

## 5. Projectile Motion

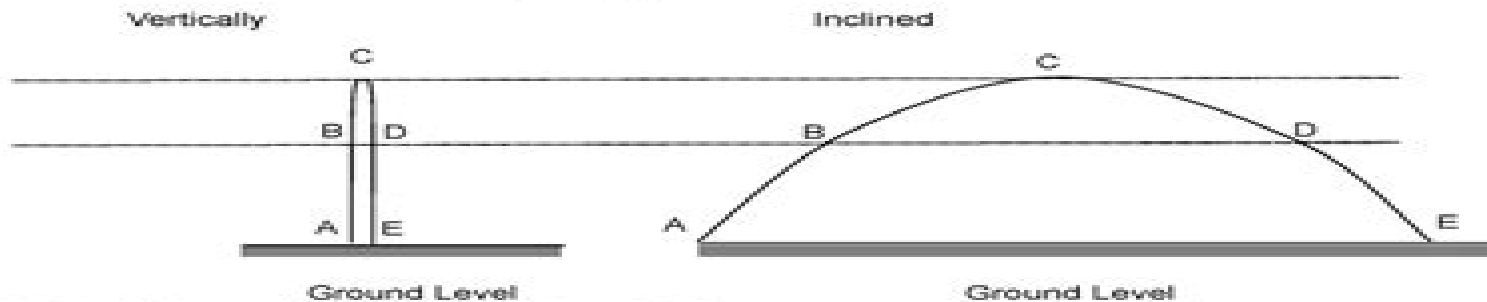
### Study Design

- investigate and analyse theoretically and practically the motion of projectiles near Earth's surface, including a qualitative description of the effects of air resistance

### Introduction

A projectile is a body that has been thrown or projected, and is travelling freely through the air. While undergoing projectile motion the object is under the constant unbalanced force of gravity. When we study projectile motion, no consideration is given to the force projecting the body or to what happens when it lands. Air resistance is considered to be negligible (in quantitative questions), but can be taken into consideration in qualitative questions. The projectile will travel either: vertically or inclined, depending on the initial angle of projection.

The vertical and horizontal motions are treated independently. Usually the vertical motion is treated first, since it determines how long the projectile is in the air.



#### For both the vertical and inclined projectiles:

- the only force acting is the weight, ie. the bodies are in free fall
- acceleration is **always**  $9.8 \text{ ms}^{-2}$  downward, (including the point C)
- the instantaneous velocity is tangential to the path
- the total energy (KE & PE) is constant
- between any two points  $\Delta \text{KE} = - \Delta \text{PE}$
- paths are symmetrical for time eg.  $\Delta t \text{ (A to B)} = \Delta t \text{ (D to E)}$ ;  
 $\Delta t \text{ (A to C)} = \Delta t \text{ (C to E)}$
- paths are symmetrical for speed eg. speed at A = speed at E; speed at B = speed at D.
- for vertical motion  $v_x = 0$ , for inclined motion  $v_x \neq 0$ .

#### Inclined or oblique projections

- the only force acting is vertically down, so the acceleration and change in velocity are vertical.
- horizontally there is no component of force, so constant horizontal velocity.
- Maximum range is when angle of projection is  $45^\circ$

# Conceptual Physics Study Guide Projectiles Answer

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## **Conceptual Physics Study Guide Projectiles Answer:**

Student Study Guide & Selected Solutions Manual David D. Reid,2007      **X+1 School/Board Exam Based**  
**Conceptual Physics (School/Board Exam Made Simple)** L M Garg,2023-06-03      **Instructor's Manual [to**  
**Accompany] Conceptual Physics, Eighth Ed** Paul G. Hewitt,1998 Conceptual Physics Tenth Edition helps readers connect physics to their everyday experiences and the world around them with additional help on solving more mathematical problems Hewitt s text is famous for engaging readers with analogies and imagery from real world situations that build a strong conceptual understanding of physical principles ranging from classical mechanics to modern physics With this strong foundation readers are better equipped to understand the equations and formulas of physics and motivated to explore the thought provoking exercises and fun projects in each chapter Included in the package is the workbook Mechanics Properties of Matter Heat Sound Electricity and Magnetism Light Atomic and Nuclear Physics Relativity For all readers interested in conceptual physics      Conceptual Physics ,1985 Rev ed of Conceptual physics a new introduction to your environment 4th ed 1981      Study Guide, Student Solutions Manual Raymond A. Serway,John R. Gordon,1998      *Student Solutions Manual and Study Guide to Accompany Physics for Scientists and Engineers* John R. Gordon,Raymond A. Serway,2004 Written by John R Gordon Ralph McGrew and Raymond Serway the two volume manual features detailed solutions to 20 percent of the end of chapter problems from the text This manual also features a list of important equations concepts and answers to selected end of chapter questions      Teaching and Learning Online Franklin S. Allaire,Jennifer E. Killham,2023-01-01 Science is unique among the disciplines since it is inherently hands on However the hands on nature of science instruction also makes it uniquely challenging when teaching in virtual environments How do we as science teachers deliver high quality experiences to secondary students in an online environment that leads to age grade level appropriate science content knowledge and literacy but also collaborative experiences in the inquiry process and the nature of science The expansion of online environments for education poses logistical and pedagogical challenges for early childhood and elementary science teachers and early learners Despite digital media becoming more available and ubiquitous and increases in online spaces for teaching and learning Killham et al 2014 Wong et al 2018 PreK 12 teachers consistently report feeling underprepared or overwhelmed by online learning environments Molnar et al 2021 Seaman et al 2018 This is coupled with persistent challenges related to elementary teachers lack of confidence and low science teaching self efficacy Brigido Borrachero Bermejo Gunning Duran Duran 2004 Ideal for undergraduate teacher candidates graduate students teacher educators classroom teachers parents and administrators this book addresses why and how teachers use online environments to teach science content and work with elementary students through a research based foundation      *Comparative Study Using Technology Vs Traditional Learning in High School Conceptual Physics* David Kim McCreight,1999      **Conceptual Physics--a New Introduction to Your Environment** ,1981      **Study Guide with ActivPhysics** Alan Van

Heuvelen, Richard Wolfson, Jay M. Pasachoff, 1999      **Physics** John D. Cutnell, 2004      **Learning and Understanding**  
National Research Council, Division of Behavioral and Social Sciences and Education, Center for Education, Committee on  
Programs for Advanced Study of Mathematics and Science in American High Schools, 2002-08-06 This book takes a fresh look  
at programs for advanced studies for high school students in the United States with a particular focus on the Advanced  
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components of the education system and participation in the programs has become key to admission at selective institutions  
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guide change within advanced study programs      **Engaging with Contemporary Challenges through Science**  
**Education Research** Olivia Levrini, Giulia Tasquier, Tamer G. Amin, Laura Branchetti, Mariana Levin, 2021-09-24 This book  
starts with the premise that beauty can be an engine of transformation and authentic engagement in an increasingly complex  
world It presents an organized picture of highlights from the 13th European Science Education Research Association  
Conference ESERA 2019 held in Bologna Italy The collection includes contributions that discuss contemporary issues such as  
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science information you need in a proven format that makes the most of your study time This high yield approach makes  
complex material easy to comprehend and apply      *Exploration and Meaning Making in the Learning of Science* Bernard  
Zubrowski, 2009-08-14 Mountaineers Rock Climbers and Science Educators Around the 1920s rock climbing separated from  
mountaineering to become a separate sport At that time European climbers developed new equipment and techniques  
enabling them to ascend mountain faces and to climb rocks which were considered unassailable up to that time American

climbers went further by expanding and improving on the equipment They even developed a system of quantification where points were given for the degree of difficulty of an ascent This system focused primarily on the pitch of the mountain and it even calculated up to de mals to give a high degree of quantification Rock climbing became a technical system Csikszentmihaly 1976 observed that the sole interest of rock climbers at that time was to climb the rock Rock climbers were known to reach the top and not even glance around at the scenery The focus was on reaching the top of the rock In contrast mountaineers saw the whole mountain as a single unit of perc tion The ascent to them is a gestalt including the aesthetic historical personal and physical sensations Csikszentmihaly 1976 p 486 This is an example of two contrasting approaches to the same kind of landscape and of two different groups of people Interestingly in the US Europe and Japan a large segment of the early rock climbers were young mathematicians and theoretical physicists while the mountaineers were a more varied lot

*Proceedings of the 18th European Conference on Game-Based Learning* Helga Dis Isfold Sigurdardottir,Robin Isfold Munkvold, **Multifaceted Graphics for Learning** Tingyi S. Lin,2006 **Physics, Volume 1** Robert Resnick,David Halliday,Kenneth S. Krane,2002 Each chapter includes questions and problems

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