Ballistic Pendulum Challenge Problem Level 4 #19

A ballistic pendulum is often used to identify the speed of a bullet by measuring how high a block on a

string moves up when it is struck by a bullet.

1. In this case, we will determine how high the ballistic pendulum will go, knowing the initial speed of the bullet.

A 30.0 gram bullet travelling at 340 m/s is shot by Louis into a ballistic pendulum with a mass of 4.00 kg and a wire length of 1.2 meters. The bullet and pendulum move as one after the collision.

1. Find the velocity of the pendulum-bullet system after the collision
2. Find the maximum height of the ballistic pendulum after the collision
3. Find the heat generated in the collision.

2. Write your own problem where the height of the ballistic pendulum is the given and you are trying to find the speed of the bullet. Solve the problem.

Level 4 #20 Cannonball Breakup (Momentum)

1. A 40 kg cannonball is flying through the air at 100 m/s when it suddenly splits into two unequal

pieces! If one piece flies forward with a velocity of 150 m/s and the other piece trails behind (still moving

forward) with a velocity of 60 m/s, what is the mass of the smaller of the two chunks?

1. A 5.5 g dart is fired into a block of wood with a mass of 22.6 g. The wood block is initially at rest on a

1.5 m tall post. After the collision, the wood block and dart land 2.5 m from the base of the post. Find the initial speed of the dart.

1. A bird perched on a swing in a cage has a mass of 52.0 g, and the base of the swing has a mass of 153 g. The swing and bird are originally at rest, and then the bird takes off horizontally at 2.00 m/s. How high will the base of the swing rise above its original level? Disregard friction.

Level 4 #21 Collision Simulation

First, solve the following:

Several students are riding in bumper cars at an amusement park. The combined mass of car *A* and its occupants is 250 kg. The combined mass of car *B* and its occupants is 200 kg. Car *A* is moving to the right at 5.0 m/s when the driver decides to bump into car *B*, which is at rest. After the collision, car *B* moves to the right at a speed of 4.8 m/s. Determine the speed and direction of car *A* after the collision.

Use the hyperphysics collisions link at goo.gl/foKrKO

to investigate the scenario about the bumper cars further.

a) Using the same inputs, find the final velocity pairs that would result in the following:

* Cart A stopping (you will have to enter a velocity value near zero, such as 0.0001 m/s)
* Cart A going the opposite direction that it went in #1
* Cart A and B colliding in a perfectly inelastic manner.

Are all of the pairs valid? Determine by checking that the Law of Conservation of Energy is not violated and show your findings.

b) Change the mass of cart B to determine:

* what mass is necessary to stop car A
* what mass is necessary to make it reverse direction.

Are all of the pairs valid? Determine by checking that the Law of Conservation of Energy is not violated and show your findings.

c) Summarize in a table and discuss your findings briefly (2-3 sentences)