Physical Science 101

Name _____Conf_____

Partner's Name _____

Equipment

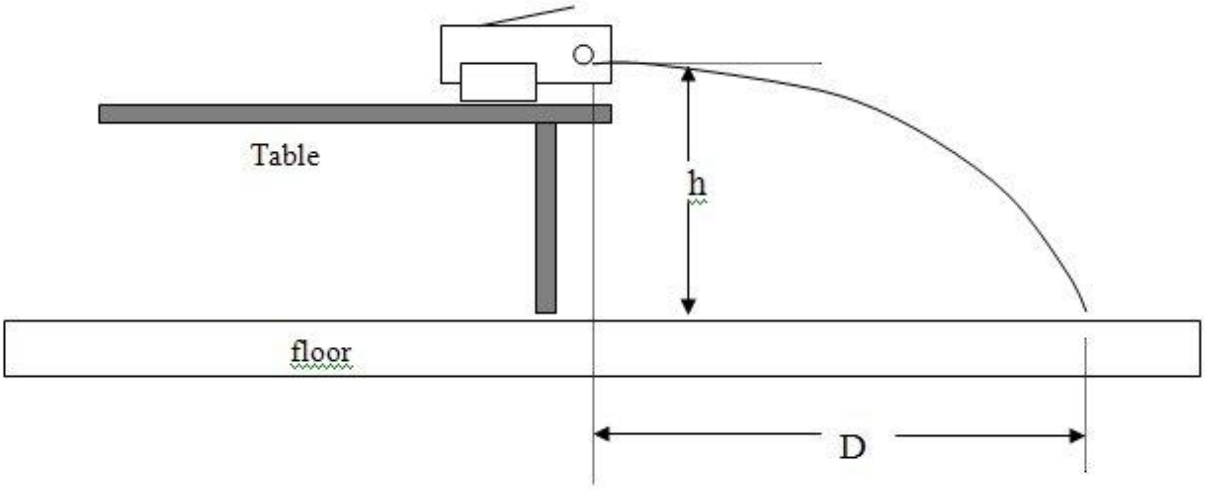
ballistic gun, meter stick, string, level

Purpose

To find the initial velocity of a projectile.

Method 1: Projectile Motion Method

1. Set the apparatus up as shown in Figure 1. The pendulum must be level. Measure the height from which the ball drops above the ground, h.



2. You should measure h from the bottom of the ball to the floor.

3. Fire the projectile horizontally so that the ball hits the floor. Repeat several times and take the average distance **D.** Record these values and the average in your data and calculations sheet. The hanging string on the gun's protractor is the best way to check for the gun being level.

   3 D values _____ _____ _____

   average D = _____ meters

4. Use the formula,

$$h = \frac{1}{2} g t^2 \qquad \text{or} \qquad t = \sqrt{\frac{2h}{g}}$$

to find the time the ball is in the air.

t= _____

The horizontal velocity is constant during this time. Find the initial horizontal velocity of the ball by rearranging $d = vt$.

V= _____

How High will the ball go?

If the ball is shot straight up the ball will take a time t=V/g to stop (i.e. reach the top).

On its way up it will have an average speed of V/2 (starts at V ends with v=0). The vertical height reached will be

H=(V/2) *(V/g)

Using V from above calculate H.

$H_{calculated}$ =_____

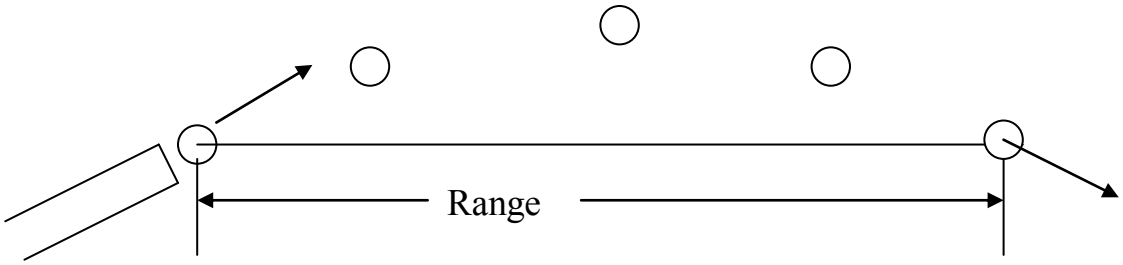
Now shoot the ball straight up and measure H. H should be measured from the ball's loaded position to its maximum height.

$H_{measured}$ = _____

Give the % difference between these.

$$\%\,\text{difference} = \frac{H_{calculated} - H_{measured}}{H_{calculated}} \times 100 =$$

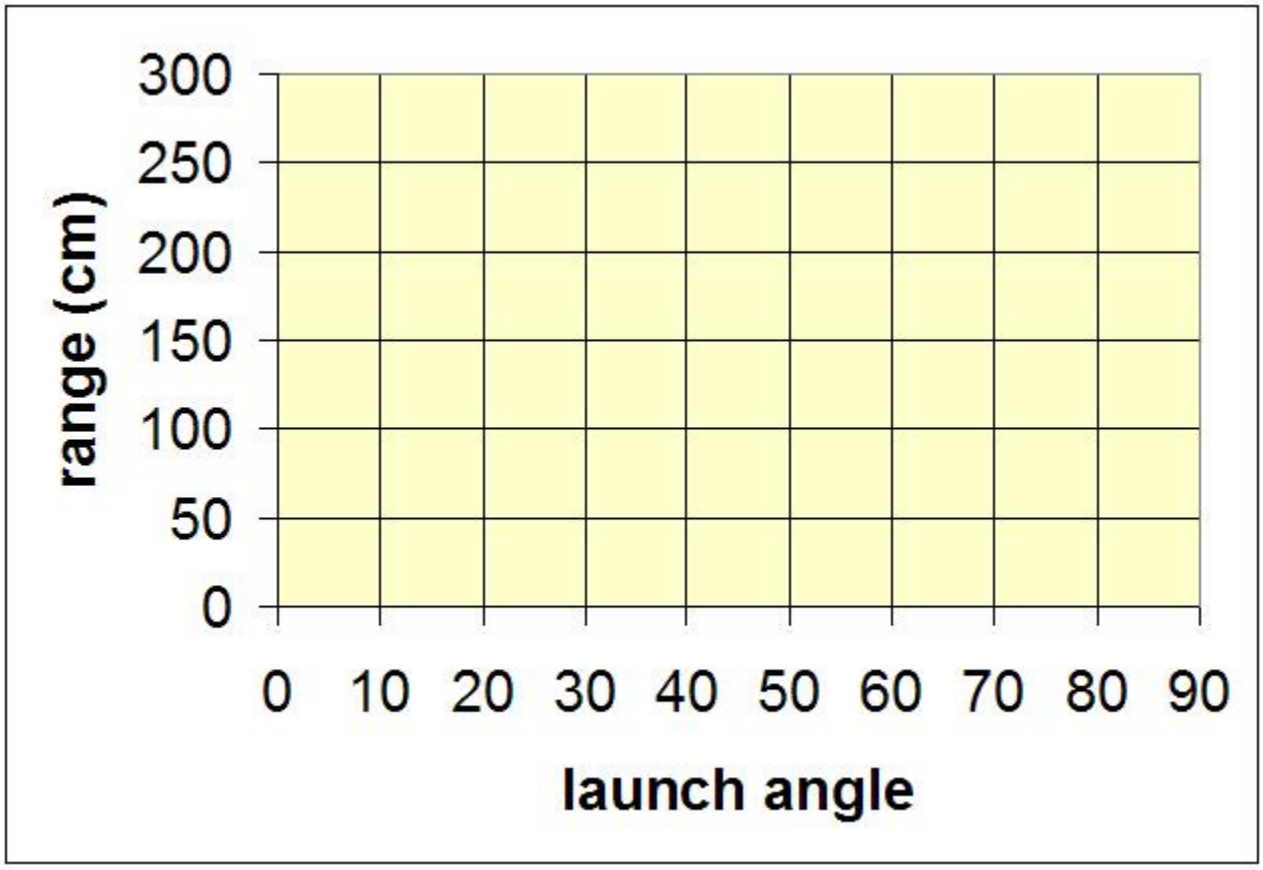
Part 2. Using the spring launcher measure the range of a projectile for different launch angles. Fill in the table below with your measured values. The Range is the horizontal distance travel from the launch point to the point at which the ball comes back to the same vertical launch level. Also use the set of axes on the next page to graph your results. Make sure to adjust the height each time so the ball leaves from table level and lands at this same level.



Launch Angle (degrees)	Horizontal Range (cm)
0	0.0
10	
20	
30	
40	
45	
50	
60	
70	
80	
90	0.0

Your text book says that 45 degrees gives the maximum horizontal range. Is this true for your experiment?

Your text book says that if two angles add up to be 90 degrees then their horizontal ranges are the same. How does your data agree with this? Explain.



Questions:

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Figure 10-B

1) A rock is thrown upward at 50 degrees with respect to the horizontal. As it rises, its vertical component of velocity 1) _____

A) remains unchanged. B) increases. C) decreases.

2) A projectile is launched vertically upward at 50 m/s. If air resistance is negligible, its speed upon returning to its starting point is 2) _____

A) 50 m/s. B) more than 50 m/s. C) less than 50 m/s.

3) A projectile is launched at ground level an angle of 15 degrees above the horizontal and lands down range. What other projection angle for the same speed would produce the same down-range distance? 3) _____

A) 45 degrees B) 90 degrees C) 75 degrees D) 30 degrees E) 50 degrees

4) After a rock thrown straight up reaches the top of its path and then falls a short distance, its acceleration is (neglect air resistance) 4) _____

A) greater than when it was a the top of its path.
B) the same as it was at the top of its path.
C) less than when it was at the top of its path.

5) Two projectiles are fired from ground level at equal speeds but different angles. One is fired at an angle of 30 degrees and the other at 60 degrees. The projectile to travel farthest (neglect air resistance) 5) _____

A) 30 degrees.
B) 60 degrees.
C) Both hit at the same distance

6) Two projectiles are fired from ground level at equal speeds but different angles. One is fired at an angle of 30 degrees and the other at 60 degrees. The projectile to hit the ground first will be the one fired at (neglect air resistance) 6) _____

A) 30 degrees.
B) 60 degrees.
C) Both hit at the same time.

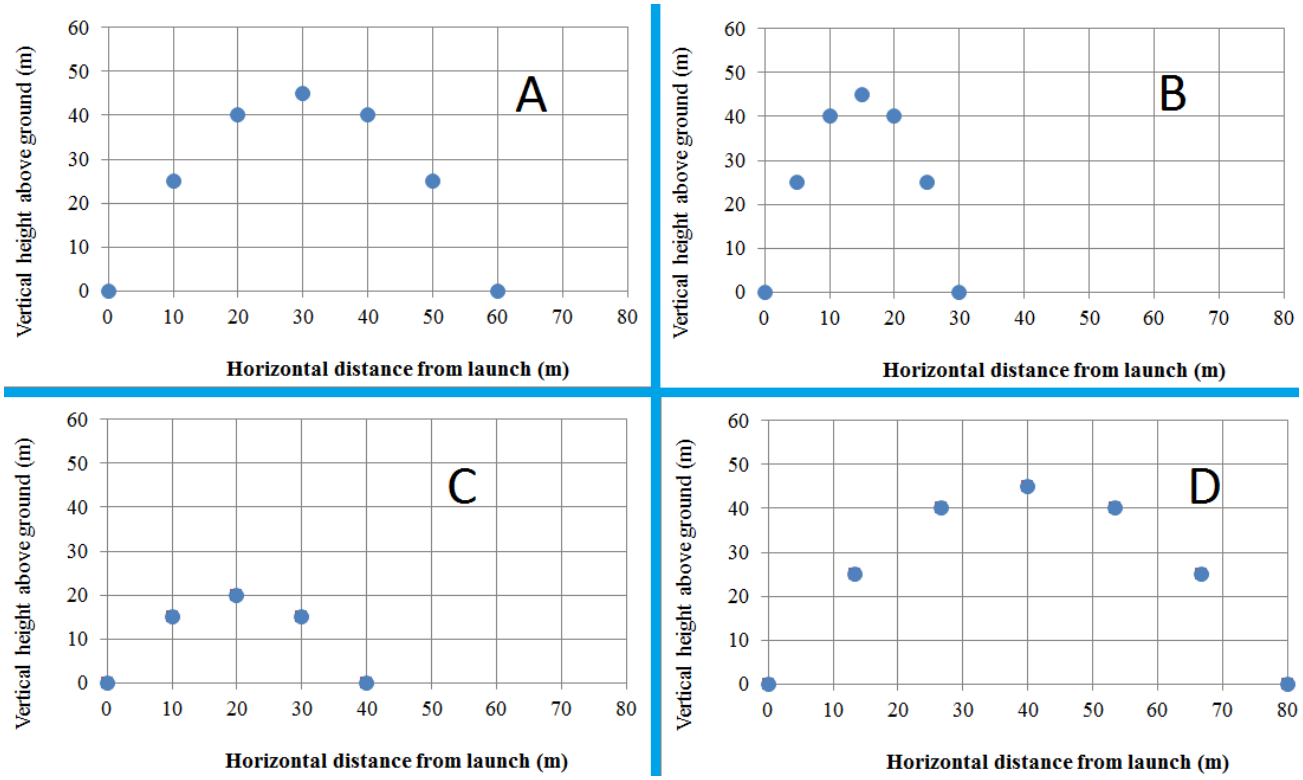
7) Two projectiles are fired from ground level at equal speeds but different angles. One is fired at an angle of 30 degrees and the other at 60 degrees. The projectile to go highest will be the one fired at (neglect air resistance) 7) _____

A) 60 degrees. B) 30 degrees. C) Both go just as high

Figure 10-B

8) A rock is thrown upward at 50 degrees with respect to the horizontal. As it rises, its horizontal component of velocity 8) _____

A) remains unchanged. B) decreases. C) increase



The graphs above are plots of a projectile launched at an angle giving it both vertical and horizontal components of velocity. The vertical and horizontal position of the ball are plotted at 1.0 second intervals. Assume that the acceleration due to gravity is 10 m/s^2 for the questions below.

A) Which graph corresponds to a projectile launched with a horizontal velocity of 10 m/s and a vertical component of velocity of 30 m/s?

ANS=_____

B) Which graph corresponds to a projectile launched with a horizontal velocity greater than 10 m/s and a vertical component of velocity of 30 m/s?

ANS=_____