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| **Grade Level: 4** | **Total Time Required: 90 minutes** |
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| **Does the height of a ramp affect the speed and distance a Hot Wheels car will travel?****Prepared By: Nikki Rumpler** |
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| **Lesson Objectives:**In this lesson, students will be able to:1. Measure the distance an object travels.
2. Record measurements using SI units
3. Construct a data table and graph displaying their results
4. Make generalizations about speed and distance.
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| **Indiana Standards:*****Content Specific:**** 4.4.3 Investigate how changes in speed or direction are caused by forces: the greater the force exerted on an object, the greater the change.

***Process Standards:**** Make predictions.
* Test predictions with multiple trials.
* Use measurement skills and apply appropriate units when collecting data
* Keep accurate records in a notebook during investigations and communicate findings to others using graphs, charts, maps and models through oral and written reports
* Identify simple patterns in data and propose explanations to account for the patterns
* Compare the results of an investigation with the prediction.
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| **Science Concepts / Vocabulary:**  |  |
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| ***Term*** | ***Definition*** |
| **Measurement** | The act of measuring |
| **SI unit** | A common system of standard units (metric system) |
| **Distance** | The measure of the space between things |
| **Speed** | Rate of motion |
| **Force** | A push or a pull |
| **Friction** | A force that opposes motion |
| **Inertia** | The tendency of an object that is not moving to remain still, or of an object that is moving to continue to move, unless something else moves or stops the object. |

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| **List the quantities of all materials and equipment needed:** |  |
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| ***Tools/Equipment*** | ***Materials*** |
| Rulers | Hot Wheels Cars |
| Timers | Hardback Books (4 per group) |
| Calculators |  |
| Measuring Tapes | Sandpaper (various coarseness)- optional |
|  | Carpet Squares- optional |
|  | Toy cars of various sizes and weights- optional |

**Hot Wheels Lab**

\*In this investigation, students will look at the height of a ramp and how it affects the speed and distance a car will travel.

1. Pose this **QUESTION/PROBLEM** to the class:

Does the height of a ramp affect the speed and distance a hot wheels car will travel? (Have students write this question in their science notebooks.)

2. Under the question, have the students write a **PREDICTION**. For example: I think that the height of the ramp will/will not affect the speed and distance a car will travel BECAUSE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Be sure that they write a reason for their thinking. They need to try to provide evidence for their prediction. Encourage them to tap into prior knowledge.

3. **PROCEDURE/TEST IT**... You can distribute the procedure to the students to refer to. You can distribute to them so that they can cut it out and glue it in their science notebooks, or you can have them write the procedure in their notebooks.

* + 1. Build the ramp one book high.
		2. Place the Hot Wheels car at the starting point and release.
		3. You will need a person to serve as the “timer”. Use a stopwatch to find the time it takes for the car to travel down the ramp before stopping.
		4. Record the time in the data table.
		5. Measure the distance the car travels down the ramp and onto the floor.
		6. Record the distance in your data table.
		7. Determine the SPEED of the car by dividing the distance/time. Round to the nearest hundredth. Record the Speed in your data table.
		8. Record any other notes or observations you think are important for this trial.
		9. Repeat steps 1-8, with 2, 3, and 4 books.
		10. Create a graph displaying your results.
		11. Write a conclusion about your findings. Be sure to refer to your prediction.

4. **DATA COLLECTION:** Students will need to complete a data table with all of their measurements and observations. These should be cut out and glued in to their science notebooks.

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| **RAMP HEIGHT** | **Distance** | **Time** | **Speed (Distance/Time)** | **Observations** |
| 1 Book |  |  |  |  |
| 2 Books |  |  |  |  |
| 3 Books |  |  |  |  |
| 4 Books |  |  |  |  |

**5. CONCLUSION/REFLECTION**

Come together as a class to go over the results of the investigation. Ask students to share their results. You can record this data on a class data table. Have students explain their findings. What they should have noticed is that as they increased the height of the ramp, they also increased the distance the car would travel. In addition, the speed of the car increased. At this point, students should write a Conclusion/Reflection in their science notebooks under their data table. The questions below can serve as a prompt to help the students complete their reflections.

**Conclusion**: Write a paragraph describing the results of your investigation. What did you learn? Was your prediction correct? Be sure to use words like SPEED and DISTANCE in your paragraph. The questions below can help you organize some thoughts.

* + 1. Did the height of the ramp increase the distance the car rolled? Why or Why not?
		2. Given the results of this investigation, if the ramp keeps getting steeper, will the car roll farther each time? Why or Why not?
		3. Do you think the same thing would happen if you used a different surface for your ramp? (Carpet, Sandpaper, Tile) Why do you think that?
		4. Which do you think is more important? The size of the car or the weight of the car? Explain your thinking.
		5. What kind of experiment could you do to test Question #3 and/or #4?

**Extensions:** Students could design fair test investigations to test the ideas in #3 and #4 above.

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**HOT WHEELS LAB**

**Problem:**  Does the height of a ramp affect the speed and distance a hot wheels car will travel?

**Prediction:** I think the height of a ramp will or will not affect the speed and distance a hot wheels car will travel. I think this because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Materials:**  1. ruler

 2. Hot Wheels car

 3. measuring tape

 4. four hardback books

 5. calculator

 6. science notebook and pencil

**Procedure:**  1. Build the ramp one book high.

 2. Place the Hot Wheels car at the starting point and release.

 3. You will need a person to serve as the “timer”. Use a stopwatch to find the time it takes for the car to travel down the ramp before stopping.

 4. Record the time in the data table.

 5. Measure the distance the car travels down the ramp and onto the floor.

 6. Record the distance in your data table.

 7. Determine the SPEED of the car by dividing the distance/time. Round to the nearest hundredth. Record the Speed in your data table.

 8. Record any other notes or observations you think are important for this trial.

 9. Repeat steps 1-8, with 2, 3, and 4 books.

10. Create a graph displaying your results.

 11. Write a conclusion about your findings. Be sure to refer to your prediction.

**Data Collection:**

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| **RAMP HEIGHT** | **Distance** | **Time** | **Speed (Distance/Time)** | **Observations** |
| 1 Book |  |  |  |  |
| 2 Books |  |  |  |  |
| 3 Books |  |  |  |  |
| 4 Books |  |  |  |  |

**Graph your results.**

**Conclusion**: Write a paragraph describing the results of your investigation. What did you learn? Was your prediction correct? Be sure to use words like SPEED and DISTANCE in your paragraph. The questions below can help you organize some thoughts.

1. Did the height of the ramp increase the distance the car rolled? Why or Why not?
2. Given the results of this investigation, if the ramp keeps getting steeper, will the car roll farther each time? Why or Why not?
3. Do you think the same thing would happen if you used a different surface for your ramp? (Carpet, Sandpaper, Tile) Why do you think that?
4. Which do you think is more important? The size of the car or the weight of the car? Explain your thinking.
5. What kind of experiment could you do to test Question #3 and/or #4?