Short Exploration Activity for The Ultimate Speed Challenge (Answer Key)

**Introduction:** In the next part of this lesson, you will be designing coaster cars. Doing some preliminary research on how the individual parts of a coaster car affect its travel time and motion will help you determine the best configuration of parts.

**Predictions:**

Which coaster car will travel fastest down the ramp? Why?

Which coaster car will travel straightest down the ramp? Why?

**Analysis Questions**: Use the data table on the following page to answer these questions.

1. Which car traveled the fastest? Why?

*The car with more wheels traveled the fastest because more wheels gave it more force to overcome friction.*

1. Which car traveled the straightest? Why?

*The car with the most mass traveled the straightest because more mass makes it harder to accelerate (in this case swerve).*

1. How does mass affect the motion of the car? **(Hint**: Newton’s 2nd Law)

*According to Newton’s 2nd law, more mass means more force but less acceleration, which meant the car swerved less, but also traveled more slowly down the ramp. However, because the heaviest car had the most force, it probably would travel the longest distance once off the ramp, and had the ramp been longer the car’s increased force might have helped it have a faster overall travel time.*

*Note: The above is an advanced explanation. Most students will have simpler, more basic explanations.*

1. Why do smaller wheels slow down the car? (**Hint**: Friction)

*Smaller wheels have more rotational friction (friction between the wheel and the axle).*

1. How does swerving affect the travel time and speed of a car?

*Swerving is a type of acceleration. Because a car must overcome inertia to swerve, unless the car has a lot of force (like the car with extra wheels), swerving will slow the car down.*

**Data Table**: Each car was tested three times on a 13cm tall ramp (3 textbooks).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Coaster Car** | **Mass (g)** | **Distance (cm)** | **Time (sec)** | **Ave. Speed (cm/sec)** | **Swerve** | | |
| **Last Year’s Winner** | 9.7g | 81cm | 2.35 | 34.5 | Trial 1 | Trial 2 | Trial 3 |
| 1R | 1R | 1R |
| **Small Wheels** | 6.3g | 81cm | 5.65 | 14.3 | Trial 1 | Trial 2 | Trial 3 |
| 1L | 1L | 1L |
| **Large Chassis** | 10.6g | 81cm | 2.57 | 31.5 | Trial 1 | Trial 2 | Trial 3 |
| 1L | 1L | 1L |
| **More Wheels** | 13.3g | 81cm | 2.3 | 35.2 | Trial 1 | Trial 2 | Trial 3 |
| 2L | 2L | 2L |
| **Less Wheel Space** | 9.5g | 81cm | 2.46 | 32.9 | Trial 1 | Trial 2 | Trial 3 |
| 1L | 1L | 1L |
| **More Mass** | 15.3g | 81cm | 3.10 | 26.1 | Trial 1 | Trial 2 | Trial 3 |
| Straight | Straight | 1L |