

Pulleys and Ramps

Pulleys

Using a pulley system, lift a 1.0 kg mass at a constant speed to a height of 10 cm above the original height. Record the force required to lift the mass and the distance you must move the end of the string for each of the arrangements described. Calculate the force you applied times the distance you moved the string. Also calculate the effect on the force you have to apply as compared to the force to simply lift the mass straight up.

Top Pulleys	Bottom Pulleys	Force to lift 1 kg	Distance to move 10 cm	F d	Force multiplier
0	0				
0	1				
1	1				
1	2				
2	2				
2	3				
3	3				

1. In all of the above trials, what did you accomplish?

2. What happens to the force required to lift 1 kg as you increase the number of bottom pulleys used? Explain using a free body diagram.

3. What happens to the force required to lift 1 kg as you increase the number of top pulleys used? (be specific.)

4. What happens to the distance your hand has to move as the number of bottom pulleys increases?

5. What happens to F d as you change the number of pulleys?

6. How could you get a force multiplier of 3? Of 5? (Show with diagrams)

Ramps

Using a ramp, raise a cart to a height of 50 cm at a constant speed. Record the force along the ramp and the distance the cart will have to travel along the ramp. Calculate the force applied times the distance the cart moves.

Arrangement	Force	Distance	F d
Lifting straight Up			
$\theta_1 =$			
$\theta_2 =$			
$\theta_3 =$			
$\theta_4 =$			
$\theta_5 =$			

1. In all of the above trials, what did you accomplish?
2. As the angle of incline decreases, what happens to the force required to raise the cart? Explain using a free body diagram.
3. As the angle of incline decreases, what happens to the distance the cart has to move?
4. As the angle of incline decreases, what happens to F d?
5. What angle would require you to pull with half of the object's weight? What would happen to the distance the object would have to move?