Speed velocity distance displacement worksheet answer key

I'm not robot!

CP PHYSICS **Answer Key**
VELOCITY AND ACCELERATION REVIEW

1. What three components do all good graphs have?
   1. Title (usually y-axis label vs. x-axis label)
   2. Labeled axes with units
   3. Regular intervals for the scales on each axis
2. Define each of the following terms. State whether they are scalar or vector quantities.
   a. distance: scalar, how far an object travels
   b. displacement: vector, how far an object is from a reference point (starting point)
   c. speed: scalar, how fast an object moves
   d. velocity: vector, the speed and direction of an object that is moving
   e. acceleration: vector, how fast an object's velocity changes
3. Identify the following variables and give their units:
   d = displacement, m   v = velocity, m/s
   t = time, s   a = acceleration, m/s^2
   v_o = initial velocity, m/s v_f = final velocity, m/s
4. A woman drives 10 miles to work. She returns home for lunch and then drives back to the office after lunch. What is her total displacement from home? What is the total distance she drove?
   Total displacement = 10 miles (from a reference point – home)
   Total distance = 30 miles (10 mi to work, 10 mi to home, 10 mi to work)
5. When does an object experience acceleration?
   An object only experiences acceleration when it changes speed, changes its direction, or changes both speed and direction.
6. If a car travels around a circular track at 22 km/h, is the car's motion described as uniform or accelerated? Explain!
   Its motion is described as accelerated since it is always changing direction even if it maintains a constant speed of 22 km/h.
7. If an object is said to have uniform motion, then what does one know about its velocity? about its acceleration?
   An object with uniform motion has a constant velocity. It has no acceleration since constant velocity means the object's speed and direction remain the same.
8. Draw all motion graphs that represent no motion or zero velocity.

Motion in One Dimension **Name:** ______________________________

Describing Motion Verbally with Distance and Displacement

Read from **Lesson 1** of the **1-D Kinematics** chapter at **The Physics Classroom**:

http://www.physicsclassroom.com/Class/1DKin/U1L1a.html
http://www.physicsclassroom.com/Class/1DKin/U1L1b.html
http://www.physicsclassroom.com/Class/1DKin/U1L1c.html

MOP Connection: Kinematic Concepts: sublevels 1 and 2

Motion can be described using words, diagrams, numerical information, equations, and graphs. Using words to describe the motion of objects involves an understanding of such concepts as position, displacement, distance, rate, speed, velocity, and acceleration.

Vectors vs. Scalars

1. Most of the quantities used to describe motion can be categorized as either vectors or scalars. *A vector is a quantity which is fully described by both magnitude and direction. A scalar is a quantity which is fully described by magnitude alone.* Categorize the following quantities by placing them under one of the two column headings.

displacement, distance, speed, velocity, acceleration

Scalars	Vectors

2. A quantity which is *ignorant of direction* is referred to as a ________________.
   a. scalar quantity   b. vector quantity
3. A quantity which is *conscious of direction* is referred to as a ________________.
   a. scalar quantity   b. vector quantity

Distance vs. Displacement

As an object moves, its location undergoes change. There are a two quantities which are used to describe the changing location. One quantity - **distance** - accumulates the amount of total change of location over the course of a motion. Distance is the amount of ground which is covered. The second quantity - **displacement** - only concerns itself with the initial and final position of the object. Displacement is the overall change in position of the object from start to finish and does not concern itself with the accumulation of distance traveled during the path from start to finish.

4. True or False: An object can be moving for 10 seconds and still have zero displacement.
   a. True   b. False
5. If the above statement is true, then describe an example of such a motion. If the above statement is false, then explain why it is false.

6. Suppose that you run along three different paths from location A to location B. Along which path(s) would your distance traveled be different than your displacement? __________

2.5 Can a body moving at a constant speed have acceleration?
Ans: A body is moving with constant speed may or may not have acceleration.
- If a body is moving with constant speed in straight line does not have acceleration.
- If a body is moving with constant speed and is not moving in straight line have acceleration.

2.6 How do riders in a Ferris wheel possess translatory motion but not circular motion?
Ans: The riders do not move in circle of constant radius therefore their motion is not circular

2.7 Sketch a distance – time graph for a body starting from rest. How will you determine the speed of a body from this graph?
Ans: The distance-time graph is shown below
The slop of the graph gives speed with the help of the formula
Speed (v) of the object = slope of line AB
$= \frac{\text{distance EF}}{\text{time CD}}$
$= \frac{20m}{10s}$
$= 2\ ms^{-1}$
The speed found from the graph is $2\ ms^{-1}$

Figure 2.19: Distance-time graph showing constant speed.

2.8 What would be the shape of speed – time graph of a body moving with variable speed?
Ans: The shape of the velocity-time graph is zigzag when the body has variable speed

2.9 Which of the following can be obtained from speed – time graph of a body?
(i) **Initial speed**
(ii) **Final speed**
(iii) **Distance covered in time t**
(iv) **Acceleration of motion**
Ans: From velocity-time graph we can calculate Initial speed, final speed, distance covered in time t and acceleration of motion.

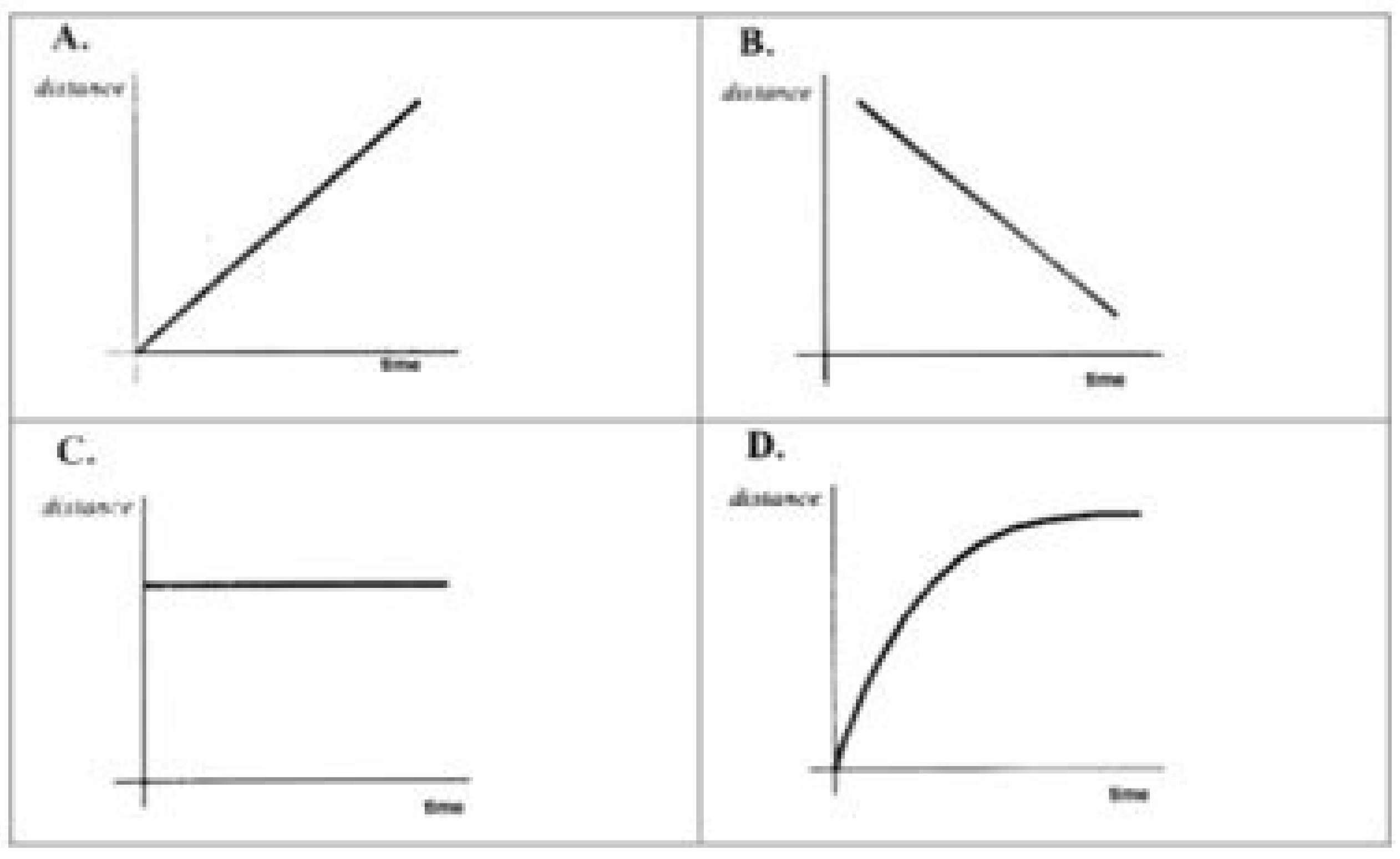
2.10 How can vector quantities be represented graphically?
Ans: A vector can be represented graphically by drawing a straight line with an arrow head at one end. The Length of the line tells the magnitude and arrow head shows the direction of the vector

2.11 Why vector quantities cannot be added and subtracted like scalar quantities?
Ans: In addition of vectors, both magnitude and direction are involved. Therefore, vectors cannot be added by simple method of scalar addition.

The distance-time graphs below represent the motion of a car. Match the descriptions with the graphs. **Explain your answers.**

Descriptions:

1. The car is stopped.
2. The car is traveling at a constant speed.
3. The speed of the car is decreasing.
4. The car is coming back.



Graph A matches description _____ because _______________________________.

Graph B matches description _____ because _______________________________.

Graph C matches description _____ because _______________________________.

Graph D matches description _____ because _______________________________.

6. A 2.5 –g (0.0025 kg) bullet traveling at 350 m/s hits a tree and slows uniformly to a stop while penetrating a distance of 12 cm into the tree's trunk. What force was exerted on the bullet in bringing it to rest?

$KE = W_{tree}$

$\frac{1}{2}mv^2 = F \cdot d$ $\quad F = 1276\ N \approx 1300\ N$

$\frac{1}{2}(.0025)(350)^2 = F(.12)$

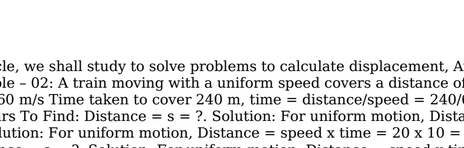
7. A 150-g baseball reaches a batter with a speed of 25 m/s. After it has been struck, it leaves the bat at 35 m/s in the opposite direction. If the ball was in contact with the bat for .001 s, find the average force exerted on it during this period. *(9 kN)*

$F = \frac{m(V_f - V_i)}{t} = \frac{0.150\ (35 - -25)}{.001} = 9000\ N$

8. A 35 g superball hits a wall at 10.0 m/s. If bounces off the wall with a speed of 8.0 m/s and the ball is in contact with the wall for 0.20 s, what is the average force exerted by the wall on the ball? *(3.2 N)*

$F = \frac{m(V_f - V_i)}{t} = \frac{.035\ (-8.0 - 10.0)}{.2} = -3.2\ N$

9. A 30.0 kg girl who is running at 3.0 m/s jumps on a stationary 10.0 kg sled on a frozen lake. How fast does the sled then move? *(2.3 m/s)*

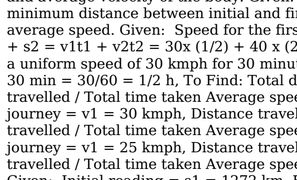


$P_i = P_f$

$(30.0)(3.0) + 10(0) = (40.0)V$ $\quad V = 2.25 \approx 2.3\ m/s$

10. A 0.50 kg clay ball is rolls down a 0.30 m ramp.

a. What is the velocity of the ball at the bottom of the ramp?

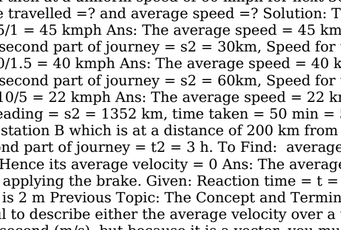


$PE_g = KE$

$mgy = \frac{1}{2}mv^2$

$(.50)(9.8)(3) = \frac{1}{2}(.50)(V)^2$ $\quad 1.47 = .25v^2$ $\quad v^2 = 5.88$ $\quad V = 2.42\ m/s$

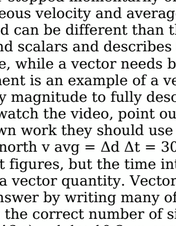
b. Then the ball rolls across a level table where it collides inelastically with a stationary toy car of mass 1.5 kg. What is the velocity of the clay-car combo?



$P_i = P_f$

$(.50)(2.42) + 0 = (.50 + 1.5)V$ $\quad 1.21 = 2.0V$ $\quad V = .606\ m/s$

c. The clay-car combo then falls off the 1.25 m high table. What is the velocity of the clay-car combo just before it hits the floor?



$KE + PE = KE$

$\frac{1}{2}(m)v^2 + mgy = \frac{1}{2}mv^2$

$\frac{1}{2}(2.0)(.600)^2 + (2.0)(9.8)(1.25) = \frac{1}{2}(2.0)v^2$

$.3675 + 24.5 = V^2$

$V = \sqrt{24.8675} = 4.9867$

$\approx 5.0\ m/s$

Speed velocity distance displacement worksheet physics answer key. Speed to velocity calculator.

In this article, we shall study to solve problems to calculate displacement, Average Speed, and average Velocity.Example – 01: A train travels a distance of 100 m due east in 10 seconds. What is its speed and velocity? Solution: Speed = distance /time = 100/10 = 10 m/s velocity = 10m/s due east Ans: The speed is 10 m/s and the velocity is 10m/s due east Example – 02: A train moving with a uniform speed covers a distance of 120 m in 2 s. Calculate the speed of the train and the time taken to cover a distance of 240m. Given: Distance travelled by train = s = 120 m, Time taken = 2 s To Find: Speed of train = v =? and time t =? when s = 240 m. Solution: For uniform motion, speed = distance/time = 120/2 = 60 m/s Time taken to cover 240 m, time = distance/speed = 240/60 = 4 s Ans: The speed of the train is 60 m/s and it will take 4 s to cover a distance of 240 m Example – 03: A car takes 3 hours to travel from Delhi to Agra with a uniform speed of 65 kmph. Find the distance between the cities. Given: Speed of car = v = 65 km/h, Time taken = t = 3 hours To Find: Distance = s = ?. Solution: For uniform motion, Distance = speed x time = 65 x 3 = 195 km Ans: The distance between delhi and Agra is 195 km Example – 04: A body travels at a uniform speed of 20 m/s. Find the distance travelled by the body in 10 s. Given: Speed of body = v = 20 m/s, Time taken = t = 10 sTo Find: Distance = s = ?. Solution: For uniform motion, Distance = speed x time = 20 x 10 = 200 m Ans: The distance travelled by the body in 10 s is 200 m Example – 05: A car is travelling with a uniform speed of 72 kmph. Find the distance travelled by it in 20 minutes Given: Speed of car = v = 72 km/h = 72x 5/18 = 20 m/s, Time = t = 20 min = 20 x 60 = 1200 s To Find: Distance = s = ?. Solution: For uniform motion, Distance = speed x time = 20 x 1200 = 24000 m = 24 km Ans: The distance travelled by car is 24 km Example – 06: A body rises vertically upward to a height of 100 m, in 5 seconds, then comes back at the same position after another 5 s. Find the distance travelled, displacement, average speed and average velocity of the body. Given: Upward distance travelled = 100 m, time taken for upward journey = 5s Solution: Total distance travelled = distance travelled in upward journey + distance travelled in downward journey Total distance travelled = 100 m + 100 m = 200 m As the body is returning back to the same position. Displacement = minimum distance between initial and final position = 0 Average speed = Total distance/ total time = 200/10 = 20 m/s As displacement is zero, velocity is also zero Example – 07: A car travels at a uniform speed of 30 kmph for 30 minutes and then at a uniform speed of 40 kmph for the next 40 min. Calculate the total distance travelled by car and its average speed. Given: Speed for the first part of journey = v1 = 30 kmph, time for first part of journey = t1 = 30 min = 30/60 = 1/2 h, Speed for the second part of journey = v2 = 40 kmph, time for first part of journey = t2 = 40 min = 40/60 = 2/3 h,To Find: Total distance travelled =? and average speed =? Solution: Total distance travelled = s = s1 + s2 = v1t1 + v2t2 = 30x (1/2) + 40 x (2/3) Total distance travelled = 125/3 = 41.67 km Total time taken = t = t1 + t2 = 1/2 + 2/3 = 7/6 h Average speed = Total disrtance travelled / Total time taken Average speed = (125/3)/(7/6) = 35.71 kmph Ans: Total distance travelled = 41,67 km and average speed = 35.71 kmph Example – 08: A car travels at a uniform speed of 30 kmph for 30 minutes and then at a uniform speed of 60 kmph for next 30 min. Calculate the average speed of the car. Given: Speed for the first part of journey = v1 = 30 kmph, time for first part of journey = t1 = 30 min = 30/60 = 1/2 h, Speed for the second part of journey = v2 = 60 kmph, time for first part of journey = t2 = 30 min = 30/60 = 1/2 h, To Find: Total distance travelled =? and average speed =? Solution: Total distance travelled = s = s1 + s2 Total distance travelled = v1t1 + v2t2 Total distance travelled = 30 x (1/2) + 60 x (1/2) Total distance travelled = 15 + 30 = 45 km Total time taken = t = t1 + t2 = 1/2 + 1/2 = 1 h Average speed = Total disrtance travelled / Total time taken Average speed = 45/1 = 45 kmph Ans: The average speed = 45 kmph Example – 09: A car travels first 30 km at a uniform speed of 30 kmph and next 30 km at a uniform speed of 60 kmph. Calculate the average speed of the car. Given: Distance travelled in first part of journey = s1 = 30km, Speed for the first part of journey = v1 = 30 kmph, Distance travelled in second part of journey = s2 = 30km, Speed for the second part of journey = v2 = 60 kmph,To Find: average speed =? Solution: Total distance travelled = s = s1 + s2 = 30 km + 30 km = 60 km Total time taken = t = t1 + t2 = s1/v1 + s2/v2 = 30/30 + 30/60 = 1.5 h Average speed = Total disrtance travelled / Total time taken Average speed = 60/1.5 = 40 kmph Ans: The average speed = 40 kmph Example – 10: A car travels first 50 km at a uniform speed of 25 kmph and next 60 km at a uniform speed of 20 kmph. Calculate the average speed of the car. Given: Distance travelled in first part of journey = s1 = 50km, Speed for the first part of journey = v1 = 25 kmph, Distance travelled in second part of journey = s2 = 60km, Speed for the second part of journey = v2 = 20 kmph, To Find: average speed =? Solution: Total distance travelled = s = s1 + s2 =50 km + 60 km = 110 km Total time taken = t = t1 + t2 = s1/v1 + s2/v2 = 50/25 + 60/20 = 5 h Average speed = Total disrtance travelled / Total time taken Average speed = 110/5 = 22 kmph Ans: The average speed = 22 kmph Example – 11: A car is fitted with a speedometer which also gives reading of distance travelled by the car. At the start of the trio reading was found to be 1272 km and after 50 imutes at end of the trip is 1352 km. Calculate the average speed of the car. Given: Initial reading = s1 = 1272 km, Final reading = s2 = 1352 km, time taken = 50 min = 50/60 = 5/6 h To Find: average speed =? Solution: Total distance travelled = s2 – s1 = 1352 – 1272 = 80 km Average speed = Total disrtance travelled / Total time takenAverage speed = 80/(5/6)= 96 kmph Ans: The average speed = 96 kmph Example – 12: A train takes 2 h to reach from station A to station B which is at a distance of 200 km from station A. It takes 3 h for the return journey. What is the average speed and average velocityof the train? Given: Distance travelled in first part of journey = s1 = 200 km, time taken for the first part of journey = t1 = 2 h, Distance travelled in second part of journey = s2 = 200 km, time taken for the second part of journey = t2 = 3 h. To Find: average speed =? Solution: Total distance travelled = s = s1 + s2 = 200 km + 200 km = 400 km Total time taken = t = t1 + t2 = 2 h + 3 h = 5h Average speed = Total disrtance travelled / Total time taken Average speed = 400/5 = 80 kmph As the train is coming back to starting point its displacement is zero. Hence its average velocity = 0 Ans: The average speed = 80 kmph, average velocity = 0 Example – 13: A driver of a car has a reaction time of 0.2 s. reaction time is a time between actually seeing the obstacle and applying the brake. He is moving with a uniform speed of 30 kmph. He spots a boy crossing the road. How much distance he travels before applying the brake. Given: Reaction time = t = 0.2 s, speed of car = v = 36 kmph = 36 x 5/18 = 10 m/s To Find: distance travelled = s =? Solution: Between seeing the boy and applying the brake car moves in uniform motion Distance travelled before applying brake = s = v t = 10 x 0.2 = 2 m Ans: Distance travelled before application of brakes is 2 m Previous Topic: The Concept and Terminology of Motion Next Topic: Newton's Kinematical Equations of Motion Science > Physics > Motion in a Straight Line > Numerical Problems on Displacement, Average Speed, Velocity The vector version of speed is velocity. Velocity describes the speed and direction of an object. As with speed, it is useful to describe either the average velocity over a time period or the velocity at a specific moment. Average velocity is displacement divided by the time over which the displacement occurs. v avg = displacement time = Δd Δt = d f − d 0 t f − t 0 v avg = displacement time = Δd Δt = d f − d 0 t f − t 0 Velocity, like speed, has SI units of meters per second (m/s), but because it is a vector, you must also include a direction. Furthermore, the variable v for velocity is bold because it is a vector, which is in contrast to the variable v for speed which is italicized because it is a scalar quantity. It is important to keep in mind that the average speed is not the same thing as the average velocity without its direction. Like we saw with displacement and distance in the last section, changes in direction over a time interval have a bigger effect on speed and velocity. Suppose a passenger moved toward the back of a plane with an average velocity of –4 m/s. We cannot tell from the average velocity whether the passenger stopped momentarily or backed up before he got to the back of the plane. To get more details, we must consider smaller segments of the trip over smaller time intervals such as those shown in Figure 2.9. If you consider infinitesimally small intervals, you can define instantaneous velocity, which is the velocity at a specific instant in time. Instantaneous velocity and average velocity are the same if the velocity is constant. Figure 2.9 The diagram shows a more detailed record of an airplane passenger heading toward the back of the plane, showing smaller segments of his trip. Earlier, you have read that distance traveled can be different than the magnitude of displacement. In the same way, speed can be different than the magnitude of velocity. For example, you drive to a store and return home in half an hour. If your car's odometer shows the total distance traveled was 6 km, then your average speed was 12 km/h. Your average velocity, however, was zero because your displacement for the round trip is zero. This video reviews vectors and scalars and describes how to calculate average velocity and average speed when you know displacement and change in time. The video also reviews how to convert km/h to m/s. Which of the following fully describes a vector and a scalar quantity and correctly provides an example of each? A scalar quantity is fully described by its magnitude, while a vector needs both magnitude and direction to fully describe it. Displacement is an example of a scalar quantity and time is an example of a vector quantity. A scalar quantity is fully described by its magnitude, while a vector needs both magnitude and direction to fully describe it. Time is an example of a scalar quantity and displacement is an example of a vector quantity. A scalar quantity is fully described by its magnitude and direction, while a vector needs only magnitude to fully describe it. Displacement is an example of a scalar quantity and time is an example of a vector quantity. A scalar quantity is fully described by its magnitude and direction, while a vector needs only magnitude to fully describe it. Time is an example of a scalar quantity and displacement is an example of a vector quantity. This video does a good job of reinforcing the difference between vectors and scalars. The student is introduced to the idea of using 's' to denote displacement, which you may or may not wish to encourage. Before students watch the video, point out that the instructor uses s→s→ for displacement instead of d, as used in this text. Explain the use of small arrows over variables is a common way to denote vectors in higher-level physics courses. Caution students that the customary abbreviations for hour and seconds are not used in this video. Remind students that in their own work they should use the abbreviations h for hour and s for seconds. A student has a displacement of 304 m north in 180 s. What was the student's average velocity? We know that the displacement is 304 m north and the time is 180 s. We can use the formula for average velocity to solve the problem. v avg = Δd Δt = 304 m 180 s =1.7 m/s north v avg = Δd Δt = 304 m 180 s =1.7 m/s north Since average velocity is a vector quantity, you must include direction as well as magnitude in the answer. Notice, however, that the direction can be omitted until the end to avoid cluttering the problem. Pay attention to the significant figures in the problem. The distance 304 m has three significant figures, but the time interval 180 s has only two, so the quotient should have only two significant figures. Note the way scalars and vectors are represented. In this book d represents distance and displacement. Similarly, v represents speed, and v represents velocity. A variable that is not bold indicates a scalar quantity, and a bold variable indicates a vector quantity. Vectors are sometimes represented by small arrows above the variable. Use this problem to emphasize the importance of using the correct number of significant figures in calculations. Some students have a tendency to include many digits in their final calculations. They incorrectly believe they are improving the accuracy of their answer by writing many of the digits shown on the calculator. Point out that doing this introduces errors into the calculations. In more complicated calculations, these errors can propagate and cause the final answer to be wrong. Instead, remind students to always carry one or two extra digits in intermediate calculations and to round the final answer to the correct number of significant figures. Layla jogs with an average velocity of 2.4 m/s east. What is her displacement after 46 seconds? We know that Layla's average velocity is 2.4 m/s east, and the time interval is 46 seconds. We can rearrange the average velocity formula to solve for the displacement. v avg = Δd Δt Δd = v avg Δt = (2.4 m/s)(46 s) = 1.1× 10 2 m east v avg = Δd Δt Δd = v avg Δt = (2.4 m/s)(46 s) = 1.1× 10 2 m east The answer is about 110 m east, which is a reasonable displacement for slightly less than a minute of jogging. A calculator shows the answer as 110.4 m. We chose to write the answer using scientific notation because we wanted to make it clear that we only used two significant figures. Dimensional analysis is a good way to determine whether you solved a problem correctly. Write the calculation using only units to be sure they match on opposite sides of the equal mark. In the worked example, you have m = (m/s)(s). Since seconds is in the denominator for the average velocity and in the numerator for the time, the unit cancels out leaving only m and, of course, m = m. Phillip walks along a straight path from his house to his school. How long will it take him to get to school if he walks 428 m west with an average velocity of 1.7 m/s west? We know that Phillip's displacement is 428 m west, and his average velocity is 1.7 m/s west. We can calculate the time required for the trip by rearranging the average velocity equation. v avg = Δd Δt Δt = Δd v avg = 428 m 1.7 m/s = 2.5× 10 2 s v avg = Δd Δt Δt = Δd v avg = 428 m 1.7 m/s = 2.5× 10 2 s Here again we had to use scientific notation because the answer could only have two significant figures. Since time is a scalar, the answer includes only a magnitude and not a direction.

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