Name: _____ Period: _____ Assigned on Wednesday, September 25, 2024

7.2 Lab: Newton's Second Law

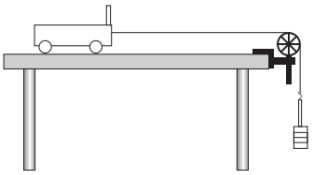
Due Wednesday, October 02, 2024

Objective

Investigate how the acceleration of an object is related to its mass and the force exerted on the object, and use experimental results to derive the mathematical form of Newton's second law.

Prelab

Watch the demonstration of the Atwood machine and answer the following questions. A diagram of the Atwood machine setup is shown to the right.



1. What practical example can you think of in real life that would use an Atwood machine?

2. "What do you observe?" during the operation of the Atwood machine?

3. "What can you measure?" during the operation of the Atwood machine?

4. "What can you change?" about the operation of the Atwood machine?

5. When performing your experiment with the cart using an Atwood machine, what will a graph of the cart's velocity (v) vs. time (t) look like after the system is released from rest?

6. If the cart's mass is increased, how will a graph of the cart's velocity vs. time change (or not change) from the original cart mass?

7. If the hanging mass is increased, how will a graph of the cart's velocity vs. time change (or not change) from the original hanging mass?

8. If both the cart's mass and the hanging mass are doubled from their original masses, how will a graph of the cart's velocity vs. time change (or not change)?

Investigation

Your group will be assigned one of two experiments to perform:

- Experiment 1: Design a procedure that includes the determination of the acceleration when the total mass of the system is kept constant and the net force is varied.
- Experiment 2: Design a procedure that includes the determination of the acceleration when the total mass of the system is varied and the net force is kept constant.

Your group will pair together with a group doing the opposite experiment and share results.

Things to think about and include in your procedure:

- What will you measure?
- How will you measure it?

- What equipment do you need?
- How will you minimize error?

Analyzing Results

1. Create a data table to collect your data. Be sure to include labels and units. You do not need to use the entire blank table.

2. Create two graphs: one of your data, and one of the other group's data. To think about: a) What will go on the x-axis? b) What will go on the y-axis? c) What does the slope of each graph represent? d) If the graph is not linear, what could you do to linearize the data? (Talk to me about this.)

3. You will notice the graph does not go through zero. Why not? Shouldn't there be zero acceleration if there is zero net force (according to Newton's First Law)?

4. What is the algebraic relationship between acceleration, mass, and force in this system? Explain how you determined this.