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PH114-08

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Conservation of Energy

Statement of Purpose:

Our group will observe the transformation of gravitational potential energy into kinetic energy via string and a pulley, and inspect the lossless nature of the system.

Introduction:

Our group used a contraption consisting of a horizontal track, pulley, cart, string, and weight. The cart is attached to the hanging weight by a string over the pulley, and is pulled along the track as the weight falls. This converts the gravitational energy of the weight into kinetic energy (and small rotational energies in the wheels) in the cart, propelling it along the track. Our team then measures the speed of the cart and uses it to compare the potential energy to the kinetic energy.

Equipment:

Track, cart, string, pulley, weights, photogates, datastudio, measuring stick.

Procedure:

1. Turn on the computer and open Datastudio
2. Check that the apparatus is correctly set up
3. Place photogates so that the cart passes them just after the weight hits the ground
4. Pull cart to back of track, measure distance to bottom of weight from the floor
5. Record distance
6. Start with 25g of weight hanging from the string
7. Release cart as datastudio is started and measure the final velocity of the cart.
8. Record the velocity and repeat 7 three more times
9. Repeat 7 and 8 again with 30g and 35g
10. Measure and record the mass of the cart and picket on it.

Data:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Hang Mass  (kg) | Height  (m) | ∆Energypotential  (J) | Velocity  (m/s) | ∆Energykinetic  (J) | % Difference |
| 0.025 | 0.531 | -0.130 | 0.61 | +0.1021 | 24.04% |
| 0.030 | 0.531 | -0.156 | 0.675 | +0.1262 | 21.12% |
| 0.035 | 0.531 | -0.182 | 0.739 | +0.1526 | 17.57% |

Masscart = 0.524kg

Energypotential = mgh

Energykinetic = .5(m+M)v2

Analysis:

The data we collected during the experiment shows the relationship between the potential energy of the weights and the kinetic energy of the car. By calculating the expected values for potential and kinetic energy, we can see that the two are similar enough given the inertia of the pulley, losses in the string, and friction in the system to be equally relatable to each other. This is supported by the diminishing trend of the differences, as the amount of potential energy increases, its translation into kinetic energy begins to overshadow the discussed losses. We can also see from the data that whenever the kinetic energy was gained, an equal or larger amount of potential energy was lost. This supports the idea that the two energies are inversely related; when one is lost, the other is gained.

Conclusion:

In our experiment we discovered the relation between energies and the nature of their conservation. In a system that incorporates vertical movement according to gravity of any sort, both energies are concerned and conserved.