Conservation of Energy

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March 5, 2013

Objective:

Determining the spring constant and studying the conservation of energy concept.

Theory:

The total amount of energy in an isolated system remains constant over time. In our lab we learned that the spring constant was consistent no matter how much weight was on the hanger.

Procedure:

First, we got the device set up and the hanger set. Then, we found and measured the equilibrium distance. After that, we did tests with different weight on the hanger and measured how far they hung from the equilibrium point, which was .061m; so that we could calculate the average spring constant of each weight.   
The next part of the lab we had the weight on the hanger and hung in from equilibrium and measured how far it dropped for the various weights doing each weight a few times to calculate the gravitational and spring potential energies.

Data:  
Determine the spring constant:

|  |  |  |  |
| --- | --- | --- | --- |
| m (kg) | x (m) | F | k |
| .05 | .089 | 0.49 | 5.51 |
| 0.1 | .179 | 0.98 | 5.47 |
| .15 | .268 | 1.47 | 5.49 |
| 0.2 | .358 | 1.96 | 5.47 |
| .22 | .393 | 2.16 | 5.50 |

Conservation of energy:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X₁ | X₂ | ΔPEg | ΔPEs | % of error |
| .04 | .654 | 1.20 | 1.17 | 2.53 |
| .08 | .619 | 1.06 | 1.03 | 2.87 |
| .12 | .594 | .929 | .929 | 0 |
| .16 | .549 | .762 | .757 | .658 |

Part 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X₁ | X₂ | ΔPEg | ΔPEs | % of error |
| .324 | .398 | .145 | .147 | 1.37 |
| .294 | .438 | .282 | .289 | 2.45 |
| .249 | .478 | .449 | .457 | 1.77 |
| .209 | .518 | .606 | .617 | 1.80 |

Formulas  
F = mg, F = kx  
ΔPEg = mg(X₂ - X₁)  
ΔPEs = (1/2) k (X₂² - X₁²)  
% difference = |A – B|/((A + B)/2)) \* 100

Results:

We found that the spring constant was consistent for all of the different weights on the hanger. Also, we found that the gravitational potential energy and the spring potential energy are very close in to each other and it shows that they work together on objects.

Error analysis:

Some of the errors I thought of were that; the measure stick was held at an angle so there wasn’t an accurate reading, the reading on the bounce might have been off my a couple millimeters, and that the hanger slightly hit the meter stick on some runs.

Conclusion:

I learned that the gravitational and spring potential constants work together and take the same amount of energy. I also learned that no matter how much weight is on the spring the spring will always keep the same spring constant until it gets stretched out or breaks.

References:

We only used each other as a reference.

Questions:

Do the data indicate that the mechanical energy is conserved for this system?  
Yes, because the potential energies for both the tests all were very close in value and it shows that energy is conserved.