

Electric Field Hockey

Purpose

To use a series of simulated game-like challenges to gain a sense of the vector nature of the electric field and the consequence of the inverse square law that governs electrostatic force.

Apparatus

computer PhET simulation, "Electric Field Hockey" (available at <http://phet.colorado.edu>)

Discussion

In the space around a charged object is an *aure* generally described as an electric field. The electric field is a vector quantity, so the fields surrounding multiple charges add vectorially. If they have the same direction, the fields add (Figure 1.a), and if they have opposite directions, they subtract and may even cancel each other (Figure 1.b). And if the directions are at angles to each other, their effects combine and act at a new angle (Figure 1.c).



Figure 1.a. Same direction—fields add



Figure 1.b. Opposite direction—fields cancel



Figure 1.c. Different directions—fields add to a different direction

Software

In "Electric Field Hockey," a player guides a charged puck into the goal (bracket). The player must strategically place positive and negative charges on the "rink" so that when the puck is released, it will be propelled by electric forces into the goal. Clicking the on-screen "Start" button sets the puck free. The charges placed on the rink are fixed in place and will not move.

Procedure

Step 1: Turn on the computer and allow it to complete its start-up cycle.

Step 2: Locate and start the PhET "Electric Field Hockey" simulation. Ask your instructor for assistance if you have difficulty.

Step 3: From the selections available near the bottom of the simulation window,

- leave "Puck is positive" selected.
- activate the "Trace." Leave the other checkboxes unchecked.
- set the mass slider control to 100. (Doing so makes it easier to follow the action on the screen.)
- leave the simulation in "Practice" mode for now.
- Complete the practice exercises that follow.

Continue until your lab time runs out or you win the prized and highly coveted "Coulomb Cup" (completion of Level 3).

Optional (if using the activity as a time-limited competition): When you score a prescribed goal, leave the trace on the screen and call the instructor over for a verification/stamp. **After** the group's papers have been stamped, click the on-screen "Clear" button and move to the next exercise.

Electric Field Hockey Answers

Christian Drosten



Electric Field Hockey Answers

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Table of Contents Electric Field Hockey Answers

1. Understanding the eBook Electric Field Hockey Answers
 - The Rise of Digital Reading Electric Field Hockey Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Electric Field Hockey Answers
 - 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 Electric Field Hockey Answers
- User-Friendly Interface
- 4. Exploring eBook Recommendations from Electric Field Hockey Answers
 - Personalized Recommendations
 - Electric Field Hockey Answers User Reviews and Ratings
 - Electric Field Hockey Answers and Bestseller Lists
- 5. Accessing Electric Field Hockey Answers Free and Paid eBooks
 - Electric Field Hockey Answers Public Domain eBooks
 - Electric Field Hockey Answers eBook Subscription Services
 - Electric Field Hockey Answers Budget-Friendly Options
- 6. Navigating Electric Field Hockey Answers eBook Formats
 - ePub, PDF, MOBI, and More
 - Electric Field Hockey Answers Compatibility with Devices
 - Electric Field Hockey Answers Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Electric Field Hockey Answers
 - Highlighting and Note-Taking Electric Field Hockey Answers
 - Interactive Elements Electric Field Hockey Answers
- 8. Staying Engaged with Electric Field Hockey Answers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Electric Field Hockey Answers
- 9. Balancing eBooks and Physical Books Electric Field Hockey Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Electric Field Hockey Answers
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Electric Field Hockey Answers

- Setting Reading Goals Electric Field Hockey Answers
- Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Electric Field Hockey Answers
 - Fact-Checking eBook Content of Electric Field Hockey Answers
 - 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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