

The Ramp (and Friction) PhET Simulation Lab

Introduction:

When an object is dragged across a horizontal surface, the force of friction that must be overcome depends on the normal force as $F_f = \mu F_n$ and the normal

force is given by $F_n = W$. When the surface becomes an inclined plane, the normal force changes and when the normal force changes, so does the friction.

In this lab, you will change the angle of an inclined plane and observe how weight is resolved into its components (F_n and F_{\parallel}) using the basic trig functions. F_{\parallel} is the force parallel to the inclined plane. F_{\parallel} is assumed to be going down the plane.

kg is a mass. To convert it to a weight you need to multiply it by the force of gravity (g). Gravity is 9.8 m/s^2 . The formula $W = mg$ is weight equals mass times gravity.



The Ramp

- Be sure to stay in the **Introduction** part of the simulation. *More features* will be used later when we investigate energy. Start by playing with the cabinet some. Have fun, really... Now...back to work.

- Move the cabinet up and down the ramp by dragging it with your mouse.
- Move the ramp to an angle of zero (horizontal) and draw a free body diagram of the cabinet here:

Horizontal plane

1. On a horizontal plane, the normal force is _____ to the weight.
2. The cabinet has a mass of 100kg. It therefore has a normal force of _____ N and a friction force (on the horizontal plane) of _____ $\mu = 0.30$

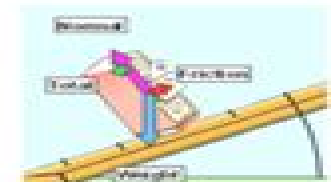
Inclined plane

- **Reset** the ramp and draw a free body diagram of the cabinet in the box here:

3. Before we add an applied force on the ramp, there is a force of _____ that acts against the force down the plane(Force parallel).

4. When we apply a force to get the cabinet moving, the friction force acts in the _____ direction as movement of the cabinet.

5. Slowly increase angle of the ramp until the cabinet starts to move on its own. What angle is this? _____ = θ



6. At this point, the force down the plane is _____ than the force of friction.

7. Since the ramp is now at an angle, the normal force is _____ than the weight.

8. At the angle above, the normal force equals _____ N. (Hint: Trig function)

9. At the angle above, the force down the plane equals _____ N.

$$g = 9.8 \text{ m/s}^2$$

10. Using the formula for friction above, the force of friction is _____ N.

11. If the plane-cabinet were frictionless, what angle would be required for the cabinet to move? _____ Calculate first, then test each object in the table below with the simulation on a horizontal plane.

The Ramp Phet Simulation Lab Answer Key

JA Banks



The Ramp Phet Simulation Lab Answer Key:

The Ramp Phet Simulation Lab Answer Key Book Review: Unveiling the Power of Words

In a world driven by information and connectivity, the power of words has become more evident than ever. They have the capability to inspire, provoke, and ignite change. Such may be the essence of the book **The Ramp Phet Simulation Lab Answer Key**, a literary masterpiece that delves deep to the significance of words and their affect our lives. Written by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book is key themes, examine its writing style, and analyze its overall impact on readers.

<https://letsgetcooking.org.uk/About/Resources/index.jsp/Rigid%20Table%20Saw%20Manual.pdf>

Table of Contents The Ramp Phet Simulation Lab Answer Key

1. Understanding the eBook The Ramp Phet Simulation Lab Answer Key
 - The Rise of Digital Reading The Ramp Phet Simulation Lab Answer Key
 - Advantages of eBooks Over Traditional Books
2. Identifying The Ramp Phet Simulation Lab Answer Key
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an The Ramp Phet Simulation Lab Answer Key
 - User-Friendly Interface
4. Exploring eBook Recommendations from The Ramp Phet Simulation Lab Answer Key
 - Personalized Recommendations
 - The Ramp Phet Simulation Lab Answer Key User Reviews and Ratings
 - The Ramp Phet Simulation Lab Answer Key and Bestseller Lists

5. Accessing The Ramp Phet Simulation Lab Answer Key Free and Paid eBooks
 - The Ramp Phet Simulation Lab Answer Key Public Domain eBooks
 - The Ramp Phet Simulation Lab Answer Key eBook Subscription Services
 - The Ramp Phet Simulation Lab Answer Key Budget-Friendly Options
6. Navigating The Ramp Phet Simulation Lab Answer Key eBook Formats
 - ePub, PDF, MOBI, and More
 - The Ramp Phet Simulation Lab Answer Key Compatibility with Devices
 - The Ramp Phet Simulation Lab Answer Key Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of The Ramp Phet Simulation Lab Answer Key
 - Highlighting and Note-Taking The Ramp Phet Simulation Lab Answer Key
 - Interactive Elements The Ramp Phet Simulation Lab Answer Key
8. Staying Engaged with The Ramp Phet Simulation Lab Answer Key
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers The Ramp Phet Simulation Lab Answer Key
9. Balancing eBooks and Physical Books The Ramp Phet Simulation Lab Answer Key
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection The Ramp Phet Simulation Lab Answer Key
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine The Ramp Phet Simulation Lab Answer Key
 - Setting Reading Goals The Ramp Phet Simulation Lab Answer Key
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of The Ramp Phet Simulation Lab Answer Key
 - Fact-Checking eBook Content of The Ramp Phet Simulation Lab Answer Key
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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