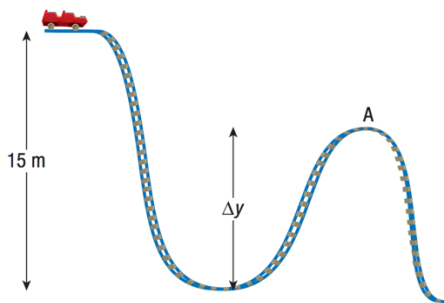


- In a 1500 kg car, 1.3 m of its front section is designed to crumple in an accident, protecting the driver and passengers. Suppose the car is travelling at 32 m/s and comes to a stop while uniformly slowing down over 1.3 m.
 - What is the duration of the collision?
 - What is the average force exerted on the car?
- Two objects undergo an elastic head-on collision in one dimension, with one object initially at rest and the other moving at 12 m/s [E]. Make a prediction for each scenario below, explaining your reasoning. Then calculate the velocity of each object after the collision for each situation.
 - The moving object is twice the mass of stationary object.
 - The stationary object is 106 times the mass of the moving object.
- Suppose that two objects undergo a perfectly elastic collision. The first object, with an initial velocity of v_i , is much more massive than the second object, which is initially at rest. Use the final velocity equations to determine the approximate final velocities of both masses.
- The Figure shows a roller coaster car at rest on the track at the top of a hill that is 15 m high. The car has a mass of 10.0 kg. It begins to move and reaches 80% of maximum speed at the top of the second hill, point A, with a curvature of 6.5 metres (not height) on the track. If friction takes away 10% of total mechanical energy up to point A, calculate the height of hill A.



- A simple pendulum with a bob with a mass of m and a string with a length of L oscillates with a large amplitude in a vertical plane. The maximum speed it attains during an oscillation is v_o . The string makes an angle θ , with the vertical at some instant during the course of motion. Use the principle of conservation of energy to find an expression for the magnitude of the **tension force** on the bob in terms of known quantities and constant.
- Mike uses a block sliding down an inclined plane to estimate the coefficient of kinetic friction, μ_k , between the block and the plane. He adjusts the inclined plane to an angle 45° above the horizontal, and allows the block to slide down the plane from rest. He uses motion detector with a computer interface to get the velocity of the block when it reaches the bottom of the plane. The distance the block slides down the inclined plane is 1.15 m. The speed of the block at this point is 2.2 m/s. Using conservation of energy, estimate μ_k .
- An amusement park features a set of light railcars, currently resting on a straight, level section of track. Each railcar has a mass of 18 kg. Ellen and her younger brother Tim are seated in two of these railcars, which are initially at rest with the rubber buffers just touching each other. Ellen's mass is 42 kg, while Tim's mass is 32 kg. Ellen pushes Tim's railcar so that it moves away with a speed of 3.0 m/s relative to the track. Assuming that the frictional forces on the railcars are small, how far the railcars will have travelled after 2.0 s?
- A spring with a spring constant of 16 464 N/m is attached to the ground. A ball with a mass of 2 kg is dropped on the spring from a height of 1 m above the top of the spring. When the ball strikes the spring, how much will the spring decrease in length?