Date of Lab_____ Date of Submission 1/8/2018

Laboratory Report

Title Conservation of Mechanical Energy

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Summary

We did two different types of experiments of mechanical movements, pendulum and spring. In the first experiment of pendulum, the sum of kinetic energy and potential energy at both highest and lowest points are the same. So, it can be said that mechanical energy is conserved.

In the second experiment of spring, potential energy of the spring was not ~~same as~~ very close to the kinetic energy of the weight. ~~So the experiment 2 is failed.~~ If the value of potential energy and kinetic energy is the same, mechanical energy is conserved.

・Meet a deadline ・Write logically ・Write clearly ・Write with your own words

Teacher's Comments
Good summary Beautiful tables and graphs

1	2	3	4	5	6	7	8	9
Due	Summary	Intro.	Method.	Results	Table/Fig.	Discussion	Clearness	General
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* Use this form as a cover sheet.
* Submit your reports by the seventh day after your lab.

Introduction

Objective:

Investigate whether the mechanical energy is conserved in the motion of (1)pendulum and (2)spring.

Hypothesis:

(1) In the motion of the pendulum, the potential energy at the maximum height is equal to the kinetic energy (+the potential energy) at the minimum height.
(2) The elastic potential energy of a spring is equal to the kinetic energy of an object attached to the spring.

Experiment

Apparatus:

Board, Metal stick, weight, String, Speed Meter (BeeSpi V), Graph paper, Hook's Law Apparatus, Spring

Method:

Experiment

1. Set up the board with the metal stick at the top right hand.
2. Put the graph paper on the board.
3. Measure the weight.
4. Tie string to the weight tightly. And tie another end of the string to the metal stick.
5. Put the speed meter to the lowest point where the weight takes. (h_0) Make sure the weight doesn't hit the speed meter.
6. Lift the weight up from the lowest point to the height h_1.
7. Release the weight and let the weight pass through the lowest point.
8. Record the measured value of the speed meter.
9. Repeat 6-8 with different height h_1.

Experiment

1. Obtain the relation between the elastic force (F= the gravity of the weight) and elongation.
2. Drawing a graph.
3. Determine the spring constant.

Experiment

1. Set up the apparatus.
2. Connect a spring and a weight with string.
3. Let the center of weight place on zero when the spring is at natural length.
4. Pull the weight and read the elongation, x.
5. Start BeeSpi V and release the weight. Read the speed.

Results

Experiment 1 (weight=0.034kg)

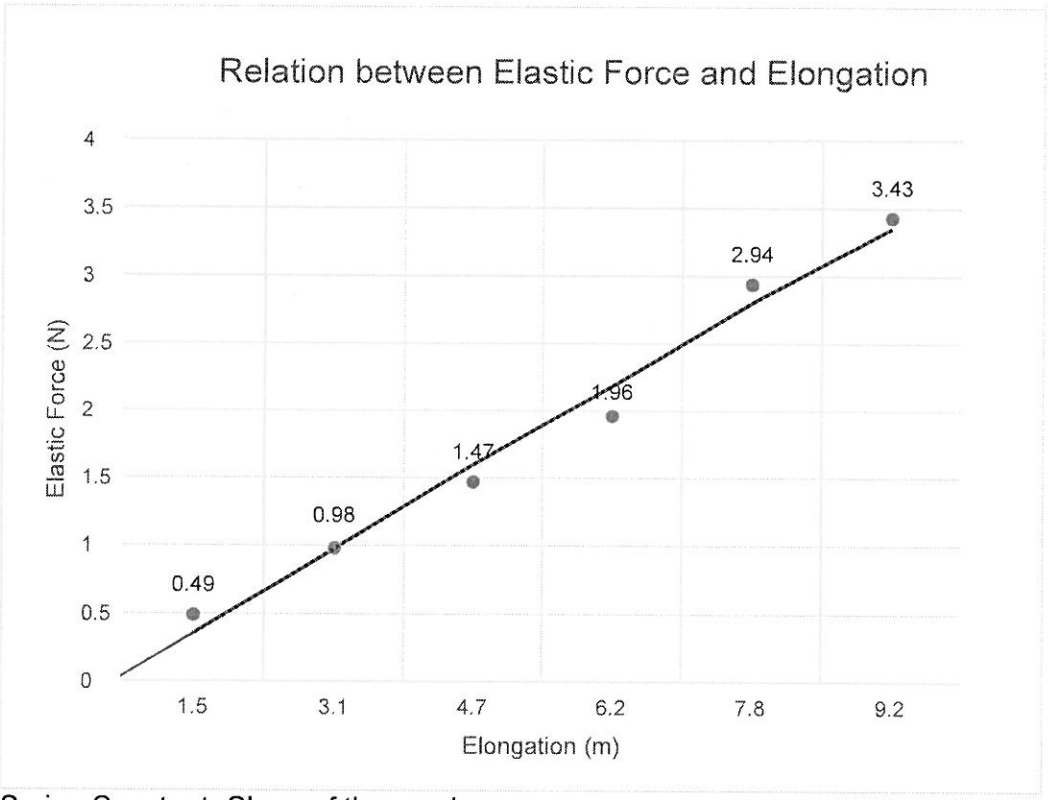
	Maximum height	Minimum height	(A-B)/A x100

	h_1	$A=mgh_1$	h_0	v	mgh_0	$1/2\ mv^2$	$B=mgh_0+1/2\ mv^2$	
Exp	m	J	m	m/s	J	J	J	%
1	0.30	0.100	0.06	2.228	0.005	0.084	0.089	11.00
2	0.25	0.083	0.06	1.970	0.004	0.066	0.070	15.66
3	0.20	0.067	0.06	1.730	0.004	0.051	0.055	17.91
4	0.10	0.033	0.06	1.115	0.002	0.021	0.023	30.30

Experiment 2

Determination of Spring Constant

m(kg)	0.05	0.10	0.15	0.20	0.25	0.30
F(N)	0.49	0.98	1.47	1.96	2.94	3.43
x(m)	1.5×10^{-2}	3.1×10^{-2}	4.7×10^{-2}	6.2×10^{-2}	7.8×10^{-2}	9.2×10^{-2}



Spring Constant=Slope of the graph

k=38N/m

m=0.034kg, k=38N/m

	spring			Weight		
	x	$A=1/2kx^2$		v	$B=1/2mv^2$	(A-B)/A x100
exp	m	J		m/s	J	%
1	0.06	0.068		1.133	0.021	69.12
2	0.10	0.190		2.600	0.115	39.47
3	0.15	0.428		2.780	0.131	69.39
4	0.20	0.760		3.321	0.187	75.39
5	0.25	1.188		3.562	0.216	81.82

Discussion

In the first experiment, sum of the potential and kinetic energy at the highest and the lowest point was almost the same. However, there were some errors during the experiment and the percentage shows the sum at the two points are not completely the same. What made the errors were when I released the weight, I might push it a little and it caused additional force. But, the values of the percentage error are not so large, it can be said that the kinetic energy and potential energy of the weight in the motion of the pendulum at the minimum height is equal to the potential energy of the weight at the maximum height.

In the second experiment, the values of potential energy and kinetic energy are completely different. The reason why the error is so large is that the speed meter was not working correctly in the experiment 2. I could not find something wrong with the BeeSpi V.

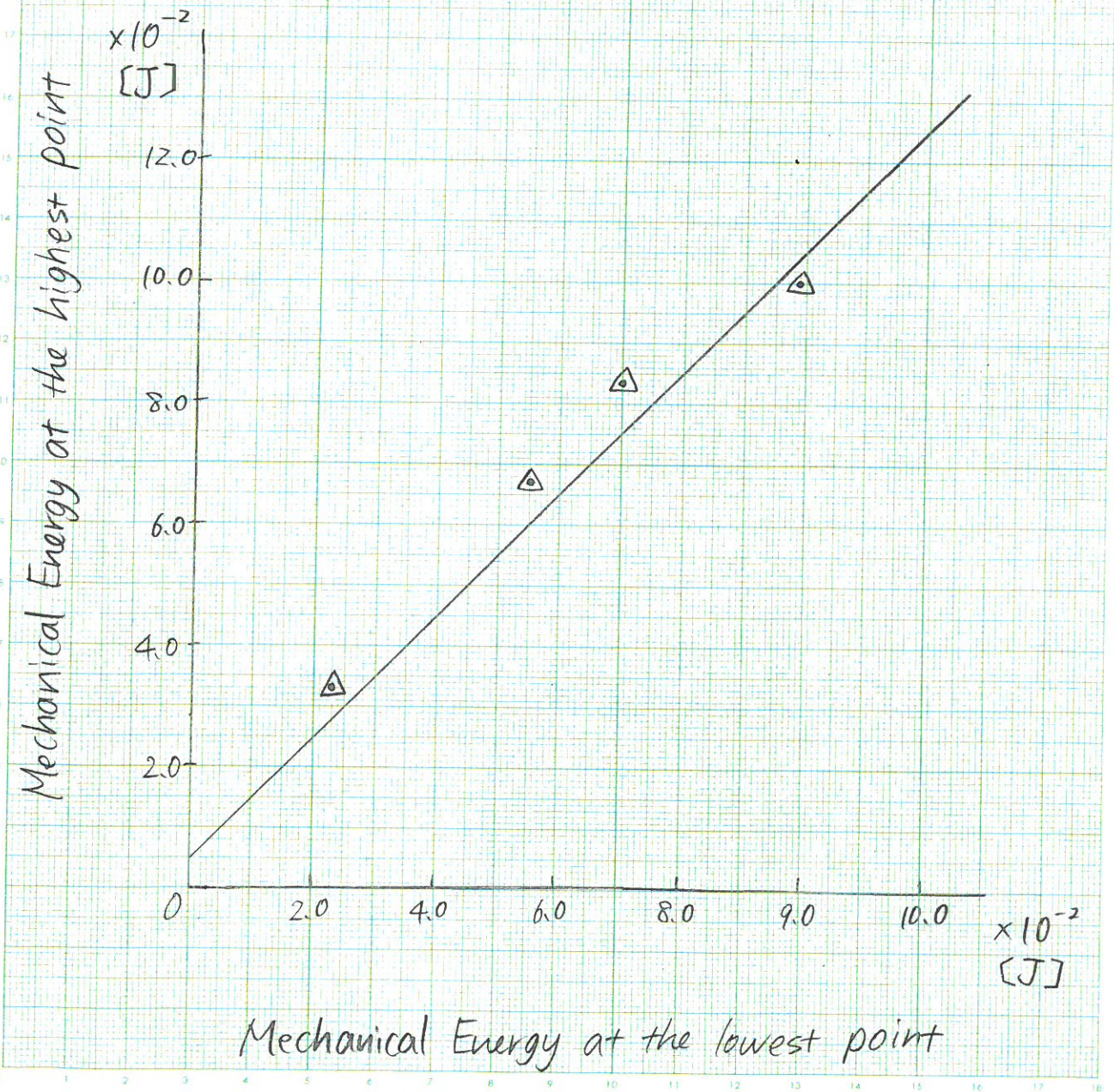
Conclusion

The data from the first experiment shows in the motion of the pendulum, the potential energy at the maximum height is mostly equal to the kinetic energy (+the potential energy) at the minimum height. So the hypothesis(1) is proved. Also, in the second experiment, the elastic potential energy of a spring is different from the kinetic energy of an object attached to the spring. So, experiment 2 was failed.

Opinion

This experiment was very complicated because I had to draw graph to get spring constant before calculating A in experiment 2. However, this process made me sure how I should find Spring constant. I learned that I can find more accurate value of spring constant by drawing graph and using the slope of it. Also, I found out the law of conservation of mechanical energy is proved from experiment 1. However, I do not think this law does not always hold. For example, in the universe, there are no gravity, so I do not know how this law works. I want to try these experiments in the universe someday. In addition, experiment 2 is failed so I want to try it again.

Exp. 1 Relation between the mechanical energy at the highest and lowest points



Exp. 2 Relation between Elastic Potential Energy and Kinetic Energy of the Weight