



First Challenge (Purpose):

1. Find out **how fast** (Avg Speed) your Hot Wheels car is going while on the orange track. **You will perform 4 different trials** (experiments) only **changing one variable** (distance, books, hills, car, lane, etc) for each experiment. You should have a **minimum of 3 runs per trial** using the **same** distance or variable.

MATERIALS

- 1 Race Track
- 2 Hot Wheels Cars
- 1 Stopwatch
- 2 Meter Stick
- 3 Rulers

HELPFUL EQUATIONS TO USE

- Average Speed or Speed =
- Velocity =
- Acceleration =

(Find these in your Equation #1 Notes)

What you will need to include or show in your notebook for CHALLENGE 1:

1. **Create a Data Table** with the data you will need to collect for average speed. (Include units) (**Reread the First Challenge above before** doing this).
2. A **sketch or drawing of your experimental design**. Make sure it is quality work and represents the trials you conducted. (show the distances and times)
3. **Write down** the formula for **AVERAGE SPEED** (see Physics #1 Equation Notes).
4. **Calculations** (with **all work & units shown**) to find the average speed of the car
5. Make a **graph for your cars speed** for the **4 different distances/runs along the track**. Plot each distance and corresponding time on your graph.

DIRECTIONS:

1. Select a car and a lane. The **two lanes may or may not be the same** in how fast they launch the cars. This means that you need to **use the same lane for ALL** of the runs in a trial to get quality data without introducing any extra **variables** into your experiment.
2. You can use **distance measuring devices** and **timing devices** as needed. You can also change the tracks position if you like. **Make sure not to hurt the track, cars, your partners or yourself when doing this.**
3. Place the cars in the starting area. Push cars in so the spring loads. Push the yellow button to launch.
4. **Please** make sure **not** to launch the cars unsafely. If you are an **unsafe driver** you will be given the opportunity to learn safely and directly from the book.
5. Please **cleanup** your equipment the last 5 minutes of the period. **DO NOT ROLLUP THE TRACK.**

Second Challenge (Purpose):

1. Find the **acceleration** of your HotWheels cars from when placed **a top three books** and allowed to roll down to the **100 cm** mark on the track.

What you will need to include or show in your notebook for CHALLENGE 2:

1. **Create** another **Data Table** with the data you will collect to determine the acceleration (include units). (*Hint:* Look at the formula for acceleration in your equation notes). See the sample on the board if you need help. You will only **perform 1 Trail** with **4 runs** keeping all the variables the same.
2. **Write down** the formula for **ACCELERATION** (look at your equation notes).
3. **Calculations** (with **all work** & **units shown**) to find the acceleration of your car.
4. Make **a graph for your cars acceleration**. Use your data from your data table for V_i and T_i and V_f and T_f of the car on its trip down the track. We are assuming that the **acceleration** (due to what force?) is **constant** when drawing the graph.
5. Answer the **Post Lab Questions in COMPLETE SENTENCES**.
6. **Conclusion** – Write a **4-6 sentence paragraph** that explains what you learned or discovered from doing the HotWheels Motion Lab. You should include **qualitative** (characteristics) and **quantitative** (numbers) information about the experiment. Explain how you were able to perform the two lab challenges.

Hot Wheels Motion Lab – POST LAB QUESTIONS:

1. List three things that are causing the car to accelerate? (**Hint:** acceleration is **change in velocity**)
2. Where was the acceleration of the car the greatest? (**Think** about what is causing it to accelerate)
3. Is the **speed of the car constant** or does it **change** as it goes down the track? Explain how you know.
4. Are the **velocity** and the **speed** of the car the **same** in this experiment? Explain your answer in a complete sentence.
5. What force is causing the car to accelerate down the track in Challenge 2?
6. What two things could you do to increase the momentum of the car?
7. List 3 things you could have used as a reference point (frame of reference) for this lab?

BONUS QUESTION: In the 1996 Olympics, gold medal winner Michael Johnson had a **faster average speed** in his **200-meter (10.35 m/s and a time of 19 sec)** race compared to his **100-meter race (10.01 m/s and 10 sec)**. Why? Draw a **Speed vs. time graph** for the 100 and 200 meter races to help you explain this question. Draw the graph with a curve from the start and accelerating up to a top speed of 12 m/s after 3 seconds.