TOPIC: Is the Pulley Effect real? Does it hold true in the real world?

Read the Introduction and look at all the diagrams and the Results. Answer these questions:

1. What method will be used to achieve the aim?
2. How will you know that you have achieved or not achieved the aim?
3. Looking at the Results table, what is the main finding, and what numbers support it?
4. Again looking at the Results, is there an anomaly? How do you know it is an anomaly?
5. Looking back at the Introduction, what possible sources of error are mentioned?

Now write the Title, Aim, Apparatus, Procedure, Discussion of Results and Conclusion. (2 hours maximum)

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Aim

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Introduction

A pulley is a simple machine made up of a wheel with a grooved rim, around which a rope or chain passes. Pulling the rope, applying an effort force, will lift an object or load. As shown in Figure 1, a fixed pulley is attached or anchored to a strong point. It does not move up or down with the load. A fixed pulley is used to change the direction of force on a rope. It has a mechanical advantage of 1. A mechanical advantage of 1 means that the force is equal on both sides of the pulley and there is no multiplication of force.

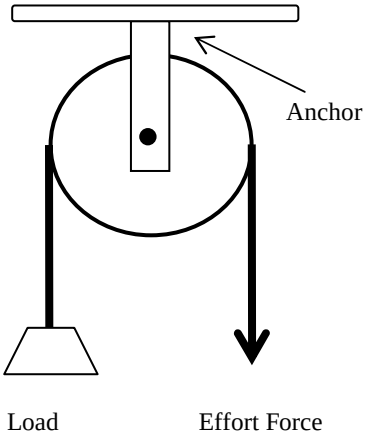


Figure 1: Simple Fixed Pulley

Since the forces must be equal on both sides of the pulley, the total force acting on the axle and on the anchor is greater than the load being lifted. The total force is equal to the load plus the opposing effort force, which is of the same magnitude. This is called the pulley effect, and is expressed in the formula:

$$F_a = 2\ L$$

where F_a is the net force acting on the anchor and L is the load.

The pulley effect is important to consider in any application where a rope, cable or chain crosses a fixed point and has a load applied to each end. The anchor must be strong enough to support double the load. The anchor of the pulley in Figure 2 must be designed to support double the load L. If not, it could fail.

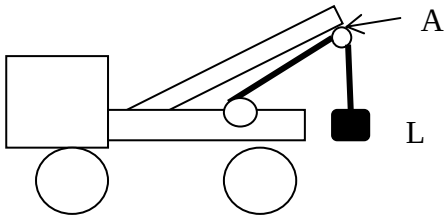


Figure 2: Fixed Pulley Application

To find out if the pulley effect is real, a fixed single pulley is suspended from a spring balance and different loads are applied to each end of the rope. The balance shows the total force acting on the anchor. This is compared to the theoretical value of 2 times the load, plus the weight of the apparatus. The effect will hold true if the observed and theoretical values are within 3% of each other.

The system must not have components that could absorb some of the applied force. A stretchy rope, for example, would absorb force and lower the total load on the pulley; therefore a steel cable is used in this experiment. It is also important for all components in the system to be motionless when forces are read from the balance, as movement could affect the results.

INSTRUCTIONS: Using the information in Figure 3 below (also refer to the Introduction and the Results sections) write a clear paragraph describing the materials and apparatus used in this experiment.

Apparatus

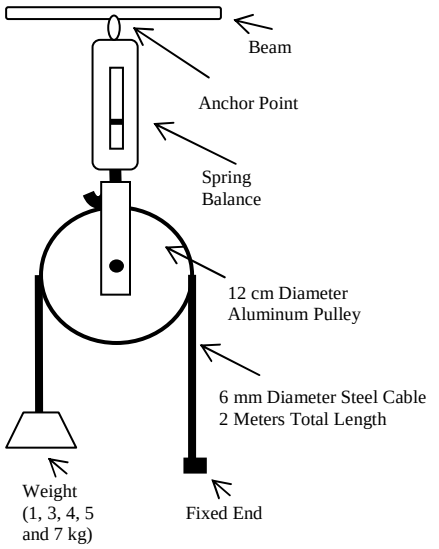
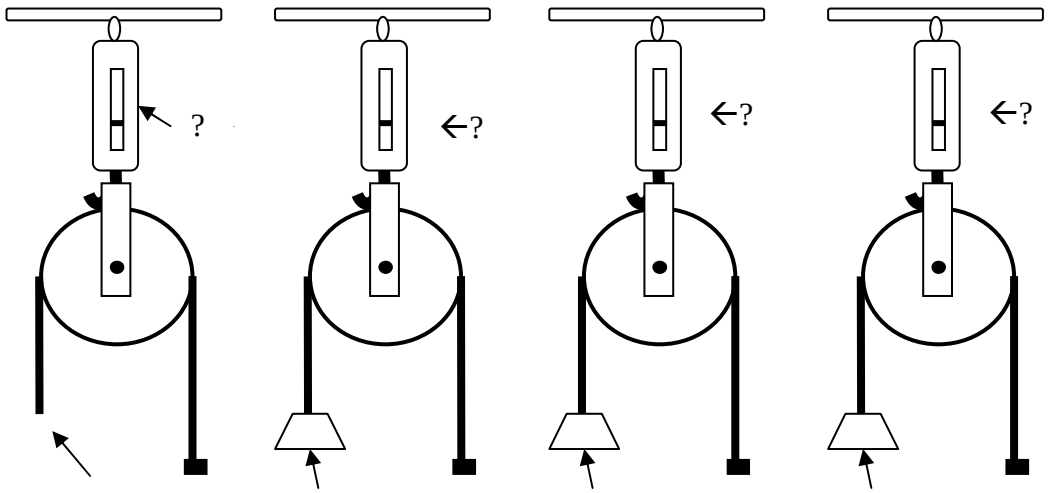


Figure 3: Experimental Setup

INSTRUCTIONS: Use the lab instructions and diagrams, the information in the Results section and your common sense to write a complete and detailed Procedure section for this report.

Lab Instructions

After setting up the system, determine the weight on the anchor without load, then find the weight with each load. Compare with theoretical pulley effect.



Procedure

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Results

Table: Theoretical and Observed Forces Acting on a Fixed Pulley

Trial	Load (kg)	Applied Force on Anchor (2 x Load) (kg)	Weight of Apparatus (kg)	Net Theoretical Force on Anchor (kg)	Observed Force on Anchor (kg)	% Difference Between Observed and Theoretical Forces
0	0	0	0.75	0.75	0.75	0
1	1	2	0.75	2.75	2.70	1.8
2	3	6	0.75	6.75	6.65	1.5
3	4	8	0.75	8.75	8.65	1.1
4	5	10	0.75	10.75	11.25	4.7
5	7	14	0.75	14.75	14.45	2.0

INSRUCTIONS: Use the information in the Results section, while keeping in mind the contents of the Introduction, to write a clear and complete Discussion of Results and Conclusion.

Discussion of Results

Conclusion