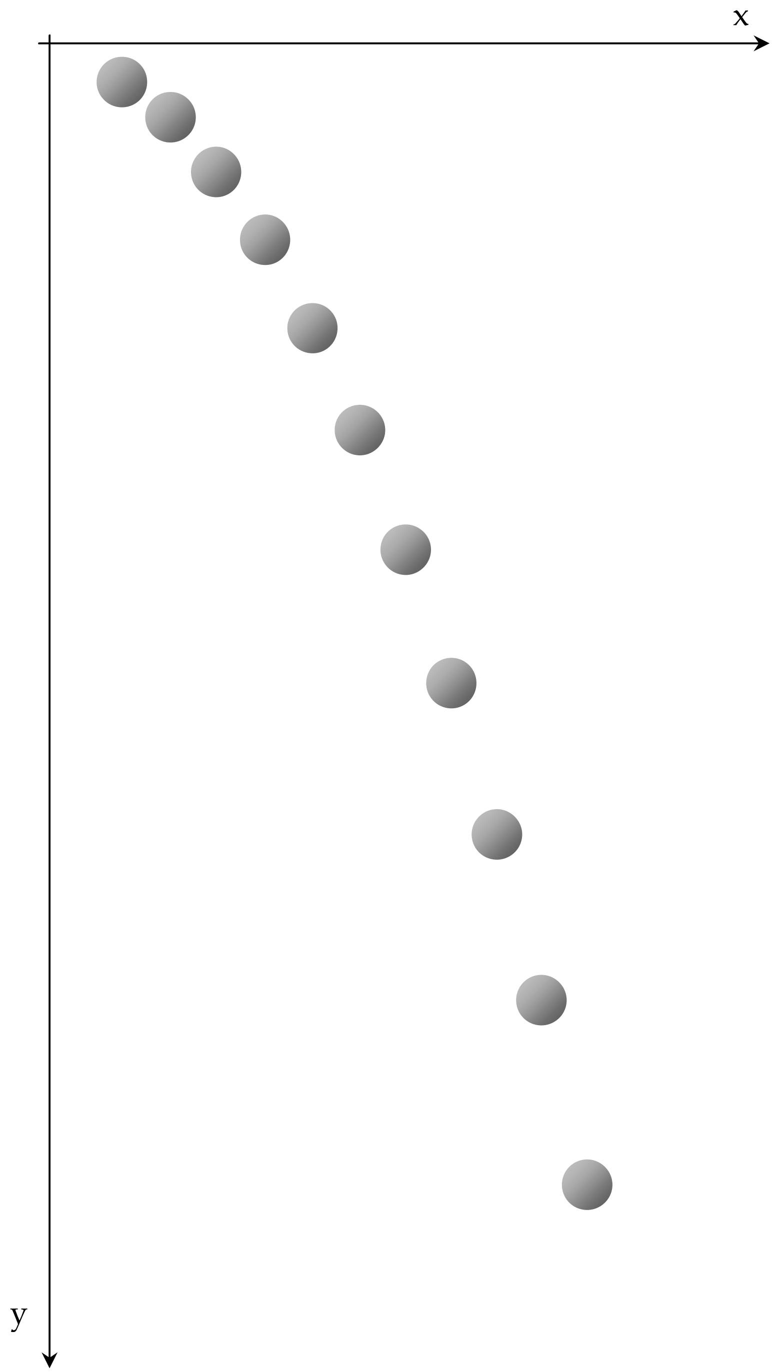
Exercise 1 — Visualize and Reason
Examine the strobe "photograph" of a horizontally launched projectile.



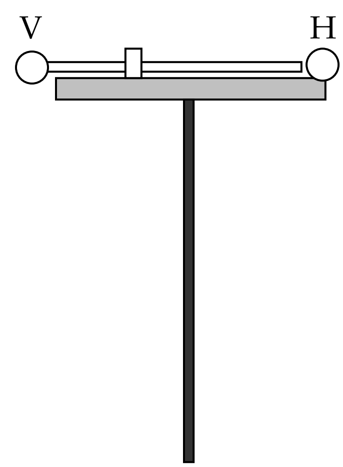
1. For each image of the projectile, locate the center of the ball and mark it with a colored (red) pen(cil).

2. On the x- and y-axes, draw a dot diagram of the ball's position as a function of time.

3. Examine the motion diagram of the ball's motion in the x-direction. What does it tell you about the object's motion in this direction? Explain your response.

4. Examine the motion diagram of the ball's motion in the y-direction. What does it tell you about the object's motion in this direction? Explain your response.

Exercise 2 — Predict and Test
Examine the demonstration apparatus at the front of the lab.



1. Consider the information from Exercise 1. Which ball will hit the ground first – the one that drops vertically (V) or the ball that is launched horizontally (H)? Explain your reasoning.

2. Observe what happens when the two balls are launched. Are the observations consistent with your predictions in the previous question? Do they hit at different times or the same time?

3. Given your observations, what can you conclude about the motion of the ball in the x-direction and the motion in the y-direction? Justify your response.

Exercise 3 — Application of Concepts — Horizontally Launched Projectile

A tennis ball rolls off of a table that is 1.15 m high. The tennis ball has a horizontal velocity of 2.85 m/s. Using the appropriate kinematical expressions, answer the following questions.

1. How long is the tennis ball in flight? What information about the motion in the x- and y-directions did you use to help answer this question?

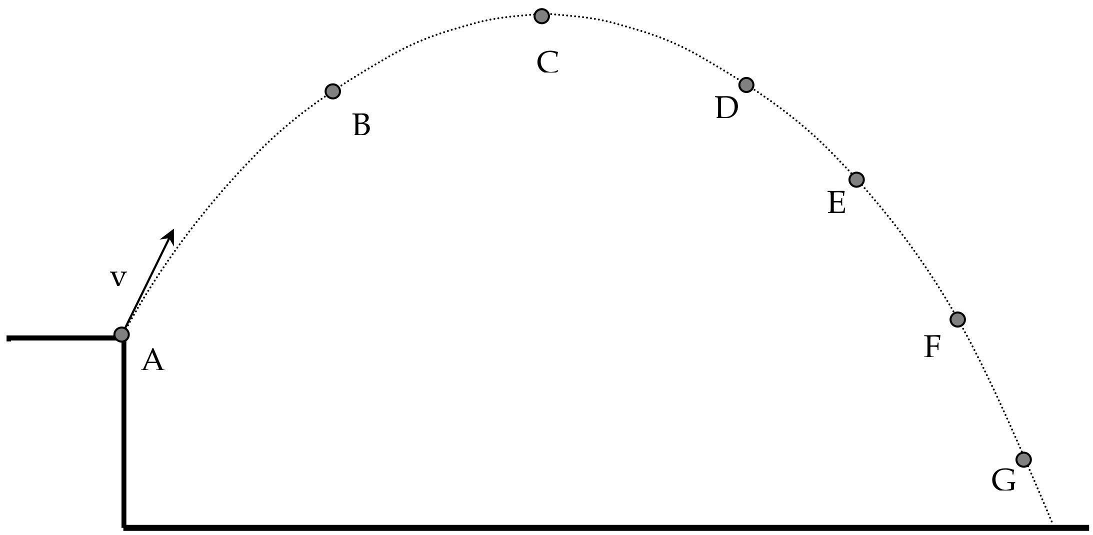
2. How far from the edge of the table does the tennis ball land? What information about the motion in the x- and y-directions did you use to help answer this question?

3. With what *velocity* (magnitude and direction) does the ball hit the ground? What information about the motion in the x- and y-directions did you use to help answer this question?

4. What did you assume about the nature of the horizontal and vertical motions in each of the three questions above?

Exercise 4 — Velocity Vectors — Represent and Reason

Examine the projectile being fired off of a cliff with an initial velocity, v_0.



Consider the following questions first:

1. Using the initial velocity vector as a reference, draw in the appropriately sized horizontal velocity component, v_x, at Point A.

2. What is true of the horizontal velocity component, v_x, while the object is in the air? Explain your response.

3. Given your responses to questions 1 + 2, draw in the appropriately sized velocity component, v_x, at Points B – G.

4. Using the initial velocity vector as a reference and the horizontal velocity component, v_x, that you have already drawn, draw in the appropriately sized *vertical* velocity component, v_x, at Point A.

5. Describe what happens to the vertical velocity component, v_y, while the object is in the air. Explain your response.

6. Given your responses to questions 4 + 5, draw in the appropriately sized velocity component, v_y, at Points B – G.

Now answer the following questions:

7. What is unique about the velocity components at Point C?

8. What is true about the velocity components at B + D? At A + F? Explain you responses.

9. At what point is the speed (magnitude of the velocity) the greatest? Explain.

Now consider the horizontal and vertical motions of the projectile. Plot the position vs. time, the velocity vs. time and the acceleration vs. time of the object in the horizontal and vertical directions.

Horizontal **Vertical**