# *Flying Spuds Lab*

| Launch Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Time to Peak | | | | | | | | |
| Horizontal Distance to Peak | | | | | | | | |
| Time in Air | | | | | | | | |
| Distance Traveled | | | | | | | | |

***We are going to act as if the launches occurred in ideal, air-resistance free conditions. Then we will compare our analysis to the real-world data. The times and distances are correct to the best of our abilities.***

**A. Horizontal**

1. Neglecting wind, was there anything that would change the horizontal motion of the potato once it left the launcher?

2. What was the horizontal acceleration be for the potato while it was in the air?

3. How can you find the horizontal part of the initial velocity?

4. Find the initial horizontal velocity ($v_{xi}$) for each launch and record these in the chart on the back of this paper. Show your work.

**B. Vertical**

1. Neglecting wind, is there anything that would change the vertical motion of the potato once it left the launcher?

2. What was the vertical acceleration for the potato while it was in the air?

3. How should the time to the maximum height compare to the time for the full motion?

4. What is the vertical part of the velocity at the top of the motion?

5. Find the initial vertical velocity ($v_{yi}$) necessary to reach the maximum height and record these values in the chart on the back of this paper. Show your work.

| Launch Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Initial Horizontal Velocity ($v_{xi}$) | | | | | | | | |
| Initial Vertical Velocity ($v_{yi}$) | | | | | | | | |
| Launch Speed | | | | | | | | |
| Launch Angle | | | | | | | | |

**C. Initial Velocity**

You found the horizontal and vertical components that make up the initial velocity.

1. Find the launch speed for each angle.

2. What are some factors that could affect the launch speed of the potato?

3. From the components of the initial velocity, you can also calculate the direction each potato was launched. Find these angles.

4. What are some factors that could cause the calculated angle to be different from the actual launch angle?

**D. Range**

1. Make a graph of the horizontal distance traveled vs. the angle of launch.

2. What would the horizontal distance be for 0? For 90? Include these on your graph.

3. With the given data, fit a curve that represents the relationship between the range of the potato and the angle of launch.

4. What is the angle for optimal range?

5. What other relationships exist between the angles?