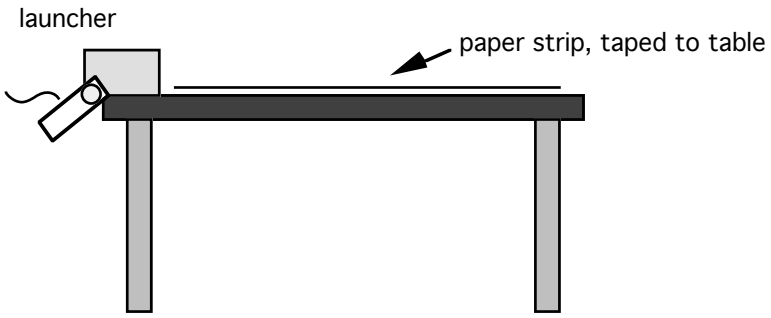
Lab 3-7: **Projectile Range**

Purpose:
1. To experimentally determine the initial launch angle that will give the maximum range of a projectile with a given initial speed.
2. To experimentally determine the relationship between angles that give the same range of a projectile with a given initial speed.
3. To use your experimental results to predict the landing position of a projectile for a given angle and to predict the angle to get a given landing position.

Materials:
1 projectile launcher
1 meter stick
1 paper strip
1 c-clamp
1 carbon paper



Procedure:
1. Clamp the projectile launcher to the end of your lab bench so that it will launch the ball bearing down your lab bench from the level of the table top. (Use the guide on the side of the launcher to see the initial launch position.)
2. Tape a strip of paper to the lab table so that the ball bearing will land on it.
3. As best you can, fire the projectile and record the range for 5° intervals, from 80° to 10°. You can assume that the angle of 90° and 0° will have a range of 0 cm. Fire the projectile to see about where it lands, place the carbon paper at that spot, and relaunch the projectile to measure its range. Try 3 launches per angle. (Angles less than 15° can be hard to do.)
4. Measure the distances to the average landing spot for each angle, and record in the data table.
5. Make a graph of Range vs. Angle. Make sure axes are labeled and your graph has a title.

Data:

Launch Angle (°)	Range (cm)
90	0
80	
75	
70	
65	
60	

Launch Angle (°)	Range (cm)
55	
50	
45	
40	
35	
30	

Launch Angle (°)	Range (cm)
25	
20	
15	
10	
0	0

Answer questions on other side.

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Conclusions:

1. Based on your data and graph, what is the relationship for launch angles that will have the same range?

2. Which angle will give the maximum range?

3. Would your results (questions 1 and 2) have worked if the projectile were fired off a cliff? Explain.

Questions:

A projectile is fired from the ground with an initial speed of 12 m/s.

1. What initial angle would give the greatest range for the projectile?

2. What initial angle would give the least range for the projectile?

3. What initial angle would give the greatest time in the air for the projectile?

4. What initial angle would give the least time in the air for the projectile?

5. Imagine it was fired at an initial angle of 35° and it lands someplace. What other angle would let the projectile land in the same place?

6. From question 5, which angle would be in the air longer?

7. What initial angle would give the greatest maximum height for the projectile?

8. What initial angle would give the least maximum height for the projectile?

9. What is the maximum range for this projectile? (*Warning! Several steps: angle=? components=? t=? and finally x=?)*