Experiment 6: Conservation of Energy

Well Done! 20/20

Physics 101- 51C

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Objective: To determine the spring constant and to study the conservation of energy.

Procedure: we used a spring that we clamped to a one meter ruler, to try and measure the displacement of the spring as well as the spring coefficient with various weights attached to a particular spring.

Materials:

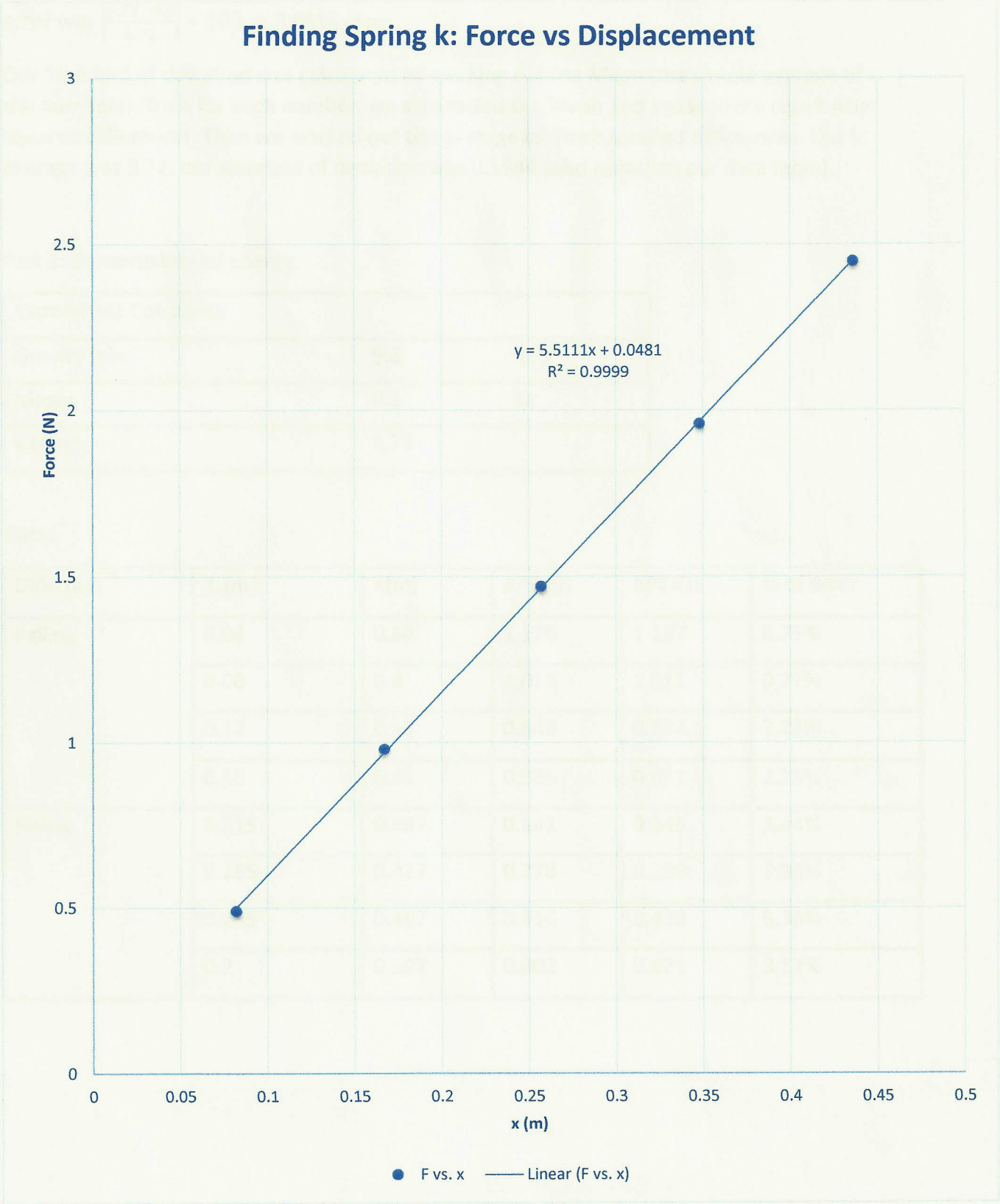
1. 1 meter ruler
2. Spring
3. Clamp
4. Various masses (ranging from 50 g to 250 g)

Part 1. Spring constant.

Data:

Lab_6_Finding Spring k Data								
Sample	Mass (kg)	F(N)	x (m)	k	k (Avg)	x (calculated)	k (calculated)	calc. vs. Avg
1	0.05	0.49	0.082	5.9756	5.72	0.08	6.11	6.39%
2	0.1	0.98	0.167	5.8683	5.72	0.17	5.80	1.31%
3	0.15	1.47	0.267	5.7198	5.72	0.26	5.70	0.38%
4	0.2	1.96	0.348	5.6322	5.72	0.35	5.65	1.23%
5	0.25	2.45	0.436	5.6193	5.72	0.44	5.62	1.73%
Std. Dev.				0.1944	0.0000	0.1405	0.1985	

We calculated our spring constant K using the formula $k = \frac{F}{x}$, where F was force and x was our measured displacement.


Finding Spring k: Force vs Displacement
y = 5.5111x + 0.0481
R² = 0.9999
Force (N)
x (m)
0
0.5
1
1.5
2
2.5
3
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
F vs. x
Linear (F vs. x)

Our percent error was calculated using the equation $\left|\frac{actual-experimental}{actual}\right| * 100$ so our % error was $\left|\frac{5.72-5.5}{5.72}\right| * 100 = 3.85\%$ error.

Our Standard of deviation was calculated by working out the Mean (the simple average of the numbers). Then for each number, we subtracted the Mean and squared the result (the squared difference). Then we worked out the average of those squared differences. Our k average was 5.72, our standard of deviation was 0.1944 (also noted on our data table).

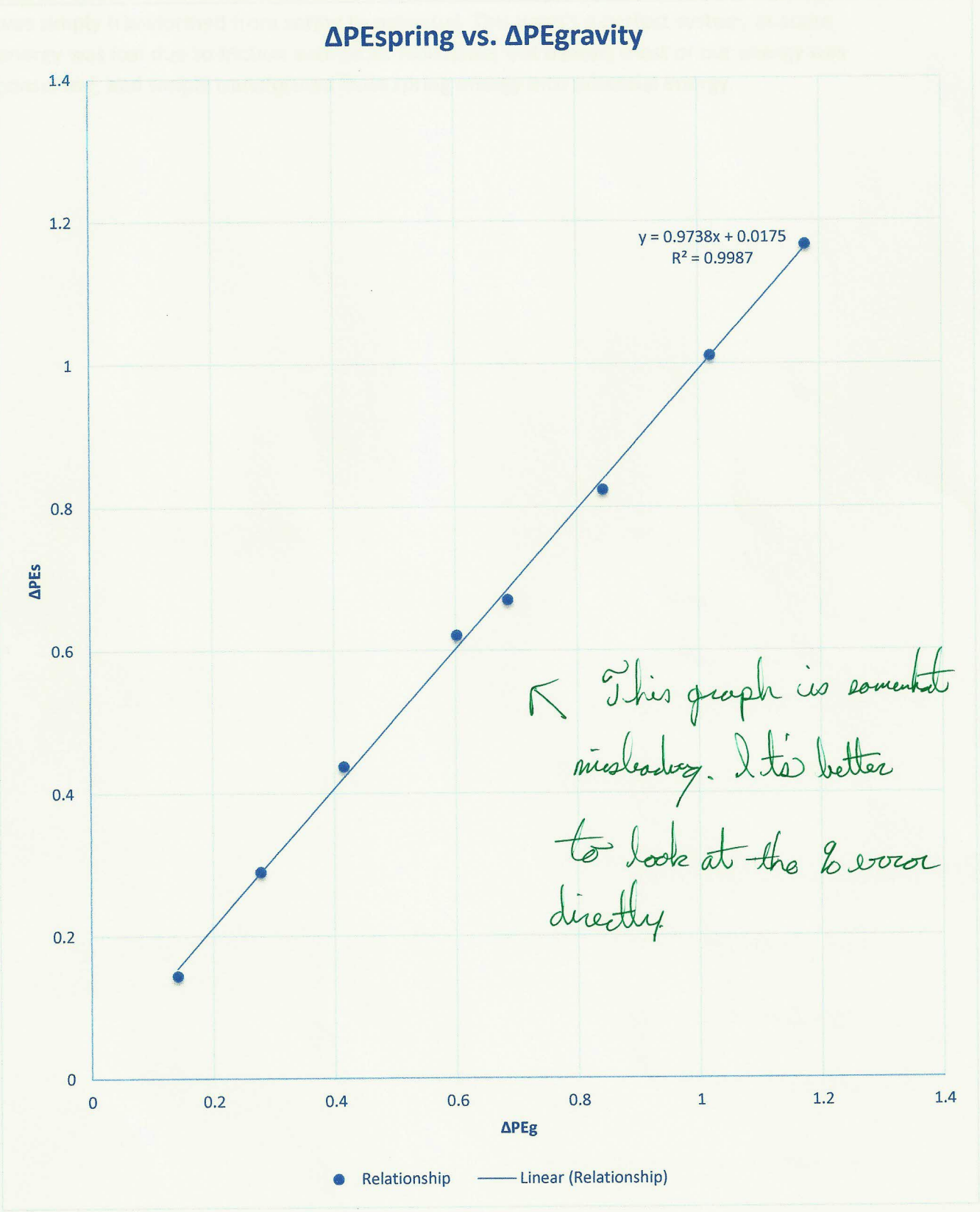
Part 2: Conservation of energy.

Experiment Constants		
Gravity (g)=	9.8	m/s^2
Mass=	0.2	kg
k (Avg)=	5.72	

Data.

Direction	X_o(m)	X(m)	ΔPEg(J)	ΔPEs(J)	% of error
Falling	0.04	0.64	1.176	1.167	0.77%
	0.08	0.6	1.019	1.011	0.77%
	0.12	0.55	0.843	0.824	2.23%
	0.16	0.51	0.686	0.671	2.23%
Rising	0.315	0.387	0.141	0.145	2.44%
	0.285	0.427	0.278	0.289	3.90%
	0.255	0.467	0.416	0.438	5.36%
	0.2	0.507	0.602	0.621	3.17%

Question:



↖ This graph is somewhat misleading. It is better to look at the % error directly

1. As shown in the graph prior, the relationship between the potential energy of the spring and the gravitational potential energy was linear, thus implying that most of the energy was simply transformed from spring to potential. This wasn't a perfect system, as some energy was lost due to friction such as air resistance, but overall, most of our energy was conserved, and simply transformed from spring energy into potential energy.