**The Ballistic Pendulum and Projectile Motion** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Partner(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Purpose:** To determine the initial velocity (u) of a projectile

A) By measuring its range and vertical distance of fall

B) By using the conservation of energy and momentum.

**Apparatus**: Ballistic pendulum, meter stick, white paper, carbon paper, tape, electronic balance, plumb-line, and small ruler.

**Theory:**

Equation for the initial horizontal velocity, u of the projectile in terms of Y, vertical distance of fall and g, acceleration due to gravity, and X, horizontal distance of travel.

 u = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Equation for the initial horizontal velocity, u of the projectile in terms of m, M, g, h2, and h1.

   u = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Among the quantities you need to measure in this lab, which one(s) will have the highest error?

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|  |

DATA TABLE:

A. Determination of the initial velocity (u) of a projectile from range and fall measurements:

Vertical distance of fall = Y = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Time of flight = t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average range = X =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Initial velocity = u =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B. Determination of the initial velocity (u) of a projectile using ballistic pendulum method.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  Trial # |    1 | 2 | 3 | 4 | 5 |
| Notch # of Pendulum Catch |  |  |  |  |  |

Average notch # =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Height h2 of pointer with pendulum catch in average notch number =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Height h1 of pointer with pendulum freely suspended =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass of ball                             m = \_\_\_\_\_\_\_\_\_\_\_\_

Mass of pendulum                   M= \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Velocity of the pendulum & ball just after collision = V = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Initial velocity,   u = \_\_\_\_\_\_\_\_\_\_\_\_ [% difference](http://phoenix.phys.clemson.edu/tutorials/error/index.html) between results of parts A and B = \_\_\_\_\_\_\_\_\_

Use your data for part (B), in SI units, to answer the following questions.

1) Calculate the kinetic energy of the ball before the collision.

2) Calculate the kinetic energy of the ball and the pendulum bob just after the collision.

 3) Calculate the energy loss due to the collision.

4) What fraction of the initial kinetic energy is lost?

5) Fraction of the initial kinetic energy lost = $\frac{M}{m+M}$. Calculate the ratio, and compare it.

6) What happened to the lost energy?