

Projectile Problem-Solving Lab

Teacher's Guide

Topic:

Vectors and Projectiles

The following information is provided to the student:

Question:

What strategies can be used to analyze and solve a horizontally-launched projectile problem?

Purpose:

To determine and describe the appropriate strategies for solving a horizontally-launched projectile problem.

A complete lab write-up includes a Title, a Purpose, a Data section, a Conclusion/Discussion. The Data section should include the provided table with clear and thorough solutions to the three types of projectile problems. The Conclusion/Discussion section should describe in some detail the process/strategy which can be used to solve for each of the three unknown quantities. Writing should be organized, thorough and clear.

URL: <http://www.physicsclassroom.com/shwave/targetsh.cfm>

Materials Required:

A page from The Shockwave Physics Studios:

<http://www.physicsclassroom.com/shwave/targetsh.cfm>

Description of Procedure:

Students log on to the above page and solve three types of projectile problems in an effort to fire a cannonball at a target. Students enter answers to the problem and click a fire Cannon button. The projectile is launched and its trajectory is shown. If the cannonball misses the target, then the correct solution to the problem is shown. If the cannonball hits the target (correct answer), then the scoreboard is updated to reflect a correct student answer. As a conclusion to the lab, students explain the details of the strategy for solving each type of problem.

Alternative Materials and Procedure:

A similar approach to this lab is provided at The Shockwave Physics Studios:

<http://www.physicsclassroom.com/shwave/targetdirns.cfm>

The alternative exercise has a similar exercise but simply requests that students score 6 points by solving two of each type of projectile problem..

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

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Suggestions, Precautions, Notes:

1. The Shockwave file delivers three types of horizontally launched projectile problems. The three types of problems are distinguished by the particular unknown value - d_x , d_y or v_{ox} . Numbers in the problem are randomly generated.
2. The program keeps track of student scores by adding a point for each successfully solved problem and deducting a point for each missed problem. Once a student scores 2 points for a given type of problem, that type of problem is no longer delivered. The score is posted on the right side of the screen.
3. Students might benefit most if they are paired with a partner for this lab.

Auxiliary Materials:

The following page is provided to the student for completion and inclusion in the Data section of their lab notebook.

Problem Type: Launch Speed and Height Known; Find Horizontal Displacement	
Record given values and use them in solution at the right. $V_{ox} = \underline{\hspace{2cm}} \text{ m/s}$ $d_y = \underline{\hspace{2cm}} \text{ m}$ $d_x = \text{????}$	Show your solution below:

For Teacher Use Only: (A check in this box indicates that you have solved the problem online.)

Problem Type: Launch Speed and Horizontal Displacement Known; Find Launch Height	
Record given values and use them in solution at the right. $V_{ox} = \underline{\hspace{2cm}} \text{ m/s}$ $d_x = \underline{\hspace{2cm}} \text{ m}$ $d_y = \text{????}$	Show your solution below:

For Teacher Use Only: (A check in this box indicates that you have solved the problem online.)

Problem Type: Launch Height and Horizontal Displacement Known; Find Launch Speed	
Record given values and use them in solution at the right. $d_x = \underline{\hspace{2cm}} \text{ m}$	Show your solution below:

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$d_y = \text{_____ m}$ $v_{ox} = \text{????}$	
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For Teacher Use Only: (A check in this box indicates that you have solved the problem online.)

Scoring Rubric:

VP8. Projectile Problem-Solving Lab	Score
<input type="checkbox"/> Included, labeled and organized all parts of the lab report.	____/____
<input type="checkbox"/> Data section includes complete solutions to the three types of projectile problems; solutions are accurate clear, sequential and easy to follow. (An organized solution is a sign of an organized mind.)	
<input type="checkbox"/> Conclusion uses words to describe the strategy which is used to solve each of the three types of projectile problems. Strategy is accurate, detailed, specific and complete. Writing is organized.	

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/vectors/u3l2e.cfm>

Connections to Minds on Physics Internet Modules:

There is no sublevel in the Vectors and Projectiles module that focuses on the method of projectile problem-solving.