

Data Table for **Determining Speed** Experiment

Nominal Speed (mm/s) (as per Ozobot)	Distance (mm) (from meter stick)	Time (s) (as per Ozobot)	Speed (mm/s) (Calculated from speed = d/t)
20	1585	71	22.32
30	1585	50	31.70
40	1585	38	41.71
50	1585	31	51.13
60	1585	25	63.40
70	1585	21	75.48
80	1585	19	83.42

Discussion Questions

1. Which speed tends to be higher—Ozobot's nominal speed or your calculated speed? Which of the two speeds do you feel more confident as being closer to the real speed? Why?

The calculated speed tends to be higher. The calculated speed is probably closer to the real speed because it is based upon actual time and distance measurements. Ozobot's speed is a nominal speed. This might differ from one Ozobot to another, based on factors such as how fully charged Ozobot's battery is.

2. If you had used a stopwatch instead of relying on Ozobot's time, which of these two times would generally be higher? Why? (As a check on your answer--if you have access to a stopwatch, measure the time for a couple of the nominal speeds with the stopwatch?)

The stopwatch time would generally be higher as it does not truncate the time to the nearest lower second.

3. If your answer to question 2 was that the stopwatch times would be longer, on average how much longer would each of the times be?

Suppose that Ozobot says the time is 17 seconds. In reality, it could actually be between 17.00 and 17.99 seconds. We would therefore expect the stopwatch time to be 0.5 seconds higher than Ozobot's time, on average.

4. Would the amount that the stopwatch times are longer be enough to account for the difference between the nominal and calculated speeds?

Possibly. For example, consider the data in our table for a nominal speed of 80 mm/s. Ozobot's time was 19 seconds. But it could have been as high as 19.99 seconds. The speed would then be $1585/19.99 = 79.29$ mm/s, which is just a little below the nominal speed of 80 mm/s.

Now consider the data in our table for a nominal speed of 20 mm/s. In this case Ozobot's time was 71 seconds. But it could have been as high as 71.99 seconds if it were measured by a stopwatch. The speed would then be $1585/71.99 = 22.02$ mm/s, which is still above the nominal speed!

Rounding the time in seconds down has a greater effect on higher nominal speeds. So, for higher nominal speeds, it appears to be more desirable to use a stopwatch. Alternatively, larger distances could be used. But then we need to remember that the longest time measurable by Ozobot is 127 seconds, as this is the highest value that can be stored as an integer in Ozobot.