

Name:

Date:



Investigate Forces and Motion

Hands-On Activity: Investigation (Student Activity Sheet)

Activity Overview

This *Expedition: Learn!* activity provides a hands-on opportunity to plan and conduct an investigation to provide evidence that the change in the motion of an object acted on by unbalanced forces depends on the mass of the object and the size of the net force. You will conduct one of two possible investigations.

Investigation Question	In this investigation you will:
<p><i>Mass Investigation</i></p> <p>How does changing the mass of cart B affect how much its motion changes when acted on by an unbalanced force?</p>	<ol style="list-style-type: none">1) observe the motion of cart B after it is pushed by cart A traveling down a ramp2) examine how changing the mass of cart B changes its motion
<p><i>Angle Investigation</i></p> <p>How does changing the size of the net force acting on cart B affect how much its motion changes?</p>	<ol style="list-style-type: none">1) observe the motion of cart B after it is pushed by cart A traveling down a ramp2) examine how changing the angle of the ramp, which determines the force applied by cart A, changes the motion of cart B

Materials

- Balance or scale (for mass investigation)
- Dynamics carts with bumpers (2 per group)
- Masking tape (1 roll per group)
- Masses (8 per group)
- Meter sticks (2 or 3 per group)
- Protractor (1 per group)
- Ramp (1 per group)

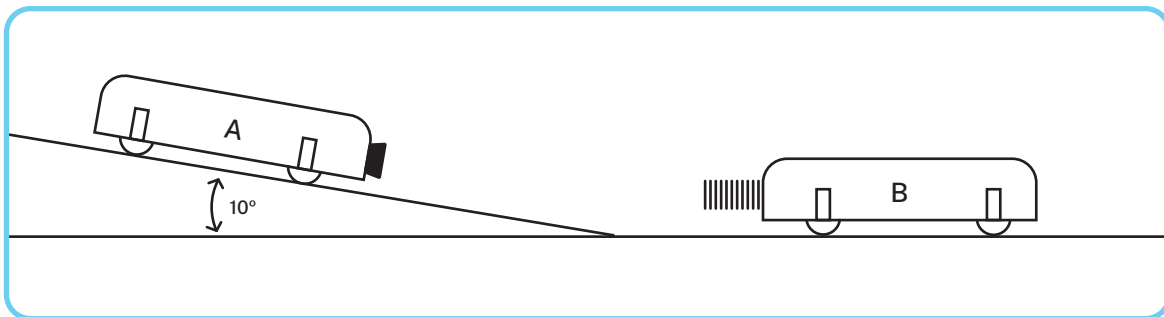
Safety

- Follow classroom rules for engaging in hands-on group activities.

Procedure

Initial Setup

1. Set up the ramp with an angle of about 10° .
2. Use the meter sticks and masking tape to create a track for the carts.
3. Attach a rubber bumper to one cart and a metal spring bumper to the other.
4. Use the diagram below to help plan the remainder of the setup based on the research question you are investigating. In the investigation, cart A will be released from a designated starting position on the ramp, while cart B will be at rest a specified distance from the bottom of the ramp.



Plan Your Investigation

Research Question (circle one)

Mass investigation: How does changing the mass of cart B affect how much its motion changes when acted on by an unbalanced force?

Angle investigation: How does changing the size of the net force acting on cart B affect how much its motion changes?

Cause
(Independent Variable)

Mechanism
(Science Ideas)

Effect
(Dependent Variable)

The change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Hypothesis

We believe that cart B will _____ (describe its motion) when the _____ (independent variable) is increased/decreased (circle one).



Procedure (the steps you will take to investigate the research question)

Constants (what you will keep the same during every trial)

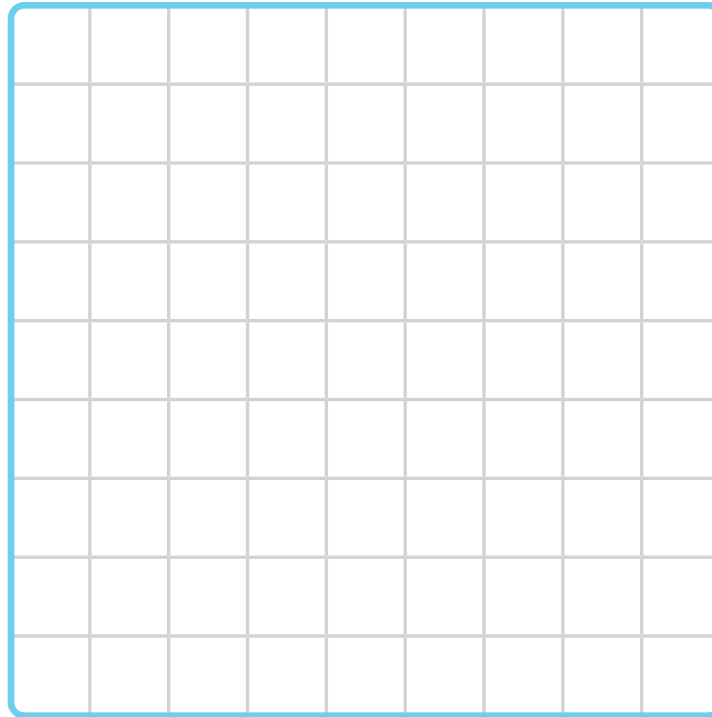


Data Table (number of trials, type of data you will collect, and measurements you will use)



Graph (the averaged data for each test of the independent variable)

Dependent Variable

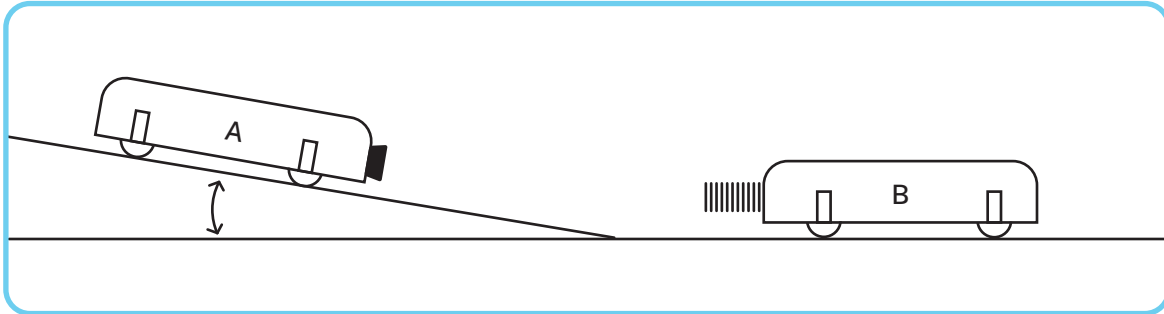


Independent Variable



Analysis

Draw and label a force diagram for your investigation.



Research Question: How does changing the mass of cart B affect how much its motion changes when acted on by an unbalanced force?

1. How did the mass of cart B affect its motion after the collision?

2. Why did the mass of cart B affect its motion after the collision?

3. How might you increase the distance cart B travels?



Research Question: How does changing the size of the net force acting on cart B affect how much its motion changes?

1. How did changing the angle of the ramp (acceleration) affect the motion of cart B?
2. Why did changing the angle of the ramp (acceleration) affect the motion of cart B?
3. How might you decrease the distance cart B travels?