

INCREDIBLE HULK COASTER® ACCELERATING WEIGHT

ACTIVITY OVERVIEW: STUDENTS WILL BE PROVIDED WITH MATERIALS AND ASKED TO DESIGN AN EXPERIMENT THAT WILL MEASURE THE RELATIONSHIP BETWEEN MASS, SPEED, AND ACCELERATION. AFTER RECEIVING APPROVAL, THEY WILL CONDUCT THEIR EXPERIMENT. THE SCIENTIFIC METHOD IS USED THROUGHOUT IN THE DESIGN, TESTING, AND MODIFICATION OF THEIR PROCEDURE. THEY WILL ANALYZE THEIR DATA THROUGH GRAPHICAL ANALYSIS TO DETERMINE THE FACTOR THAT HAS THE GREATEST IMPACT ON SPEED AND ACCELERATION. STUDENTS WILL THEN MAKE PREDICTIONS ON THE CHANGE IN ACCELERATION IN SPEED AND ACCELERATION IF GRAVITY WERE TO CHANGE. THIS NEW DATA WILL BE GRAPHED AND ANALYZED.

THEIR MATH SKILLS WILL BE TESTED THROUGH THE USE OF ALGEBRAIC FORMULAS TO CALCULATE SPEED AND ACCELERATION. THEY WILL ALSO BE GRAPHING THEIR DATA AND THEN ANALYZING THEIR GRAPHS TO LOOK FOR TRENDS. MATHEMATICAL PREDICTIONS WILL BE TESTED FOR ACCURACY THROUGH GRAPHING.

MATH STANDARDS

Measurement: Standard 1

The student measures quantities in the real world and uses the measures to solve problems. (MA.B.1.4.1; MA.B.1.4.2)

Measurement: Standard 2:

The student compares, contrasts, and converts within systems of measurement (both standard/nonstandard and metric/customary). (MA.B.2.4.1; MA.B.2.4.2)

Measurement: Standard 3

The student estimates measurements in real-world problem situations. (MA.B.3.4.1)

Measurement: Standard 4

The student selects and uses appropriate units and instruments for measurement to achieve the degree of precision and accuracy required in real-world situations. (MA.B.4.4.2)

Geometry: Standard 3

The student uses coordinate geometry to locate objects in both two and three dimensions and to describe objects algebraically. (MA.C.3.4.2)

Algebraic Thinking: Standard 1

The student describes, analyzes, and generalizes a wide variety of patterns, relations, and functions. (MA.D.1.4.1; MA.D.1.4.2)

Algebraic Thinking: Standard 2

The student uses expressions, equations, inequalities, graphs, and formulas to represent and interpret situations. (MA.D.2.4.1)

Data Analysis: Standard 1

The student understands and uses the tools of data analysis for managing information. (MA.E.1.4.1)

SCIENCE STANDARDS

Force and Motion: Standard 1

The student understands that types of motion may be described, measured, and predicted. (SC.C.1.4.1; 1.4.2)

Force and Motion: Standard 2

The student understands that the types of force that act on an object and the effect of that force can be described, measured, and predicted. (SC.C.2.4.1; 2.4.6)

Nature of Science: Standard 1

The student uses the scientific processes and habits of mind to solve problems. (SC.H.1.4.1)

Nature of Science: Standard 3

The student understands that science, technology and society are interwoven and interdependent. (SC.H.3.4.1)

Materials:

One board (1" x 6") 1 meter long, 2 stop watches, 10 Science Text Books, 1 small toy truck, different size weights, 10' tape measure, graph paper

Procedure:

1. Construct a ramp by placing the board on one of the science text books.
2. Measure 10 feet from the edge of the ramp and mark with a piece of tape (duct or masking)
3. Weigh the truck.
4. Have truck roll down the ramp.
5. Time the length of time the truck required to arrive at the bottom of the ramp and to the 10 foot mark.
6. Increase the height of the ramp by adding text books. Continue recording the times required for two books, five books and ten books.
7. Increase weight by adding weights to the truck and measuring elapsed times for different amounts of books.
8. Repeat in as many different combinations as you have time to try.

Wrap-Up:

1. Have students prepare data table showing results.
2. Have students graph the results using weight versus time for each height.
3. Have students answer the following questions:
 - a. Which factor had the greatest influence on speed?
 - b. Which factor increased acceleration the most?
 - c. At which point is acceleration the greatest? Explain.
 - d. At which point does acceleration stop? Explain.

Challenge:

4. Have students discuss how the world would be different if gravity was half the force it is now or twice the force.

After the Thrill:

Most people seem to enjoy changes in acceleration. At which points on the Incredible Hulk Coaster do you think the acceleration was the greatest? Does this correspond with your findings from the truck acceleration experiment?