An Experiment on Calculating Acceleration

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Introduction

Suppose that your car goes from 0 mi/hr to 60 mi/hr in 12 seconds. Then your average acceleration is 5 mi/hr/s. As an example from your science classroom, suppose that a cart starting at rest reaches a speed of 80 cm/s in 4 seconds. Then the average acceleration of the cart is 20 cm/s/s, or 20 cm/s^2. In general, if the change in speed is denoted by Δv, and the change in time is Δt, then the average acceleration $a = \Delta v / \Delta t$.

Lesson Details

In this lesson you will be investigating acceleration with the aid of Ozobot Evo or Ozobot Bit. You will do this by loading the provided OzoBlockly program *acceleration.ozocode* into Ozobot. You then collect time and distance measurements as Ozobot line-follows a straight line. The straight line is drawn on a 2-meter length of adding machine tape as shown in Figure 1. Ozobot starts at the far-left end of the tape facing the direction shown by the arrow. As Ozobot moves to the right, it encounters the red hash marks that you have drawn on the tape. The distance in centimeters between each pair of hashmarks is shown in the diagram. When you create the tape, make sure that the distances between hash marks are as shown in Figure 1.

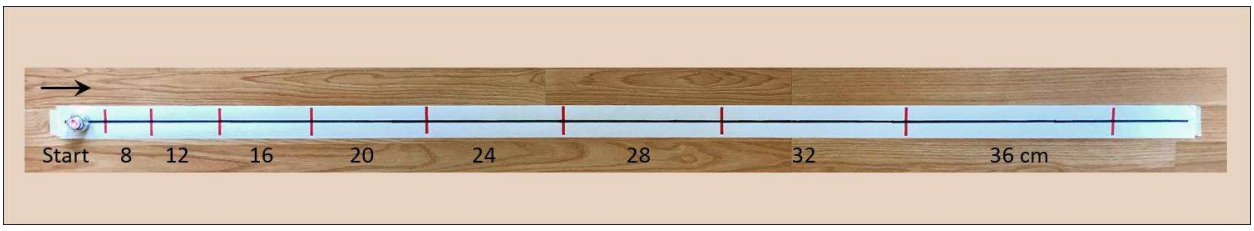


Figure 1

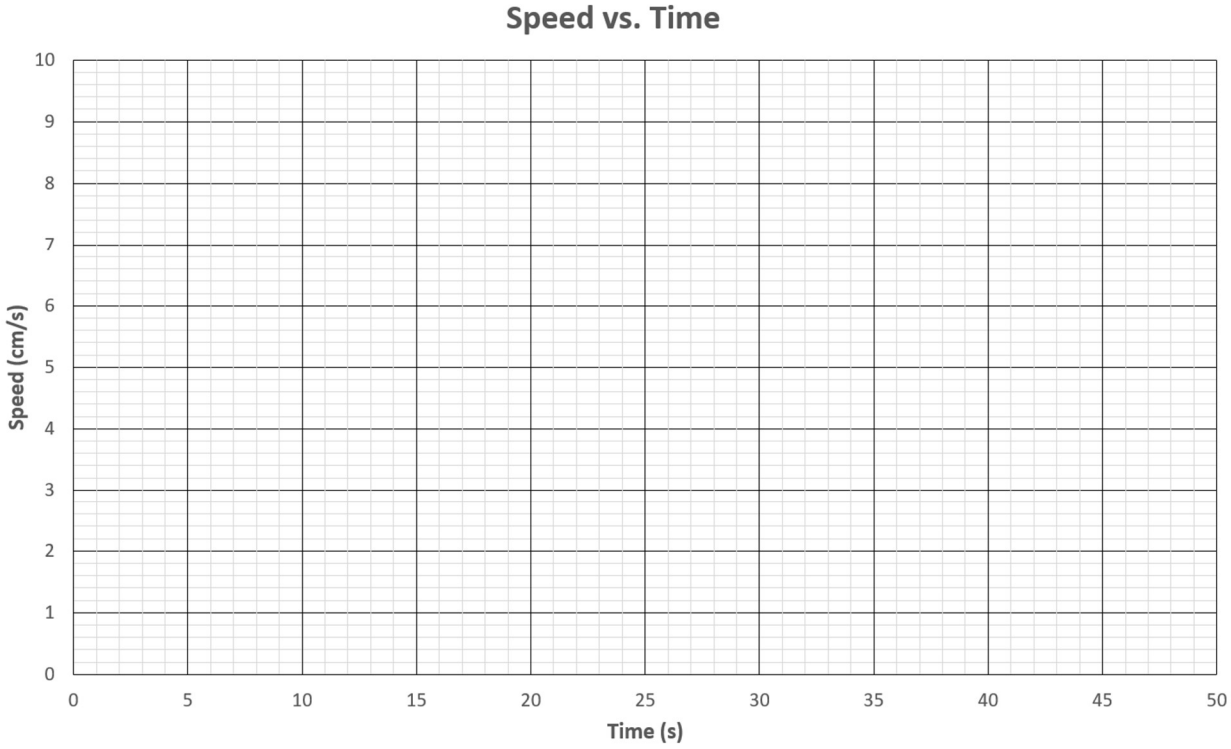
You will notice that Ozobot speeds up gradually while moving to the right. In other words, Ozobot is accelerating. Your goal is to determine Ozobot's average acceleration during its journey while traveling the length of the tape. You will accomplish this goal by measuring the time required to travel each of the segments between red hash marks. You can use any timer that permits "lap" times to measure these times. Many cell phones contain such an app, or you

can search and download one for your cell phone. The distance for each of the segments is known since you used a meter stick to set up these distances as per Figure 1.

You are now ready to start the experiment. You can use the table below to record your data.

Time, Δt for each segment (s)	*Total time (s)*	*Length, Δd for each segment (cm)*	*Speed, Δd/Δt (cm/s)*
		8	
		12	
		16	
		20	
		24	
		28	
		32	
		36	

After completing the data table, plot your speed vs. total time data in the graph shown below. Use a ruler and draw a "straight line of best fit" through your data points.



Finally, you can determine Ozobot's average acceleration by computing the slope of the straight line of best fit. Slope would be determined by the change in speed divided by change in time. What is the average acceleration in cm/s^2?