Contents

Velocity and Speed

1. Put a check mark (✓) next to the answer that is most correct.

a) What do you know about a motion when you know the velocity?

- ○ **A** direction and speed
- ○ **B** speed and acceleration
- ○ **C** acceleration and force
- ○ **D** force and direction

b) Which of these is a velocity?

- ○ **A** 50 miles west
- ○ **B** 50 miles per hour north
- ○ **C** 50 miles per hour for 2 hours
- ○ **D** 50 miles per hour for 10 miles

c) What is speed?

- ○ **A** distance plus time
- ○ **B** distance times time
- ○ **C** distance minus time
- ○ **D** distance divided by time

2. Circle the word True if the statement is true. Circle the word False if it is false.

a) Velocity is another word for speed.
　　True　　　**False**

b) Velocity is a very fast speed.
　　True　　　**False**

c) Velocity is speed and direction.
　　True　　　**False**

d) Velocity can be shown by an arrow.
　　True　　　**False**

e) Velocity slows down until it becomes speed.
　　True　　　**False**

Velocity and Speed

We have learned that, to find something's speed, all we need to know is how far it traveled and how long it took to get there. O.K., there *is* one more thing that is good to know about something in motion. It's good to know in which direction it is moving. It is *really* good to know if the thing is going to hit you.
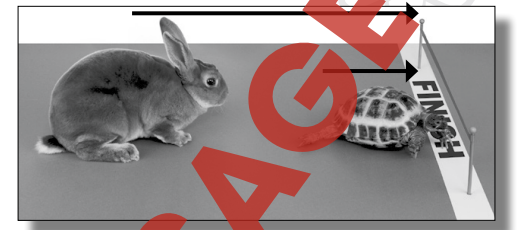
Arrows Show Velocity

Suppose you are running straight north at 10 miles per hour. Someone else, running straight south at 5 miles per hour, runs straight into you. The jolt you get would be the same as running into a wall at 15 miles per hour (10 + 5 = 15).

Now suppose you are both running north, and you run into the other person from behind. The jolt would be like running into a wall at 5 miles per hour (10 – 5 = 5). So you see that direction can be an important part of speed.

> **STOP** An airplane is flying across the country at a speed of 500 miles per hour. What else would you need to know about the plane to know its velocity?
>
> _____
>
> _____

When you know both the speed and direction, you know the **velocity.** Velocity is speed in a given direction. "The motorcycle was traveling at 50 miles per hour," tells the motorcycle's speed. "The motorcycle was traveling north at 50 miles per hour," tells the motorcycle's velocity.

Sometimes an arrow is used to show velocity. The *length* of the arrow shows the speed, and the *point* shows which way the thing is moving. This two-inch arrow shows something moving to the right.

→

If each inch equals 10 miles per hour, then the arrow shows something moving to the right at 20 miles per hour.

Velocity and Speed

1. In the space to the left, write the letter V if it is VELOCITY, Write the letter S if it is SPEED, or the letter N if it is NEITHER velocity nor speed.

- [ ] **a)** 2 feet per second
- [ ] **b)** 2 meters per second per second
- [ ] **c)** 50 miles per hour straight down
- [ ] **d)** 7 miles to the north
- [ ] **e)** 1,000 miles per hour

2. Put a check mark (✓) next to the answer that is most correct.

a) When an arrow is used to show velocity what does the arrow tell you?

- ○ **A** mass and force
- ○ **B** force and direction
- ○ **C** direction and speed
- ○ **D** speed and distance

b) An arrow showing the velocity of a skateboard is 2 centimeters long. If 1 centimeter means 20 miles per hour, how fast is the skateboard moving?

- ○ **A** 10 miles per hour
- ○ **B** 18 miles per hour
- ○ **C** 22 miles per hour
- ○ **D** 40 miles per hour

c) You know that an airplane leaves Chicago at noon, travels at 500 miles per hour for 2 hours, and then lands. When you know these facts, you can find out all these things, except:

- ○ **A** the airplane's speed
- ○ **B** when the airplane will land
- ○ **C** where the airplane will land
- ○ **D** how far the airplane will travel

Velocity and Speed

Answer the questions in complete sentences.

3. What is **speed**? Give an example of a speed.

_____

_____

_____

4. What is **velocity**? Give an example of a velocity.

_____

_____

_____

5. Why is it useful to know the velocity of something?

_____

_____

_____

Extension & Application

6. Four students left school in four different directions at four different speeds:

- **Justin** walked north at 1 mile per hour.
- **Britney** skateboarded south at 3 miles per hour.
- **Nadia** walked east at 2 miles per hour.
- **Ashley** rollerbladed west at 4 miles per hour.

On the graph on the next page, show each student's velocity by drawing an arrow. The width of one square equals 1 mile per hour. Write each student's name next to the arrow you draw for their velocity. The school is in the center. (Use a ruler to draw your arrows.)

Hands-On Activity #3

Circular Motion

This activity is best done with TWO people. You and your partner will need something to sit or stand on that will spin. A swivel office chair works well. A large "lazy Susan" platter will also work. You will also need a bicycle wheel. You will need the whole wheel and axle system, not just a tire. (Your teacher may be able to help you find these things.)

This activity has two parts.

Part A

1. Hold the bicycle wheel by the axle with two hands. Have the other person spin the wheel as fast as he or she can.

2. When the wheel is spinning, try to change its ANGLE by moving one hand up while keeping the other where it is.

3. Tell what happened. Something in motion changed direction, so it must have been acted on by a force. What **changed direction**? What was the **force**?

_____

_____

_____

Part B

1. Sit in the office chair and hold your arms straight out. Have someone spin you as fast as they can by pushing on one of your arms.

2. Now, pull your arms in tight against your body. What happened?

_____

3. While you are still spinning, put your arms out again. What happened?

_____

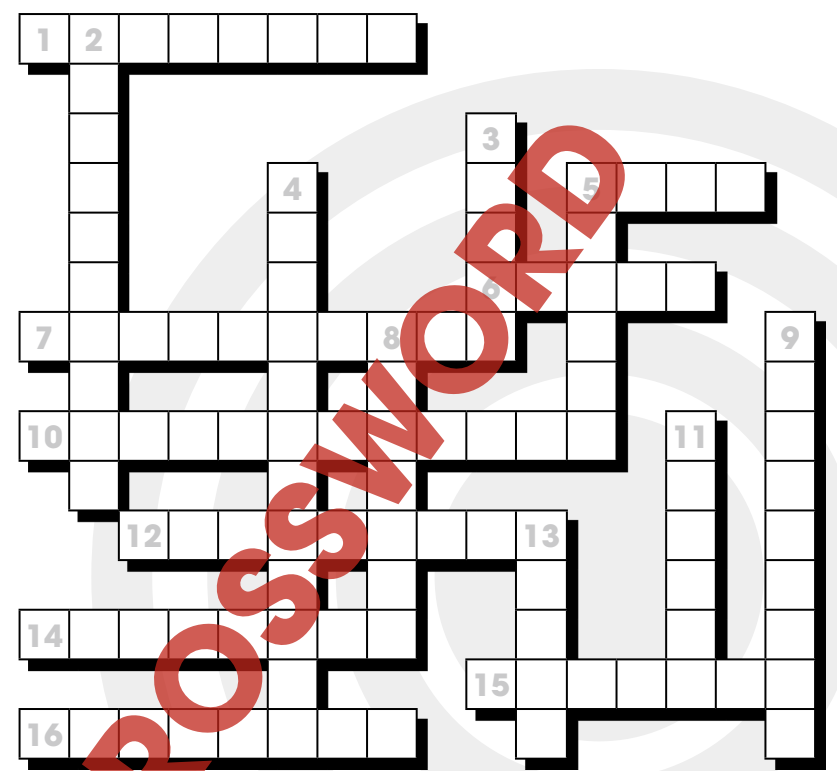4. For Steps 2 and 3, what was the **change in motion?** What **force** was involved?

_____

After You Read

NAME: _____

Crossword Puzzle!

Word List
acceleration
resistance
distance
medium
friction
frequency
seismic
gravity
velocity
deceleration
pitch
graph
mass
motion
rotations
speed
wavelength

Across

1. A force that resists motion.
5. A measure of how much stuff is in something.
6. The frequency of a musical note.
7. The distance between the high points of two waves.
10. A speeding up motion.
12. Spins
14. Speed in a given direction.
15. The kind of waves caused by earthquakes.
16. Divide it by time to get speed.

Down

2. Falling things are slowed down by air _____.
3. Steady speed is a straight, sloping line on a _____ of distance and time.
4. A slowing down motion.
5. A change of position.
8. The force that makes things fall.
9. The number of vibrations per second.
11. What waves travel through.
13. Distance divided by time.

NAME: _____

After You Read

Comprehension Quiz

Part C

Here are some short answer questions. The first three are about the same spaceship.

1. You have been captured by aliens who have locked you in a windowless room on their spaceship. The spaceship is in outer space far from Earth or anything else. As you sit in the room, which of these questions could you answer? Write "**could tell**" or "**could not tell**" after each question. **5**

   a) Is the ship moving at a constant speed?_____

   b) Is the ship accelerating? _____

   c) Is the ship rotating? _____

   d) Is the ship changing direction? _____

   e) Is the ship standing still? _____

2. You discover a window in the wall of the spaceship. You pull open the curtains and look out. All you see are very distant stars. Could you learn anything new about the ship's motion that you didn't know before? Explain why or why not. **2**

   _____

3. Help is on the way! You see the space shuttle coming to rescue you. Its engines are going full blast. Can you hear the space shuttle's engines as it approaches? Explain why or why not. **2**
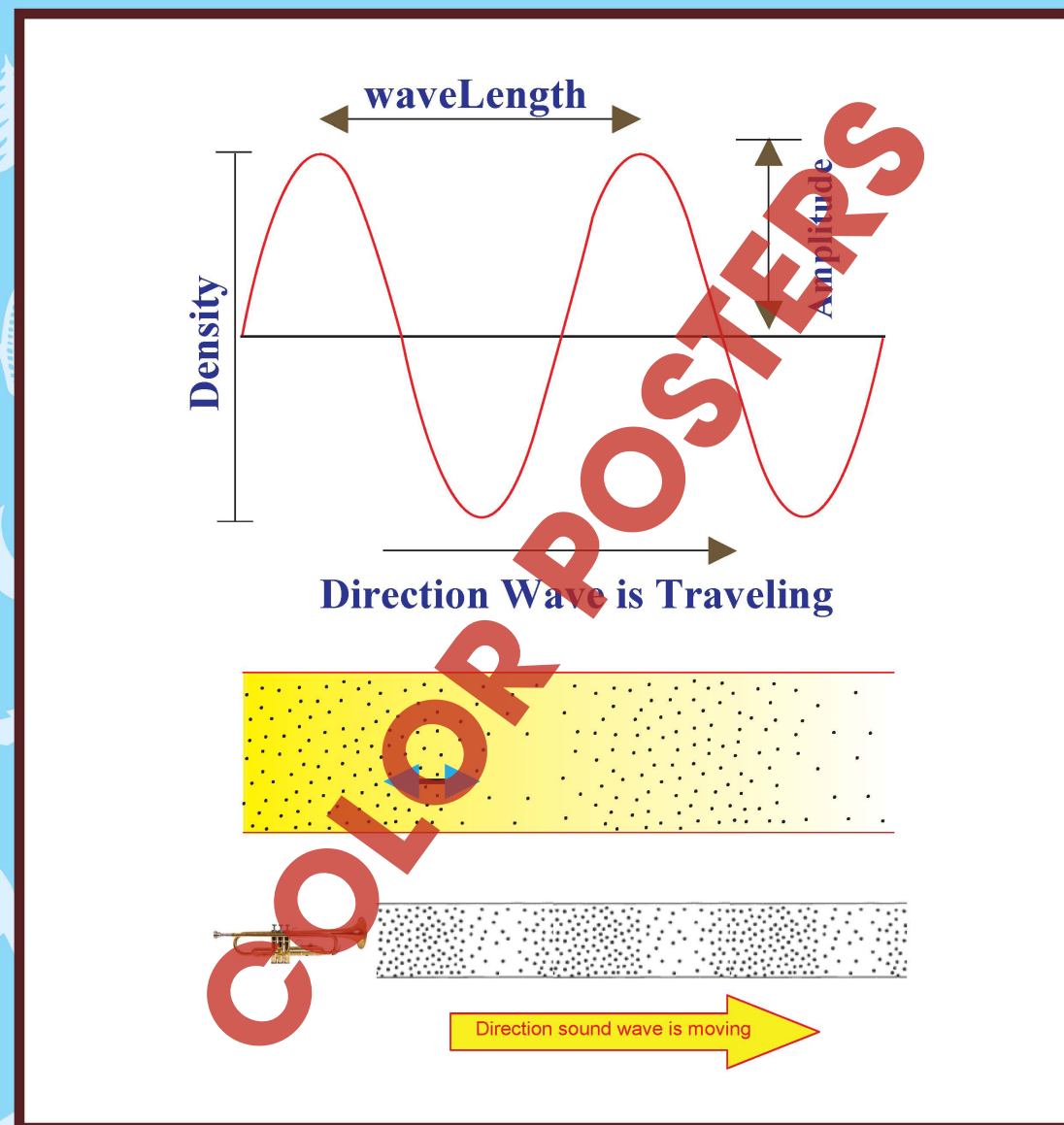
   _____

4. Things change their motion because they are being acted on by a force. **2**

   a) How does the **size of the force** affect how much the motion changes?

   b) How does the **mass of the thing** affect how much the motion changes?

5. Name **two** things that appear to move across the sky but do not. What motion of Earth makes it look like these things move across the sky? **3**
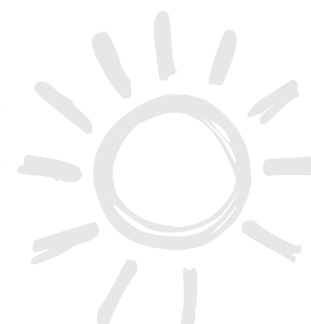
   _____

   _____

SUBTOTAL: ___/14

Wave Characteristics

waveLength

Density

Amplitude

Direction Wave is Traveling

Direction sound wave is moving

NAME: _____

Velocity and Speed

Answer the questions in complete sentences.

3. What is **speed**? Give an example of a speed.

_____

_____

_____

4. What is **velocity**? Give an example of a velocity.

_____

_____

_____

5. Why is it useful to know the velocity of something?

_____

_____

_____

_____

Extension & Application

6. Four students left school in four different directions at four different speeds:

- **Justin walked north at 1 mile per hour.**
- **Britney skateboarded south at 3 miles per hour.**
- **Nadia walked east at 2 miles per hour.**
- **Ashley rollerbladed west at 4 miles per hour.**

On the graph on the next page, show each student's velocity by drawing an arrow. The width of one square equals 1 mile per hour. Write each student's name next to the arrow you draw for their velocity. The school is in the center. (Use a ruler to draw your arrows.)

(10)

EASY MARKING ANSWER KEY

3.
Speed is distance divided by time. Answers will vary (e.g. 50 miles per hour)

4.
Velocity is speed in a given direction. Answers will vary (e.g. 50 miles per hour north)

5.
Accept any reasonable answer

6.
[compass and grid with Ashley, Justin, Nadia, Britney labeled]

(10)

Answers will vary

(12)

Answers will vary

(13)

Part A

3.
The change of direction was the change of the wheel's motion. The force was the force of hands.

Part B

2.
Spinning sped up

3.
Spinning slowed down

4.
Change in motion was acceleration when arms came in and deceleration when arms went out. Force was force of arms acting against centrifugal force.

(14)

EZ

Shorter string gives higher pitch. Half the length raises the pitch one octave.

(15)

Across:

1. friction
5. mass
6. pitch
7. wavelength
10. acceleration
12. rotations
14. velocity
15. seismic
16. distance

Down:

2. resistance
3. graph
4. deceleration
5. motion
8. gravity
9. frequency
11. medium
13. speed

(16)