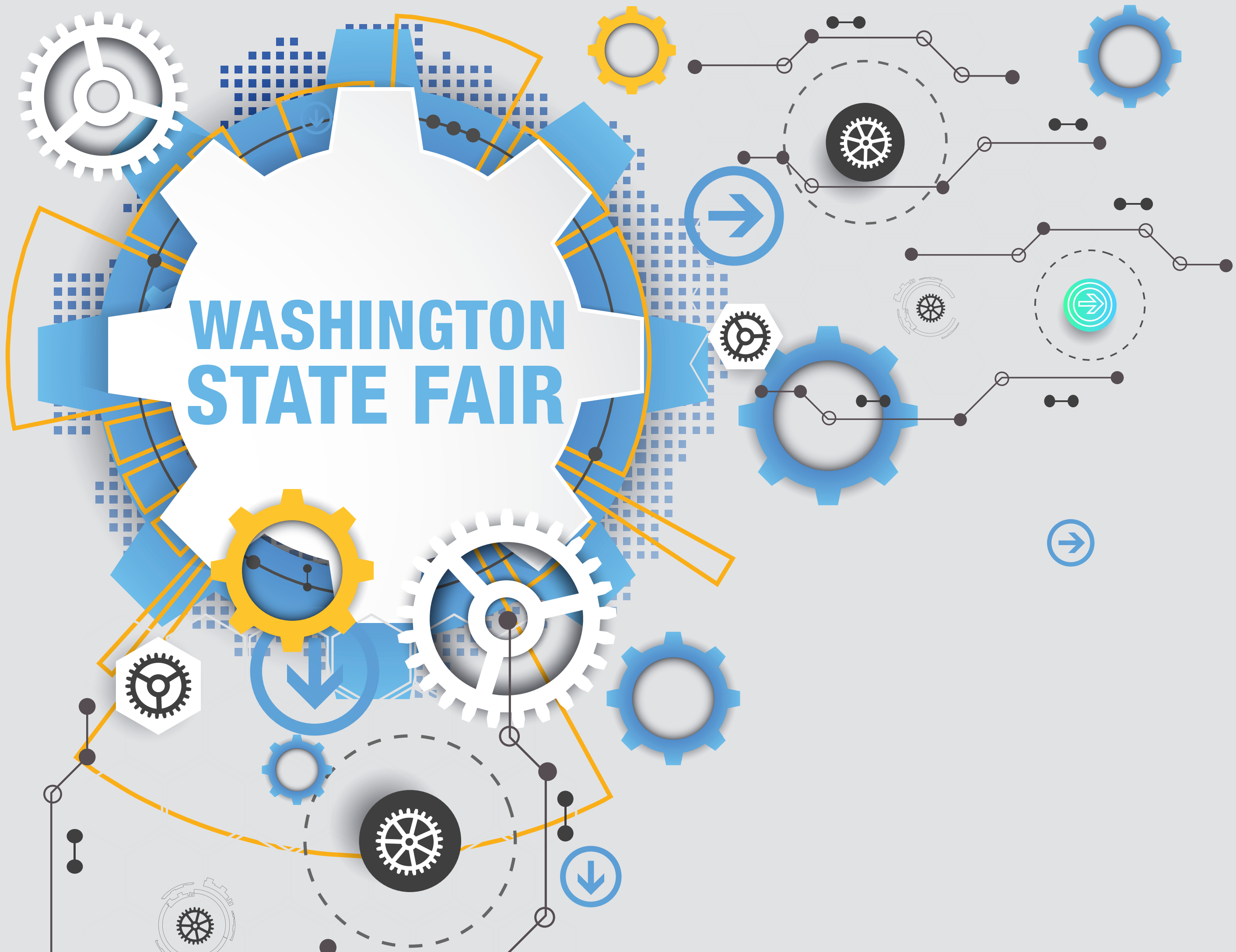
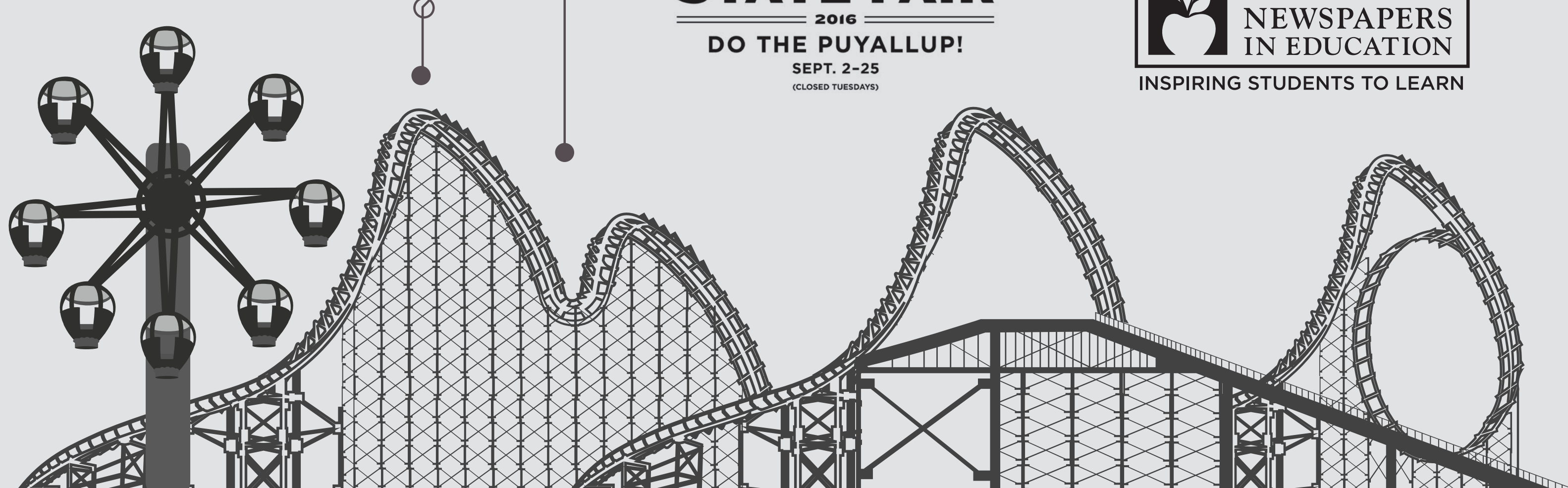


PHYSICS AND THE FAIR

TEACHER'S GUIDE

Washington STATE FAIR
2016
DO THE PUYALLUP!
SEPT. 2–25
(CLOSED TUESDAYS)

The Seattle Times NEWSPAPERS IN EDUCATION
INSPIRING STUDENTS TO LEARN



To register or learn more about our program, visit us at nie.seattletimes.com or call 206.652.6290.

INTRODUCTION
This year, our NIE program focuses on physics concepts found at the Fair. The guide connects to Next Generation Science Standards for grades 4-12. All of the lessons are to be used with content that will appear in The Seattle Times on September 8, 15 and 22. The guide will appear in September on both The Seattle Times Newspapers In Education (NIE) website (**nie.seattletimes.com**) and the Washington State Fair's website (**thefair.com**).

Note to Educators
Activities in this guide are built on knowledge and information provided in the e-Edition of The Seattle Times on September 8, 15 and 22. Each Thursday, you will find a full page of physics-related content in the newspaper. You can visit the NIE website (**nie.seattletimes.com**) to find the exact location of these pages in the newspaper. Have students take notes from the in-paper content each week to use in combination with this guide. Teachers are encouraged to modify the guide to fit their individual classroom needs.

TABLE OF CONTENTS

The Seattle Times Newspapers In Education (NIE)
To enroll in The Seattle Times NIE program and receive free access to the electronic version (e-Edition) of the newspaper, lesson plans and curriculum guides, as well as the in-paper content for this guide, please email **nie@seattletimes.com** or call **206.652.6290**.

Web: **nie.seattletimes.com**
Phone: **206.652.6290**
Toll free: **1.888.775.2655**
Email: **nie@seattletimes.com**

ROLLER COASTER ROUNDUP

Objective
Students will build and compare roller coaster models to discover how physics concepts (kinetic and potential energy, velocity, acceleration, force) are incorporated into roller coaster design.

Standards
MS-PS3-2
Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

Materials
- The Seattle Times – Washington State Fair, article 1
- Marbles
- Roller coaster track materials
- Pencil
- Paper

Engage
Look at the pictures of roller coasters (right). Write down what you notice:
a. How are they similar?
b. How are they different?
c. Why do you think these differences and similarities exist?

Teacher note: You might want to draw students' attention to where the biggest hill on the roller coaster is. Why do they think that is the case?

Explore
Using your materials, you will build a model of each of the following three types of roller coasters:
1. A roller coaster with biggest hill in the front
2. A roller coaster with the biggest hill in the middle
3. A roller coaster with biggest hill at the end

For each model you build, you will draw a diagram and predict what will happen to the marble (Will it go fast? Will it so slow? Will it make it to the end of the track?) on your roller coaster data sheet. After making your predictions, you will roll the marble, labeling any observations that you have on your diagram (for instance, if the marble slows down in a certain part, or stops completely).

Explain
1. Read the The Seattle Times – Washington State Fair, Article 1, as you read, write down the definitions for the following terms:
   1. Mass:
   2. Force:
   3. Gravity:
   4. Acceleration:
   5. Velocity:
   6. Kinetic Energy:
   7. Potential Energy:
   8. Inertia:

2. After reading, revisit your initial predictions from your model tests, and explain why the prediction did or did not work.

Elaborate
Now that you know how rollercoasters work, design a new roller coaster. The roller coaster must:
a. Allow the marble to travel all the way through without stopping
b. Contain a loop

Evaluate
Draw a picture of your new roller coaster. Label the following:
1. The point with maximum potential energy
2. The point with maximum kinetic energy
3. One point where the marble is accelerating
4. One point where the marble's velocity changes

Name: ______________________________

Date: ______________________________

ROLLER COASTER DATA

1. a. What will happen if I build a roller coaster with biggest hill in the front?

   b. Draw your roller coaster:

   c. When you rolled the marble through the roller coaster, how was the outcome different than your prediction?

2. a. What will happen if I build a roller coaster with the biggest hill in the middle?

   b. Draw your roller coaster:

   c. When you rolled the marble through the roller coaster, how was the outcome different than your prediction?

3. a. What will happen if I build a roller coaster with biggest hill at the end?

   b. Draw your roller coaster:

   c. When you rolled the marble through the roller coaster, how was the outcome different than your prediction?

BAT MACHINES

Objective
Students will explore simple machines to determine how they alter the force needed to transfer energy from one object to another.

Standards
MS-PS3.C
Relationship Between Energy and Forces – When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object (MS-PS3-2).

Materials
- Stapler, can opener, wheel barrow, hand drill, bicycle, or any other complex machine that students can examine (good pictures or videos of these objects will also work)
- The Seattle Times – Washington State Fair, article 2

Engage
Take a look at the six simple machines described on the NIE insert. Can you think of any examples of these simple machines used in everyday life? Take a few minutes and try to brainstorm a list of as many as you can. (You might even just want to look around the room you are in to get some ideas.) Make sure to label what kind of simple machine you think it is.

Explore
Explore the following objects: stapler, can opener, wheelbarrow, hand drill, bicycle, or any other complex machines that are available. Mark your observations on the Machine Observation Sheet (page 6). Can you find the simple machines in each of these following everyday objects? There are also several websites that allow students to virtually explore machines.

Explain
Read about how simple machines work together to make a car, such as the Batmobile, on the The Seattle Times – Washington State Fair, Article 2 . These are known as complex machines. What other complex machines can you think of?

Elaborate
Now design your own complex machine, or combination of simple machines working together, for Batman (or any other superhero) to complete a task. Challenge yourself to use at least one of every simple machine. Label the simple machines that you decided to use. If you choose not to use a certain simple machine, explain why. How does the system of your simple machine work together in order to provide a mechanical advantage?

Evaluate
Fill out the "Machine Observations" worksheet (page 6).

Name: ______________________________

Date: ______________________________

MACHINE OBSERVATIONS

Machine	Draw a picture	What simple machines is it made out of?	What is the mechanical advantage? (How does it make the work easier?)
Stapler			
Can opener			
Wheelbarrow			
Hand drill			
Bicycle			
Your choice:			
Your choice:			

WONDERING ABOUT WAVES

Objective
Students will examine the characteristics of sound waves.
Students will use their knowledge of sound waves to create percussion instruments with varying sounds.

Standards
PS4.A
Wave Properties:
- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

Materials
- Paper
- Pencil
- Calculator
- Slinky
- Jump rope
- Ruler
- The Seattle Times – Washington State Fair, article 3
- A selection of different sizes of containers such as coffee cans, Tupperware, milk jugs, etc. (You might want to ask students to bring some in from home).

Engage
Draw what you think sound looks like. On the bottom or the back of the page, explain what you drew and why.

Explore
1. As a class, discuss what waves are and how they transfer energy. List some different types of waves. Use examples from your school, the Fair and the world (sound, light, earthquakes, etc.).

2. Do a demonstration (using student volunteers) to show different types of waves. Use a Slinky to show compressional or longitudinal waves and a jump-rope to show transverse waves. Discuss the demonstration and draw what each type of wave looked like in your notebook. Discuss how the demonstration waves are different or similar to your original drawing.

3. Label and define the following on your notebook drawings.
   a. Wavelength
   b. Frequency
   c. Amplitude

Teacher Note: Depending upon the age of your students, you may also take this time to discuss refraction.

Explain
Read The Seattle Times – Washington State Fair, Article 3 about how sound travels, use what you learn to answer the following questions:
- How does sound travel?
- Draw and label a sinusoidal wave. Be sure to label the wavelength, period, amplitude.
- What is wavelength? What does wavelength tell you about the wave?
- What is frequency?
- What part of sound does frequency correspond to?

Elaborate
1. Check out this video of Street Beat (a percussion group that performs this year at the Fair): **https://www.youtube.com/watch?v=TxcqwxhwkKw**

2. What did you observe in the video? What "instruments" are they playing? Describe the types of sound you hear (pitch, volume, tone) when they hit different instruments. Why do you think they get different sounds out of different instruments?

3. Experiment by making your own instruments out of the containers that you have been provided with. What do you notice about the sounds of different sizes/shapes of containers? Why do you think the size/shape of a container can affect the sound the instrument produces?

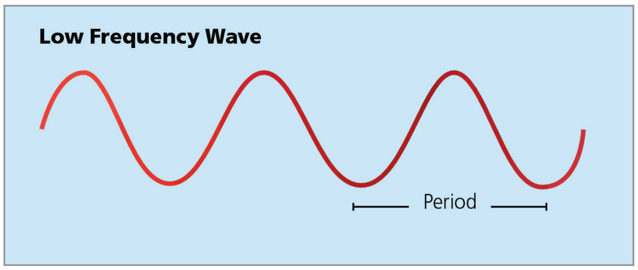
Evaluate
Fill out the "Sound Off" worksheet (page 8).

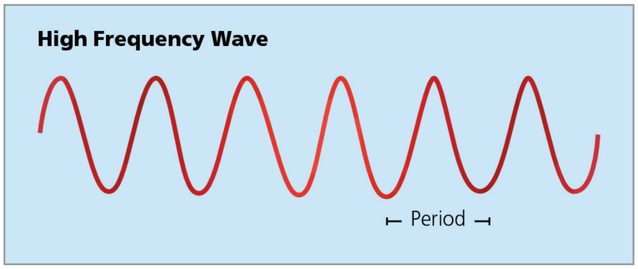
Name: ____

Date: ____

SOUND OFF

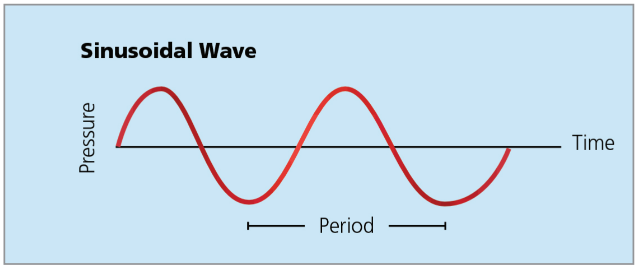
What kind of sound will each of the following waves make?





What is amplitude?

What part of sound does amplitude relate to?



Using the above diagram and a ruler, determine the wavelength and amplitude of the wave.