

## Lab 8 Analysis and Conclusion

In this lab our goal was to analyze the concept of work for different forces at a constant velocity. To achieve this, we used an inclined level track with a cart on it and attempted to pull that cart (by a string) up and down that track for multiple trials with different variables. Before we pulled the cart we measured the angle of the track and found it to be at  $4.88^\circ$  then after each trial we used the formula for work:  $W = Fd \cos\theta = (F \cos\theta)d = F(d \cos\theta)$  to calculate the amount of work done on the cart in each trial. Because the cart was being pulled at constant speed by a person there was some degree of human error but overall, it does not create large discrepancies in the data we collected. As always there is also a degree of random error present in this experiment but that too does not have an overarching effect on the data. The dependent variables for this lab were the mass of the cart, mass of the steel bar put on the cart, and length of the string used to move the cart. The independent variables of this experiment are the angle of the track, angle of the string, displacement of the cart, and force applied to the string. These of course vary throughout the different trials depending on what is being changed in that trial.

For our first trial we were testing the work done on a cart that was moving up the ramp at constant velocity. The work calculated for this trial:

$$Work = F \times d \cos\theta \rightarrow (0.44)(0.5)(0.996) = 0.219 J$$

The second trial was work done on the car when it's moving down the ramp at constant velocity and the calculated work was,

$$Work = F \times d \cos\theta \rightarrow (-0.07)(0.5)(0.996) = -0.035 J$$

The third trial tested work done on the cart moving upwards with a spring scale inclined at 60 degrees to the track. Work was calculated the same way as it was in the two equations above (reference Lab 8 Data and Observations to see calculations). For this trial the work calculated was  $0.009964 J$ . The fourth trial was work done by "you" on the cart moving downwards with a spring scale inclined at 60 degrees to the track. The calculated work was  $-0.01993 J$ . The trials conducted allowed us to conclude that changing the angle of the string decreased the magnitude of the work done on the system by a relative factor of 10.

Using motion diagrams, we were able to visualize all the forces that were acting upon the system and calculate the magnitude of the forces identified. We determined that tension force, the force of gravity, and normal force would all be acting on the system and therefore these were the forces that needed to be calculated. We were able to calculate the force of gravity for both upwards and downwards motion and determined it to be  $0.75 N$ .

We ran out of time in lab to complete the potential and kinetic energy portions of this lab and therefore were not able to conduct those trials or provide data relating to that section. Throughout this lab we learned what work is and how it relates to force and displacement both mathematically and conceptually. The results of this lab allowed us to calculate the work done on the cart to a relatively high degree of certainty given inevitable human error present throughout the lab. From this we were able to create a real world connection between

displacement, velocity, magnitude, force, and work which provided us a more in-depth understanding of the innerworkings these physics concepts,