AS Physics   Name_____

Enrichment – 2D Kinematics

Introduction

2D Kinematics is the study of two-dimensional motion without looking at the forces involved.

Instructions

Answer the following questions:

1. One day after school, you are enjoying a soda in the back yard. When the can is empty, you decide to throw it in the trashcan. What effects whether or not it gets in the can?

2. Go to https://phet.colorado.edu/en/simulation/legacy/projectile-motion.
    Make a complete list of things that affect the landing site of a projectile including your ideas from question #1 and any discoveries you made using the simulation. Next to each item, briefly explain why you think the landing location changes.

3. What is meant by the expression "flight path of a projectile"? Draw the flight path of your soda can and describe the shape.

4. Suppose your friend asks you to tell them about projectiles. You start to explain, but she interrupts. "Wait," she says, "You're using a lot of words I don't understand. Can you explain in English?" Knowing that a picture is worth a thousand words, you draw a picture of a projectile path and label all the terms that are on the simulation page. Draw a picture like you would for your friend and write what you would tell her about the terms.

This rest of the assignment has 2 options: an experiment and a program. You may choose to do one or both.

Experiment

1. Find an object that is able to launch something with a consistent velocity (i.e. a nerf gun).
2. Design an experiment in which you will determine the launch velocity. Submit the following:
    a. State any precautions you must take to keep the experiment accurate.
    b. A description of your experiment
    c. Your written work
3. Use that launch velocity to predict the range of the object (x-displacement) when it is launched horizontally from a table (of known height). Submit the following:
    a. Your written work for your prediction
    b. The actual range of the projectile and your percent error
    c. At least 2 possible sources of error

VPython

In this activity you will use a computer program to demonstrate and analyze the motion of various scenarios. BEFORE beginning this lesson you need to complete the VPython Directions document (also posted on the weebly). I expect a high comment-to-code ratio in all code submissions.

Go to *glowscript.org*, and click on the *Sign In* link in the upper right corner.
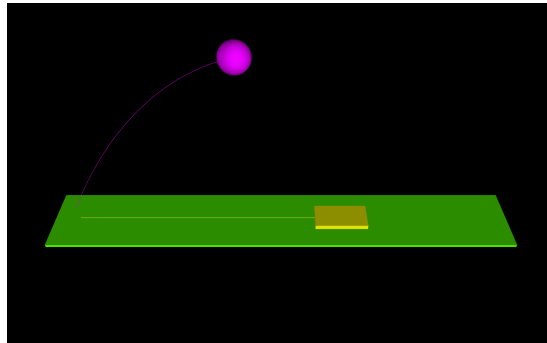
1. Create an object that is shot horizontally from a certain height and another object that is dropped from the same height.
    a. Write a paragraph explaining the result of your experiment and the reasoning behind it.
    b. Submit your code along with your written explanation.
2. Create a new object that is shot at an angle from ground level. Create multiple objects that are launched at least 5 different angles between 0 and 90°.
    a. Write a paragraph explaining the result of your experiment and the reasoning behind it. Pay special attention to the components of the initial launch velocity.
    b. Submit your code along with your written explanation.

Resources used to create this activity: Computer Science for Teachers conference, https://phet.colorado.edu/