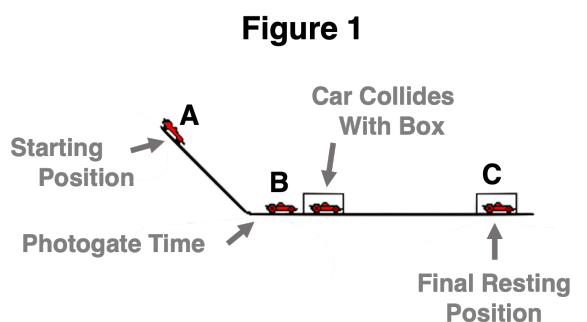


Hot Wheels Stopping Distance

Activity 1: Planning and Carrying Out the Investigation

A group of physics students are conducting a study using a Hot Wheels™ car. Their arrangement of equipment is shown in **Figure 1**. The car is placed on the track at position (**A**) and released from rest. The car rolls down the track to ground level and passes through a photogate timer. The photogate timer measures the time for the car to pass through it, allowing the students to calculate the speed. Immediately after passing through the timer, the car hits a small box (**B**). The car lodges in the box and slides across the floor to a final stopping position (**C**). The students measure the initial height of the car (h_A) and the photogate time (t) and calculate the speed (v_B). The students also place a meter stick along the floor so that they can measure the distance that the box and car skid before stopping (d_{BC}). Students plan to conduct five trials. Their data collection plan is shown in **Table 1**.



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Table 1: Planning Stage

Trial	h_A (m)	Photogate Time (s)	v_B (m/s)	Skid Distance (cm)
1	0.200			
2	0.400			
3	0.600			
4	0.800			
5	1.000			

Activity 2: Data Interpretation and Analysis

The students performed their lab and collected data. Calculations of speed were made. And now its time to analyze the data. Their data is shown in **Table 1**. It is your task to help them analyze the data.

Table 1: Student Data

Trial	h_A (m)	Photogate Time (s)	v_B (m/s)	Skid Distance (cm)
1	0.200	0.00904	1.77	18.3 ± 3.0
2	0.400	0.00639	2.50	37.1 ± 3.0
3	0.600	0.00522	3.07	55.2 ± 3.0
4	0.800	0.00452	3.54	73.9 ± 3.0
5	1.000	0.00404	3.96	92.5 ± 3.0

Activity 3: Using the Model to Make Predictions

The collected data reveal a clear pattern of how the dependent variables change for every change in the independent variable. Predictions can be made about how the system would respond to subsequent trials. In this activity, you will use the established patterns from **Table 1** to make predictions.

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Activity 4: Speed and Stopping Distance

The teacher directs students to focus on finding some relationships between car speed and stopping distance. Look for patterns in those two columns of **Table 1** in order to complete **Activity 4**.

Table 1: Student Data

Trial	h_A (m)	Photogate Time (s)	v_B (m/s)	Skid Distance (cm)
1	0.200	0.00904	1.77	18.3 ± 3.0
2	0.400	0.00639	2.50	37.1 ± 3.0
3	0.600	0.00522	3.07	55.2 ± 3.0
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Activity 5: Energy Analysis

The teacher directed students to focus on energy explanations for their observed results. She states its important to consider the entire motion as consisting of two parts: A to B and B to C. The system is defined as the car-Earth. She suggests students ask qualitative questions regarding potential energy, kinetic energy, total system energy