.3$ s). I highly recommend collecting data by clicking on the dark stripe on the astronaut's right leg – the position vs. time graph is scaled for data collected at that location. Clicking on the very right edge of the dark stripe for each frame will give you consistent data.

(d)   Please do a manual curve fit using the Excel Modeling Worksheet, like we did in section 4.5 of the Activity Guide. Since we started data collection at $t = 8.0$ s, you will want to enter "8.0" in cell B4 for t_1.

4-3)   Problem 4.7.2 from the Activity Guide.