Performance Task

3.2 Representing Acceleration with Equations and Graphs 16.

Design an experiment to measure displacement and elapsed time. Use the data to calculate final velocity, average velocity, acceleration, and acceleration.

Materials

- a small marble or ball bearing
- a garden hose
- a measuring tape
- a stopwatch or stopwatch software download
- a sloping driveway or lawn as long as the garden hose with a level area beyond

(a) How would you use the garden hose, stopwatch, marble, measuring tape, and slope to measure displacement and elapsed time? Hint—The marble is the accelerating object, and the length of the hose is total displacement.

(b) How would you use the displacement and time data to calculate velocity, average velocity, and acceleration? Which kinematic equations would you use?

(c) How would you use the materials, the measured and calculated data, and the flat area below the slope to determine the negative acceleration? What would you measure, and which kinematic equation would you use?

Teacher Support

Teacher Support This performance task supports NGSS HS-PS2-1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Performance Task Rubric

(a) Insert the marble—without a push—into the end of the hose at the top of the slope. With the stopwatch, measure the time, t, from when the marble was introduced at the top until it appears at the bottom. The length of the hose is displacement, x.

(b) Use Equation 1 to calculate average velocity; use Equation 2 to calculate velocity; and use Equation 3 to calculate acceleration.

(c) Measure the time from when the marble comes out of the hose until it stops to get t. You will not need x. Use the average v measurement from above for v_0. The value of v is zero. Use Equation 3 to calculate deceleration. The sign of a will be minus.