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Ballistic pendulum lab equations

Purpose: Develop a description of the ballistic pendulum collision by using momentum conservation to determine changes in the direction of balls and pendulums and assess system energy changes. Equipment: Triple Beam Balance TI-84 Photo Gate Calculator Vernier Ruler Ballistic Launcher (see illustration below) Procedure: Please see the video to experience in advance of our procedure. Data: Ball Mass: 59.0 grams= .059 kg Height Change: 10.5 cm= .105 m Time Change: 0.010148 sec Diameter ball: 25.4 mm = .0254 m Data Analysis/Calculation: Direction (ball) : Diameter/Change In Time = .04 m/ .010148 sec= 2.50 m/s Halaju(take-off)=(2gh)^(1/2)= (2 x 9.8 m/s^2 x .105 m)^(1/2)= 1.5.8 m/s^2 x .105 m)^(1/2)= 1.1.8 m/s^2 x .105 m)^(1/2)= 1.1.8 m/s^2 x .105 m)^(1/2)= 1.1.8 m/s^2 x .105 m)^(1/2))= 43 m/s Pendulum Mass: m(ball) x v(ball) = v(final) x (m(ball) + m (pendulum)) (.059 kg x 2.5 m/s) = 1.43 m/s (.059 kg + m (pendulum)= .044 kg : (1/2)(.059 kg)(2.50 m/s)^2= .184 J Kinetic Energy Starting Balls and Pendulums: (1/2)(.103 kg)(1.43 m/s)^2= .105 JChange in Kinetic Energy : .105 J-.184 J= -.079 Kinetic Energy JFraction Lost : .079 J/ .184 J= .429 J Change is Potential Energy: mgh= (.103 kg)(9.81 m/s^2)(.105 m)= .106 JConclusion: By completing this open lab, we learned to evaluate ballistic pendulum collisions by using momentum conservation to determine changes in the velocity of balls and pendulums and assess system energy changes. In a truly inelastic clash like a ballistic pendulum, the two bodies stick together and move with the same direction. This process absorbs some of the system's kinetic energy. The system can also eliminate kinetic energy in producing sound or heat. Our system eliminates about .079 J. This small change in kinetic energy is most likely due to the heat that the ball gives up when it collides with the catcher's pendulum (see illustration.) Since there is no external power acting on the system at the time of the collision, we can assume that linear momentum has been preserved; However, we cannot use Energy Conservation Laws because the amount of kinetic energy is not preserved. It is likely that the source of error can include air resistance and rounding measurements. Author: Jacob HoffnerLab Partners: Zach Christoff and Alyssa JordanDate: January 2016 To investigate momentum conservation during the perfect clash of inelastic projectile through corner measurements. Momentum Conservation Law states that the momentum of one object can affect the momentum of other objects through collisions in the system. In this laboratory, we will find out how the projector momentum to affect the final momentum in the pendulum. We will investigate l (length), v0 (initial velocity), and mass m and M to find h (height), v' (final velocity), and theta (step By knowing the calm associated with the system and through derivatives of the equation, we can find unknown variables. By setting the total amount on each side of the same collision with each other, we can get an equation to finish the final velined. Since we know both the mass (mass m and M) and the initial velocity of the projector, we can find the final velocity. Since we know the energetic system and the final velince that is now known, we can find height. We also know the acceleration of gravity. Now because every variable is found, we can find theta by getting the equation, replacing the final velence and height equation into the equations used to find theta. To run this lab, we first established a projected launcher to launch the projector. This is attached to the pillar, and at the top of the pendulum pillars has been attached. The pendulum is connected to an angle measurement, which finds the maximum angle of the swung pendulum. Velocity is measured using two photo doors attached to the front of the projectile launcher. First, a projector has been launched in a projectile launcher three times, each time at a different setting from three settings. Each launch sends a projection into the pendulum, which swirls into the maximum angle step. This angle step is recorded on a connected computer using DataStudio. Secondly, the pendulum has been disconnected and the photo door is attached to find the velocity of three different settings for our projectile. Speed measured through a computer using DataStudio.Thirdly, we measure the pendulum from the fulcrum at the top to the mass center near the bottom to find l, or long. We also measure the pendulum for M mass and projector for a massive m.By mounted speed found and the crowd found into the equation obtained, we can find the final velocity, v'. Height, h, also available. Install all this data into the theta's mappage equation allows us to find calculated angle steps for all three projector tests launched. We can now compare calculated angles to be found with measured angles found before. By using percent differences, we can see how close they actually come to each other. Using this data, we can prove The Momentum Conservation Law. Here are measured and calculated angle measurements found on different launch settings. There was also a preliminary speed discovered that the projectile had been launched. Pendulum Pillar Mass: 0.1711 kilogram Projectile: 0.15187 kilogramLength (l): 0.3505 m Below are the calculations of the calculated angle step samples and percent difference. Calculated The Percentage Difference Corner Step In this laboratory, we will investigate the momentum in a perfectly inelastic clash in the ballistic pendulum. By comparing measured angles during trials with calculated angles found, we found only a small percentage difference in comparison. Error at this may be due to instrumental measurements/mistakes in which we read each data point in DataStudio to demand what theta. There may be a bit of instrumental instrumental in the device; it may be a bit of a loser, causing a minuscule wobble during launch. Air resistance may be able to play a very small role in slowing down the pendulum. To solve the problem of wobble, we can try to find a way to tighten the basic projectile launcher/pendulum. Overall, our theory has been proven , because the equation obtained leads us to know that the angle measured and calculated angles are very similar. The biggest percentage difference was only 3.8%. The equation obtained proves (and the overall theory proves) that momentum is preserved in a perfectly inelastic clash. Giancoli, Douglas C. Momentum Linear. Physics for Scientists & Engineer with Modern Physics. 4 ed. Upper Saddle River, NJ: Prentice Hall, 2000. Print. Bowman, D. (n.d.). Lahs Physics. Receded October 1, 2015, from Bowman, D. (2015, October 1). Chapter 9: Linear Momentum. Lectures presented in Physics, Lehighton. Lehighton.

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