_____ Sci #___ Pd: _____ # Day 7: Motion ___/64.5 pts 2 pts ec printing

**#1 Motion Standards:** The velocity of an object is the rate of change of its _____.

a. Position is defined in relation to some choice of a standard _____ point & a set of reference _____.

b. _____ speed is the total distance traveled divided by the total time elapsed & that the speed of an object along the path traveled can _____.

c. Solve problems involving distance, time, & average speed.

d. The velocity of an object must be described by specifying both the _____ & the _____ of the object.

e. Changes in _____ may be due to changes in speed, direction, or both.

f. Interpret graphs of position versus time & graphs of speed versus time for motion in a single direction.

_____/14 pts
1 pt each

**Motion Vocabulary:** Write the correct term letter next to the definition

____1. The location of an object compared to a reference point
____2. Speed in a given direction.
____3. the overall rate at which an object moves. Calculated by dividing distance by total time
____4. The rate at which velocity changes in a given period of time.
____5. an object's change in position over time when compared with a reference point
____6. A push or pull.
____The rate at which an object moves.
____8. The tendency of an object to resist change in motion.
____9. A "perpendicular" force that acts on the surface of a book resting on a table.
____10. The metric unit for force.
____11. acceleration in which velocity decreases
____12. an object that appears to stay in place in relation to an object being observed for motion
____13. A measure of the gravitational force on an object.
____14. Mass x Velocity

a. Acceleration
b. Force
c. Position
d. Speed
e. Velocity
f. Weight
g. Inertia
h. Momentum
i. Newton
j. Normal Force
k. Motion
L. Average speed
m. Deceleration
n. Reference point

**Motion Equations:** For each problem, state whether you would be finding the speed, average speed, velocity, or acceleration of the object. Answers will be used more than once.

_____/4pt ½ pt each

| | |
|---|---|
| _____A bear walks 5 km in 30 min., then 15 km in 90 min. | _____ A truck travels 75 mi north in 2.5 hr |
| _____A plane traveled 3,000 mi from NYC to CA in 5 hrs. | _____ A car traveled 543 km in 6 hours. |
| _____A falling raindrop goes from 10 m/s to 30 m/s in 2 sec | _____A dog runs 3800 meters in 2 min. |
| _____A cyclist goes 32 km in the first 2 hrs, then 13 km the next hr. | _____ A car goes from rest to 60 mph in 9 sec. |

**Solving Speed Problems**

**Example:** What is the speed of a cheetah that travels 112.0 meters in 4.0 seconds?

**Looking for:** Speed of cheetah

**Given:** Distance = 112.0 meters
Time = 4.0 seconds

Solution

$$\text{speed} = \frac{d}{t} = \frac{112.0\ \text{m}}{4.0\ \text{s}} = \frac{28\ \text{m}}{\text{s}}$$

The speed of the cheetah is 28 meters per second.

½ pt each
_____/3.5

| | |
|---|---|
| 1. A bicyclist travels 60.0 km in 3.5 hours. What is the cyclist's average speed? | 2. What is the average speed of a car that traveled 300.0 miles in 5.5 hours? |
| 3. How much time would it take for the sound of thunder to travel 1,500 meters if sound travels at a speed of 330 m/s? | 4. A snail can move approximately 0.30 meters per minute. How many meters can the snail cover in 15 minutes? |

5. Suppose you are walking home after school. The distance from school to your home is five km. On foot, you can get home in 25 min. However, if you rode a bike, you could get home in 10 minutes. **SHOW YOUR WORK TO GET CREDIT !**

| What is your average speed while walking? | What is your average speed while bicycling? | How much faster you travel on your bicycle? |
|---|---|---|
| | | |

# Solving *Velocity* Problems

**Remember:** The velocity of an object is determined by measuring both the *speed* & *direction*.
If the speed of an object changes, then its velocity also changes.
If the direction in which an object is traveling changes, then its velocity changes.
A change in either speed, direction, or both causes a change in velocity.
The velocity of an object in motion is equal to the distance it travels per unit of time in a given direction.

Use v = d/t
to solve velocity

**Example 1:** What is the velocity of a car that travels 100.0 meters, northeast in 4.65 seconds?

**Looking for:** Velocity of the car.

**Given:**
Distance = 100.0 meters
Time = 4.65 seconds

**Solution**

$$\text{velocity} = \frac{d}{t} = \frac{100.0\text{ m}}{4.65\text{ s}} = \frac{21.5\text{ m}}{\text{s}}$$

The velocity of the car is 21.5 meters per second northeast.

1 pt each
___/5 pts

1. An airplane flies 525 kilometers north in 1.25 hours. What is the airplane's velocity?

2. A soccer player kicks a ball 6.5 meters. How much time is needed for the ball to travel this distance if its velocity is 22 meters per second, south?

3. A Girl Scout troop hiked 5.8 kilometers southeast in 1.5 hours. What was the troop's velocity?

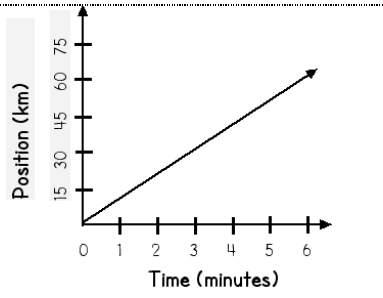
4. A family drives 881 miles from Houston, Texas to Santa Fe, New Mexico for vacation. How long will it take the family to reach their destination if they travel at a velocity of 55.0 miles per hour, northwest?

5. A shopping cart is pushed 15.6 meters west across a parking lot in 5.2 seconds. What is the velocity of the shopping cart?

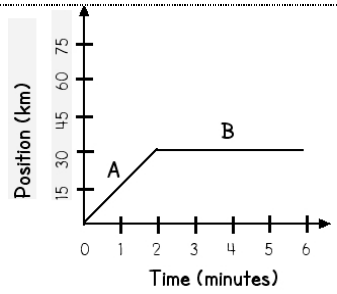
## Position – Time Graphs

Use the graph to determine the speed or both speeds (A & B) of each object.

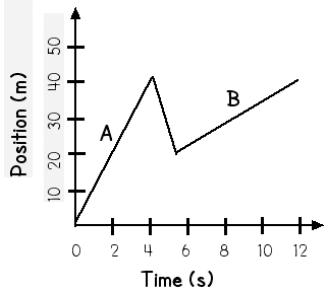
1 pt ea
_____/7




1. _____

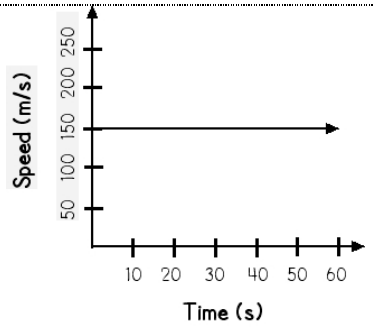



2. Point A = _____
Point B = _____

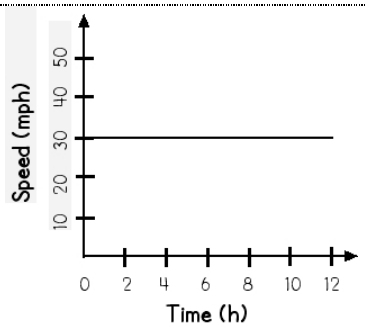



3. Point A = _____
Point B = _____

## Speed – Time Graphs




4. How far did the vehicle travel during the first 30 seconds?




5. How far did the vehicle travel during the time interval from 4 hours to 8 hours?

6. Show the formulas for acceleration

7. Show the formula for speed

**Motion Questions:**

**1. An athlete can run 9 kilometers in 1 hour. If the athlete runs at that same average speed for 30 minutes, how far will the athlete travel?**

a. 18 km b. 9 km c. 4.5 km d. 3.3 km

**2. How much time is required for a bicycle to travel a distance of 100 m at an average speed of 2 m/s?**

a. 0.02 s b. 50 s c. 100 s d. 200 s

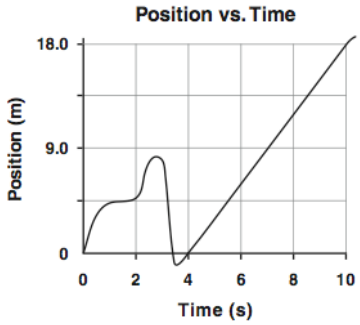
**3. Which of the following represents the velocity of a moving object?**

a. 40 b. 40 m north c. 40 m/s d. 40 m/s north

**4. Which characteristic of motion could change without changing the velocity of an object?**

a. the speed b. the position c. the direction d. the acceleration

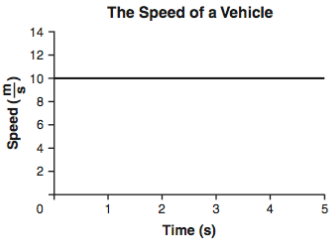
**5. The graph below shows how the position of an object changes over time.**




**6. What is the speed of the object during the time interval from 4 seconds to 10 seconds?**

a. 2 m/s b. 3 m/s c. 8 m/s d. 6 m/s

**The graph below shows the speed of a vehicle over time.**




**7.How far did the vehicle travel during the first two seconds?**

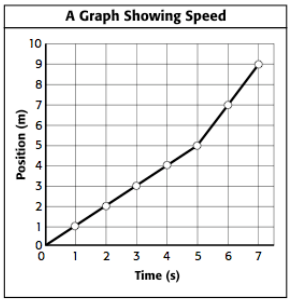
**a.** 0.2 m b. 5 m c. 10 m d. 20 m

**8. What term or phrase describes a point that appears to stay in place and can be used to detect the motion of an object?**

a. a reference point b. a compass c. a ruler d. a beacon

**9. What is the difference between speed and velocity?**

a. Velocity is expressed in m/s. Speed is expressed in m/s$^2$.
b. Speed involves a constant rate of acceleration, and velocity does not.
c. Speed is measured by time and distance, but velocity also includes direction.
d. Velocity involves moving in a direction in a straight line, and speed does not.




1 pts each

____/20 pts

**10.The graph above shows a person walking. Which of the following sentences best describes the walker's speed?**

A She travels an average of 10 m/s.
B She travels an average of 4 m/s.
C Her rate of speed decreases after 5 seconds
D Her rate of speed increases after 5 seconds

**11. The best way to describe the rate of motion of an object that changes speed several times is to calculate the object's**

A. average speed B. constant speed
C. instantaneous speed D. variable speed

**12. Which of the following is a force?**

A. inertia B. friction C. velocity D. acceleration

**13. The unit for _____ is m/s$^2$.**

A. weight B. acceleration C. inertia D. velocity

**14. Which of the following is not used in calculating acceleration?**

A. initial velocity B. average speed
C. time interval D. final velocity

**15. A body accelerates if it _____.**

A. speeds up B. slows down
C. changes direction D. all of these

**16. The gravitational force between two objects depends on their _____.**

A. speed B. masses C. velocities D. shapes

**17. _____ acts only between surfaces that are in contact.**

A. Inertia B. Friction C. Gravity D. A net force

**18. In a head-on car crash, passengers not wearing seat belts continue to move forward with the same _____ that the car had prior to impact.**

A. momentum B. force C. potential energy D. speed

**19. An object of large mass has _____ than an object of small mass.**

A. less inertia B. more inertia
C. less weight D. greater acceleration

**20. A constant velocity means acceleration is _____.**

a. positive b. negative c. increasing d. zero

**Speed & Velocity SHOW WORK & UNITS!! 1 Pt each problem _____/11 pts**

| Problem | Distance | Time | Speed |
|---|---|---|---|
| Example: A bicyclist travels 60.0 kilometers in 4 hours. What is the cyclist's average speed? | 60 km | 4 hours | S = 60 km / 4 h<br>**S = 15 km/h** |
| 1.What is the speed of a car that traveled 300.0 miles in 5.5 hrs? | | | |
| 2. How much time would it take for the sound of thunder to travel 1,500 meters if sound travels at a speed of 330 m/s? | | | |
| 3. Jen drives 20 miles southwest to her favorite mall. What is her velocity if she arrives at the mall in 8 minutes? | | | |
| 4. A person in a kayak paddles down river at an average speed of 10 km/h. After 3.25 hours, how far has she traveled? | | | |
| 5. How much time is required for a bicycle to travel a distance of 100 m at a speed of 2 m/s? | | | |

Average Speed = _____

| Problem | Distance | Time | Average Speed |
|---|---|---|---|
| Example: Joe drives 450 meters in 4 minutes, then 150 meters in 2 minutes. What is Joe's average speed? | 450 + 150 = 600 m | 4 + 2 = 6 min | **S = 600 m / 6 min**<br>**S = 100 m / min** |
| 6. A worm covers 5 cm in 10 seconds, then 25 cm in 155 seconds. What is its average speed? | | | |
| 7. Rita runs 1 mile in 5.4 minutes, then 2 miles in 12 minutes. What is her average speed? | | | |
| 8. A bird flies 80 km in 2 hours, then 120 km in 3.8 hours. What is its average speed? | | | |

Acceleration = _____

| Problem | Final Velocity | Initial Velocity | Time | Acceleration |
|---|---|---|---|---|
| Example: After traveling for 5.0 seconds, a runner reaches a speed of 10 m/s. What is the runner's acceleration? | 10 m/s | 0 m/s | 5 s | A = $\frac{10 - 0 \text{ m/s}}{5 \text{ s}}$<br>**A = 2 m/s²** |
| 9. A skater increases her velocity from 2.0 m/s to 10.0 m/s in 3.0 seconds. What is the skater's acceleration? | | | | |
| 10. A parachute on a racing dragster opens & changes the speed of the car from 85 m/s to 45 m/s in a period of 4.5 seconds. What is the acceleration? | | | | |
| 11. A car starting from rest accelerates at a rate of 8.0 m/s. What is its final speed at the end of 4.0 seconds? | | | | |