

25 points maximum based on accuracy
completeness, neatness, on-task,
cooperation, clean-up

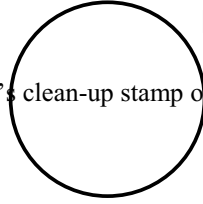
Experimenter _____ Period/My Name/Seat #

Materials _____

Recorder _____

Reporter _____

Teacher's clean-up stamp of approval



NEWTON'S THIRD LAW OF MOTION LABORATORY

Purpose: *Forces act in sets of two.* Identify Action - Reaction “force p_____”.

$F = ma$ Explain how Mass or Force affects acceleration as judged by distance traveled.

Newton's Third Law of Motion: When the first object exerts a force on a second object, the second object will exert a forces of equal m_____ back on the first object, so that

both objects a _____ away from each other in o _____ directions.

Materials & Equipment:

18 wooden Dowels

3 rubber bands

1 meter stick

6 loops of 20 cm long string

1 Newton cart

Pair of scissors

3 wooden blocks of different mass: light, medium, heavy

Procedure:

1. Mass each of the three wooden blocks and record their masses in the data table.
2. Space the dowel rods 5 cm apart alongside the meter stick.
3. With your partner holding one of the dowel rods, wrap a piece of string about 20 cm long around the dowel rod. Your partner puts a finger on the string to hold it in place while you tie a square knot to create a string loop. Remove the string loop from the dowel rod.
4. Repeat step 3 to prepare a total of six string loops.
5. Referring to the picture of the set-up (**Figure 1**), pass a rubber band through one string loop, then attach the ends of the rubber band to the two screws on the left and the string loop to the center screw on the right of the Newton cart. This creates a loaded “sling shot.”
6. Place the lightest wooden block on the Newton cart with the pointed end of the block against the rubber band.
7. Line up the cart so that the cart's back end is at the 0 cm mark on the meter stick. This is your reference point.
8. Hold the scissors upright with the cutting blades pointed down. Get ready to lift your hand up quickly and out of the way. Carefully cut the string releasing the wooden block and allowing the cart to move on the dowel rods. Did you move your hand away fast enough?
9. Note the distance the reference point on the cart traveled and record it in the data table.
10. Repeat steps 5 - 9 using the medium mass wooden block and the heavy mass block.
11. Repeat steps 5 - 9 using two rubber bands to create even greater force.

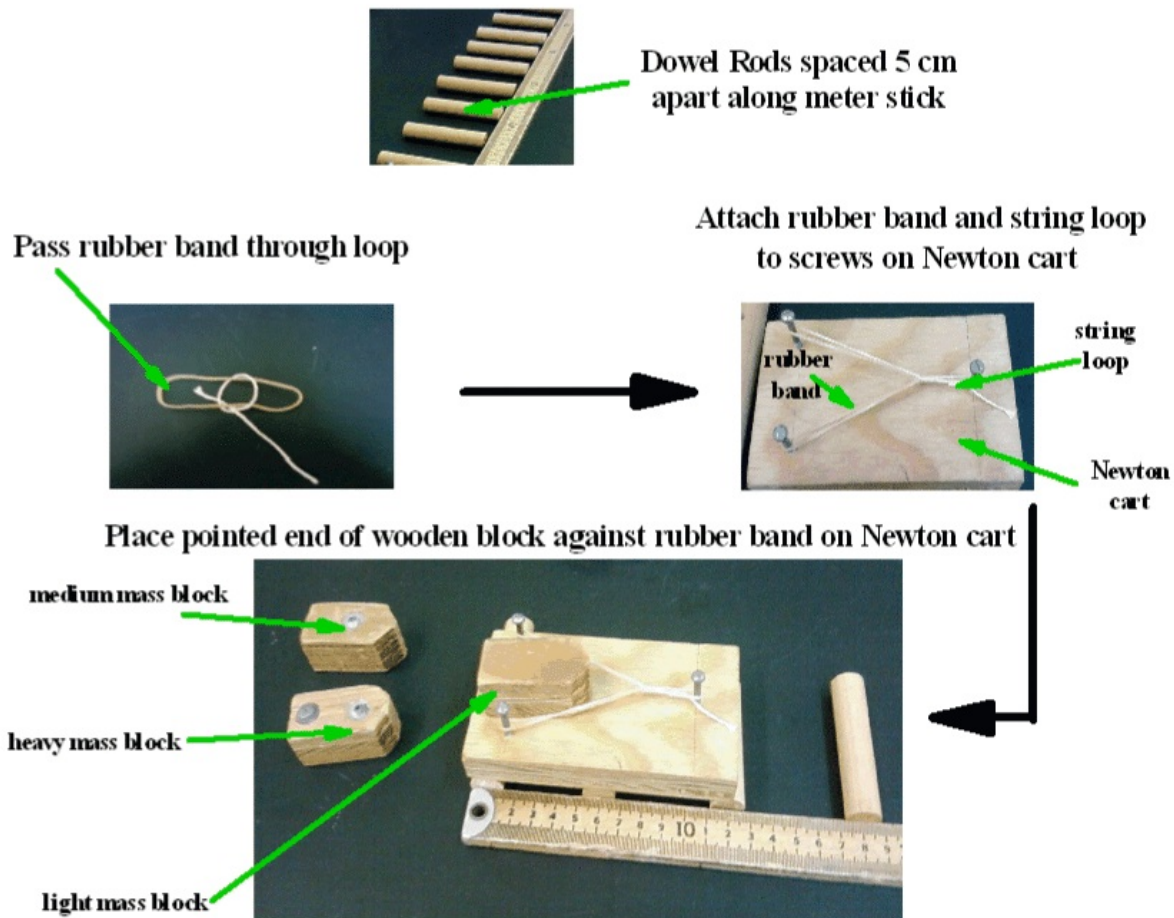


FIGURE 1

Newton Cart Set-up Procedure

HYPOTHESIS A

If mass ($\pm 0.1\text{g}$) increases, **then** acceleration will: *(circle 1)*

- increase
- stay constant
- decrease

when force is kept constant, as judged by distance (cm) the cart travels.

HYPOTHESIS B

If force (# rubber bands) increases, **then** acceleration will: *(circle 1)*

- increase
- stay constant
- decrease

when mass ($\pm 0.1\text{ g}$) stays constant, as judged by distance (cm) the cart travels.

DATA TABLES

Mass of Wooden Blocks

Record the mass of each of the three wooden blocks to the nearest gram.

_____	_____	_____
Light Block	Medium Block	Heavy Block

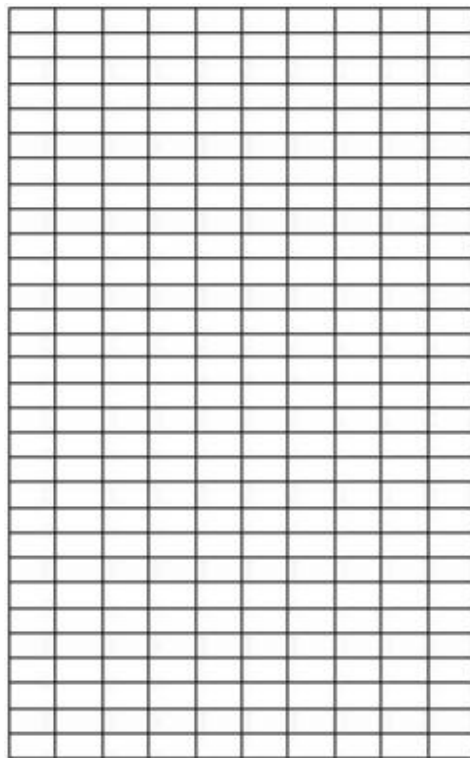
Test Results

Record the distance the Newton car traveled to the nearest (± 0.1 cm) centimeter

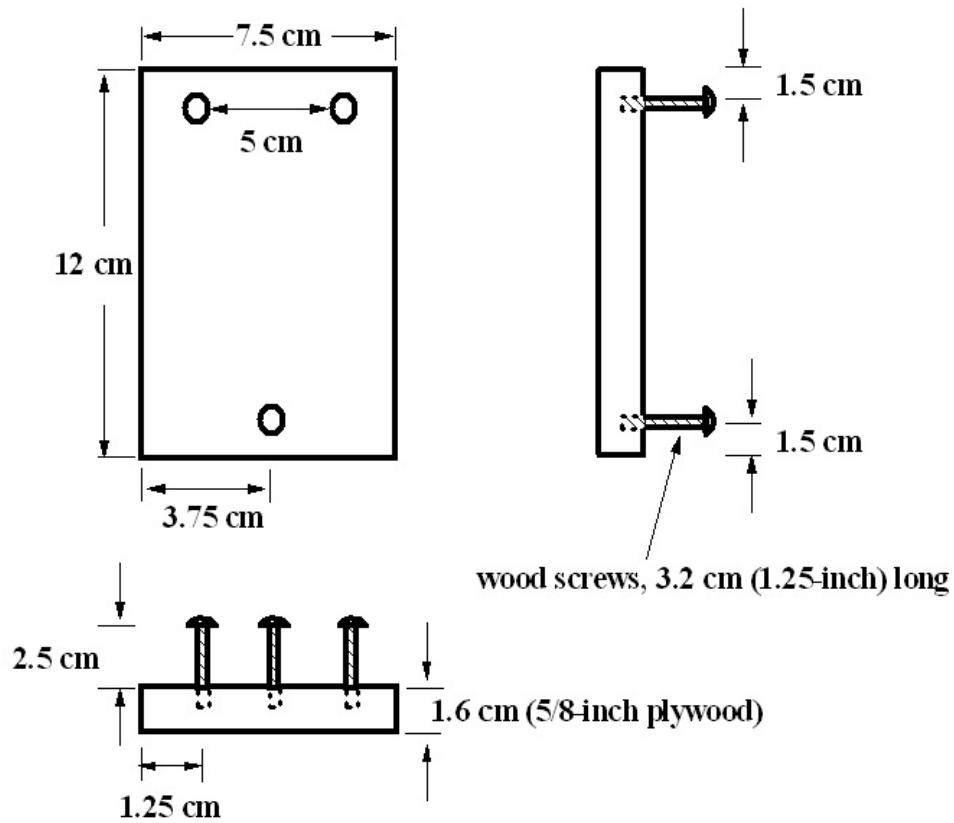
	<u>Trial 1: 1 Rubber Band</u>	<u>Trial 2: 2 Rubber Bands</u>
Light Mass Block	_____	_____
Medium Mass Block	_____	_____
Heavy Mass Block	_____	_____

BAR GRAPH

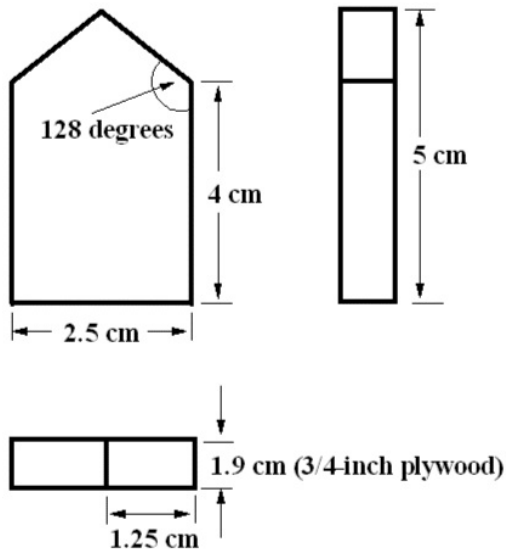
Make a line graph of your results with the x axis = block mass and the y axis = distance. Use metric units. For each block, color two bars; one color for each trial. Make a key. Title your graph.



Newton Cart Dimensions

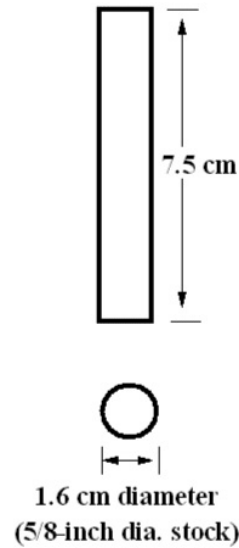


Wooden Block Dimensions



10 gram lead weights can be imbedded in block to create blocks with different masses

Dowel Rod Dimensions



ANALYSIS

1. Explain how this lab relates to Newton's 3rd Law of Motion by identifying the force pair.

Action force: (*Hint – what do the rubber bands push?*)

Reaction force: (*Hint – what does the wood block push?*)

2. According to Newton's 1st Law, inertia is a p_____ of matter that describes what an object is already doing, before the object is acted upon by a force.
3. Describe an example of inertia you observed during this lab:
4. This lab relates to Newton's 2nd Law.
Describe how cart acceleration changed when force stayed constant and mass increased.
5. This lab relates to Newton's 2nd Law.
Describe how cart acceleration changed when mass stayed constant and force increased.