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PH114-08

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Newton's Lawlz

Statement of Purpose:

Our group will observe the interaction of two carts in relation to their inertia, equal reactions and acceleration due to gravity. This will be achieved with an inclined track and crudely designed spring mechanism.

Introduction:

Our group completed this experiment because it was posed to us in lab. It may be assumed that the objective to the event was to incorporate Newton's three most well recognized laws of physics into mindless data collection for the benefit of posterity. The section of the experiment that pertained to Newton's first law incorporated setting a cart in motion and observing its velocity again further down the track. Secondly we looked at Newton's third law, not his second, and used a spring between two carts to see if they received equal initial and opposite force. Third, we observed the second by tilting the track and rolling the cart down it; a feat considerably more entertaining with hotwheels and jumps.

Equipment:

Carts, balance, photogate, track, ring stand, meter stick, blocks.

Procedure:

1. Turn on the computer and open Datastudio.
2. Open photogates for each of the two photogates.
3. Configure the photogates in Datastudio.
4. Level the track.
5. Place two photogates along the track.
6. Place a cart on the track.
7. Place picket fence on cart and adjust to 2cm gaps.
8. Roll the cart down the track such that it passes by both photogates.
9. Record the data.
10. Repeat the data recording two more times.
11. Get the cart with a plunger sticking out of it.
12. Attempt to 'cock' the plunger.
13. Keep trying.
14. You're not wasting your time, this is for science!
15. Randomly, the plunger will take and hold in a depressed position.
16. Place the two carts together at the middle of the track.
17. Adjust the photogates.
18. Begin recording data.
19. Gently push the plunger release to launch the carts.
20. Fuck, your finger messed up the way the two carts departed.
21. Repeat 11-20 until 20 does not apply.
22. Record data.
23. Repeat 11-22 two more times.
24. Incline the track. Measure h and d. Measure D.
25. Adjust photogates.
26. Begin recording.
27. Release the cart from the top of the track.
28. Stop recording and record data.
29. Repeat 26-29 two more times.
30. Add a mass block to the cart.
31. Repeat 26-30 two more times.
32. Finish data sheet.
33. Write report.

Data:

It's no amazing coincidence that we are not to use the default data sheets, I'm sure my elementary school teachers would scoff at such poor utilization of any choice of document editing tools, especially from a university class. But enough with the hard and true facts, let's look at numbers.

Newton's First Law (fig1):

Newton's Third Law:

(fig2):

(fig3):

Newton's Second Law:

D=.400m h=.0745m d=.393m =10.7°

m=.507kg (fig4):

m=1.07kg (fig5):

m=1.57kg (fig6):

Acceleration (fig7):

Force (fig8):

Analysis:

The data we collected in the first part of this experiment shows the relationship between a cart's speed and two locations. Through all three runs, the second velocity is lower than the first, in fact, no one V2 is higher than any other V1. This trend shows that the cart's velocity was not conserved with respect to the only force taken into account during the experiment. Possible sources for error include poor track design, poor cart design, human error in the launching of the cart, and error on behalf of the photogate and picket fence system. Next we placed two carts together and used a spring to propel them apart toward photogates. In no run did the two velocities match up, V2 being consistently and absolutely lower than V1. It's possible that the descrepancy is a result of the carts having different masses, this would allow the velocity differences to make much more sense. Oh, except that the momentums (fig 3) don't match either. This doesn't necessarily mean that Newton's third law is wrong, it just means that according to our experiment's data it doesn't exist. Possible sources of error include crappy spring loaded plunger design, human error on instigating the departure, track friction, et cetera et cetera. The final section of the experiment involved allowing a cart to roll down an inclined plane. The data from this section actually made a form of conventional sense, from the velocity data we can clearly see that the cart went under an acceleration during the descent and passed the second photogate with a higher velocity. Each set of runs with larger masses on the cart display a higher acceleration, which implies that the constant of gravity (g) for the planet *changed* between trials. By calculating the acceleration we can see that the averages of the acceleration increased from each consecutive run, albeit with a rather grievous exception in run 2. This would imply that gravity, does in fact, increase and pull harder on heavier items/people. Lastly, the chart for the average force in each trial shows a nice, nearly linear increase; this means that f=ma may actually be a real physics equation worth remembering, since the force shows an increase each time we increase m and a magically increases as well.

Conclusion:

In our experiment we discovered the relation between ~~this lab and the cost of tuition~~ the stated laws of Newtonian physics and lossy, real examples. Newton's first and third laws do not match the data our group collected, and in the scope of the experiment appear to be false. Newton's third law does match, but only with the sneaking suspicion that *we used the fact that f=ma is true to calculate a and f*. As a result of this experiment, I conclude that I can no longer trust this institution to teach reliable and non contradictory information to its students.