Contents

TEACHER GUIDE

STUDENT HANDOUTS

NAME: _____

Before You Read

Acceleration

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

a) Acceleration is one kind of change in motion.
True **False**

b) If you are in a bus that suddenly accelerates, you can feel it.
True **False**

c) Forces push, but they do not pull.
True **False**

d) Only solid things have mass.
True **False**

e) Acceleration is the same thing as velocity.
True **False**

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

a) What is acceleration?

- ○ **A** speeding up
- ○ **B** slowing down
- ○ **C** a steady speed
- ○ **D** a very fast speed

b) Which of these is an acceleration?

- ○ **A** 50 meters per second to the north
- ○ **B** 50 meters per second per second
- ○ **C** 50 meters per second for 10 seconds
- ○ **D** 50 meters per second in a straight line

c) Why do things accelerate when they fall?

- ○ **A** Air has no friction.
- ○ **B** Gravity pulls on them.
- ○ **C** Falling things have no mass.
- ○ **D** Air pressure pushes on them.

Reading Passage

NAME: _____

Acceleration

You may remember that speeding up is called acceleration, and slowing down is called deceleration. **Constant acceleration** means speeding up in a steady way. Each second, the thing that is accelerating gains the same amount of speed.

Things that are falling have constant acceleration. Every second a falling rock increases its speed by 32 feet per second. We say that the rock accelerates at 32 feet per second *per second*. If you throw a rock into the air, it decelerates by 32 feet per second per second until it reaches zero speed at its greatest height. Then it falls back to the ground accelerating at 32 feet per second per second.

A car might accelerate from zero to 55 miles per hour in 10 seconds. A speed of 55 miles per hour is the same as 80 feet per second. This means the car has accelerated at 8 feet per second per second (80 ÷ 10 = 8).

STOP

In a foot race, runners run from the starting line to the finish line 100 meters away.

1. When is the acceleration of the runners greatest?

_____

2. When are the runners sure to be decelerating?

_____

What makes things accelerate or decelerate? There is a law of motion that says, "Things don't change their motion unless they are acted on by a **force**." A force is a push or a pull. The accelerating car is acted on by the force of the wheels pushing on the highway. A falling rock is acted on by the force of **gravity.** Force is also needed to make something change the direction in which it is moving. The greater the force the more it will change the motion of something.

After You Read

NAME: _____

Acceleration

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

a) Which two things tell how much something will accelerate when it is given a push?

- ○ **A** size and shape
- ○ **B** shape and the amount of force
- ○ **C** the amount of force and mass
- ○ **D** mass and size

b) A baseball player comes to a stop as he slides into a base. Which two things slow him down as he slides?

- ○ **A** friction and air resistance
- ○ **B** air resistance and gravity
- ○ **C** gravity and mass
- ○ **D** mass and friction

c) A car accelerates from zero to 60 feet per second in 10 seconds. What is the car's acceleration?

- ○ **A** 6 feet per second per second
- ○ **B** 10 feet per second per second
- ○ **C** 60 feet per second per second
- ○ **D** 600 feet per second per second

2. Fill in each blank with a word from the list.

mass **force** **accelerate** **gravity** **decelerate**

When something is thrown into the air, it _____(a)_____s going up and _____(b)_____s coming down. Things accelerate most when the _____(c)_____ is large and the _____(d)_____ is small. _____(e)_____ is the force that causes falling things to accelerate.

NAME: _____

After You Read

Acceleration

Answer the questions in complete sentences.

3. What does the term **constant acceleration** mean? Give an example of something that has constant acceleration.

_____

_____

_____

4. A worker pushes on a box of apples and it slides across the floor of a barn. While he is pushing, the box accelerates. After the box leaves his hands it decelerates until it comes to a stop.

a) Tell **two** things that would have made the box accelerate more if they were changed.

_____

_____

b) Tell **two** things that cause the box to decelerate.

_____

_____

Extension & Application

5. When sky divers jump from airplanes they are acted on by two main forces on their way to the ground. The forces are **gravity** and **air resistance**. When the sky diver opens the parachute, things change because a parachute has more air resistance than a body. You also need to know that air resistance increases with speed. Think of all these things as you answer these questions.

a) When is the sky diver accelerating?

_____

b) What happens to the sky diver's motion when air resistance becomes equal to the force of gravity?

_____

c) What happens to the sky diver's motion when the parachute is opened?

_____

Hands-On Activity # 4

Vibrating Strings

In this activity, you will study vibrating strings. You will try to find out what the length of a string has to do with the frequency of the note it makes when it vibrates.

For this activity all you really need is a rubber band. You could learn more, however, if you have any of the following: a guitar, pitch pipe, piano, or set of tuning forks.

This is what you do:

1. Stretch the rubber band as tight as you can between two points the way a guitar string is stretched across the neck of a guitar.
2. Pluck the rubber band and listen to the note it makes. Try to find the same note on a piano, tuning fork, or pitch pipe (if you have them).
3. Hold the rubber band down in the middle and pluck one side of it. How did the note change? Can you find the new note the piano?
4. Try holding the rubber band down at other places to make different lengths that will make different notes. You can do the same thing with guitar strings if you have a guitar.

What does string LENGTH have to do with FREQUENCY? (Remember, higher pitch is higher frequency.) Remember the frequency of a note is twice the frequency of the note one octave below it. On the piano keyboard, octaves are eight white keys apart. Can you figure out how to make rubber band notes an octave apart?

NAME: _____

After You Read

Word Search

Find all of the words in the Word Search. Words are written horizontally, vertically, diagonally, and some are even written backwards.

ACCELERATION
AMPLITUDE
CONSTANT
DECELERATION
FREQUENCY
FRICTION
GRAPH
GRAVITY
FORCE
MASS
MATTER
MEDIUM
MOTION
PITCH
POSITION
ROTATION
TIME
SEISMIC
SLOPE
SPEED
VELOCITY
VIBRATE
VIBRATION
WAVE
SIZE

E	C	R	O	F	M	Y	Z	B	C	D	F	G	S
S	I	Z	E	U	M	D	D	L	H	K	J	H	E
S	T	N	I	V	E	W	E	X	C	Y	Z	B	I
J	R	D	O	E	D	H	C	G	T	I	M	E	S
K	E	L	P	I	U	M	E	N	I	H	P	Q	M
M	T	S	W	V	T	T	L	S	P	Z	R	O	I
Y	T	Z	B	C	I	A	E	A	D	F	T	G	C
E	A	C	C	E	I	E	R	A	T	I	O	N	G
T	M	M	V	L	P	G	A	B	O	K	J	R	H
A	N	A	P	Q	M	R	T	N	I	S	A	T	N
R	W	C	B	A	A	Z	I	Y	X	V	W	O	V
B	D	F	S	G	H	P	O	S	I	T	I	O	N
I	N	S	L	O	P	E	N	T	M	T	L	K	J
V	E	L	O	C	I	T	Y	P	A	Q	R	S	T
B	Z	Y	X	W	T	N	A	T	S	N	O	C	V
C	F	R	I	C	T	I	O	N	K	L	M	N	P
D	F	G	H	J	F	R	E	Q	U	E	N	C	Y

After You Read

NAME: _____

Comprehension Quiz

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Part A

Circle the word True if the statement is true. Circle the word False if it is false. 7

1) Speed is time divided by distance.
   True **False**
2) Velocity is speed in a given direction.
   True **False**
3) Things in motion decelerate because of the force of friction.
   True **False**
4) All sounds come from something that is vibrating.
   True **False**
5) The slope of a distance and time graph is speed.
   True **False**
6) The more mass a thing has, the more a force will change its motion.
   True **False**
7) Sound can travel across empty space.
   True **False**

Part B

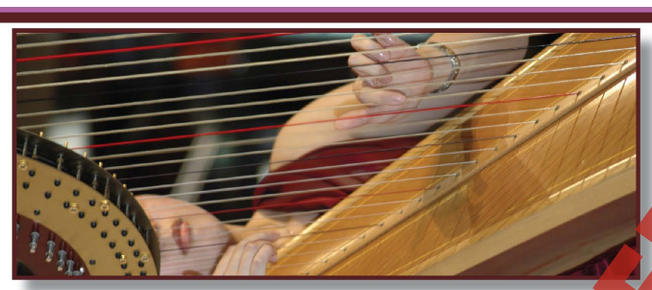
3

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

1. **What is a measure of the height of a wave on water?**
   - ○ **A** amplitude
   - ○ **B** frequency
   - ○ **C** medium
   - ○ **D** wavelength
2. **Which kind of motion does a rock have just after it dropped from a high bridge?**
   - ○ **A** constant speed
   - ○ **B** constant velocity
   - ○ **C** constant acceleration
   - ○ **D** constant deceleration
3. **Which two things could you graph to show speed?**
   - ○ **A** force and mass
   - ○ **B** velocity and time
   - ○ **C** distance and time
   - ○ **D** mass and distance

SUBTOTAL: /10

Vibrating and Oscillating Motions



Harp
25-400
Vibrations
Per Second

Bee
Over 200
Wing-Beats
Per Second

Humming Bird
15-80
Wing-Beats
Per Second

Wood Pecker
20-50
Pecks
Per Second

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_____

_____

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_____

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_____

c) What happens to the sky diver's motion when the parachute is opened?

_____

3.

Speeding up in a steady way. Answers will vary (e.g. rock falling through the air)

4.

a) Answers will vary. The box would have accelerated more if there had been more force or if there had been fewer apples in the box.

…on and air …sistance cause the box to decelerate.

5.

a) Just after jumping

b) Constant speed/no change in motion

c) Deceleration

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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

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