

Objective: Support Newton's Second Law of Motion by collecting and summarizing data.

Background: The acceleration of an object is directly related to the net force acting on it.

Procedure: Model the modified set up of an “Atwood Machine” as shown in the diagram below. Collect data that supports the relationship between a changing force and the acceleration of a mass ( $m_1$ ). The horizontal tension force is provided by gravity working on a changing  $m_2$ .

Materials:

Use the internet simulation found at :

<http://users.hal-pc.org/~clement/Simulations/Physlets/TST/ModifiedAtwood%20with%20friction.html>

*physics classroom.com: atwood machine simulator*

Collect the required data by moving the slider bars and running the animation

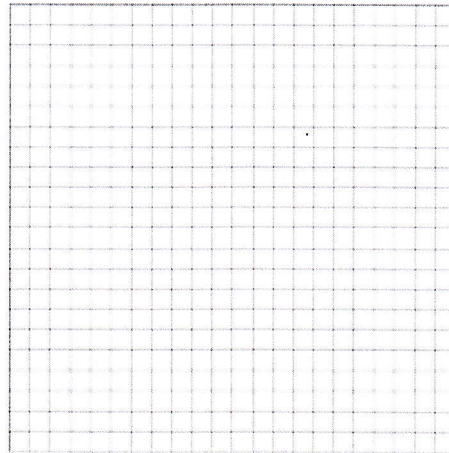
Data: (2points)

total mass of cart +  $m_1$  (kilograms) : \_\_\_\_\_

mass dropping ( $m_2$ - kilograms)	acceleration due to gravity ( $m/s^2$ )	calculated force of tension (Newtons)	change in position ( $\Delta x$ - meters)	time (seconds)	calculated acceleration of cart [ $\Delta x = 1/2at^2$ ] ( $m/s^2$ )

Analysis

Graph the relationship investigated in this experiment – show the trend (6 points)



Summarize:

The data shows a \_\_\_\_\_ relationship between \_\_\_\_\_ and \_\_\_\_\_ . The support for this statement is found :

Conclusion and Extention (2 pts each)

1. Does the  $F_{\text{tension}} = \text{mass}_{\text{cart}} \times \text{acceleration}_{\text{cart}}$ ? - *cite supporting evidence* (4 pts)

2. Identify the main reason Newton's Law  $F=ma$  might not be supported by experimental data.

3. Propose a different experiment with similar equipment that might support the relationship.

4. Evaluate your level of accuracy during data collection and suggest how to make improvements.

5. If this experiment were to be run under more ideal conditions – what might be changed to observe the results that are expected?