

**Introduction:**

Projectiles travel with two components of motion, X and Y. The acceleration and velocity in the Y direction is independent of the acceleration (if any) and velocity in the X direction. In this module, you will investigate the motion of a simple projectile. Realize that while gravity (acceleration) acts on the projectile in the vertical direction, it does not affect the velocity of the projectile in the horizontal direction.



Projectile Motion

**Procedure:**

- Run the PhET Simulation (<https://phet.colorado.edu/en/simulation/legacy/projectile-motion>)
- The cannon can be moved to add or remove initial Y position and X position.
- The cannon can be pivoted to change the firing angle,  $\theta$ .
- The tape measure can be moved and dragged to measure range to target.
- To fire the cannon, **Fire**.
- To erase the projectile's path, **Erase**.

Be sure air resistance is off and spend some time firing various projectiles.

- Set the initial speed to a value between 10-15 m/s. Choose your favorite projectile.
- Find the range of the projectile at various angles.

$\theta = 30^\circ$ : Range ( $\Delta x$ ) = 12.7 m

$\theta = 70^\circ$ : Range ( $\Delta x$ ) = 9.44 m

$\theta = 40^\circ$ : Range ( $\Delta x$ ) = 14.2 m

$\theta = 80^\circ$ : Range ( $\Delta x$ ) = 5.01 m

$\theta = 50^\circ$ : Range ( $\Delta x$ ) = 14.6 m

$\theta = 10^\circ$ : Range ( $\Delta x$ ) = 5.01 m

$\theta = 60^\circ$ : Range ( $\Delta x$ ) = 12.7 m

$\theta = 45^\circ$ : Range ( $\Delta x$ ) = 14.8 m

Add two more  $\rightarrow$

- Measure the distance from the cannon to the target using the tape measure.
- Move the target to 21.0 m from the cannon. Attempt to hit the target with three different angles by changing the firing angle and initial velocity.

Range ( $\Delta x$ ) = 21.0m  $\theta =$   $80^\circ$   $v_i =$   $25 \text{ m/s}$

Range ( $\Delta x$ ) = 21.0m  $\theta =$   $60^\circ$   $v_i =$   $15 \text{ m/s}$

Range ( $\Delta x$ ) = 21.0m  $\theta =$   $30^\circ$   $v_i =$   $15 \text{ m/s}$

**VERY IMPORTANT**

- ❖ A projectile's velocity ( $v$ ) has an x-component ( $v_x$ ) and a y-component ( $v_y$ ). The x-component ( $v_x$ ) is found by multiplying the magnitude of the velocity by the *cosine* of the angle,  $\theta$ .
- ❖ Similarly, the y-component of velocity is found by multiplying the magnitude of the velocity by the *sine* of the angle,  $\theta$ .

$$v_x = v \cos \theta$$

$$v_y = v \sin \theta$$

So, a projectile fired at 20 m/s at  $65^\circ$  has an x-velocity of  $v_x = 20 \cos 65$  or 8.5 m/s.

The projectile would have a y-velocity of  $v_y = 20 \sin 65$  or 18 m/s.

So, the projectile would fire as far as one fired horizontally at 8.5 m/s and as high as one fired straight up at 18 m/s.

A projectile fired at 30 degrees with a velocity of 15 m/s would have an x-velocity component of 13 m/s and a y-velocity component of 7.5 m/s.

# Phet Lab Physics Answer Key

**K Morrison**



## **Phet Lab Physics Answer Key:**

*Virtual and Augmented Reality, Simulation and Serious Games for Education* Yiyu Cai, Wouter van Joolingen, Koen Veermans, 2021-08-13 This book introduces state of the art research on virtual reality simulation and serious games for education and its chapters presented the best papers from the 4th Asia Europe Symposium on Simulation and Serious Games 4th AESSSG held in Turku Finland December 2018 The chapters of the book present a multi facet view on different approaches to deal with challenges that surround the uptake of educational applications of virtual reality simulations and serious games in school practices The different approaches highlight challenges and potential solutions and provide future directions for virtual reality simulation and serious games research for the design of learning material and for implementation in classrooms By doing so the book is a useful resource for both students and scholars interested in research in this field for designers of learning material and for practitioners that want to embrace virtual reality simulation and or serious games in their education

2008 Physics Education Research Conference Charles Henderson, Mel Sabella, Leon Hsu, 2008-11-21 The 2008 Physics Education Research Conference brought together researchers studying a wide variety of topics in physics education The conference theme was Physics Education Research with Diverse Student Populations Researchers specializing in diversity issues were invited to help establish a dialog and spur discussion about how the results from this work can inform the physics education research community The organizers encouraged physics education researchers who are using research based instructional materials with non traditional students at either the pre college level or the college level to share their experiences as instructors and researchers in these classes

Climate Smart & Energy Wise Mark S. McCaffrey, 2014-09-09 Today s answers to our most urgent climate issues The twenty first century ushered in a set of unmistakably urgent global challenges that are too important to be an afterthought in today s classrooms Climate Smart Energy Wise offers a virtual blueprint to climate and energy education packed with resources and strategies including A high level overview of where climate and energy topics fit or don t fit into your current curriculum with connections to the NGSS Proven methods to teach climate change and related topics in a grade appropriate way Sample learning activities and high quality online resources

The EdTech Playbook: Your Definitive Guide to Teaching, Learning and Leading with Technology and AI in Education Mark Anderson, Olly Lewis, 2025-05-04 The EdTech Playbook is your go to guide to using EdTech in evidence informed ways to help you work smarter transform your teaching and enrich students learning Whether you re an experienced educator or newly qualified this book is packed with practical strategies and real life examples from fellow teachers you can benefit from Learn about expert advice from experienced authors who know what works powerful case studies showcasing how educators at all levels use technology to make a difference time saving tips to reclaim your precious time how to leverage AI to support your teaching and their learning workable ideas to bring light into your everyday teaching practice how to support digital transformation at scale the importance of online safety and the role of safeguarding

and data privacy in EdTech The EdTech Playbook is your roadmap to increasing not just your knowledge and skills but also your creativity in how you apply technology in the classroom Dive in and become the tech savvy educator you ve always dreamed of being     Government Reports Announcements & Index ,1995-12     Physics Video Lab Manual Answer Key (RES) Responsive Education Solutions,2016-06-01     Physics: Fundamentals and Frontiers. Solution - Answer Key and Laboratory Guide Robert Stollberg,Faith Fitch Hill,1965     *Physics Video Lab Manual* Responsive Education Solutions,2016-08     Solution-answer Key and Laboratory Guide for Physics Robert Stollberg,Faith Fitch Hill,1965

*Physical Science Lab Manual Answer Key* ,2006-02-23 Help students explore and understand the world around them With the full color Physical Science text students learn the properties of matter elements compounds electricity and sound and light Students reading significantly below grade level gain practice in working with data and sharpen their abilities to infer classify and theorize Lexile Level 840 Reading Level 3 4 Interest Level 6 12     **Teachers Manual and Answer Key [to] Whitman-Peck Physics and Laboratory Manual** Walter George Whitman,     **Modern Physics** Holt, Rinehart, and Winston, inc,Trinklein,Harcourt Brace Jovanovich,1992-01-01     **Answer Key for the Laboratory Manual, Darrel Hess [to Accompany] Physical Geography** Darrel Hess,Tom Lee McKnight,Stephen J. Stadler,2007

The Top Books of the Year Phet Lab Physics Answer Key The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous captivating novels enthralling the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the captivating narratives that have charmed audiences this year. The Must-Read : Colleen Hoover "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Phet Lab Physics Answer Key : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This intriguing historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids absorbing storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These top-selling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of compelling stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a brilliant and suspenseful novel that will keep you wondering until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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