Udit Aggarwal

Pulleys

Background Information

A Push or Pull which can vary in magnitude or direction on an object is called Force. The direction of force is the direction of push or pull. If the push and pull are on opposite directions, they act simultaneously, in other words the one with the greater push gives the direction of force. The standard unit for force in International system is Newton (N). Altogether there are five types of forces which are given below with their definitions mentioned-

1. **Muscular Force- The force exerted by the muscles is known as Muscular force.**

2. **Gravitational Force- When an object is thrown in the air, it automatically comes down. This is because the Earth attracts every object or body towards it with a force called the force of Gravitation.**

3. **Magnetic Force- The force exerted by a magnet is called Magnetic force. For e.g. If I bring a magnet near some pins, they will all get pulled towards the magnet. It therefore, implies that the magnet has exerted some force on the pins.**

4. **Electrostatic Force- The force exerted by electrostatic charge is called Electrostatic force. This type of force can be repulsive or attractive. For e.g. Rub a comb with a dry cloth and bring it near small pieces of paper. We would be astonished to discover that the pieces of paper are pulled towards the comb. This attraction is due to electrostatic force.**

5. **Frictional Force- The force which opposes the motion of a body moving on a surface is called Frictional force. This type of a force acts between the two surfaces in contact. For e.g. Roll a ball on a smooth polished surface, next on a rough floor. We will be surprised to discover that, on the smooth surface, it travels over a long distance before coming to rest as compared to the distance it travels on a rough surface.**

Weight and Mass- The gravitational pull of the Earth on a body is called its weight. Weight of a body can be measured by a device called Spring Balance. It is measured in Newton's. Quantity of matter contained in body is called its Mass. It is measured by a physical balance and its units are Kilograms.

Machines

A machine is a device which helps us to apply force easily and make our work easier and convenient. A wide variety of machines are extensively used at home, in school, factories and in other activities in life. Some of the common used simple machines are: Tongs, Knife, Screw driver, Nut cracker, Tweezer, Pliers, Scissors and pulleys. There are some complex machines too such as: Bicycle, Sewing machine and Tractors.

Machines Enable us to Apply Force at a Convenient Point

While using a pair of scissors, we use force at the end of the blades whereas the cloth is cut in between the sharp edges of the blades. When we are pushing a screw inside a block of wood, we are using a screw driver, the force is therefore being applied to the handle of the screw driver, but it acts on the head of the screw and moves its sharp tip inside.

Machines Enable us to Change the Direction of Force

While drawing water out from a well, he rope is passed over a pulley. The rope is pulled downwards whereas the bucket of water is pulled upwards. Pushing the rope downward is more convenient as compared to moving it up. So the use of machines enables us to change the direction of force.

Lever: Lever is a rod which moves freely about a pivot. A crowbar is a perfect example.

Fulcrum: It is a pivot abut which a rod or a system mover freely.

Load: The weight of an object required to be lifted is called the Load.

Effort: The force applied on an object is called effort.

There are three types of levers depending upon the relative positions:

First Type: The first type of lever involves the fulcrum in between the effort and the load.

Second Type: In this second type of lever the load is in between the fulcrum and the effort. Wheelbarrow is a lever in which the load is in between the fulcrum and the effort.

Third Type: In this third type of lever, the effort lies in between the fulcrum and the load. Tongs and fishing rods are examples of this category.

Law of Moments: Clockwise = Anti- Clockwise

Formula: Force X Distance

Pulley

A pulley consists of a wheel that turns freely about an axle passing through its centre. It is designed in such a manner that its periphery (Outer part) has a groove over which passes a rope or a chain. Pulling or releasing the rope turns the wheel. The pulley enables us to change the direction of force.

Equipment

- **Meter's Rule.**
- **Newton Meter's.**
- **Block of wood used for balancing.**
- **Pen to record the results.**

Method

- **Firstly, I had gathered all the equipment and had set up the experiment. As I was accomplishing the experiment alone, it took me a while to conduct the experiment.**
- **Secondly, I had started to conduct the experiment by placing the weights on both the sides so they can balance. As I had conducted the experiment before I achieved the desired results.**

- **Thirdly and lastly after accomplishing the experiment I had put all the equipment back to their original places and copied down the results in a table format which are mentioned in the results column.**

Prediction

I predict that as the distance decreases, the force required increases. I also predict that as the object moves away from the pivot, the effort required in less.

Fair Test

There was only one issue for the fair testing which is, mentioned below-

- **I had used the same Newton meter same time as it might not have the same spring inside which would have lead me inaccurate results.**

Safety

While I was conducting the experiment there weren't much safety issued to be observed but some of the safety issues are mentioned below-

- **I was careful, while handling with the weights as if they would have fallen on someone's foot it could have been injurious.**
- **While carrying out the experiment, there were many people doing important work, I was careful not to cause noise pollution.**
- **Lastly, I was careful while handling with the ruler as it was delicate piece of equipment.**

Results

ANTI – CLOCKWISE MOMENTS			CLOCKWISE MOMENTS		
Distance (M)	Force (N)	Moment (NM)	Distance (M)	Force (N)	Moment (NM)
40	5	200 Nm's	8	5	40 Nm's
25	16	400 Nm's	50	8	400 Nm's
27	20	540 Nm's	54	10	540 Nm's
38	10	380 Nm's	47.5	8	380 Nm's
50	4	200 Nm's	20	10	200 Nm's
65	6	390 Nm's	60	6.5	390 Nm's
70	2	140 Nm's	70	2	140 Nm's
82	7	574 Nm's	71.75	8	574 Nm's
93	5	465 Nm's	93	5	465 Nm's
100	2	200 Nm's	25	8	200 Nm's

Conclusion

My results agree with my prediction and all the columns in the results table are balanced. In other words:
ANTI- CLOCKWISE = CLOCKWISE

Evaluation

I believe that I have been successful in accomplishing the experiment as I achieved the results which I had desired. I also believe that I have achieved my goals which were to obtain perfect results. Even though I was successful in obtaining perfect results, I had encountered some problems which are mentioned below-

1. **The first problem I had encountered was, while I was trying to balance the weights on the meter rule, I had kept on changing the positions of the weights from left to right as it would not balance both the ends even though my calculations were correct.**
2. **Secondly, I think there was some problem on the meter rule as the as the weights would not balance perfectly.**
3. **Lastly, I think there was some with the block of wood which was used to balance the meter rule. I think the plank of wood was defected i.e. chipped off.**

Some Simple Machines