**PHYS 123, Lab 4 Questions**

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1. Answer the following questions using the data you acquired in this experiment:

(a) For the first experiment, create a data table for the different masses (M1, M2), the incline

angles, the velocities and accelerations obtained from the computer software, and the theoretical accelerations using Equation 3 of the lab manual.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| M1 (kg) | M2 (kg) | Height | Angle | Velocity | Acceleration (Theoretical) | Acceleration (Observed) |
| 0.005 | 0.21 | 0.05 | 2.349 | 0.27 | 0.5 | 0.47 |
| 0.005 | 0.21 | 0.05 | 2.349 | 0.27 | 0.5 | 0.47 |
| 0.005 | 0.21 | 0.05 | 2.349 | 0.27 | 0.5 | 0.46 |
| 0.005 | 0.21 | 0.075 | 3.525 | 0.43 | 0.74 | 0.73 |
| 0.005 | 0.21 | 0.075 | 3.525 | 0.43 | 0.74 | 0.73 |
| 0.005 | 0.21 | 0.075 | 3.525 | 0.43 | 0.74 | 0.72 |
| 0.005 | 0.21 | 0.1 | 4.702 | 0.51 | 0.98 | 0.9 |
| 0.005 | 0.21 | 0.1 | 4.702 | 0.52 | 0.98 | 0.9 |
| 0.005 | 0.21 | 0.1 | 4.702 | 0.52 | 0.98 | 0.9 |

(b) How do your measurements compare with the theoretical calculations? What are the sources of error?

*The measured values are very similar to theoretical values, but the actual acceleration is different due to the possibility of a frictional force that is acting opposite of the force of acceleration.*

(c) Make a graph of experimental acceleration (aexp) versus (M2 − M1sin(θ))/(M1 + M2). Explain the slope.



(d) Make a plot of your data that shows the inverse proportionality for the second experiment.

Briefly comment on the slope.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| M1 (kg) | M2 (kg) | Height | Angle | Velocity | Acceleration (Theoretical) | Acceleration (Observed) |
| 0.015 | 0.25 | 0.01 | 0.47 | 0.28 | 0.15 | 0.13 |
| 0.015 | 0.25 | 0.01 | 0.47 | 0.27 | 0.15 | 0.13 |
| 0.015 | 0.29 | 0.01 | 0.47 | 0.34 | 0.14 | 0.125 |
| 0.015 | 0.29 | 0.01 | 0.47 | 0.34 | 0.14 | 0.125 |

*The slope of the graph is negative, therefore the acceleration is inversely proportional to the mass on the object. As the mass of an object increases, the acceleration decreases.*

(e) Can friction truly be ignored in this experiment? Explain using your data.

*Friction shouldn’t be ignored, as it can still impact the acceleration. The inverse proportionality will still be seen, although not as accurately as during the experiment.*

2. Why is it important that the string connecting the masses be parallel with the air track?

*The string that connects the masses must be parallel to the air track as it may trip the photogate sensor as the mass passes through it, and it’s important that the force is applied parallel to the air track as to maintain an even normal force.*

3. In 1589 Galileo dropped two different masses from the Leaning Tower of Pisa and observed their time of flights to be independent of mass. How does Galileo’s freefall experiment relate to the second experiment if there was no applied force? How does the addition of an applied force change things?

*If there was no applied force, then there acceleration will be dependent only on gravity. Acceleration is found using Force/mass, and if there is no applied force, the acceleration will be the same regardless of the mass. If there is an applied force, now the equation factors it into the acceleration, and the acceleration would be inversely proportional to the mass.*