Linear and Rotational Kinetic Energy Lab

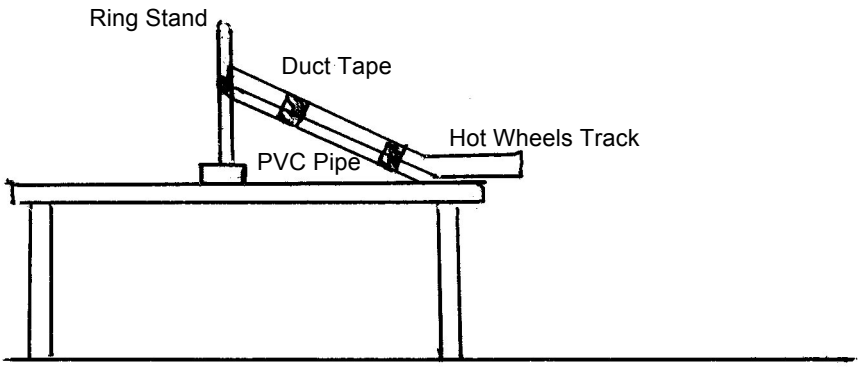
Purpose

The purpose of the lab is to explore conservation of energy for a rolling body.

Required Equipment and Supplies

- Hot Wheels track
- Meter Stick
- String
- Ring Stand
- One half diameter of PVC pipe approximately one meter long.
- Steel Ball Bearing
- Duct tape

Procedure



Use the materials provided to build a ramp on your table that will be used to roll a steel ball down. The top of the ramp should be at least 0.4m above the surface of your table. The lower section of the ramp must be horizontal so that the ball bearing is moving only horizontally when it becomes a projectile.

Measure the vertical height from the bottom of the ramp to the point where you will release the ball on the ramp. You might want to use tape to mark the position on the ramp from which you will release the ball.

Vertical height of the ball from the bottom of the ramp = _____ m

Measure the mass of the ball.

Mass of the ball = _____ kg

Calculate the potential energy of the ball.

Potential Energy of the ball = _____ J

Use the concept of conservation of energy to determine the kinetic energy of the ball as it leaves the ramp. Calculate the horizontal speed of the ball from the formula for kinetic energy as it leaves the ramp.

Kinetic Energy of the ball = _____ J

Horizontal speed of the ball = _____ m/s

Use the kinematics formulas for projectile motion to predict the landing point of the ball on the floor. Measure the vertical distance the ball must drop from the bottom end of the ramp to the floor.

Vertical distance from the bottom end of the ramp to the floor = _____ m

Use the following kinematic formula to calculate the time it takes the ball to drop for the bottom end of the ramp to the floor.

$$y = \frac{1}{2} g t^2$$

Where: g is acceleration due to gravity
y is vertical distance
t is time

Time is takes the ball to fall from the bottom end of the ramp to the floor = _____ s

Use the following kinematic formula to predict the horizontal distance the ball will travel from the end of the ramp before it lands on the floor.

$$x = vt$$

Where: v is the horizontal velocity
x is horizontal distance
t is time

Predicted horizontal distance the ball will travel = _____ m

Use tape to mark the predicted landing point of the ball on the floor.

Before you release the ball, determine the point on the floor directly above where the ball leaves the ramp. Use tape to fasten one end of a piece of string there. Your lab partner should be prepared to record where the ball lands. Release the ball on the ramp and observe where it lands. Repeat several times until you are convinced you have a consistent value for the landing distance. Stretch out the string so that it forms a straight line through the landing point. The stretch string will help you measure this distance.

Actual horizontal distance the ball traveled = _____ m

Analysis

Calculate the percent difference between the actual and the predicted landing distances.

How far did the ball land from your predicted landing point? Is it short, long, or relatively close? Close would be within two or three percent.

Compare your findings with those of the rest of the class. Is there a pattern to the results?

How would you account for the discrepancy between the predicted and actual landing points?

Use Lab Report Rubric for Quantitative Observational Labs with Procedures