Newton’s Second Law of Motion
Straw Rockets

OBJECTIVES

- Demonstrate safe practices during field and laboratory investigations
- Collect data by observing and measuring
- Analyze and interpret information to construct reasonable explanations from direct and indirect evidence
- Communicate valid conclusions
- Collect, analyze, and record information using tools including timing devices, balances, and calculators,
- Identify and describe the changes in position, direction of motion, and speed of an object when acted upon by force
- Demonstrate that changes in motion can be measured and graphically represented

PROCEDURE:

- Tape the straw along one edge of the index card
- Form the paper clips into hooks and punch them through the index card as shown in the figure
- Tie one end of the string to something and stretch the string across the room
- Thread the straw onto the free end of the string
- Blow up one of the balloons but do not tie it
- Tape the balloon to the index card without letting any air out or tying it
- Hold the string tight and release the balloon (start the stopwatch as soon as you release the balloon and stop it once it reaches the other side of the string)
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DATA:

<table>
<thead>
<tr>
<th></th>
<th># of washers</th>
<th># of balloons</th>
<th>Time (trial 1)</th>
<th>Time (trial 2)</th>
<th>Average Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 4</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ASSESSMENT:

1. What happened to the acceleration (the time it took the balloon to get to the other side) when the force increased (the number of balloons)? Hint: Look at trials 1 and 2.

2. What happened to the acceleration (the time it took the balloon to get to the other side) when the mass increased (the number of washers)? Hint: Look at trials 1 and 3.
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3. What can you say about the acceleration (the time it took the balloon to get to the other side) in trials 1 and 4?

4. What force causes the balloon to slow down? Do you think the acceleration would increase or decrease if we used fishing line rather than kite string? Explain your answer.

5. Bonus: Can you identify the relationship between force (number of balloons), mass (the number of washers), and acceleration (time it took the balloon to get to the other side)?