

W1.06**Displacement and Velocity Problems-KEY**

(9/04/03)

- 1) A honeybee leaves the hive and travels 2 kilometers before returning. Is the displacement for the trip the same as the distance traveled? If not, why not?

Distance is "how far the bee flew -"what the feet feel" [2km+2km=4km]

Displacement is distance & direction from starting point to ending point [start = finish 0 km]

- 2) a) What does the slope of a position versus time graph represent? b) If the slope gradually increases, what does this mean?

Instantaneous velocity

Changing slope = Δ velocity or acceleration $\neq 0$

- 3) A squirrel runs in a straight line with a constant velocity of 2.0 meters per second. How far will the squirrel travel in 2.5 seconds?

2.0 meters/sec x 2.5 sec = 5 meters

- 4) Sound travels at a constant speed of 343 m/s in air at 20 °C. Approximately how much time (in seconds) does it take for the sound of thunder to travel 1.609 kilometers (1 mile)?

1,609 meters divided by 343 meters/sec = 4.69 seconds

- 5) A plane is sitting on the runway, awaiting takeoff. On an adjacent parallel runway, another plane lands and passes the stationary plane at a constant speed of 45 m/s. The arriving plane has a length of 36 meters. By looking out of the window (very narrow view), a passenger on the stationary plane can see the moving plane. For how long a time is the moving plane visible?

36 meters divided by 45 meters/sec = .8 seconds

- 6) Bats judge their position relative to their surroundings by emitting high-pitched sound and listening for the echo. Imagine that a bat hovers in mid-air and screeches. The bat hears the echo 0.51 seconds later. a) How far away is the object off which the sound rebounded? (Sound travels at 343 meters per second in air at 20 °C.) b) How many miles is that?

343 meters/sec x .51 sec = 174.9 meters so 87.45 meters [174.9 meters divided by 2]

87.45 meters x 1 mile/1,609 meters = .05 miles

- 7) A sky diver, with parachute unopened, falls 625 meters in 15.0 seconds. Then she opens her parachute and falls another 356 meters in 142 seconds. What is her average velocity for the entire fall?

Average velocity = total displacement divided by total time

(625 m + 356 m) divided by (15.0 sec + 142 sec) = 981 m divided by 157 sec = 6.24 meters/sec

- 8) During a long distance run, a jogger travels 3.1 meters per second for 15 minutes, slows down to 2.4 meters per second for 9 minutes, and then speeds up to 4.1 meters per second for 5 minutes. a) How far did the person jog? b) What is her average speed?

3.1 m/s x 900 s = 2,790 m 2.4 m/s x 540 s = 1,296 m 4.1 m/s x 300 s = 1,230 m

so 2,790 m + 1,296 m + 1,230 m = 5,316 m

Average speed = total distance (5,316 m) divided by total time (900 s + 540 s + 300 s = 1,740 s)

3.06 meters/second

- 9) A car travels 40 mph for three quarters of an hour, 80 mph for 15 minutes, and then 50 mph for 30 minutes. a) How far did the car travel? b) What is the car's average speed?

40 miles/hr x .75 hr + 80 miles/hr x .25 hr + 50 miles/hr x .5 hr

30 miles + 20 miles + 25 miles = 75 miles

Average speed = total distance (75 miles) divided by total time (1.5 hrs) = 50 mph