PHYSICS 4AL

EXPERIMENT 3: CONSERVATION OF MECHANICAL ENERGY

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DISCUSSION

We aligned the photocomb at the 36th tooth from the left. We then correspondingly always pulled the glider to the left when performing our experiment.

Potential energy of a spring is given by the equation $F = -kx$, where F is the force exert of the spring, k is the spring constant, and x is the distance pulled. To obtain our potential energy calculations, we first obtained the spring constant k by hanging a mass from the spring and measuring the distance stretched, shown in **Figure 3.1**. k is found to be $6.016 \pm 0.001\ N/m$.

To calculate both the kinetic and potential energy in space, block event times were measured using the DAQ. Because we know that each tooth and gap between each tooth is 2 mm $\pm$ 30 μm, each block event time represented an increase in 4 mm. The potential energy is calculated with the average distance $\bar{x}$ using the formula $E_p(\bar{x}(i)) = \frac{1}{2}k\bar{x}^2$ and calculated k.

Velocity of the glider was calculated by differentiating displacement with respect to time using the equation $v(\bar{x}(i)) = \frac{x_{i+1}-x_i}{t_{i+1}-t_i}$. Because kinetic energy E_k can be found by the formula $E_k(\bar{x}(i)) = \frac{1}{2}mv(\bar{x}(i))^2$, when can substitute $v(\bar{x}(i))$ and obtain kinetic energy with this final equation $E_k(\bar{x}(i)) = \frac{1}{2}m(\frac{x_{i+1}-x_i}{t_{i+1}-t_i})^2$.

We then plotted $E_k(\bar{x}(i))$, $E_p(\bar{x}(i))$, and E_{total} on a plot with respect to average distance $\bar{x}$. The potential energy is an upward facing parabola, while kinetic energy is a downward facing parabola. When the spring is pulled, potential energy is at it's maximum and kinetic energy is zero. When the spring and glider system is released, potential energy is transformed into kinetic energy and the glider gains speed, until it reaches the equilibrium point where kinetic energy is maximized. After, kinetic energy is transformed once again into potential energy as the spring pulls on the glider. Other than a slight loss of energy to friction (shown in **Figure 3.2**), the energy level of the system remained the same. Energy was only being transferred between potential and kinetic energy as the glider moved.

PLOTS AND TABLES

Mass of Glider with Photogate Comb = 0.225 $\pm$ 0.0005 kg

Hanging Mass (kg)	Applied Force (N)	Glider Displacement (m)
0.100 $\pm$ 0.0005	0.98 $\pm$ 0.005	0.162 $\pm$ 0.00005
0.060 $\pm$ 0.0005	0.588 $\pm$ 0.005	0.099 $\pm$ 0.00005
0.035 $\pm$ 0.0005	0.343 $\pm$ 0.005	0.056 $\pm$ 0.00005
0.020 $\pm$ 0.0005	0.196 $\pm$ 0.005	0.032 $\pm$ 0.00005
0.005 $\pm$ 0.0005	0.049 $\pm$ 0.005	0.008 $\pm$ 0.00005

Table 3.1 Force exerted on spring vs displacement.

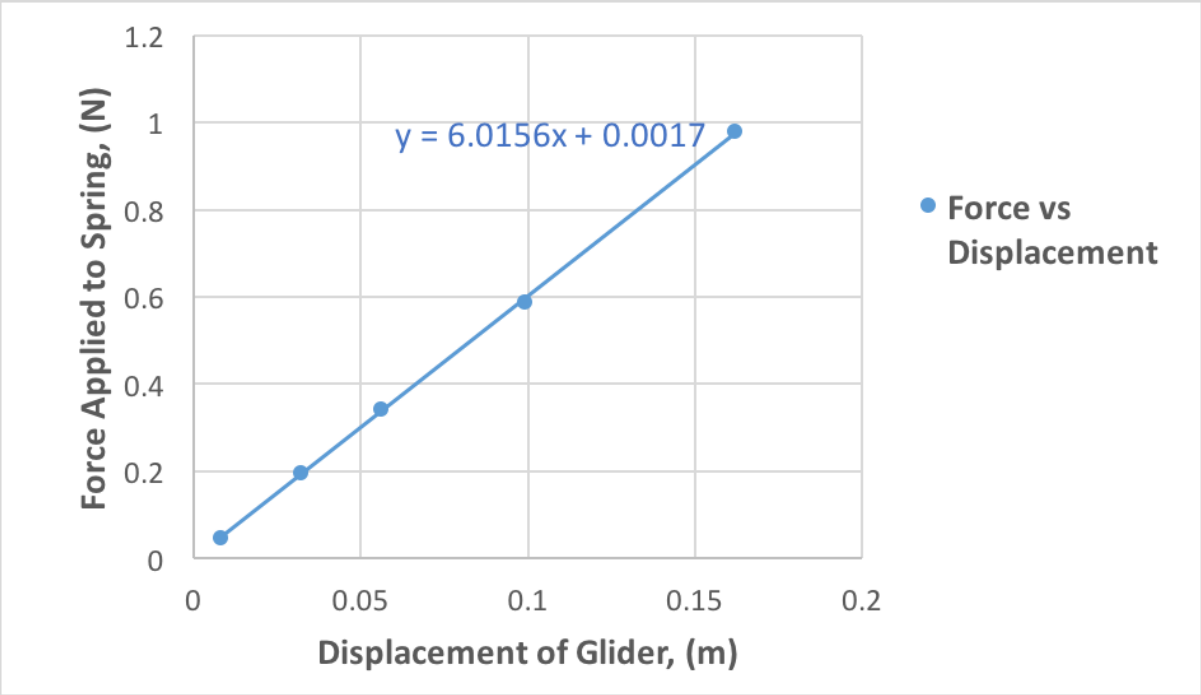

Figure 3.1 Measuring Spring Constant by comparing force applied by hanging mass and displacement. The spring constant found in this case is $k = 6.016 \pm 0.002$ in N/m.

REPORT

Abstract