

Uniform Motion

1. A ball is rolling on the ground at a constant speed of 2.5 m/s. After 5.0 s, how far has it moved?
2. A student sprints at a constant speed of 8.10 m/s. How long will it take him to run 100. m?
3. A car travels east at 40.0 km/h for 30 min and then east at 60.0 km/h for 15 min. How far does it travel in this time?
4. A marathon runner completes a 42.0 km race in 2 h 37 min. What is his average speed in m/s?
5. A woman jogs 1500 m west to the grocery store and walks 450 m east to the bus stop. If this takes 1200 s, what is her
 - a. average speed,
 - b. average velocity?
6. A motorist travels for 3.0 h at 80.0 km/h and 2.0 h at 100.0 km/h.
 - a. How far does she travel?
 - b. What is her average speed?
7. A bike travels with an average velocity of 8.0 m/s west for 30.0 min, then 10.0 m/s east for 20.0 min.
 - a. What distance did the bike travel?
 - b. What is the displacement of the bike?
8. A car drives 8.0 km at 10.0 m/s, then 40.0 km at 25 m/s. What is the average speed?
9. A race car circles 10 times around an 8.0 km track in 20.0 min.
 - a. What is its average speed?
 - b. What is its average velocity?
10. In the final 100. M of a relay race, the Griffin runner can run 100. min 9.8 s, while the Joker runner can run 100. min 10.1 s. When the Griffin runner begins the final 100. m, the Joker runner is already partway through the final 100. m.
 - a. What is the speed of the Joker runner?
 - b. How far can the Joker runner travel during the 9.8 sit takes the Griffin runner to finish?
 - c. How much of a head start does the Joker runner need in order to win the race?

11. Runner A and Runner B run in the same direction around a 400 m circular track. Runner A starts at the start line and runs at a constant speed of 7.6 m/s. Runner B starts from the same line 5.0 s later and runs at a constant speed of 8.0 m/s.
- How far has Runner A travelled when Runner B starts?
 - How quickly is Runner B gaining on Runner A?
 - How long after Runner B starts will it take Runner B to close the gap?
 - How long after Runner A starts do the runners first meet?
 - How far has Runner A travelled when they meet?
 - Where on the 400 m track do they meet?
12. A 200 km trip has two highway segments and one rest stop. The first 120 km is travelled at 100. km/h. During the next 80.0 km, the first 20.0 km is through construction at 60.0 km/h. You take a 10.0 min rest break between the two highway segments. You want your overall average speed for the entire 200 km trip, including the rest break, to be 90.0 km/h.
- How much total time can the entire 200 km trip take?
 - How long does the first 120 km take?
 - How long does the 20.0 km construction zone take?
 - Convert the 10.0 min rest break to hours.
 - How much time remains to travel the final 60.0 km?
 - What constant speed must you travel during the final 60.0 km?
13. A river is 500 m wide and has a current of 1.5 m/s east. A boat can travel at 3.0 m/s relative to the water. The boat is pointed upstream so that its actual path is straight across the river.
- Draw a diagram showing the river current, the boat's velocity relative to the water, and the boat's resulting velocity straight across the river.
 - What westward component of the boat's velocity is needed to cancel the river current?
 - What is the boat's velocity directly across the river?
 - How long does it take the boat to cross the 500 m river?
14. Runner A and Runner B run in the same direction around a 200 m circular track. Runner B begins 10.0 s before Runner A. Runner A runs at a constant speed of $v_A = 7.5$ m/s and Runner B runs at a constant speed of $v_B = 6.0$ m/s.
- How far has Runner B travelled when Runner A starts?
 - How quickly is Runner A gaining on Runner B?
 - How long after Runner A starts will it take Runner A to close the gap?
 - How far has Runner A travelled when they first meet?
 - Where on the 200 m track does their first meeting occur?
 - How many full laps has each runner completed when they first meet?
 - After they meet, how much farther must Runner A gain on Runner B before they meet again?