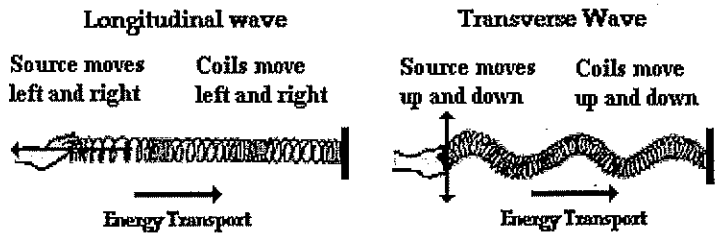
Name_____ Date_____ P___

MS-PS4-1

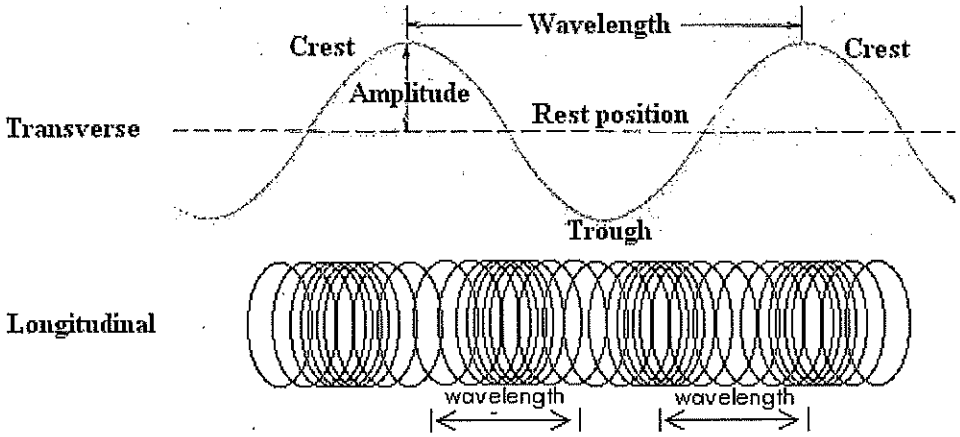
Slinky Wave Lab

Background

A wave can be described as an energy disturbance that travels through a medium from one location to another. Waves, simply put, are **energy moving** from one place to another. As the wave moves through the **medium** (water, slinky, air), energy is being passed from one particle to the next. Waves occur around us every day. Some common places we experience waves are in sound, light, water, and earthquakes.

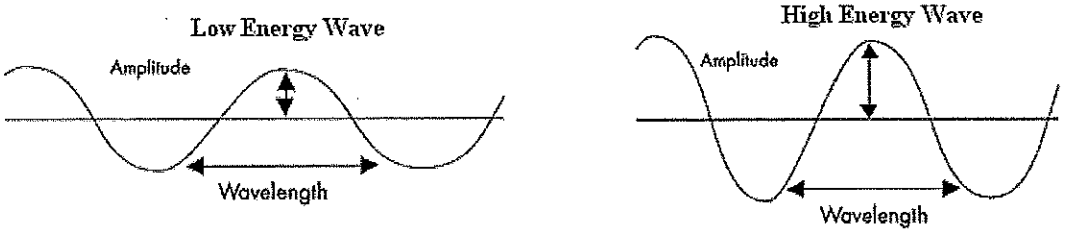


In addition to being a great toy, the Slinky is an excellent device for creating and studying waves. A slinky can easily demonstrate the two basic types of waves, longitudinal and transverse. In a **longitudinal wave** the particles move parallel to the direction the wave is moving. In a **transverse wave** the particles move at right angles to the direction of wave travel.



There are three basic characteristics used to describe waves.

1. **Frequency** – The number of waves produced in a given time period. This is usually measured in waves per second called Hertz (Hz).
2. **Wavelength** – The length of a wave. This can be measured easily from crest to crest or from trough to trough.
3. **Amplitude** – The height or depth of a wave. The amount of energy carried by a wave is related to amplitude. A high energy wave is characterized by high amplitude; a low energy wave by low amplitude.

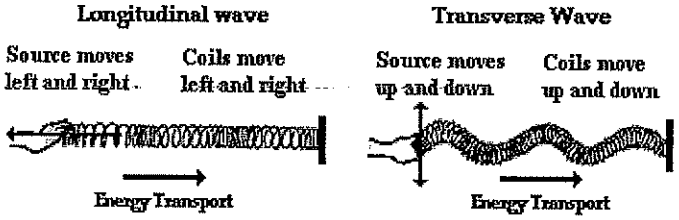


Name_____ Date_____ P___

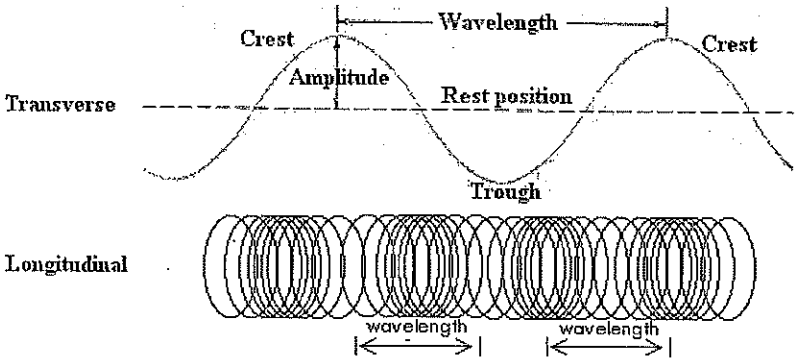
Slinky Wave Lab

Background

A wave can be described as an _____ _____ that travels through a _____ from one location to another. Waves, simply put, are _____ _____ from one place to another. As the wave moves through the _____(water, slinky, air), _____ is being _____ from one particle to the next. _____occur around us every day. Some common places we experience waves are in _____, _____, _____, and _____.

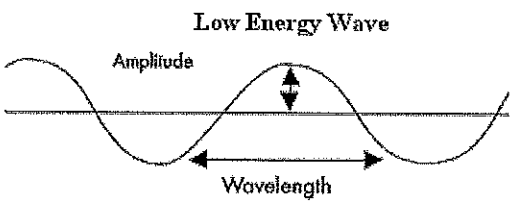


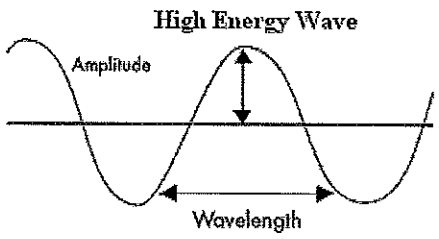
In addition to being a great toy, the Slinky is an excellent device for creating and studying waves. A slinky can easily demonstrate the two basic types of waves, _____ and _____. In a _____ _____the particles move _____to the direction the wave is moving. In a _____ _____the particles move at _____ _____to the direction of wave travel.



There are three basic characteristics used to describe waves.

1. _____ – The number of waves produced in a given time period. This is usually measured in waves per second called _____ (Hz).
2. _____ – The _____of a wave. This can be measured easily from crest to crest or from trough to trough.
3. _____ – The _____ or depth of a wave. The amount of energy carried by a wave is related to amplitude. A high energy wave is characterized by high amplitude; a low energy wave by low amplitude.





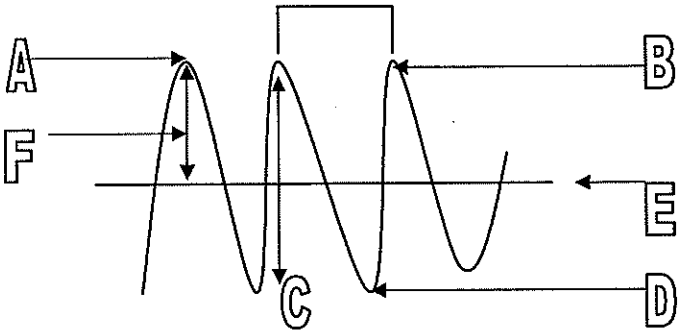
Name_____ Date_____ P___

This is a _____ wave.

A: _____ B: _____

C: _____ D: _____

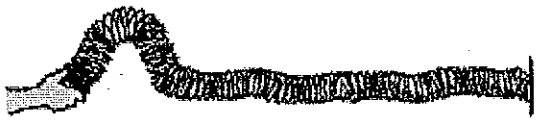
E: _____ F: _____



Materials:
Slinky, meter stick, pencil

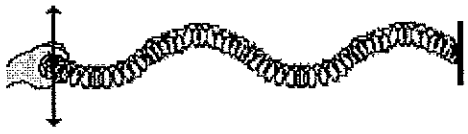
Purpose:
The purpose of the lab is to study the types of waves and their properties using a slinky.

Procedure:
1. Select a lab partner and gather the lab materials.
2. On a smooth floor, stretch the slinky out between you and your partner, to a length of about four meters. *(Caution – Do not over stretch the slinky!)*
3. Send a single wave to your partner (see below).



4. Observe what happens to the wave when it reaches your partner's end. Observe the reflected wave.

5. Move one end of the slinky back and forth on the floor repeatedly (see diagram below). Observe what happens as you vary the rate at which your hand moves or vibrates.



6. Next create a series of waves by moving your hand towards and away from your partner (see the diagram below). Observe this wave and how it travels.

7. Answer the questions on the answer sheet.

Name_____ Date_____ P___

Slinky Wave Lab - Answer Sheet

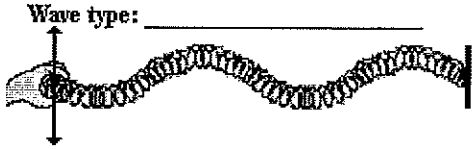
Questions:

1. What is a wave?

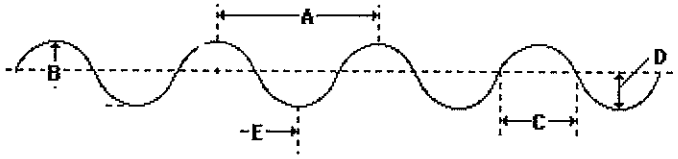
2. Label the diagrams below with the appropriate wave type.

Wave type: _____

Wave type: _____



3. Identify the parts of the wave below



a._____
b._____
c._____
d._____
e._____

4. What happens to the frequency of the waves when you increased the rate of vibration (how fast your hand moved back and forth).

5. What happens to the wavelength when you increase the rate of vibration (how fast your hand moved back and forth).

6. What is the relationship between wavelength and frequency?

7. Are the waves created in step 5 transverse or longitudinal?

8. Are the waves created in step 6 transverse or longitudinal?

9. For each wave produced did any of the spring coils actually travel from one end of the slinky to another?

10. If the wave coils did not travel than what did?

Lab Station: Coat Hanger

* Required

1. **Name (First and Last) ***

_____

2. **Period ***

_____

All students will work in groups but each student will submit a google form.

You will complete the lab by:
1. Reading the objectives.
2. Answering the pre-lab questions.
3. Watching the video.
4. Reading the materials list and all of the set up procedures.
5. Answer: Checking understanding of the directions
6. Answering the post-lab questions.
7. Breaking down the materials.

READ ALL DIRECTIONS CAREFULLY to complete the lab correctly.

Objectives

MS-PS-4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
In this lab station you will connect three different kinds of string types to three different hangers (yarn, fishing line, and metal string). You will discover the different sounds they make within the air, as well as with a connection with a solid directly into you ears.
Each person in your group will receive a turn to listen to each of the trials.

3. **Which medium allows the speed of sound to travel the fastest. ***
Mark only one oval.

- ◯ liquids
- ◯ solids
- ◯ gasses

4. **Which of the following does NOT affect the speed of sound. ***
Mark only one oval.

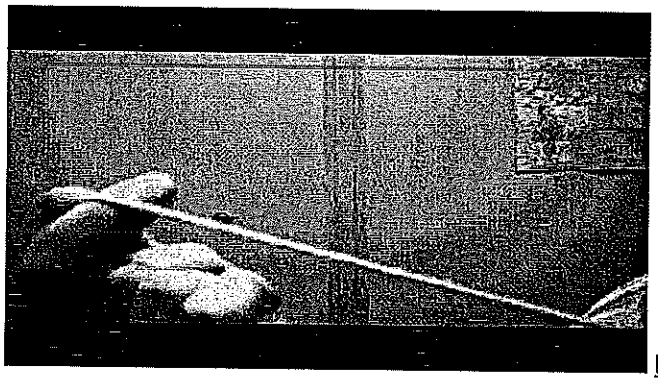
- ◯ stiffness of the medium
- ◯ density of the medium
- ◯ frequency of the medium

5. **Which medium will be the loudest (have the highest amplitude), when you swing the coat hanger against the wall? ***

Mark only one oval.

- ◯ none of the strings/ the air
- ◯ metal string
- ◯ yarn
- ◯ fishing wire

Watch this video for the basis of this lab's procedures. Then READ ALL DIRECTIONS in Materials & Set Up Procedures to obtain the specific directions.



http://youtube.com/watch?v=WrEnuOj7UbA

Materials & Set Up Procedures

Materials:
3 hangers
1 long (3 ft/1 meter or more) metal "string" or rope
1 long piece of yarn
1 long piece of fishing line

Set Up Procedures:
1. Place your goggles on.
2. Take the coat hanger from your station and tie two similar strings, one meter in length, onto the coat hanger:
   coat hanger 1: fishing coated wire
   coat hanger 2: yarn
   coat hanger 3: metal wire
3. Select a coat hanger.
4. Wrap each of the strings from the coat hanger around each of your pointer fingers.
5. Take the the hanger and yourself next to the nearest wall.
6. Plug your fingers in your ears.
7. Swing the coat hanger toward the wall and listen to the sounds the coat hanger makes.
   a. One in which your fingers are in your ear.
   b. One in which your fingers are NOT in your ear.
8. Take note of your observations.
9. Answer the questions below to check for understanding and complete the post lab using this information.

6. **Within your group, how many hangers are your group making? ***
Mark only one oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4

7. **How many trials will you complete in swinging the hanger against the wall? ***
Mark only one oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4

Post Lab Questions

Within the typed answers, write in full and complete sentences.
I am looking for:
1. Full and complete sentences
2. Correct spelling and grammar
3. Accurate descriptions of your observations

8. **Briefly describe (One to three sentences) the sounds the coat hanger made when it bumped into the wall (without your fingers in your ears). ***

_____

_____

_____

_____

_____

9. **Briefly describe (One to three sentences) the sounds the coat hanger made when it bumped into the wall (with the metal wire string). ***

_____

_____

_____

_____

_____

10. **Briefly describe (One to three sentences) the sounds the coat hanger made when it bumped into the wall (with the yarn). ***

11. **Briefly describe (One to three sentences) the sounds the coat hanger made when it bumped into the wall (with the fishing string). ***

12. **Which of the mediums was the most stiff. ***
Mark only one oval.

- ◯ air
- ◯ metal wire string
- ◯ yarn
- ◯ fishing wire

Extra Credit: Extra points cannot bring the grade to be over a 100. A 100 is the highest obtainable grade for this assignment.

13. **Predict what you think would happen if you used a thicker piece of metal wire. What do you think the thicker piece of metal wire would sound like?**

Lab Station: Good Vibrations Waves and Rice

MS-PS4-2

Name (First and Last) *

Period *

All students will work in groups but each student will submit a google form.

You will complete the lab by:
1. Reading the objectives.
2. Answering the pre-lab questions.
3. Watching the video.
4. Reading the materials list and all of the set up procedures.
5. Answer: Checking understanding of the directions
6. Answering the post-lab questions.
7. Breaking down the materials.

READ ALL DIRECTIONS CAREFULLY to complete the lab correctly.

Objectives

MS-PS-4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
Tap the metal near the rice and observe what takes place.

What kind of wave is a soundwave? * 10 points

- transverse wave
- surface wave
- longitudinal wave

What moves through one end of a soundwave to the other end? * 10 points

- light
- the molecules themselves
- energy

What happens to the molecules when the sound waves move through them? * 10 points

- The molecules stay still.
- The molecules moves in the direction of the wave in a right angle.
- The molecules vibrate.

Materials & Set Up Procedures

Materials:

1st Experiment
Rice
Bowl
Plastic Wrap
Metal dish or tray
Some type of hitting instrument like a hammer or spoon.

2nd Experiment:
Rice
Pan/Aluminum tray
Tuning Forks

Set Up Procedures:

1st Experiment
1. Place your goggles on.
2. Place the plastic wrap tightly over the rim of the bowl. Be sure all of the wrinkles are out.
3. Sprinkle a bit of rice on the top of the bowl/plastic wrap.
4. Take the metal dish/ tray and hold it beside the bowl.
5. Hit the metal dish/tray with the spoon.
6. Take note of your observations.

.
.
.

2nd Experiment
7. Grab the empty beaker and fill it about halfway with water.
8. Have someone hold the beaker in place
9. Take the tuning fork and tap it with the hammer in the tuning fork kit.
10. Carefully place the tuning fork, prongs down in the water.
11. Take note of your observations.
12. Wait till the water settles and repeat the steps above with different tuning forks.

13. Answer the questions below to check for understanding and complete the post lab using this information.

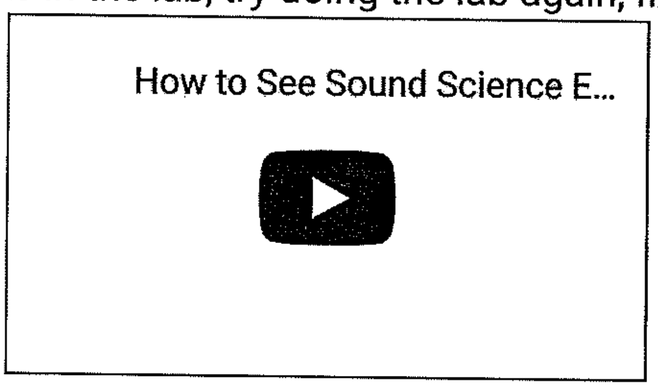
How many experiments are being completed at this lab station? * 10 points

- 1
- 2
- 3
- 4

Are you touching the rice when producing the noises in the experiment with the pan and rice? * 10 points

- Yes, the items are touching the rice.
- No, the objects are near the rice but not touching it.

Watch this video for the basis of this lab's procedures after you have completed the procedures to be sure you have done the lab correctly. If you have made a mistake in the lab, try doing the lab again, fixing the mistake.



Post Lab Questions

Within the typed answers, write in full and complete sentences of 2-3 sentences.
I am looking for:
1. Full and complete sentences
2. Correct spelling and grammar
3. Accurate descriptions of your observations

What is coming from the pan and spoon that causes the rice to move? * 10 points

- ◯ Sound/Energy
- ◯ Wind
- ◯ Biometric Pressures

What do you think would happen to the rice if you used a smaller and shallower pan? Would the rice move at a greater or smaller distance? Why or why not? * 10 points

What happened to the water when you gently placed the tuning fork into the water? * 10 points

Did your observations with the water change when you used a different tuning fork? How did it change? * 10 points

Which tuning fork had the greatest response from the water? Why do you think this happened? * 10 points

Extra Credit: Extra points cannot bring the grade to be over a 100. A 100 is the highest obtainable grade for this assignment.

What do you think affected the rice, in the experiment concerning the bowl and rice? The frequency of the soundwave or the amplitude? Explain. 5 points

Can you explain another instance where an object will vibrate once the amplitude of a nearby object has reached a certain level? 5 points

MS-PS4-2

Lab Station: Tubes

* Required

1. **Name (First and Last) ***

_____

2. **Period ***

_____

All students will work in groups but each student will submit a google form.

You will complete the lab by:
1. Reading the objectives.
2. Answering the pre-lab questions.
3. Watching the video.
4. Reading the materials list and all of the set up procedures.
5. Answer: Checking understanding of the directions
6. Answering the post-lab questions.
7. Breaking down the materials.

READ ALL DIRECTIONS CAREFULLY to complete the lab correctly.

Objectives

MS-PS-4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

3. **What is the action a soundwave has when it bends around corners? ***
Mark only one oval.

- ◯ reflection
- ◯ refraction
- ◯ diffraction

4. **If an object is in front of a speaker, that object will inhibit someone from hearing the music coming out of the speaker? Provided the object is in between the person and the speaker. ***
Mark only one oval.

- ◯ True
- ◯ False

5. **Diffraction allows the straw to appear bent in a glass of water.** *
Mark only one oval.

- ◯ True
- ◯ False

Materials & Set Up Procedures

Materials:

2 tubes

Set Up Procedures:

1. Two students will hold two tubes at an angle pointed toward the same wall.
2. One student will place their ear to the tube and the other whispers into the tube.
3. Switch roles.
4. After observing the sound, use the laser pointer or flashlight to shine the light into one of the tubes.
5. Determine if a light can be seen through the other tube.
6. Take note of your observations.

8. Answer the questions below to check for understanding and complete the post lab using this information.

6. **This experiment involves** *
Mark only one oval.

- ◯ Light
- ◯ Sound
- ◯ Speed and sound
- ◯ Sound and light.

7. **For this experiment to be effective:** *
Mark only one oval.

- ◯ One student is listening in the tube, while the other one is speaking into the tube.
- ◯ Both students place their ears at the end of the tube to listen.
- ◯ Both students talk into the tube.

Post Lab Questions

Within the typed answers, write in full and complete sentences of 2-3 sentences.
I am looking for:
1. Full and complete sentences
2. Correct spelling and grammar
3. Accurate descriptions of your observations

8. **How well did you hear the other person as they spoke into the tube? Kindly describe.** *

_____

_____

_____

_____

_____

9. **How are you able to listen into the tube and hear the person next to you talking into the tube?** *

_____

_____

_____

_____

_____

10. **What happened to the sound waves going through the tube when the person was talking into it? ***

11. **What happened to the light when you shown it into the tube? ***

12. **Was there a difference between the flashlight and the laser light? (Ask Mrs. Barnes for a laser if you do not have one) ***

Name _____ Date _____ Class _____

Quick Lab — 20 min

MS-PS4-3

How Cell Phones Work

Many people use cell phones every day without thinking about how their calls get through to them. In this activity, you will model how cell phones work.

INQUIRY FOCUS Make Models

Procedure

1. Designate one person to be the caller and one person to be the receiver. The caller starts with the tennis ball.
2. Designate two people to represent towers. Give them yellow slips of paper to hold up.
3. Designate one person to be the hub. Give this person a red piece of paper to hold up.
4. Have the group members spread out in the room.
5. The caller tries to place a "call" by tossing the ball to the closest tower.
6. The tower should toss the ball to the hub, who will toss it to the other tower, who will then toss it to the receiver.
7. If at any point the ball cannot be tossed to the next person in the sequence, the call has been "dropped." Everyone must reposition themselves and try to complete a successful call.
8. Once your group has completed a call, combine with another group. Try to make multiple calls at once, using all of the hubs and towers.

Materials

- tennis ball
- red pieces of paper
- yellow pieces of paper

Think It Over

1. Describe the factors that made your group drop a call. What are some similar problems that cell phone systems experience?

_____

_____

2. Name at least two factors that determined to which tower or hub a call was directed.

_____

_____

3. Unlike tennis balls, cell phones relay messages using high-frequency microwaves. Name at least two advantages electromagnetic waves have over the model you used.

_____

_____