Sound

Major Topic and SOL: Sound

Science SOL PS.1b,f PS.8a,c

Length of Unit: **4 - 50 minute class periods**

Major Understandings:

Students will understand…

- Sound is a vibration that travels through matter.
- All waves exhibit certain characteristics: wavelength, frequency, and amplitude. As wavelength increases, frequency decreases.
- A compression (longitudinal) wave consists of a repeating pattern of compressions and rarefactions.
- Wavelength is measured as the distance from one compression to the next compression or the distance from one rarefaction to the next rarefaction.
- Pitch is caused by changes in frequency.
- Volume is caused by changes in amplitude.

Essential Questions

- How would you describe sound?
- What characteristics do waves, including sound waves, include?
- How would you describe wavelength, frequency, and amplitude?
- How would you describe the relationship between frequency and the sound that is produced?
- How would you describe the relationship between amplitude and sound which is produced?
- What is the relationship between the frequency of a wave, its wavelength, and the sound of the wave?

Student Objectives

Students will be able to

- Accurately measure length in metric units.
- Accurately identify independent and dependent variables.
- Differentiate between qualitative and quantitative data.
- Analyze data and make valid conclusions.
- Use valid research methods to investigate questions.
- Present conclusions in appropriate written form.
- Use models to illustrate and describe the properties of a sound wave.
- Construct and analyze line plots.
- Investigate and understand speed, velocity, and acceleration.

Lesson Contributed by: Judith Chambliss
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- Identify the wavelength, frequency, speed, amplitude, rarefaction, and compression on a picture/model of a sound wave;
- Differentiate between wavelength, frequency, speed, amplitude, rarefaction, and compression;
- Describe and analyze how frequency, amplitude, and wavelength affect the sound produced.

Bloom's Taxonomy Skills	**21st Century Learning Skills**
• Creating • Evaluating • Analyzing • Understanding • Remembering • Applying	• Critical Thinking • Problem Solving • Communication • Collaboration

Assessment Evidence

Performance Tasks

Students will

- Explain what causes sound waves
- Sketch and label wave properties
- Experiment with whistles

Other Evidence

- Class Participation
- Teacher Observations
- Laboratory Assignments/Reports
- Group Work
- Drawings

Technology Computers, Internet Connection, Projector System, Interactive Whiteboard (optional)

Internet Resources:

- http://www.oocities.org/wave032002/longitudinal.htm
- http://physics.tutorvista.com/waves/longitudinal-waves.html
- http://encyclopedia2.thefreedictionary.com/Waves

Supplies/Materials:

- Slinky
- Notebook/Drawing Paper
- Pencil or Pen
- Scissors
- Straws
- Newspaper
- Rulers
- Goggles
- Disinfectant (bleach water or Listerine)

Lesson 1: Making Waves (1- 50 minute period)

Engage:

- The teacher will write on the whiteboard (aka a *bell assignment*):
  - What is a wave?
  - What is sound?
- Students will be instructed to answer these questions in their notebook or on paper.
- Then, use the Slinkey's on the table to model a wave and sketch it.
- Teacher will show website to describe compression waves.

Explore:

- Students will use Slinkey's to model compression waves.

Explain:

- Go over the *bell assignment* and share student explanations and models.
- Expand on work to segue into notes.

Note: Teacher may use the additional websites to assist (see *Internet Resources*).

Elaborate:

- Use the PowerPoint (attached) with the students after passing out the *guided/interactive notes* (attached) with the students.
- Have students record their notes.
- Use an Interactive whiteboard (if possible) to allow sketches to be drawn on slides to enhance presentation.

Evaluate:

- Students will be assessed on the notes and sketches in notebook.
- Provide students with an *Exit slip* (can be also recorded in notes):

- Which wave property causes pitch and which causes volume?

Lesson 2: Drawing for Straws (3- 50 periods)

Engage:

- Construct a whistle as students watch (use Straw Whistle lab handout to assist you in doing this – attached).
- Model how to collect data using teacher built straws and data table from Straw Whistle lab (attached)
- Use a different size straw than they will use.

Note: One of the large plastic pixie sticks is good because it can lead to discussions during the wrap up session on how a larger diameter straw affects the sound.
Be sure to practice this before doing it in front of the students.

Explore:

- Students will be given the Straw Whistle lab to complete Part 1 (attached).
- Go over lab procedures and how they should be collecting data.

Explain:

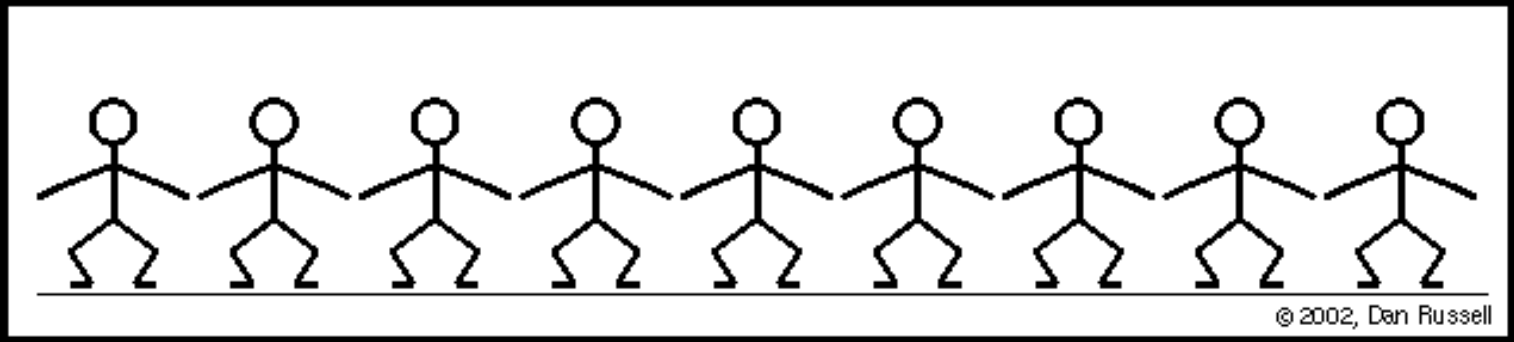
- Review how properties affect sound.
- Have students get into small groups and complete Part 2 of the lab.
- Have the students use their *guided notes* to answer the questions and review terms as needed.

Elaborate:

- Review experiment questions and answers with the students.
- Model writing a conclusion using the HERD organizer (attached).

Evaluate:

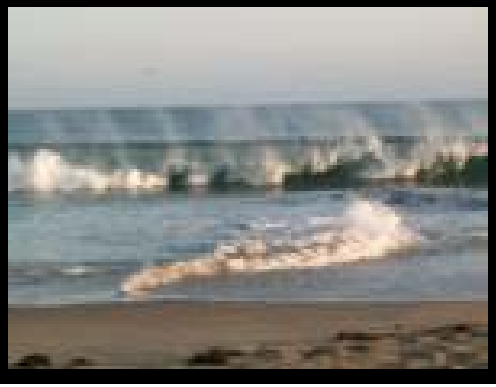
- Students will have opportunity to redo answers and reevaluate data based upon class discussion.
- Student will be evaluated through their lab, discussion, and HERD organizer.

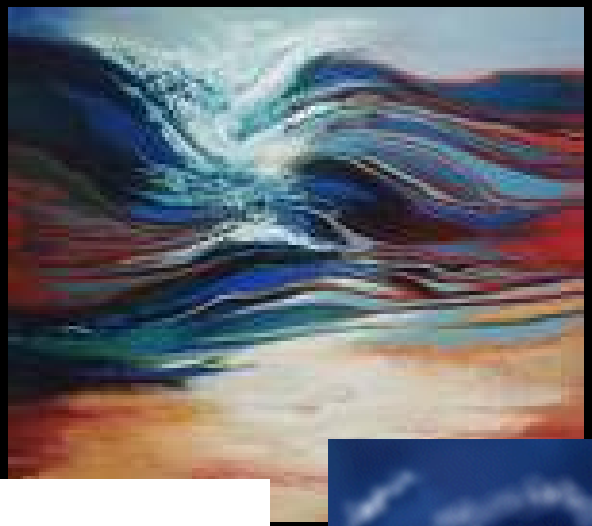


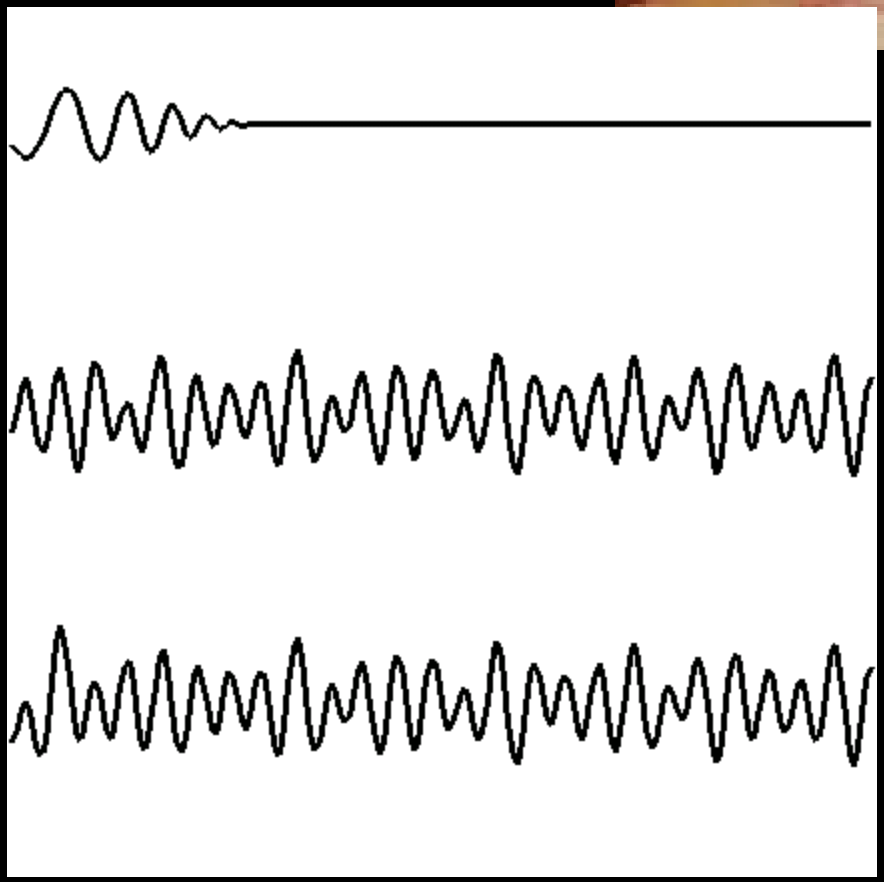
Mechanical Waves and Sound

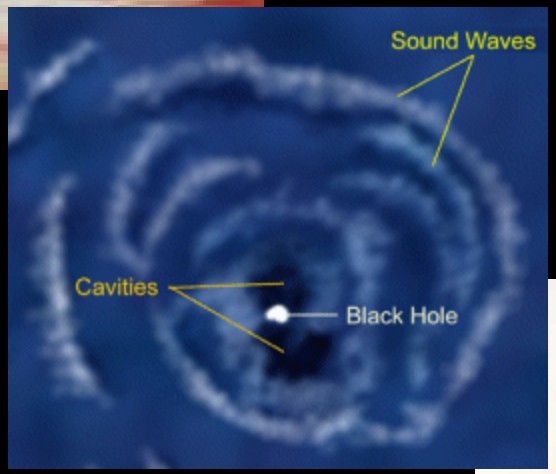
Mechanical Waves
&
Properties of Mechanical Waves

Review








Sound Waves
Cavities
Black Hole

What are *mechanical waves?*

What do you think waves carry?

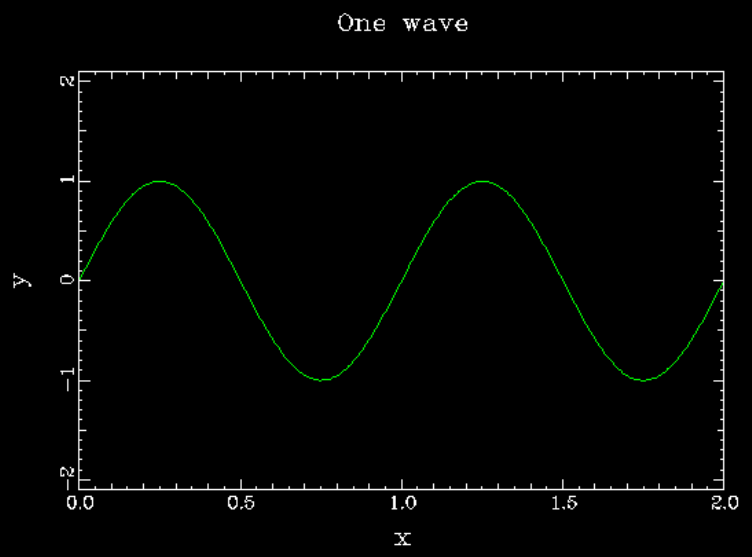
Mechanical Waves

- ***Mechanical waves*** are disturbances in matter that carry energy from one place to another.
  - Usually require matter through which to travel
  - The matter a wave travels through is called a ***medium***.
    - Medium can be a solid, liquid, or gas
    - It's easiest to travel through a solid.

How are mechanical waves created?

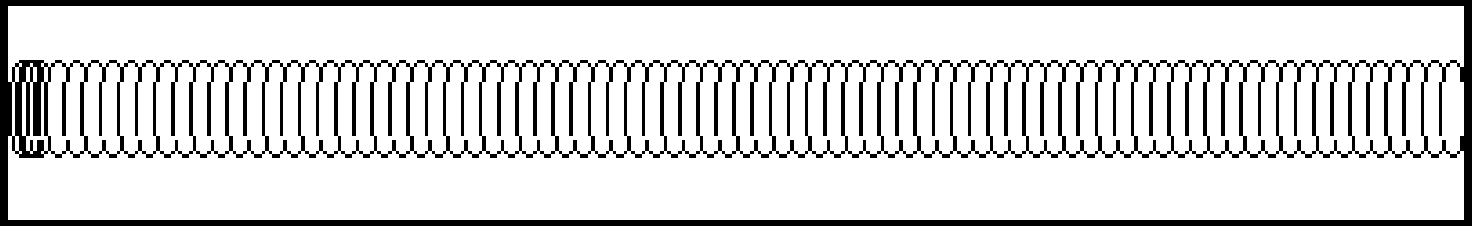
Creation of mechanical waves:

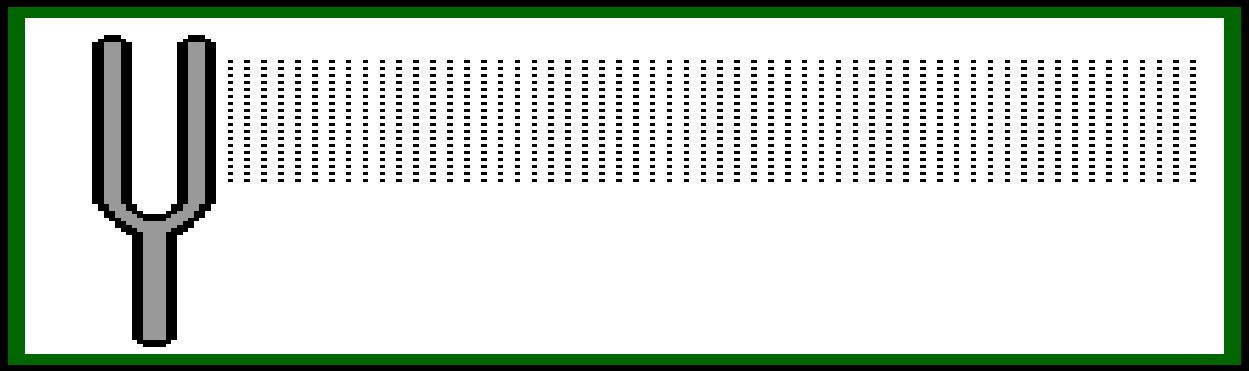
- Need a source of energy!
- That energy causes a vibration to travel through the medium



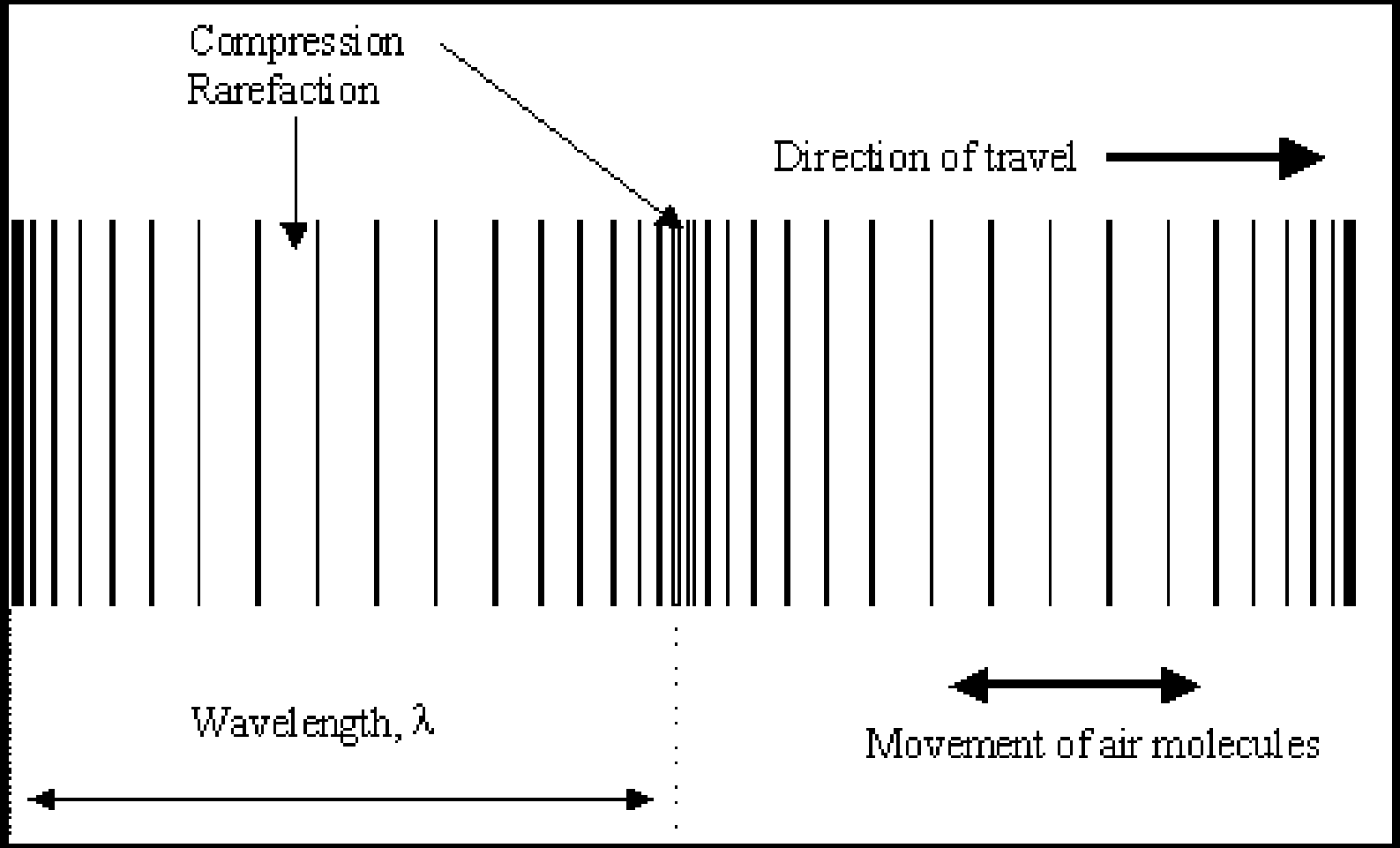
Sound waves

- **Sound waves are compression waves**
  - **A wave in which the vibration of the medium is parallel to the direction the wave travels**



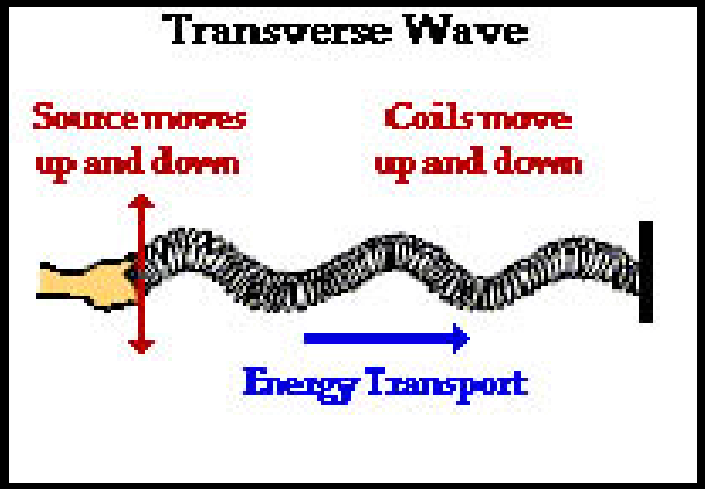


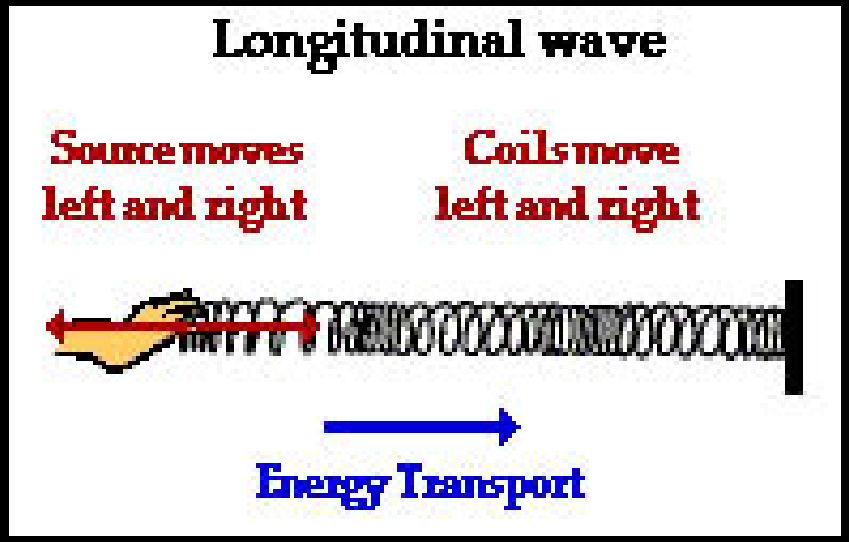
Parts of a longitudinal wave:



Remember!

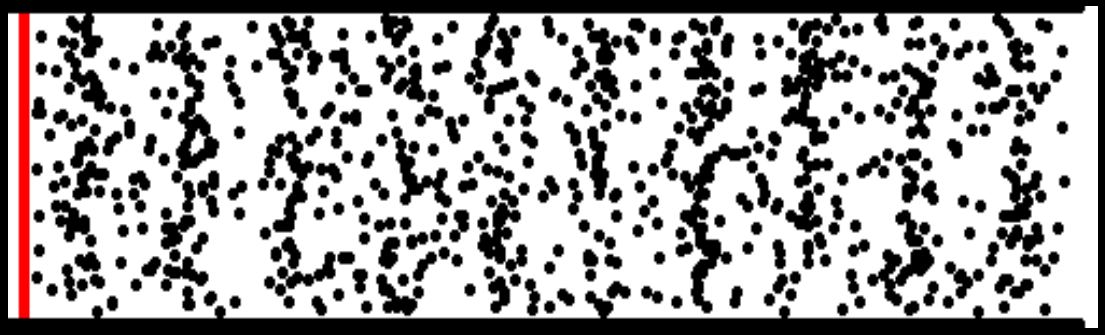
- A wave doesn't move the medium…it's just energy traveling through the medium!

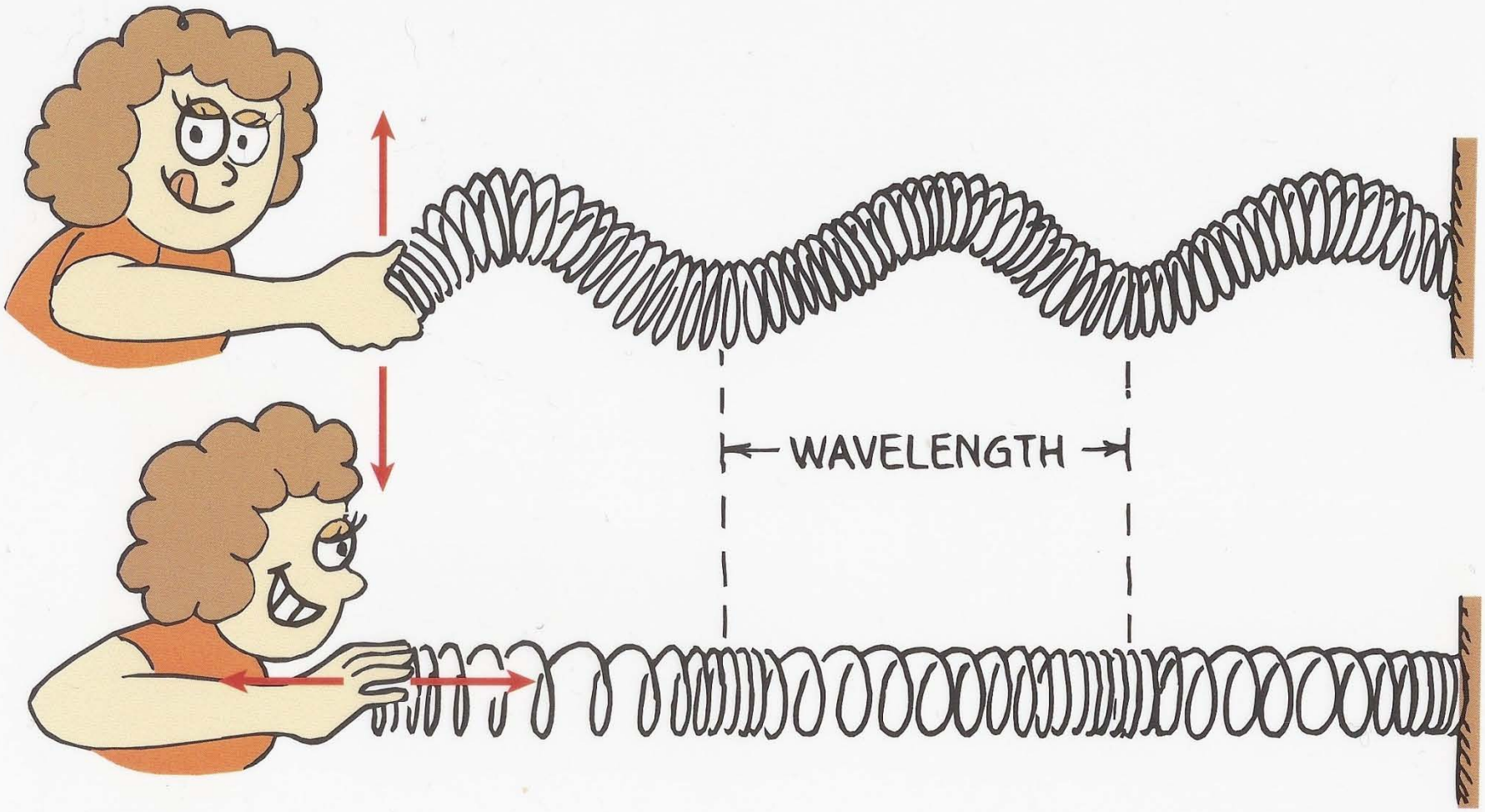




Transverse and Longitudinal Wave

Which is which?

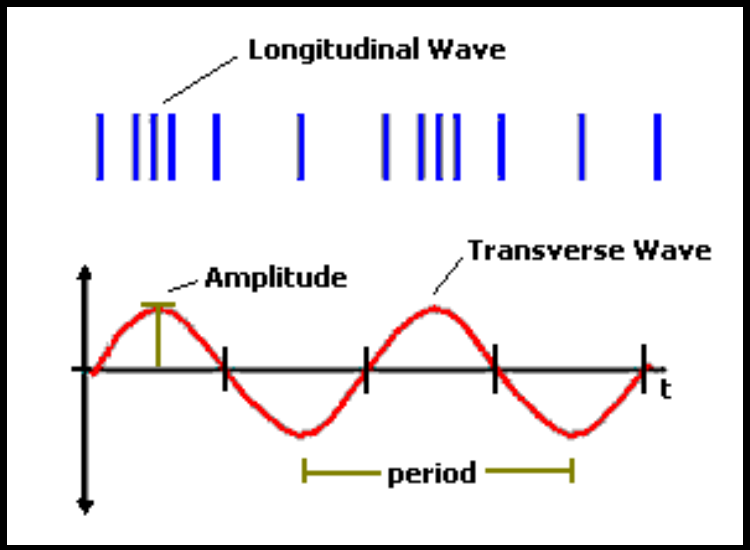


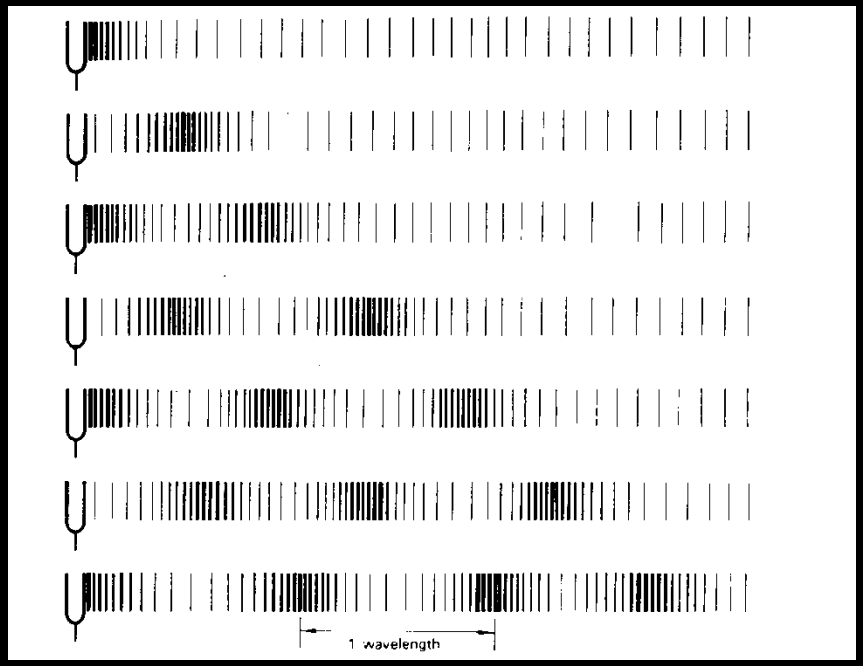


Where is the compression and rarefaction?

Properties of Sound Waves

- What type of waves are sound waves?





The following information goes in your interactive notebook

Amplitude

- **Amplitude is how big the wave is.**
- **It is measured by the size/height of the wave.**

Amplitude & Volume

- **Volume is how loud or soft a wave is.**
- **Volume indicates the amplitude of the wave.**

- **Bigger amplitude = louder sound**

Frequency

- **The number of times a wave passes a given point in 1 second.**
- **Measured in Hertz (Hz)**

- Frequency of a sound wave depends on how fast the source of the sound is vibrating.

Frequency & Pitch

- **Pitch is one way we hear/describe sound.**
- **Pitch will be high or low**
- **High frequency = high pitch.**
- **Low frequency = low pitch**

Wavelength

- Is measured from compression to compression or rarefaction to rarefaction.

Wavelength & Frequency

- **Inverse relationship**
- **Long wavelength = low frequency**
- **Short wavelength = high frequency**

- **Can you figure out pitch using wavelength?**
- **Sometimes!**

Wavelength & Frequency

- **Inverse relationship**
- **Long wavelength > low frequency > low pitch**
- **Short wavelength > high frequency > high pitch**

Use the slinkey's to model wave behaviors—amplitude, wavelength, frequency

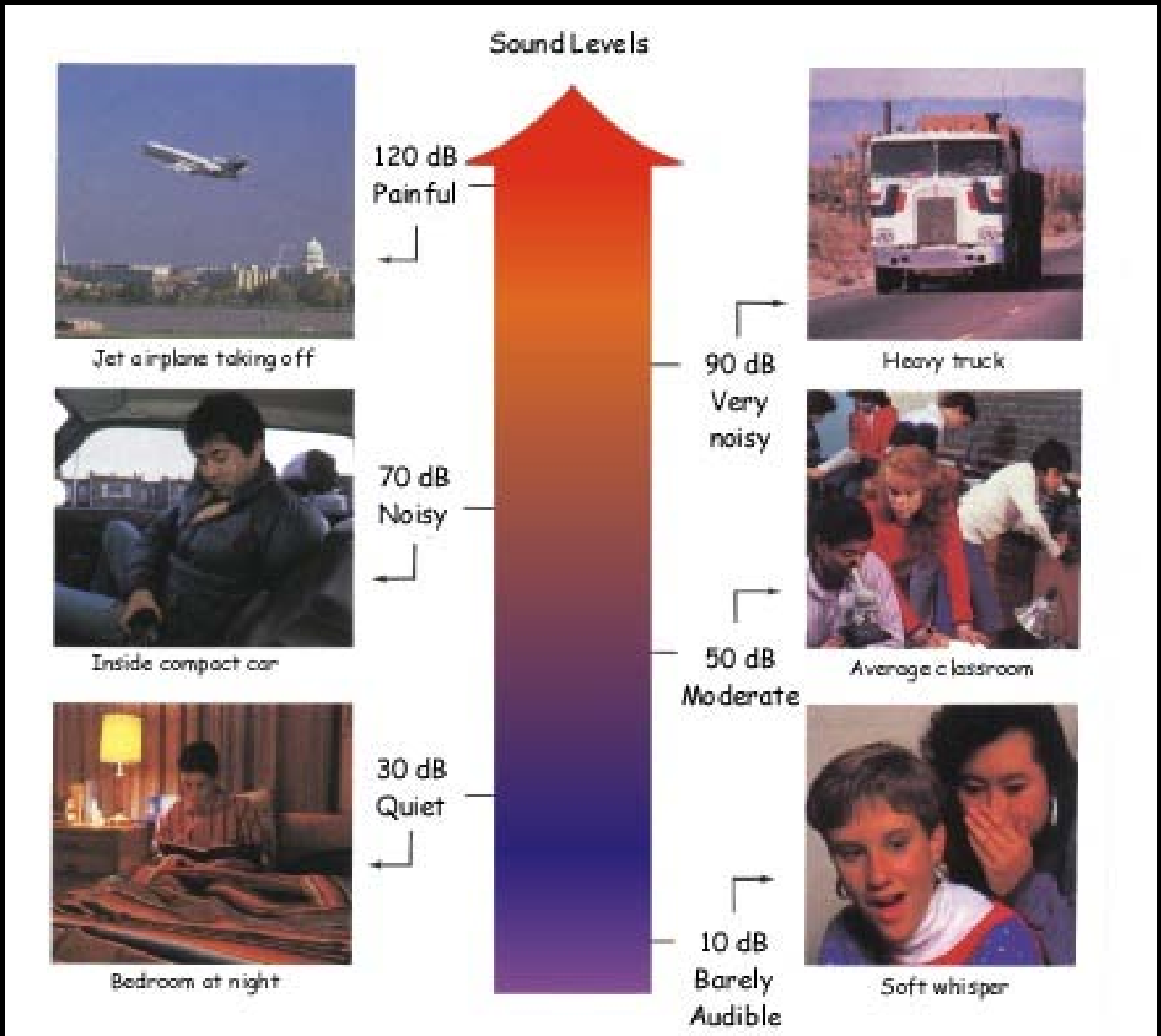
Sketch each one in your interactive notebook

Check before you sketch!!!

Optional

Intensity

- Intensity: the rate at which a wave's energy flows through an area
- Sound intensity depends on
  - Amplitude
  - Distance from source
- Measured in decibels (dB)



Decibel scale showing the intensity level of some familiar sounds.