

The objective of this lab exercise is to compare both the force required and the amount of work done to pull an object up an incline versus pulling it straight up.

**Materials:**

- cart
- ramp
- spring scale
- protractor
- meter stick

You will be comparing the upward movement of a cart via pulls at various angles over a distance of 1.0 m versus pulls straight up over several pre-determined distances. Angled pulls should be made parallel to the surface and at a constant velocity.

**Angled Pulls**

Angle of Incline	Force (N)	Distance (m)	Work (J)
<i>10°</i>		<i>1.0</i>	
<i>20°</i>		<i>1.0</i>	
<i>30°</i>		<i>1.0</i>	
<i>37°</i>		<i>1.0</i>	
<i>45°</i>		<i>1.0</i>	

**Vertical Pulls**

Force (N)	Distance (m)	Work (J)
	<i>0.17</i>	
	<i>0.34</i>	
	<i>0.50</i>	
	<i>0.60</i>	
	<i>0.71</i>	

**Questions to consider:**

1. Compare the amount of work done in corresponding rows in the data tables above.

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Name:

Date:

2. As the angle of incline increases, how does the force needed to pull the cart up the incline change? Include a free-body diagram in your explanation.

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3. Cargo and moving trucks often come with a ramp that is hidden above the rear bumper and can be pulled out when loading cargo. What is the benefit of using such a ramp?

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