Lesson plan *Forces and Motion* activity 2: Graphing position, velocity, acceleration and force http://phet.colorado.edu 90 minutes (uses *Moving Man* too)

Learning Goals:
Students will be able to:

- Use free body diagrams to draw position, velocity, acceleration and force graphs and vice versa
- Explain how the graphs relate to one another.
- Given a scenario or a graph, sketch all four graphs

Background:
We will have done the *Forces and Motion* activity "How do external forces effect speed and direction?" and the *Moving man* activity. So the students are familiar with *Forces and Motion, free body diagrams* and relating position, velocity and acceleration graphs. Also, we will have done the *Moving Man* activity.

*Forces and Motion* Introduction:
I'll remind them that when using *Moving Man*: Using the sliders makes for more smooth graphs; it is handy to *Pause* before changing conditions; *Playback* is a great analysis tool.

I'll open *Forces and Motion* and point to the same tools, plus I think it's easier to look at the vectors that appear right on the object because they are larger. Matching motion graphs is more difficult than with *Moving Man* because the students have to use force to change the motion.

I want to remember: The little guy is just an agent of change; he's supposed to help the students' see that an applied force comes from some action like a person pushing. He is not a clickable object. There are three ways to apply a force: the slider on the left, click & drag the object, or use the free body diagram box. *I think it might be easier to have just the position and force graphs open as you are trying to match a story.*

Lesson:
For my class, it seems easier to have them copy and paste the graphs because then they can control the size. Have the students use the lab sheet for guidance. The activity is expected to take my honors physics students about 50minutes.

Post lesson: I will use the clicker questions that are on the document called *Forces and Motion* activity clicker questions