

Newton's Second Law: Force, Mass & Acceleration

Name: _____ Date: _____

LEARNING OBJECTIVE

The student will investigate how changing an object's mass affects its acceleration down a ramp when force stays constant.

MATERIALS NEEDED

- A toy car or ball
- a board or stiff cardboard to make a ramp
- books to prop up the ramp
- tape
- extra weight (coins, small washers, or clay)
- stopwatch
- ruler
- paper
- pencil

HANDS-ON ACTIVITY

1. Build a ramp by propping a board or stiff cardboard against a stack of books at a consistent angle, and mark a fixed release point and a finish line of known distance.
2. Release the empty toy car or ball from the same release point three times, timing how long it takes to reach the finish line each time, and average the results.
3. Tape a measured amount of extra weight (e.g., 5 coins) onto the car or attach it to the ball, and repeat three timed trials from the same release point.
4. Add even more weight (e.g., 10 coins total) and repeat three more timed trials.
5. Record all trial times and calculate the average time for each mass condition in a table.

QUESTIONS

1. **What happened to the time it took to reach the finish line as you added more mass to the car or ball?**
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2. **According to Newton's Second Law (Force = mass x acceleration), if the force stays the same but mass increases, what should happen to acceleration?**
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3. Did your experimental results match what Newton's Second Law predicts? If not, what real-world factors might explain the difference?

4. Give a real-world example (not from this experiment) where increasing an object's mass would make it accelerate more slowly for the same applied force.
