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

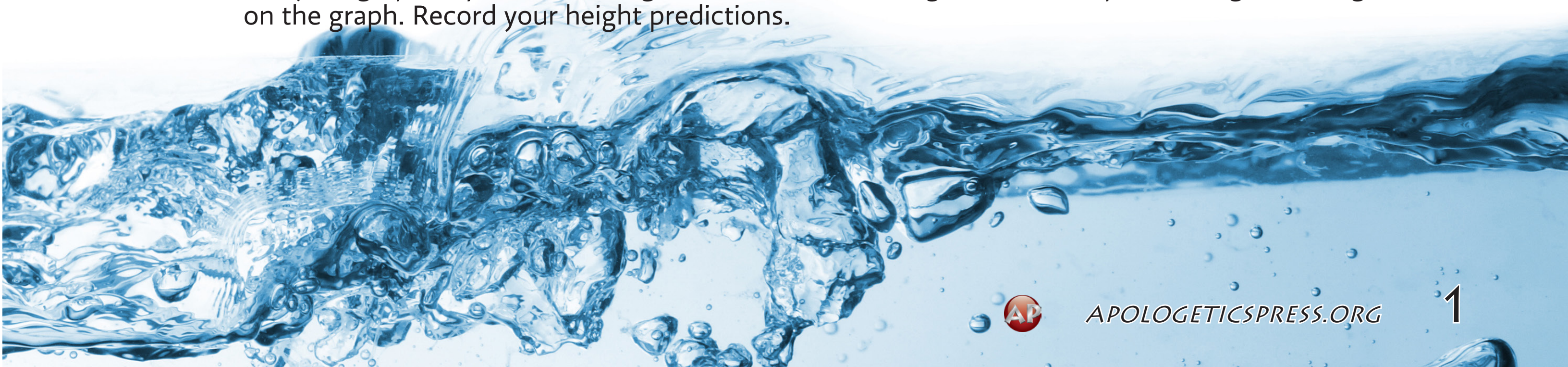
- Square Tupperware container, at least 6x6x4 inches in size
- Enough baking powder to fill the container roughly 2 inches deep (or sand) (approximately 24 oz.)
- Yard/Meter stick
- Mini-tape measure
- Large marble/rubber ball (approximately 1 inch diameter or more)

METHODS

1. Student: Fill the container with at least 2 inches of baking powder. Pack it down and smooth out the surface.
2. Student: Using a yard stick, drop a marble from six different heights (0.5 ft., 1 ft., 1.5 ft., 2 ft., 2.5 ft., and 3 ft.) and use the ruler to measure the diameter and depth 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 in the chart on the next page.
    - Describe the characteristics of the “impact crater” and other notable observations of the impact
    - When possible, measure how far the baking powder splashes
3. Repeat step 2.
4. Repeat step 2, 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 secret height.
6. Student: Use the ruler to measure the diameter. Record your answer.
7. Teacher/student: repeat steps 4-5 at a different height.

RESULTS

1. Make a graph of the mean results from steps 2-3 with “height” on the x-axis and “crater diameter/depth” (from 0 to 2 in.) on the y-axis (make a line graphing the diameters in red and a separate line for depths in blue, but on the same graph). Use the graph that is provided on the next page.
2. Use your graph to predict the height of the unknown height marble drops, marking them in green on the graph. Record your height predictions.



3. Using the equations below, calculate the final velocity of the marble at the heights of 1 ft., 2 ft., and 3 ft. (hint: make sure your dimensions are all in feet, not inches).

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

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

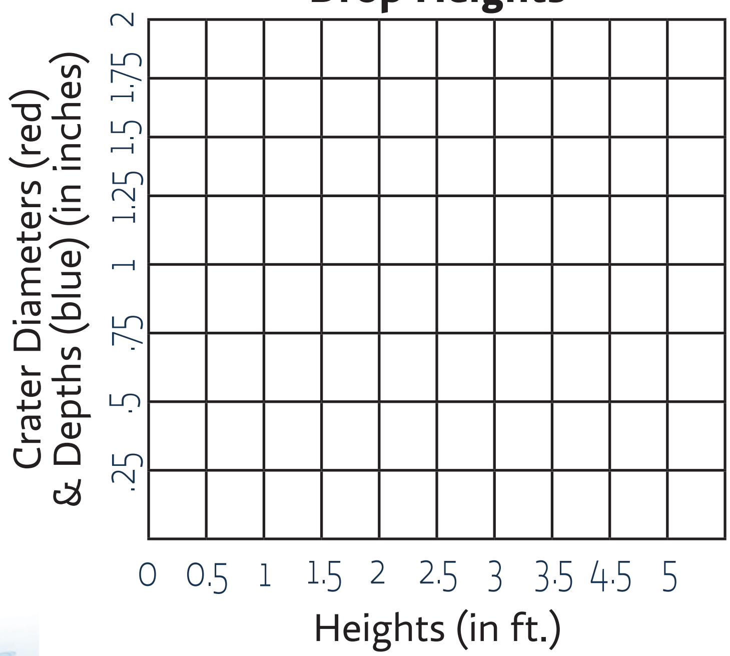
$$v_f = v_o + g * t$$

Dropped Heights (in ft.):	**.5'**	**1'**	**1.5'**	**2'**	**2.5'**	**3'**
Crater Dia., Round 1 (in.)						
Crater Dia., Round 2 (in.)						
Crater Dia., Round 3 (in.)						
Average:						
Crater Depth, Round 1 (in.)						
Crater Depth, Round 2 (in.)						
Crater Depth, Round 3 (in.)						
Average:						

Teacher Results	**Dia.**	**Depth**
Drop #1		
Drop #2		

- Height prediction for drop #1: ___________________
- Height prediction for drop #2: ___________________

Average Crater Diameters and Depths from Different Drop Heights



Lab #7: *Physics* (Write-up)

Results

Final Velocity Calculations:

- Final Velocity (1 ft.): ___________
- Final Velocity (2 ft.): ___________
- Final Velocity (3 ft.): ___________

DISCUSSION QUESTIONS

1. Discuss what is ultimately causing the differences in crater diameter in this experiment (assuming there is no user error). ____ ______________________________
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? ______________ ____ ____