COMPILATION: Unit 1 - free fall lab (in suite of labs)

Date: Sat, 22 Sep 2001 21:07:56 -1000
From: gheri fouts <gfouts@PIXI.COM>

I am at another school in Honolulu this year and I am teaching the modeling physics to freshmen! I find this very interesting, and I am so glad that I had Rex Rice as a mentor. I savored his advice about how much to give freshmen and it seems to be working, at least so far. My kids are mostly taking algebra right now with this physics course, and when we hit that acceleration lab, I could see that their poor math background was going to tie them up. I did just what the curriculum said and asked only for the x-t graph. With my juniors and seniors of previous years I was able to show them tangents and let them go all the way with it. But not with freshmen.

The freshmen all recognized the x-t graph was not a straight line and eventually surmised that the slope must be changing so the velocity must be changing. Well, that was enough for me! Then the next day I had GA on the TV screen (no computers at this school, except for the teacher computer), I took the tangents at various points and plotted them and the line was linear. That exercise becomes important because the next lab is to drop the picket fence thru a photogate and decide whether an object in free fall is accelerating or falling at a constant velocity.

This suite of labs is just fabulous, and every year I really appreciate the ease of presenting kinematics using these activities. The students are so proud of their newfound knowledge! Most of my freshmen are jumping out of their chairs on this free fall activity because they can recognize the model. There are a few who decided early that they wanted to memorize science and they are now finding themselves out of the loop, asking "how do you know that?" (which is supposed to be my line).

Date: Sat, 29 Sep 2001
From: Bob Baker <bob.baker@WORLDNET.ATT.NET>
Subject: Papertape free fall Lab

I like the paper tape lab when done with 1/60 s 120 V AC paper tape timers because the students instantly recognize the dots on the tape as a motion map. The paper tape lab follows the rail lab and development of xf = xi + vi t + 1/2 a t^2 from a graph. The mathematical representation obtained by the students in the paper tape lab is very close to x = 4.9 m/s/s t^2. After the students convert x = 4.9 m/s/s t^2 to x = 1/2 (9.8 m/s/s) t^2 , they recognize that acceleration in free fall must be 9.8 m/s/s.

Some groups perform the paper tape lab with 100 g masses and other groups perform the lab with 200 g masses which helps remove the misconception that heavier objects accelerate more in free fall.

Date: Mon, 8 Oct 2001
From: Kathleen Andre Harper
Subject: Re: How to model without money?

Brian Mears asked about developing free-fall model without having fancy computer equipment.

Do you have ticker-timers, or something of the like? As a college instructor for a fairly large class, we often have to take the introductory lab portions of the class and do them as a group in the big lecture hall. We used a sparker apparatus this year and got great results. We used this to develop constant acceleration and then talked about free-fall later. Just by looking at the dot intervals (which helps reinforce motion maps), the students can see that the velocity isn't constant.

We then took measurements every 6 dots or so and graphed position versus time, getting a very nice parabola. We computed average velocities over the time intervals (another nice review with some good discussion resulting) and plotted v vs. t. The graph turned out beautifully straight, with a tiny y-intercept, and a value just slightly under 9.8 m/s^2. The students were quick to realize that there were factors that made this number a little smaller than it probably ought to be. I was, on the whole, really happy with how this turned out.