Lab #7: *Physics* (Chapter 4)

Meteorites and Scientific Predictions

INTRODUCTION:

The objective of this laboratory is to illustrate how the principles of physics can be used to make predictions about meteorite impacts from the past.

MATERIALS

- Square Tupperware container, at least 6x6x4 inches in size
- Enough baking soda to fill the container roughly 2 inches deep (or sand)
- Yard stick
- Ruler
- Large marble/rubber ball (approximately 1 inch diameter or more)

METHODS

1. Student: Fill the container with at least 2 inches of baking soda. Pack it down and smooth out the surface.
2. Student: Using a yard stick, drop a marble from six different heights (0.5', 1', 1.5', 2', 2.5', and 3') and use the ruler to measure the diameter of the impact crater made from each marble drop. *Make sure the ball is dropped without spin; smooth the surface between drops
   - Record your answers.
   - Describe the characteristics of the "impact crater" and other notable observations of the impact
   - When possible, measure how far the baking soda splashes
3. Repeat step 2.
4. Repeat step 2 again, and calculate the mean diameter for each of the six drops.
5. Teacher: While the students look the other way, using the yard stick, drop the marble from a height of 15".
6. Student: Use the ruler to measure the diameter. Record your answer.
7. Teacher/student: repeat steps 5-6 at a height of 30".

RESULTS

1. Make a table that records your mean results: make the rows be the various heights; the columns should be diameter and depth
2. Make a graph of the mean results from steps 2-3 with "height" on the x-axis and "crater diameter/

depth" (from 0 to 1.5 in.) on the y-axis (make a line graphing the diameters and a separate line for depths, but on the same graph)

3. Use your graph to predict the height of the unknown height marble drops, marking them on the graph in a different color. Record your height predictions.
4. Calculate the final velocity of the marble at the heights of 1', 2', and 3' (hint: make sure your dimensions are all in feet, not inches)

$$x_f = x_o + v_o * t + {}^1/_2 * g * t^2$$

$[g = -32.2\frac{ft}{s^2}, x_f = final\ position, x_o = initial\ position,$
$v_o = initial\ velocity, g = acceleration\ of\ gravity, t = time(in\ seconds)]$

$$v_f = v_o + g * t$$

DISCUSSION

1. Discuss what is ultimately causing the differences in crater diameter.
2. What would also play a role in affecting real-life crater diameter?
3. The initial velocity of each marble drop was 0. What would you predict would happen if the marble had a velocity of more than 0 when initially "dropped"?
4. The marble dropped to the baking powder, impacting it at a right angle. What would you predict to happen to the crater if the marble impacted the baking powder at an obtuse/acute angle?
5. What could be done to give more accuracy for the values plotted on the diameter graph?