The Relationship between Changes of Mechanical Advantage and Work Done

Abstract (Moe Okubo)

In this experiment, we investigated the relationship between the difference in work and mechanical advantage. Furthermore, we wanted to determine the difference between total work done lifting a 1kg mass up a height and dragging up a ramp as a function of mechanical advantage. We planned to change the height each times with pile-upped books and change the angles. Firstly, we measure the height of the books we piled up, the length. Then measure the angle of the ramp and we use a plank, and a spring balance to lift up and drag up the mass we repeat these steps for five times. In the result, when we changed height the work of lifting up the mass would not change but th e work of dragging up the ramp would affect and we could see that when the angle of the ramp changed, work of dragging up would use more work. Also we could see that the mechanical advantage would affect too, it has getting less act when the angle of the ramp going bigger.

Abstract (Eric Liu)

Basically, in this lab we're going to determine the difference between total work done lifting a 1kg mass directly up a height h and dragging a 1kg mass

up a ramp of length l as a function of mechanical advantage. How much easier and faster a machine makes your work is the mechanical advantage of that machine. In our experiment, mechanical advantage can be measured by the equation:

length of the ramp / the height of the ramp

which we're going to use to find the differe nce of work between taking the 1kg mass up and dragging it up the ramp.

We are first going to set up the ramp with a height of 5 books, then measure the length of the ramp which is about 1 meter.

Then, we pull up the 1kg mass up the ramp with a spring b alance along observing the number of Newton it has.

We can now calculate

work * force * distance

We put 2 books each time and repeat ,process of calculating the work.

The results will be generated after when we subtract the work of going up the height by the dragging done along the ramp.

Our results state that moving an object up an inclined plane than straight up, the amount of effort force required is reduced and accurate distance is required, so

the amount of work is the same. Mechanical advantage inc reases as the height of textbooks decrease.

Introduction (Ritoko Baba)

In our daily life, people carry their belongings with them to go to any places. At least most of people have felt that the belongings get heavier when they go up a hill. There is a reason why belongings get heavier. Our experiment used ramp which is a slope that joins two parts when one is higher than the other (Ostdiek, 2005). For this experiment, work is force times the distance through which it acts (Mifflin, 2009). The experiment contributes that people can realize how the gravity works when they go up a hill. So they will find the easiest way to carry their belongings. It can also use to make a roller coaster because it tells a limit of the degree that is not dangerous if pe ople fall. However the hypothesis of our experiment is that when the degree of ramp increase, the work of load will increase. And the dependent variabl es are degree of the ramp. Also the independent variable is work. Then the control variable is height of the ramp.

Introduction (Benjamin Ho)

Machines, as many people know, make our work faster and easier. Without the help of machines, our life will be in miserable and tiring. In our experiment, we used the ramp as our simple machine to test how the si mple machine helped us to make work easier. The formula for work is force times distance and the formula for mechanical advantage is l/h. Our hypothesis for this experiment is that when the degree of ramp increase, the work of load will increase. The dependent variable is the metal object and the independent variable is the number of books.

Materials and Methods

Materials

-1 board

-1 ruler

- 2~6 textbooks

-1 balance scale

-1 plank

-1 protractor

Methods

1. Use a board, and some textbooks to make a ramp.
2. Measure the degree and height of the ramp.

3. Put the plank to balance scale.

4. Measure the force for height and length of the ramp.

5. Calculate the mechanical advantage (MA).

Result

lcm*hcm degree	**Workh**	**Workl**	**Δ(Workh-Workl)**	**MA=l/h**
100cm*14.5cm 10°	10N	4N	**Δ**(10N-4N)=6N	≈6.9
100cm*18cm 20°	10N	5N	**Δ**(10N-5N)=5N	≈5.6
100cm*21cm 25°	10N	5.3N	**Δ**(10N-5.3N)=4.7N	≈4.8
100cm*24cm 29°	10N	6N	**Δ**(10N-6N)=4N	≈4.2
100cm*27cm 30°	10N	6.3N	**Δ**(10N-6.3N)=3.7N	≈3.7

-100cm*14.5cm: 10°

Workh: 10N

Workl: 4N

(Workh-Workl): 6N

MA: ≈6.9

-100cm*18cm: 20°

Workh: 10N

Workl: 5N

(Workh-Workl): 5N

MA: ≈5.6

-100cm*21cm: 25°

Workh: 10N

Workl: 5.3N

(Workh-Workl): 4.7N

MA: ≈4.8

-100cm*24cm: 29°

Workh: 10N

Workl: 6N

(Workh-Workl): 4N

MA: ≈4.2

-100cm*27cm: 30°

Workh: 10N

Workl: 6.3N

(Workh-Workl): 3.7N

MA: ≈3.7

The table describes the result of our ramp lab. It shows that the Workh which is the work of height doesn't change even the height of the ramp changes. Also, when the height of ramp increases, Workl also increases. However Mechanical Advantage (MA) will decrease when the height of the ramp increases. Therefore the table shows when the degree of the ramp which is the

height of the ramp increases, we need to use more work.

Discussion (Jacqueline Ko)

Our results of the experiment are in line with our hypothesis and prediction: when the degree of ramp increase, the work of load will increase. When t the degree of ramp increase the more work we need to do. This experiment shows a negative relationship between the degree of ramp an d the work we need to do. It is also understood that degree of ramp influences the work.

The result of our experiment was a total success because not only did we have a collaborative team, but also we had a careful planning before we did our experiment. At first, we made a decision that we would pile up more books. We thought of a method, based on 5 books and did an experiment on it with records. And later on, we put more books and did the same experience again. In this way, we thought that the record would be more accurate.

To ensure the accuracy, we measured for 5 times altogether. Although it was really tedious and monotonous, we still insisted to have it done for 5 times hoping that the data collected were more accurate. Again, to ensure the accuracy, we used some skills learnt in mathematics to help, that was

calculating the mean among the four times of try out. Among all the times we did, the results were generally consistent with one another. It allows us to claim that the experience was a great succe ss.

Reflection (Austin Tan)

In this experiment, our design of the ramp is carefully measured and analyzed. We stack up textbooks from the classroom and lay the wooden ramp on the textbooks, making sure it's at the right angle by using a protractor. Then we made sure the height from the table to the top of rank is at a suitable height. The minimum settings for the ramp height were at five feet, and we added a textbook each time we do different results. To get the best and most accurate results, the accuracy of the methods are also carefully planned, we first measure the effort needed to lift the load horizontally then we measure the effort needed to pull the load up the ramp.

We need to cooperate more during experiments to get the widest range of view and we could make more drastic changes to the experiment. Changes such as adding more than a one kilogram load would help us see clearer differences when doing our experiment.

This experiment teaches us that by using th e simple machine, ramp, we can reduce the effort used to lift the load up horizontally. The ramp lets us use less effort to move the load up a certain height we want. We learned that the

higher the angle of the ramp is, the more effort you would need to pu ll the load up the ramp. This is similar to running up the slope, the steeper the slope is, and the harder you would have to run just to keep your pace.

Works Cited

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