Lab Report

Complete this report YOURSELF except DATA taking parts! This report will not be submitted (except the very last page), but you should carefully complete it as preparation for the applied exam.

Suggested Pre-Lab Questions

Q1. What would the expression for uncertainty in the velocity that is Δv? Write an expression in terms of height and range values and their uncertainties. Consult page 28-29 in your book.

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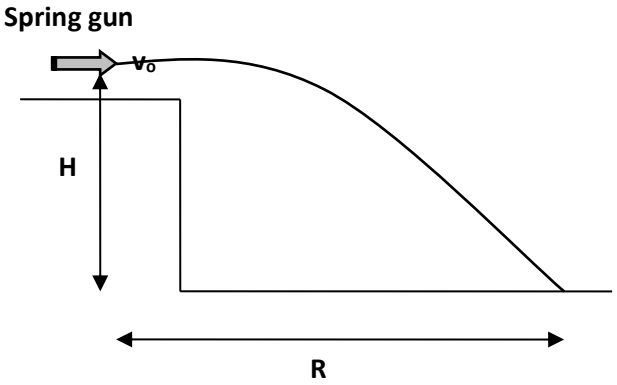
Experiment



OBJECTIVE : To study the fundamentals of projectile motion.

THEORY **:** When the ball is shot with an initial speed v in the horizontal direction, its range will be

$$R = vt$$

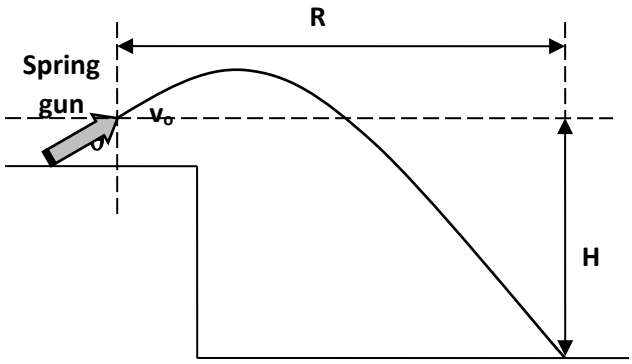
where t is the time of flight and it will be free falling. The height it falls down will determine the flight time:

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

By combining these two equations, we can determine the initial speed in terms of the range and the height:

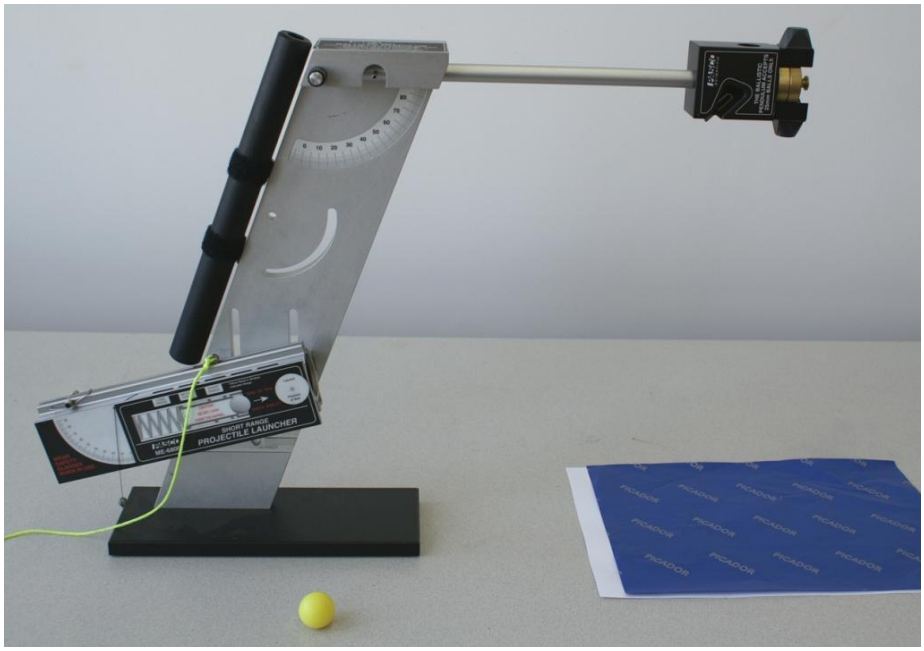
$$v_o = R\sqrt{\frac{g}{2H}}$$

On the other hand, when the ball is shot at an angle θ, it will follow a parabolic trajectory:



It can be shown that the trajectory equation is

$$\frac{gR^2}{2v_o^2}\tan^2\theta - R\tan\theta + \left(\frac{gR^2}{2v_o^2} - H\right) = 0$$



APPARATUS : Ballistic pendulum with plastic ball, meter stick, balance, carbon paper.

PROCEDURE :

Part 1: The spring gun is leveled on the table and the plastic ball is projected horizontally. The initial velocity of the ball can be determined by measuring the range, R, and the initial height, H, of the ball.

Part 2: The spring gun is inclined at an angle θ with the horizontal and the ball is shot freely. Range, height and the initial velocity of the ball are used to calculate θ.

DATA & CALCULATIONS & RESULTS

PART 1 – HORIZONTAL MOTION

Description / Symbol			Value & Unit
Height	H	=	.....
Range (1st trial)	R_1	=	.....
Range (2nd trial)	R_2	=	.....
Average Range	R_{ave}	=	.....

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Initial velocity of the ball v_o = ...

PART 2 – PROJECTILE MOTION

Description and Symbol			Value & Unit
Height	H	=	.....
Range (1st trial)	R_1	=	.....
Range (2nd trial)	R_2	=	.....
Average Range	R_{ave}	=	.....
Measured Angle	θ_{MV}	=	.....

CALCULATIONS and RESULT:

Equation for θ : $\frac{gR^2}{2v_o^2}\tan^2\theta - R\tan\theta + \left(\frac{gR^2}{2v_o^2} - H\right) = 0$

Solve for $\tan\theta$:

Description	**Calculations (show each step)**	**Result & Unit**
$Arctan\,\theta_{EV1}$ =	.....	.....
	.....	
$Arctan\,\theta_{EV2}$ =	.....	.....
	.....	

Chose the physically meaningful θ above as the experimental value and ignore the other one!

% Difference in θ experimental and measured values:

....

Suggested Post-Lab Questions

Q1. What are the possible sources of error in this experiment? Answer this question in terms of the classification given in your book.

Q2. In this experiment we are ignoring the effect of air friction. Assuming that the experiment is done in a very viscous liquid, discuss the effect of the friction due to the liquid on the motion of the ball.

Q3. Assume that the ballistic pendulum is moving upward with a speed of v_b in the first part. Derive the equations for the range and the final velocity with which the ball strikes the floor.

In the applied exam, you will have a similar setup, but you will observe conservation of momentum!

Post-Lab Report

Aim of the experiment:

Suggestions for possible solutions to the problems experienced during the experiment:

Conclusion:

6 I have completed this experiment myself as specified in the lab sheet and as explained by the lab instructor.

Name & Surname:

Student ID:

Lab Section:

Table #:

Date:

Signature of the student

As the instructor of this Lab Section I confirm that the student has participated in and completed this experiment on time.

Stamp of the PHYS Labs and signature of the instructor

This page serves as proof of the fact that the student participated in and completed the experiment, only if it is submitted in time and accepted by the Lab instructor. The student and the instructor shall sign it along with the stamp of the Physics Laboratories.