

General Physics Lesson Plan

2D Motion

Before starting this unit the students should already have a good understand of one dimension motion. They should be familiar with motion equations and be comfortable using them.

Objectives

The understanding of the motion of objects in two dimensions both conceptually and experimentally. When completed the students should have an understanding of the vertical and horizontal components and how they relate to each other.

Strand: Physical Science

Substrand: Energy Transformations

Benchmark: The student will understand energy forms, transformations and transfers.

- Standards:
1. The student will know that potential energy is stored energy and is associated with gravitational or electrical force, mechanical position or chemical composition.
 2. The student will differentiate between kinetic and potential energy and identify situations where kinetic energy is converted into potential energy and vice versa.

Substrand: Motion

Benchmark: The student will understand the nature of force and motion.

- Standards:
1. The student will use Newton's three laws of motion to qualitatively and quantitatively describe the interaction of objects.
 2. The student will describe the effect of friction and gravity on the motion of an object.

This unit contains lecture, worksheets, demonstrations, and lab activities. A test will be given over 1D and 2D motion after this unit.

Day 1

20min lecture on the concepts of 2D motion. Topics to be covered are the horizontal and vertical components of the motion and how they are related. Frames of reference needs to be addressed and the fact time is independent of direction which needs to be demonstrated.

Demo 1 – Monkey Hunter demo. See attached sheet for setup 10min – 15 min. Multiple attempts at different speeds and distances.

Simulation – 2D motion at PhET website. Look at the velocity and acceleration of a ball moving in 2D.

End the day with a review of 2D motion – question and answer session

Day 2

Demo 2 – 5-10min Ballistic car – a moving car shoots a ball straight up into the air. The ball should land back in the cart. This will go along with a quick review from Day 1

20-30min Lecture on how the equations relate to 2D motion. Example problems will take $\frac{1}{2}$ to $\frac{3}{4}$ of this time.

Worksheet on 2D problems – see attached example

Given time in class to work so they can ask questions and get a good understanding before they leave.

Day 3

Lab - see attached lab

Spit class in two. Half will do lab and the other will work on a worksheet. Half-way through the class we will switch.

1. A 2000kg car drives off a cliff at 35m/s. If the cliff is 100ft high, how far away will the car land?

2. A plane is flying at 450mph due east. If the wind is blowing at 60mph straight north, what is the actual velocity of the plane?

3. A marble rolls off a table with a velocity of 5m/s. If the marble lands 3.3m from the table, how high is the table?

4. A boat is moving directly across the river at 8m/s. What is the actual velocity of the boat if the river is moving at 5m/s?

5. A rocket blasts off with a velocity of 120m/s. The engine stops just as it is leaving the ground. How far away does the rocket land if the wind is blowing at 7m/s? The rocket does not have a parachute.

Extra credit. A golf ball is hit with a velocity of 60m/s at an angle of 30° to the ground. How far away does the ball hit the ground?

2D Motion Lab

Purpose: An increased understanding of how the vertical and horizontal components are related.

Materials: Ball, ramp, stopwatch, table, cup, and meter stick.

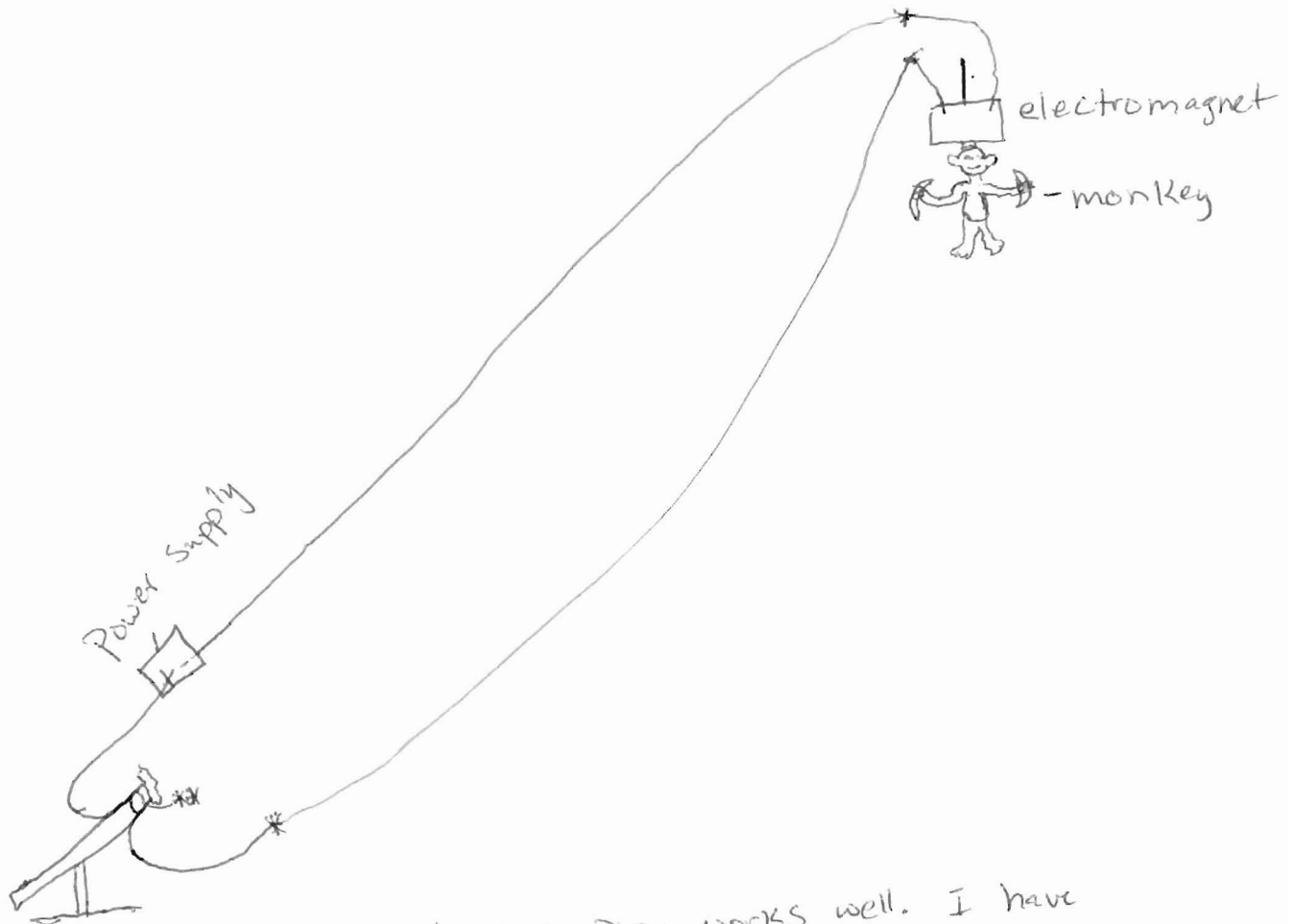
Procedure:

1. Set up the ramp on the floor.
2. Measure one meter from the bottom of the ramp and mark the floor with a piece of tape.
3. Release the ball from the top of the ramp and time how long it takes to go from the bottom of the ramp to the on meter mark.
4. Repeat 3 times and find the average of the times.
5. Find the velocity of the ball.
6. Give the ball back to the instructor.
7. Move the ramp to the top of the table making sure to keep it at least 20cm from the edge of the table.
8. Using the equations we have learn calculate where the ball is going to hit the floor and place a cup there.
9. Get the instructor and test your results.

** Make sure to include calculations in the lab report.

Conclusion: What were the results? Did the lab work? If not, why? How could the lab be improved? These are a few questions you should think about while writing the conclusion.

Monkey Hunter



gun - air gun made with PVC Pipe works well. I have also used spring loaded gun.

** Strip the ends of the wires and connect them with a piece of Aluminum foil. Make sure the dart breaks the connection as it leaves the gun.