

Newton's Second Law: Balloon Rocket & Mass Investigation

Name: _____ Date: _____

LEARNING OBJECTIVE

Students will investigate how force and mass affect acceleration and apply the formula $F = ma$.

MATERIALS NEEDED

- balloon
- straw
- string (about 3 meters)
- tape
- toy car or lightweight cart
- small weights such as coins or washers
- stopwatch
- measuring tape

HANDS-ON ACTIVITY

1. Thread a string through a straw, stretch it tight across a room (tied to two chairs), and tape the straw to an inflated, pinched-shut balloon.
2. Release the balloon and time how long it takes to travel a measured distance along the string; record distance and time, and calculate speed.
3. Add a small piece of tape or paper (extra mass) to the balloon-straw system and repeat with a similar amount of air; record the new time and calculate the new speed.
4. Compare whether adding mass increased or decreased acceleration, recording data in a table of Trial, Mass added, Time, and Speed.
5. Using a toy car and small weights, push the empty car and the weighted car with the same-strength push across a measured distance, timing each and recording which accelerated faster.

QUESTIONS

1. What is Newton's Second Law formula, and what does each variable represent?

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2. Based on your balloon rocket results, what happened to the speed/acceleration when you added mass?
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3. If a 2 kg object accelerates at 3 m/s squared, how much net force is acting on it?

4. Why is it hard to keep your push force exactly the same between trials with the toy car, and how could you improve the experiment?
