

Motion: Position and Velocity

- Describe why frame of reference is important and give two examples of how a choice of frame of reference can give two different results for the same object in motion.
- Suppose you are in a car traveling 60 km/h East; relative to you, what is the velocity of the following cars (velocities given are relative to an observer on the side of the road)
 - A bus is driving 35 km/h [E].
 - A minivan is driving 50 km/h [E].
 - A truck is driving 85 km/h [W].
 - A police car is driving 100 km/h [W].
- Define distance and displacement. In what situation are their magnitudes the same? Different?
- What is the difference between position and displacement? Speed and Velocity?
- In what situation are the magnitudes of speed and velocity the same? Different?
- Give an example when an object's average velocity is zero but its average speed is not zero.
- Suppose you drive between two cities called A and B (weird, I know) with an average velocity of v and it takes time t .
 - Now suppose you drive the same road between A and B but at twice the average velocity. Relative to the first trip how long did it take to drive?
 - You have to drive one more time between A and B but this time it takes four times as long. Relative to the first trip what was your average velocity?
- Sam is driving along the highway towards Saint John. He travels 150km in 3.00hrs. What is his average speed for his trip? (50 km/h)
- A vehicle travels 2345 m [W] in 315 s toward the evening sun. What is its average velocity? (7.4 m/s [W])
- What distance will a car, traveling 65 km/hr, cover in 3.0 hrs? (195 km)
- How long will it take to go 150 km [E] traveling at 50 km/hr [E]? (3.0 hr)
- What is the displacement of the Earth after one orbit about the Sun? What is the average velocity of the Earth after one orbit in m/s? (0 m; 0 m/s)
- What is the average velocity of the Earth the instant it has traveled half of its circular orbit about the Sun in m/s? ($v_{avg} = 19\,025$ m/s)
- Calculate the average speed of the Earth about the Sun in m/s. (29 885 m/s)
- How long will it take to travel 200 000 m [N] traveling 10 m/s [N]? (20 000 s)
- A car drives 12 m/s [S] for 5.0 seconds, then 18 m/s [N] for 9.0 seconds, and finally 15 m/s [S] for 11 seconds. Calculate the average speed and average velocity. ($v_{sp} = 15.5$ m/s; $v_{avg} = -2.5$ m/s or 2.5 m/s [S])
- A soccer ball is kicked 25 m [E], then 15 m [E], 8 m [W], and finally 12 m [E]. All this takes place in 45 seconds. Calculate the average speed and velocity of the ball. ($v_{sp} = 1.3$ m/s; $v_{avg} = +0.98$ m/s [E])