Lab 12 – Pendula and Springs Worksheet.

1. Theoretically, how does the mass of the pendulum affect its period? Do your measurements for the period agree with theory? Explain any discrepancies that you observe.

In theory, the mass of the pendulum is not affected by the mass, rather the length of the string connecting the mass and the balancing beam thingy. Our measurements showed that there wasn’t any significant difference between the periods even though the mass of the pendulum differed from 7 grams to 70 grams, a 90% increase. So, yes, our measurements do agree with the theory. Possible discrepancies could arise from how we let go of the pendulum; the angle that we let go; whether we accidentally brushed it with our fingers to give some push, resistance, what not. Something that also may have affected our period was when we started taking count, would the data have differed if we started the stopwatch after the pendulum had completed one period compared to starting the stopwatch immediately after letting go of the pendulum.

1. Theoretically, how does the diameter of the pendulum bob affect its period? Do your measurements for the period agree with theory? You should think about how the diameter of the ball affects the length of the pendulum. Explain any discrepancies that you observe.

Theoretically, it should not have any effect. Again, similar to Question 1, the period of the pendulum is affected by the length of the string and not its mass or its diameter. With our measurements, we got some fairly consistent periods despite the diameter changing, this leads us to believe that the theory is correct and that our measurements agree with said theory. Perhaps the diameter does affect the period through air resistance, the larger the diameter, the bigger the ball, the more air resistance there is, however that kind of resistance for an object so small may almost be negligible.

1. Compare the two methods that you used to measure the spring constant of the springs. Which one gives more accurate results? Discuss the errors associated with each measurement technique.

The first method was taking the extended length of the spring and subtracting the equilibrium length measured initially. The second method was gently pulling on the spring that had a hanging mass of 50 grams attached, and letting it bounce up and down, measuring the force and using that to calculate the spring constant. Based on the data that we collected both methods gave pretty close results for the longer spring, having a difference of 0.07, while the shorter spring had a larger difference of 0.81. It’s a little difficult to know which method gave more accurate results as we were not given the spring constant, not to our knowledge, therefore we do not have any data to compare to. However, the second method may be more accurate as we are enlisting the help of software to measure the force whereas the first method we are simply relying on our eyesight and measuring capabilities. The second method may then be the one less riddled with errors compared to the first. Errors associated with the first method are mentioned above, we are fully reliant on our eyesight to measure the length of the spring accurately and precisely, both at equilibrium and at no extension. The second method’s errors may arise from the initial force exerted on the spring, not entirely sure if it will throw off the data too much, but conservation of energy may keep the force the same throughout the recorded period.

1. Why does the period of the pendulum not depend on the mass but the period of a mass on a spring does depend on the mass?

Two words: spring constant. The spring has it, the other regular string pendulum does not. In the spring, we have two forces acting on the mass: gravity and the spring constant and maybe the length of the spring; whereas the regular pendulum only has the force of gravity and its length to worry about.

1. Explain why it is better to measure many periods of the oscillations for both the pendulum and mass on the spring than measuring just one period.

It reduces inaccuracy in the long run by eliminating any single unusual occurrences. Taking the average value in the long run evens it out and removes any sources of potential errors.

1. Discuss any additional sources of errors in your measurements.

Sources of errors already mentioned:

* Angle of drop, tried to be as consistent as possible, but a little hard without a proper dropping mechanism.
* Removing external forces acting on the pendulum: Fingers brushing, slight gentle unintentional push, that kinda stuff.
* Inaccuracy with measuring using eyesight: We both wear glasses; our vision isn’t exactly 20/20. Tried to measure to the best of our ability but we may have been off by about ± 10 mm. Perhaps a digital measurement tool may have reduced this potential error.
* Timing: When did we start and stop the stopwatch may have had an effect on our measurements as we need to account for reflexes and reaction time. This is most likely ± 0.2 seconds perhaps.

Additional errors:

* Lack of sleep: user not functioning at max capability.

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