8th grade Science Assignments 1-3: Application of Waves

Due: Weekly assignments due each Sunday by 10am

Application of Waves Week 1 Assignment: Wave Properties Review **Due: Sunday 5/10 10am**

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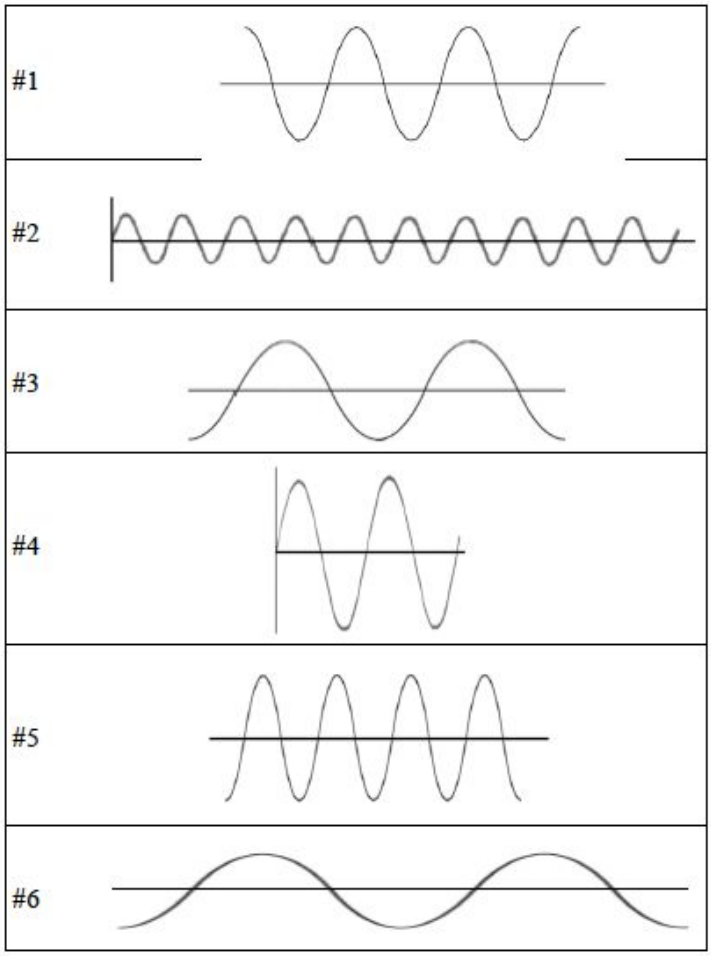
Answer each question assuming that each wave sequence occurred over 2 s



1. Each of the six waves listed above are examples of what type of wave? Transverse or longitudinal?

2. List the waves in order from smallest amplitude to highest amplitude

3. List the waves in order from shortest wavelength to longest wavelength

4. List the waves from lowest frequency to highest frequency

5. Compare the wavelength and frequency of wave 1 and 2. What is the relationship between frequency and wavelength?

6. Which of the following waves is more likely transferring the greatest amount of energy? Wave 2 or Wave 6? Explain how you know.

7. Which of the following waves is more than likely transferring the greatest amount of energy? Wave 4 or Wave 3? Explain how you know.

8. Assume each wave is representing a sound being produced. Which wave would produce the highest pitched sound? How do you know?

9. Assume each wave is representing a sound being produced. Which wave would produce the lowest pitched sound? How do you know?

10. Assume each wave is representing a sound being produced. Which wave would produce the quietest sound? How do you know?

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials

Application of Waves Week 2 Assignment: Speed of sound CER **Due: Sunday 5/17 10am**

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Directions: Develop a claim that answers the driving question, then use the articles and video link provided to gather evidence in support of your claim. Finally, construct a multi paragraph CER response.

Driving Question:

Which travels faster, an echo that forms in water or one that forms in the air?

Claim Statement: *Remember, your claim statement is a specific answer to the driving question.*

Evidence:

Use the articles and video linked below to complete the double entry diary. Only use the resources provided below or those that have been shared on google classroom, DO NOT GOOGLE SEARCH THE ANSWER. For each piece of evidence that you plan to use to support your claims (make sure it is at least 3) you should provide the scientific reasoning for why it is important.

Evidence *Write the evidence you have gathered from the reading and your data*	**Reasoning** *Write why this fact is important in supporting your claim.*

Articles:

1. https://www.schoolnet.org.za/PILAfrica/en/webs/19537/physics4.html
2. https://www.ck12.org/c/physics/speed-of-sound/lesson/Speed-of-Sound-MS-PS/

Videos:

https://www.youtube.com/watch?v=AxNdr0Bcx20

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Reasoning: Construct a multi paragraph response that answers the driving question and that is supported by evidence from the resources provided. Be sure to explain why or how the evidence you presented supports your claim. Be mindful to include key vocabulary from your study of sound and waves. Below are a few vocabulary words that should be present in your final writing piece.

Compressional or longitudinal wave, waves, medium, reflection, wavelength, frequency, molecules, energy, particles, vibration

Claim: Write a statement using the results from the investigation that answers the leading questions.
Evidence: Provide scientific data that supports the claim.
Reasoning: Explain why your evidence supports your claim.
Conclusion: Provide a statement that supports your scientific explanation.'

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Article #1: The Speed of Sound

Sound travels at different speeds depending on what it is traveling through. Of the three mediums (gas, l solid) sound waves travel the slowest through gases, faster through liquids, and fastest through solids. T also affects the speed of sound.

Gases: The speed of sound depends upon the properties of the medium it is passing through. When we look at the properties of a gas, we see that only when molecules collide with each other can the condensations and rarefactions of a sound wave move about. So, it makes sense that the speed of sound has the same order of magnitude as the average molecular speed between collisions. In a gas, it is particularly important to know the temperature. This is because at lower temperatures, molecules collide more often, giving the sound wave more chances to move around rapidly. At freezing (0º Celcius), sound travels through air at 331 meters per second (about 740 mph). But, at 20ºC, room temperature, sound travels at 343 meters per second (767 mph).

Liquids: Sound travels faster in liquids than in gases because molecules are more tightly packed. In fresh water, sound waves travel at 1,482 meters per second (about 3,315 mph). That's well over 4 times faster than in air! Several ocean-dwelling animals rely upon sound waves to communicate with other animals and to locate food and obstacles. The reason that they are able to effectively use this method of communication over long distances is that sound travels so much faster in water.

Solids: Sound travels fastest through solids. This is because molecules in a solid medium are much closer together than those in a liquid or gas, allowing sound waves to travel more quickly through it. In fact, sound waves travel over 17 times faster through steel than through air. The exact speed of sound in steel is 5,960 meters per second (13,332 mph)! But, this is only for the majority of solids. The speed of sound in all solids are not faster than in all liquids.

Substance	Temp (ºC)	Speed (m/s)
Gases		
Carbon Dioxide	0	259
Oxygen	0	316
Air	0	331
Air	20	343
Helium	0	965
Liquids		
Chloroform	20	1004
Ethanol	20	1162
Mercury	20	1450
Water	20	1482
Solids		
Lead	–	1960
Copper	–	5010
Glass	–	5640
Steel	–	5960

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Article #2: Speed of Sound

Has this ever happened to you? You see a flash of lightning on the horizon, but several seconds pass before you hear the rumble of thunder. The reason? The speed of light is much faster than the speed of sound.

What Is the Speed of Sound? The speed of sound is the distance that sound waves travel in a given amount of time. You'll often see the speed of sound given as 343 meters per second. But that's just the speed of sound under a certain set of conditions, specifically, through dry air at 20 ◦C. The speed of sound may be very different through other matter or at other temperatures.

Speed of Sound in Different Media: Sound waves are mechanical waves, and mechanical waves can only travel through matter. The matter through which the waves travel is called the medium (plural, media). The Table 1.1 gives the speed of sound in several different media. Generally, sound waves travel most quickly through solids, followed by liquids, and then by gases. Particles of matter are closest together in solids and farthest apart in gases. When particles are closer together, they can more quickly pass the energy of vibrations to nearby particles.

TABLE 1.1: Speed of Sound in Various Media

Medium (20 °C)	Speed of Sound Waves (m/s)
Dry Air	343
Water	1437
Wood	3850
Glass	4540
Aluminum	6320

Q: The table gives the speed of sound in dry air. Do you think that sound travels more or less quickly through air that contains water vapor? (Hint: Compare the speed of sound in water and air in the table.)

A: Sound travels at a higher speed through water than air, so it travels more quickly through air that contains water vapor than it does through dry air.

Temperature and Speed of Sound: The speed of sound also depends on the temperature of the medium. For a given medium, sound has a slower speed at lower temperatures. You can compare the speed of sound in dry air at different temperatures in the following Table 1.2. At a lower temperature, particles of the medium are moving more slowly, so it takes them longer to transfer the energy of the sound waves.

TABLE 1.2: Speed of Sound in Dry Air at Different Temperatures

Temperature of Air	Speed of Sound Waves (m/s)
0 °C	331
20 °C	343
100 °C	386

Q: What do you think the speed of sound might be in dry air at a temperature of -20 °C?

A: For each 1 degree Celsius that temperature decreases, the speed of sound decreases by 0.6 m/s. So sound travels through dry, -20 °C air at a speed of 319 m/s.

Application of Waves Week 3 Assignment: Hearing Range **Due: Sunday 5/24 10am**

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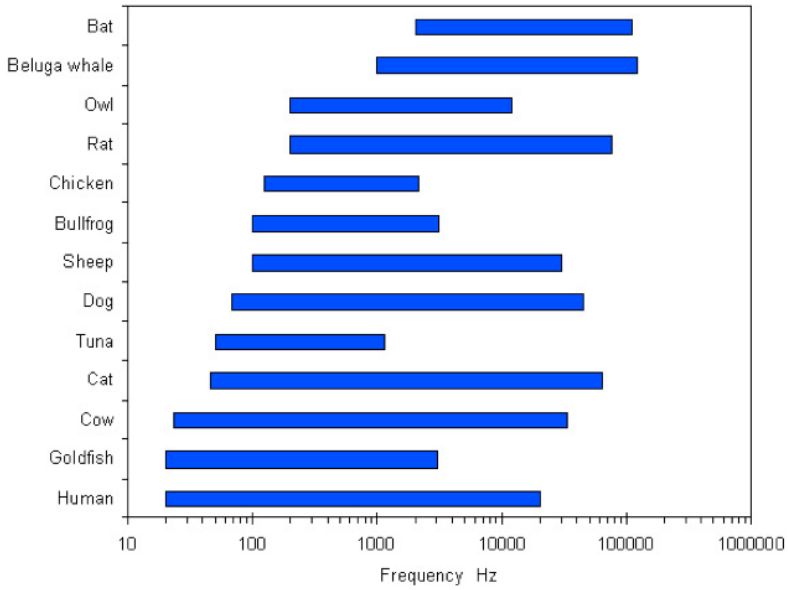
Task 1: Hearing Ranges of different animals

1. The graph below and to the right represents the range of hearing for different animals. The frequency scale on the x axis is logarithmic meaning it increases by a value of 10. Remember, frequency is directly related to the pitch of the sound. The higher the frequency, the higher the pitch. Use the graph to fill in the hearing ranges for each animal in the chart below.

Animal	Hearing Range (Hz)
Human	
Goldfish	
Cow	
Cat	
Tuna	
Dog	
Sheep	
Bullfrog	
Chicken	
Rat	
Owl	
Beluga whale	
Bat	



2. What animal has a hearing range most similar to human beings?

3. Which animals can hear frequencies above 75000Hz?

4. What can hear higher pitched sounds, a cat or a dog?

5. Which animal can hear the highest frequency sounds?

6. Why do you think whales have such a wide range of hearing?

7. Ultrasonic is a term used to describe sounds with a frequency above 20,000 Hz. What animals can hear frequencies that are ultrasonic to humans?

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Task 2: Decibel Scale

The two tables below provide information about intensity (loudness) of sound waves (Table 1) and how much exposure you can have to a certain level of loudness before it causes hearing damage (Table 2).

Table 1	
Level	**Source**
10 dB	**A quiet whisper 3 feet away**
40 dB	**Background noise in a house**
60 dB	**Ordinary conversation 3 feet away**
70 dB	**City traffic**
90 dB	**A jackhammer cutting up the street 10 feet away**
100 dB	**Listening to headphones at maximum volume**
110 dB	**Front row of a rock concert**
120 dB	**The threshold of physical pain from loudness**

Table 2	
Continuous dB Level	**Permissible Exposure Time**
85 dB	**8 hours**
88 dB	**4 hours**
91 dB	**2 hours**
94 dB	**1 hours**
97 dB	**30 min**
100 dB	**15 min**
103 dB	**7.5 min**
106 dB	**3.75 min**
109 dB	**1.875 min**
112 dB	**0.9375 min**

1. Describe the relationship between dB level and exposure time. Make sure to use words like decreases, increases, linear, or nonlinear.

2. Predict the permissible exposure time for a decibel level of 82 dB. Explain how you got your answer.

3. Predict the permissible exposure time for a decibel level of 118 dB.

4. Describe what math operation you did to solve problem 3.

5. Use Table 2 in conjunction with Table 1 to predict 4 occupations that might suffer from hearing loss due to continuous high decibel exposure.

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