

The Demon!

Type of Ride:

Roller Coaster, Gravity driven

Objectives:

- To determine the height of a distant object.
- To apply estimation skills in determining distances.
- To accurately use a stop watch.
- To calculate the speed of the coaster train at various points during the ride.
- To relate qualitative observations of forces during the ride.

Key Terms:

Acceleration, Friction, Force, Inertia, Kinetic Energy, Mass, Momentum, Potential Energy, and Velocity.

Useful Formulas:

For similar triangles: $h_1 / h_2 = l_1 / l_2$

For triangulation: $h_1 = L \tan \theta$

Total height = $h_1 + h_2$

For Speed: $S = d / t$

Conversions:

88 ft/s = 60 mph; 1 ft/s \approx 1 mph; 1 m/s \approx 2mph

1 ft/s = 0.30 m/s; 1 mph = 1.60 km/hr

Data:

Length of track = 2,300 ft. or 700 m

Height of first hill = 100 ft or 30.3 m

Preparation / Pre Lab

Measuring Heights:

Materials:

meter/yard sticks, protractors, thread, small fishing weights, data books, and chalk.

1. Using Similar Triangles:

- * Review proportions with students
- * Have students record each other's heights .
- * Students should then find the average of one walking pace. (walk along a meter/yard stick)
- * Record both personal height & pace in lab book.
- * Measuring shadows on a sunny day. (Partners should record each others' shadow , then measure or pace off the shadow of a distant object cast on the playground, ie: flagpole, building, or telephone pole.)
- * Bring data back into the class room to do calculations.
- * Compare answers, if possible obtain exact height of pole to compare with students' measures.

2.Using Triangulation:

- * Prepare protractor for measuring θ by stringing a fishing line through the vertex hole in protractor bring line together using a pinch fishing weight.
- * The straight edge of the protractor will be used as a sight line; the angle measure is read by the partner eyeing the plumb line.(see worksheet).
- * Review with students how to determine the tangent of an angle.
- * Student partners should record each other's height from the eye level to ground (h_1)

- * Return to the outdoors. Students should take a position a measurable distance from the flagpole, telephone pole etc..
- * Protractors should be used to measure angle to top of pole from a standing position facing the pole. The angle measure is recorded by the partner.
- * Pace off or measure the distance from the flagpole.
- * Fit data into formula and solve for h .

Calculating Speed:

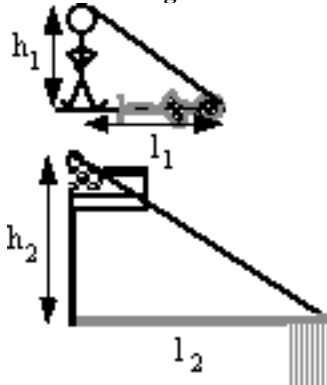
Materials:

Stopwatch, skateboard/coaster or similar, and lab book.

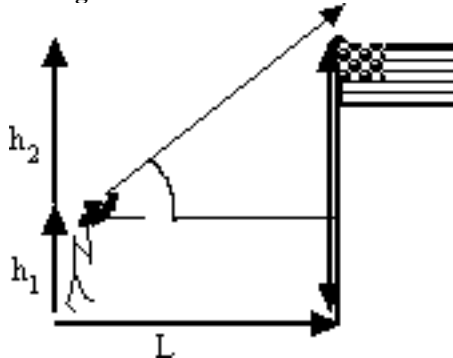
3. Measuring Speed

- * Measure out the distance of your chosen ramp or hill, a trundle wheel is helpful in measuring the course.
- * Student at top of ramp roll down ramp / hill at signal of timer.
- * Timers record duration of ride.
- * Repeated trials are necessary to improve accuracy and to give everyone a chance to race down the ramp / hill.
- * A variation to be practiced is timing as the racers pass by a single point.
- * Make a "train" of racers (two students back-to-back on skateboards).
- * Measure the total length of the "train".

Similar Triangles:



Triangulation:



Measuring Speed:

