Mass, Weight and Acceleration

Questions

How are mass, weight, and acceleration of a freely falling object related?

Knowledge Probe

State Newton’s 2nd Law in word form AND equation form.

Prediction

I think that objects of different masses will ________________________________ when dropped because________________________________________________________.

Materials

1. Plastic bottle with eyehook
2. 100 pennies
3. Ring stand
4. Test tube clamp
5. Spring scale
6. Stopwatch

Cautions

This procedure poses no special safety hazards not covered by standard lab safety procedures.

Investigation Plan

1. Suspend the spring scale from the test tube clamp attached to the ring stand.
2. Place 20 pennies in the bottle and replace the cap.
3. Suspend the bottle from the spring scale and record the mass in kilograms (there are 1000 grams for every kilogram) and the weight in Newtons in the Observations section below.
4. Drop the bottle from lab bench height and time how long it takes to hit the floor using the stopwatch. Record this time in the Observations section. Repeat this measurement two more times.
5. Repeat Steps 1 through 4 with 40, 60, 80, and 100 pennies.

Data Analysis

1. Use Google Sheets to create an XY scatterplot using just the weight and mass data where mass is on the x-axis and weight is on the y-axis. Make sure your graph includes a descriptive title, axis labels (with appropriate units) and a linear trend line. You will turn in your graph on Google Classroom.

2. For each trial average the three recorded drop times and record in the Observations Section

Observations
<table>
<thead>
<tr>
<th># of Pennies</th>
<th>Mass (Kilograms)</th>
<th>Weight (Newtons)</th>
<th>Time (s)</th>
<th>Average Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
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<td>100</td>
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</tbody>
</table>

**Explanation**

1. Complete this sentence... Weight is the ________ that an object experiences due to gravity.

2. What sort of relationship does your graph show between mass and weight?

3. Did the mass of the bottle affect the average drop time? Explain.

4. How are your answers to questions 2 and 3 related?

5. How do your results relate to Newton’s 2nd Law?

6. How confident were you about your results? Explain.

**Evaluation**

1. What are your sources of error?

2. What surprised you?

**Acknowledgments**

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