Physics Laboratory Report

Lab number and Title: Lab 6a1 – Work and Energy

Name: Arsh Bhamla

Group ID: 3

Date of Experiment: 10/19/2023

Date of Report Submission: 10/26/2023

Course & Section Number: PHYS111A - 011

Instructor's Name: Professor Thuan Nguyen

Partners' Names: Logan Chappel, Jose Tabuena, Connor Nguyen

1. INTRODUCTION (10 points)

1.1 Objectives

This lab, Lab 6A1, is about applying the work-energy theorem, and proving its correlation with forces. It introduced us to the more advanced concept of work, kinetic energy, and potential energy, all of which had their own formulas and uses within the experiments. By doing this lab, the goal is to fully apply the work-energy theorem to the lab work we are doing and gain a better understanding of how these new things relate to our previously learnt material. In this experiment, we are using a glider on a frictionless surface attached to a pully and a hanging mass to determine both forces, work, and energy.

1.2 Theoretical background

There are four main formulas that we learned in class that are important to understand the lab. The first one is w = F*x, where w represents the work, F is the net force on the object, and x is the distance travelled. Work can also be described as w = ΔKE + ΔPE, which represents the change in kinetic energy plus the change in potential energy. We already know that energy can not be created nor destroyed, but energy can be transferred from the system to its surroundings. Work having two formulas also means that they can be made related to one another once you know one of the two. The third formula is that of kinetic energy, which has an equation of KE = ½ mv^2, which is fundamental in allowing us a way to calculate for velocity or mass. Lastly, the formula for gravitational potential energy is PE = mgh, where m is mass, g is gravity, and h is the height. The four of these equations allowed us to carry out the lab and understand what was going on.

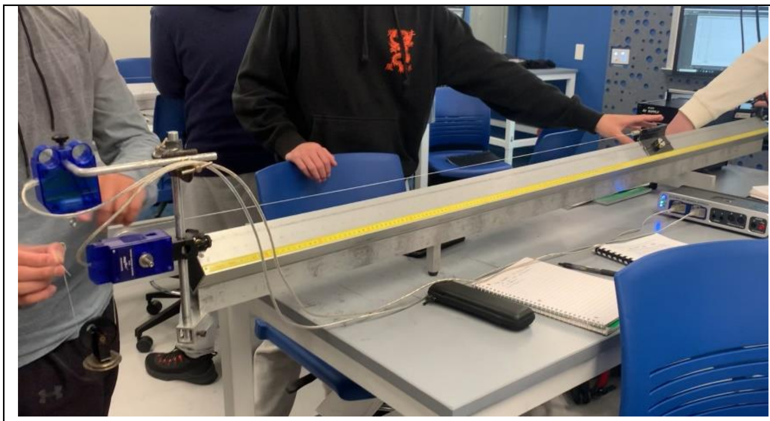
2 EXPERIMENTAL PROCEDURE (10 points)

Experiment One

Our group followed the directions in the lab manual with one exception. As directed in class, we used two weights on the glider as opposed to four as instructed in the manual. In summary, we had a glider with one set mass on a horizontal frictionless surface attached by a string to a pulley which led to a hanging mass. We used the computer to determine the values of forces and displacement.

Mass of Glider (0.28045kg)

Glider on the Platform

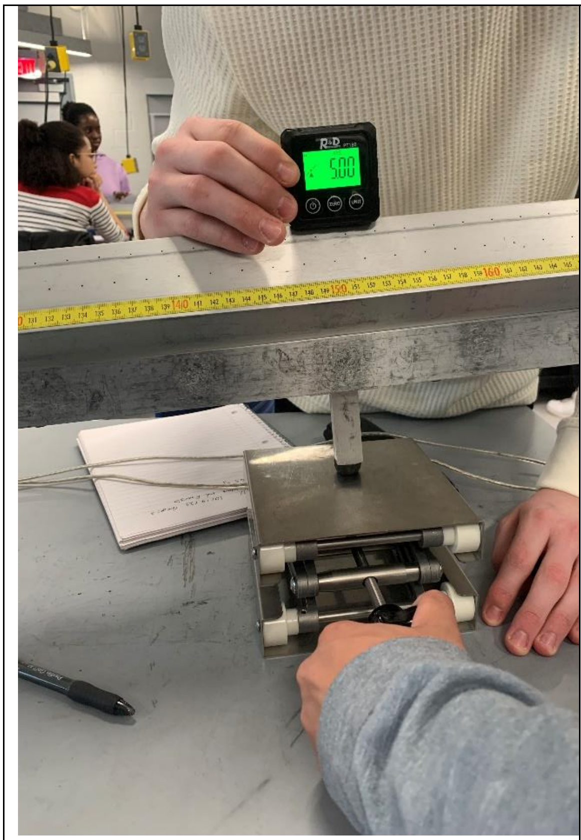
 Experiment Setup	 Putting String on Sensor

Variables

- Mass of Glider (m)
- Gravity (g)
- Position (x)
- Velocity (v)
- Tension Force (T)
- Net Force (F)

Experiment Two

For experiment two, all values remained the same except for the angle of the platform, which was placed at an upwards incline. This introduces a new variable into the system.



Angle of Incline (5°)

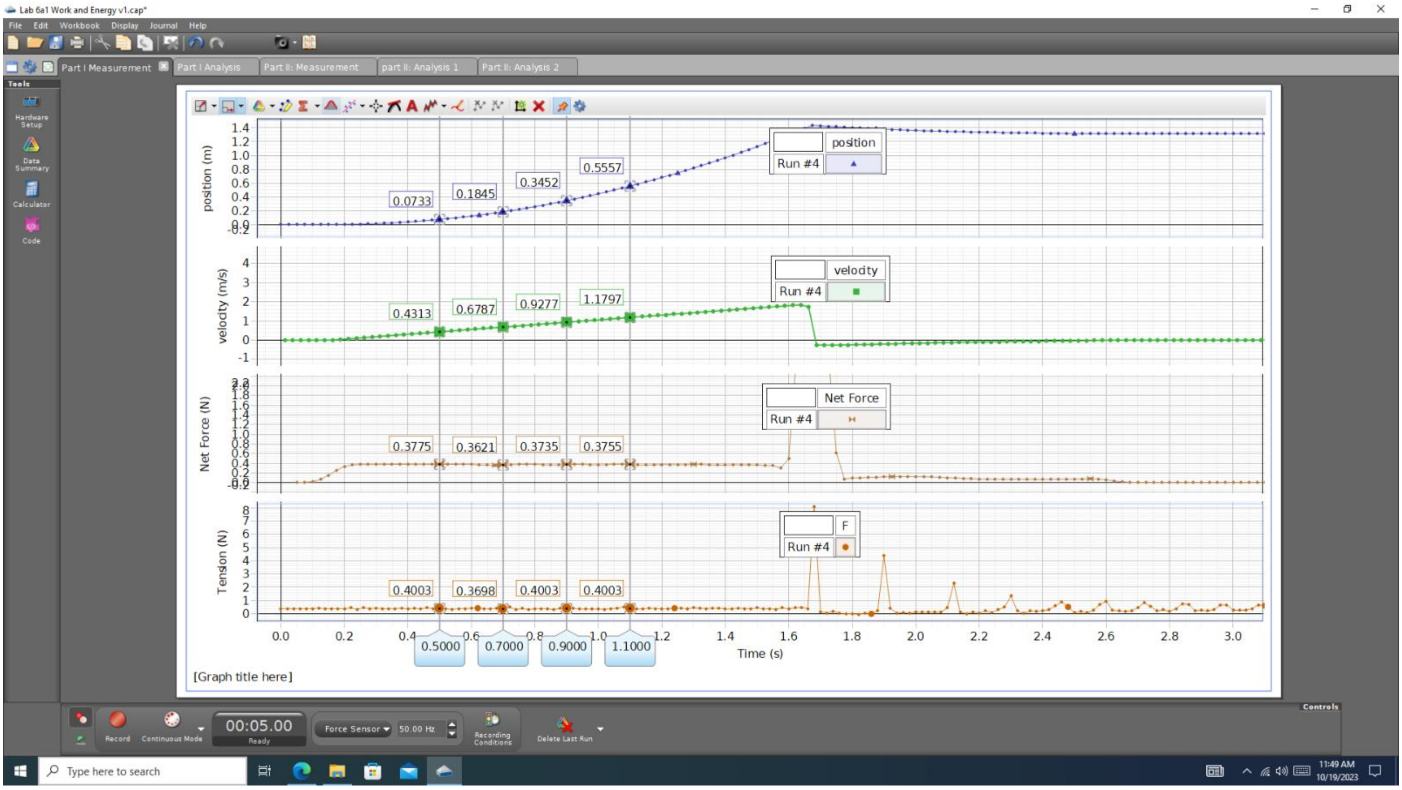
Experiment Setup

Variables

- Mass of Glider (m)
- Gravity (g)
- Position (x)
- Velocity (v)
- Tension Force (T)
- Net Force (F)
- Angle of Incline (ϴ)

3 RESULTS (30 points in total)

Experiment One



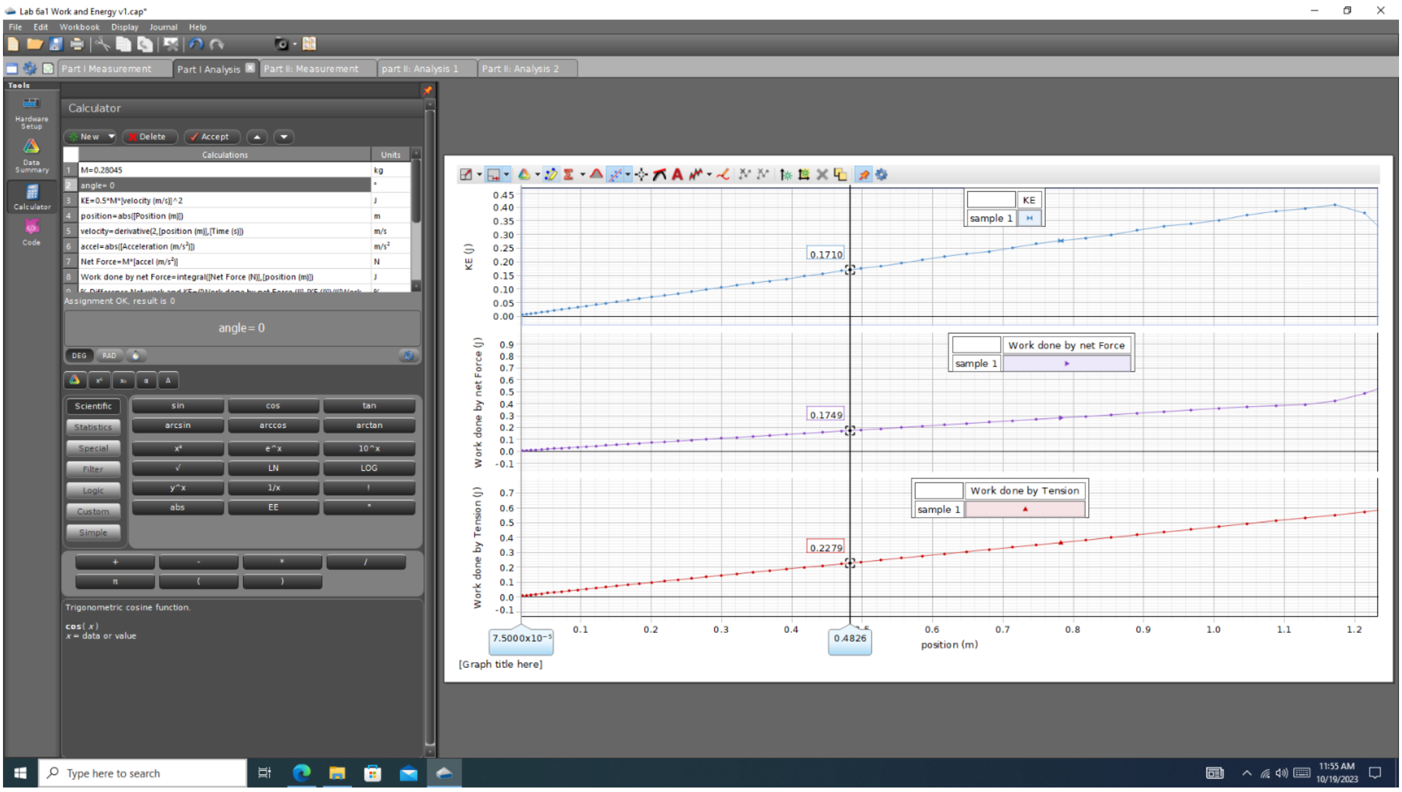


Table 1.1

i → f	S = $x_f - x_i$	W = T*s	KE_i	KE_f	ΔKE	%Difference
1 → 2	0.1112m	0.0445m	0.0261J	0.0646J	0.0385J	14.46%
2 → 3	0.1607m	0.0594m	0.0646J	0.1207J	0.0561J	5.714%

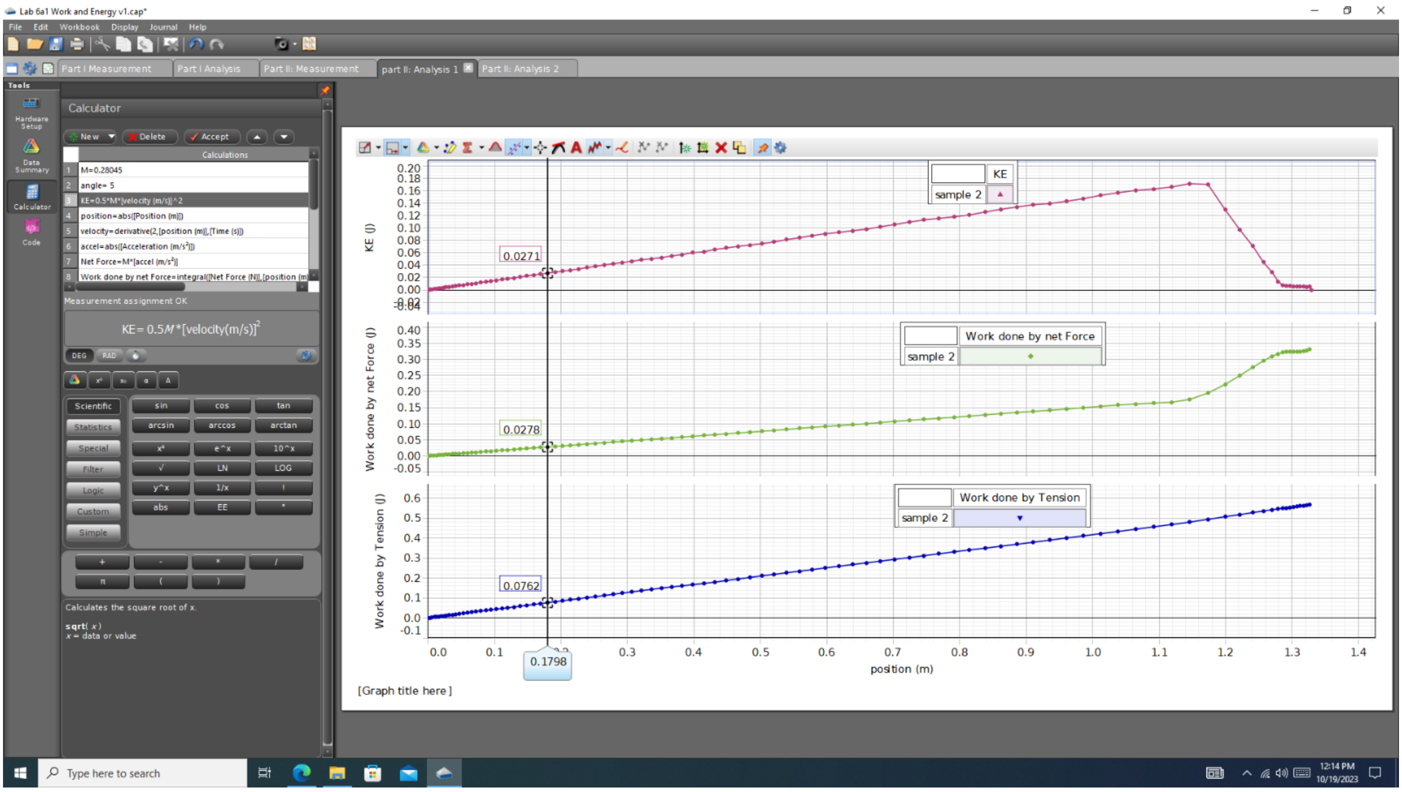
3 → 4	0.2105m	0.0843m	0.1207J	0.1952J	0.0745J	12.34%
4 → 1	0.4824m	0.193m	0.0261J	0.1952J	0.1691J	13.25%

Calculations were not asked for in this experiment.

Experiment Two

Mass of Glider (Including the 2 Extra Masses): 0.28045kg

Incline Angle: 5 degrees



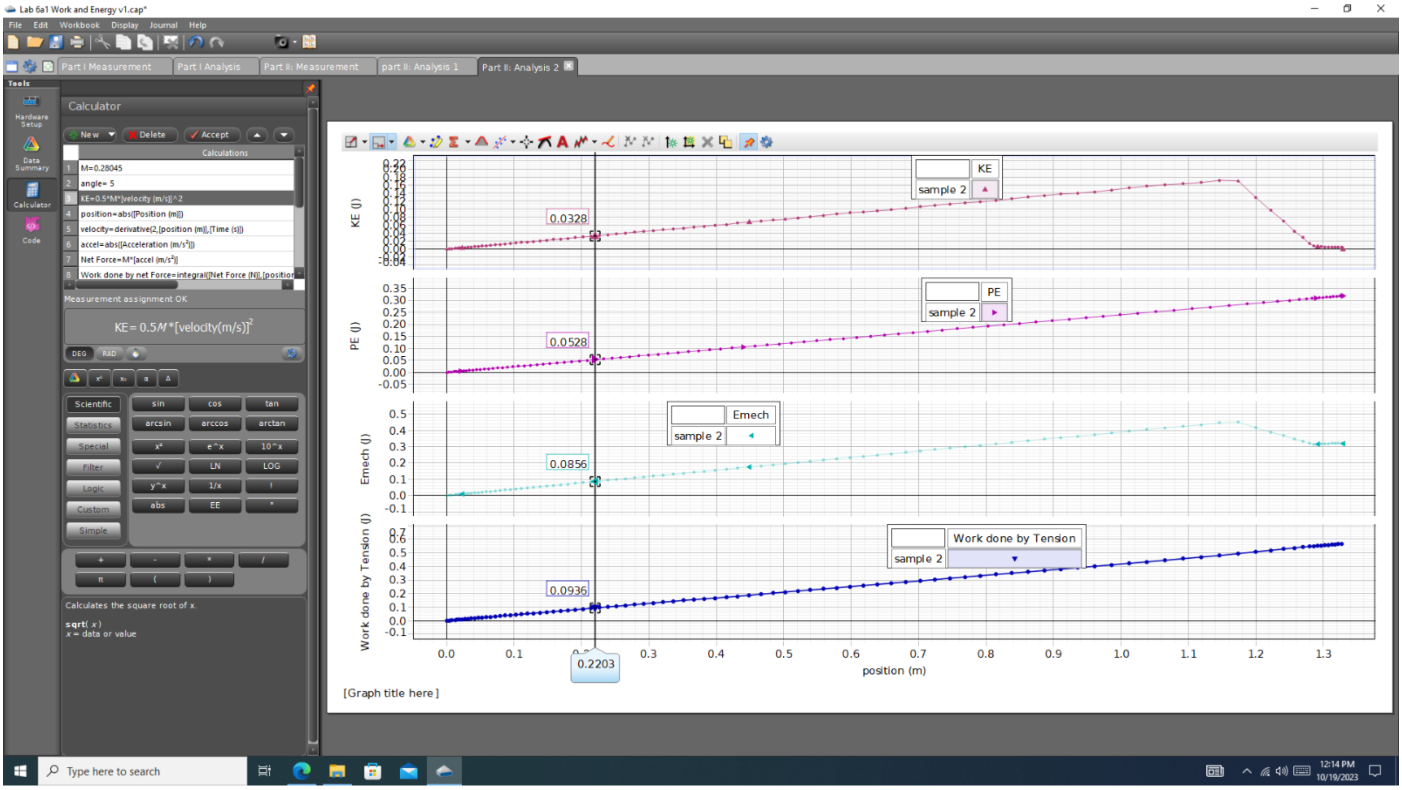


Table 2.1

Position	x_i	v_i	Tension (T)	Net Force (F)
1	0.0794m	0.2985 m/s	0.4308N	0.1454N
2	0.193m	0.4553 m/s	0.4308N	0.1412N
3	0.352m	0.6105 m/s	0.4308N	0.1398N
4	0.5578m	0.7650 m/s	0.4308N	0.1486N

Table 2.2

i → f	$S = x_f - x_i$	W = T*s	ΔKE	ΔPE	ΔE	%Difference
1 → 2	0.1131m	0.0487J	0.0166J	0.0271J	0.0437J	10.82%
2 → 3	0.1598m	0.0668J	0.0232J	0.0383J	0.0615J	11.20%
3 → 4	0.2064m	0.0889J	0.0298J	0.0494J	0.0792J	11.54%
4 → 1	0.4793m	0.192J	0.0696J	0.115J	0.184J	3.986%

Calculations were not required.

4 ANALYSIS and DISCUSSION (20 points)

We got the raw data in the experiment from the computer, which provided tension force, net force, work, and energy. The values were in graphs, in which we had to use set a value

for the distance and use these raw values to calculate other values. The results we got did meet the requirements for the lab since we satisfied all the given variables in the charts that the manual had. One thing to note is the error percentage, which is at around 10-15%, which can point to some systematic error or rounding issues. However, this value is not very big in comparison to past labs and is an acceptable amount. We can assume the values we use are not super accurate, but still show trends and values we know.
This lab did not have any lab questions.

5 CONCLUSIONS

In summary, we learned what work and energy were and how they related to each other. Furthermore, we learned how to apply what we learned in previous weeks (in regard to $F = ma$) to substitute for the value of F in the work equation. I really enjoyed this lab and how it connects the current material to what we learned before. It does raise new questions about how different variables, mainly friction, would make change to it. Another thing I would like to change is the value of theta, which could also be negative. The experiments were both straightforward, but a change that should be implemented is the inclusion of various variables. Overall, I found this lab very insightful.