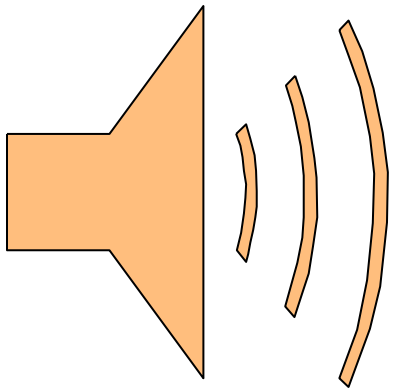
Hearing Sound

by Denise Carroll



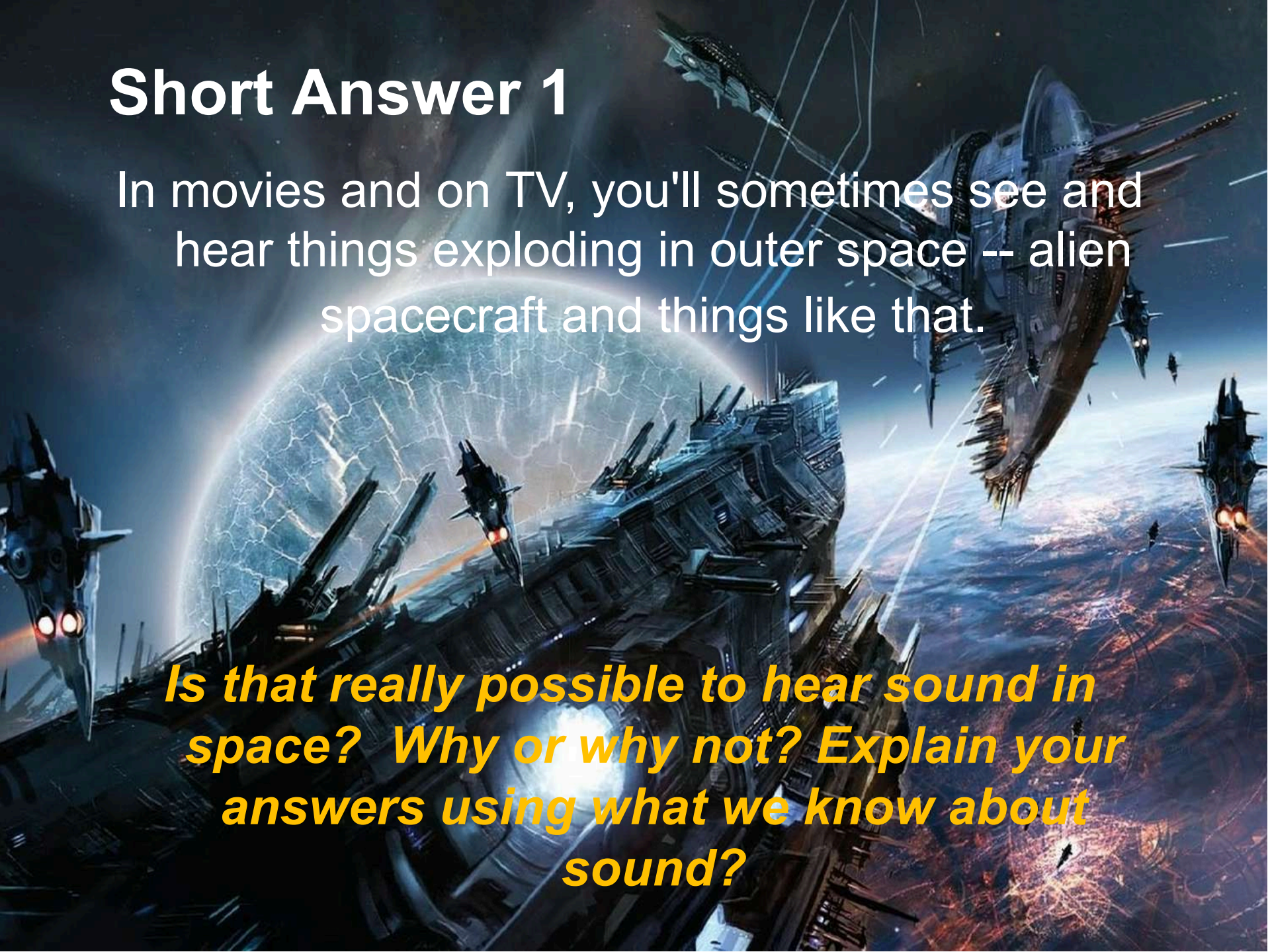
Science of Sound Test

- Sit and review notes for five minutes
  - The test will begin shortly!

There will be two short answer questions to add to your paper

Short Answer 1

In movies and on TV, you'll sometimes see and hear things exploding in outer space -- alien spacecraft and things like that.



Is that really possible to hear sound in space? Why or why not? Explain your answers using what we know about sound?

What do you hear?

- Did you hear something? Maybe the sound you heard was as quiet as your cat licking her paws. Or maybe it was loud, like a siren going by.
- Sounds are everywhere, and you have two cool parts on your body that let you hear them all: your ears!
- No matter where we go, sound waves are all around us.

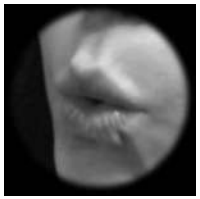
Sounds

Close your eyes and listen to these sounds.

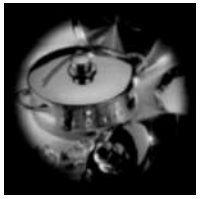
Click 

Click 

Click 

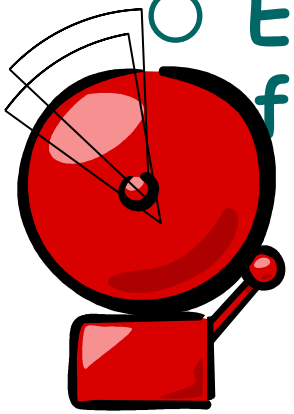
Click 

Click 

Click 

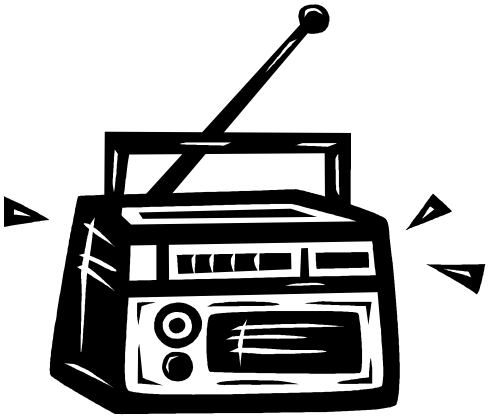
What is sound?

- **Sound** is a form of energy that can be heard and travels in waves.
- When matter **vibrates** or moves back and forth very quickly, a sound is made.
- Sound waves can travel through solids, liquids, or gases.
- Example: When a school bell rings, parts of the bell will vibrate creating sound.

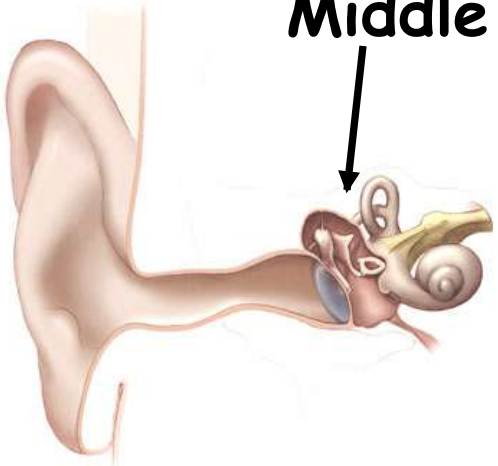


How does the ear work?

Sound waves are sent.
The outer ear "catches the sound waves".
The middle ear takes the sound waves and "vibrates" the eardrum.
The inner ear sends the messages to the brain.



Sound Waves



The brain puts it together and hooray! You hear your favorite song on the radio.

Sound Travels

- Sound travels in waves.
- Sound must travel through matter to be heard.
- Remember: Matter can be a solid, a liquid, or a gas.
- A sound is made when things vibrate.
- Sound travels by sending vibrations through matter.

Sound Travels Through Matter

Gases

Most of the sounds we hear travel through gases, such as air.

Sound waves travel slowly through the air.

For example: Sound from a bell, a horn, or an alarm clock travels through the air.

Liquids

Some sounds that we hear travel through water.

Sound waves travel a faster through water than through the air.

Sonar is the way to use sounds to locate objects under water.

What animals use sonar?

Solids

Some sounds that we hear travel through solids.

Sound waves travel very fast through solids.

For example: When you hit a drum, it vibrates, then the sound travels through the air, to your ears.

Sound makes the air vibrate.

- For sound to be heard, sound vibrations must have air or some other kind of matter to travel through.
- You cannot hear sound in outer space because there is no air or other matter to carry sound vibrations.
- ow do you think astronauts are able talk each other in outer space?

Sound can also be blocked.

THINK:

Why do some people wear ear coverings?

Cover your ears!

- Some people who work near loud machines wear ear coverings.
- The coverings block some of the sound vibrations from reaching the ears.
- The ear coverings protect your ears from the noise.
- Have you ever covered your ears? Why?

Audiologist

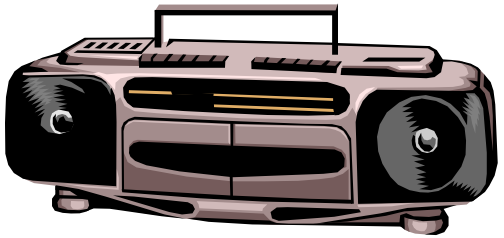
- An audiologist is a person who tests people's hearing.
- They use special machines that make sounds.
- They also help people who do not hear well.
- Have you had your hearing tested?

How You Make Sounds

- We use our vocal cords to make sounds in our throat.
- When we speak, our vocal cords vibrate.
- Place your hand on your throat when you talk, and you can feel the vocal cords vibrate.

Loudness or Volume

- **Volume** is the loudness or the softness of a sound.
- Loud sounds use a lot of energy.
- Soft sounds use a little energy.
- Example: The harder a drum is hit, the more the drum will vibrate . The more an object vibrates, the louder the sound it makes.



Pitch

- Pitch is the highest or lowest sound an object makes.
- Objects that vibrate slowly, make a low pitch. Example-drum.
- Objects that vibrate quickly, make a higher pitch. Example-recorder

Music

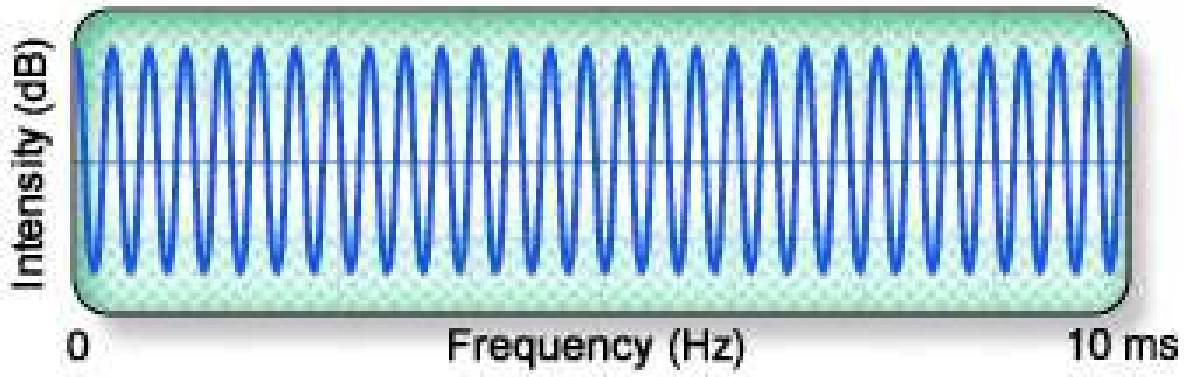
- **Music** is a combination or sequences of sounds that people enjoy listening to.
- Musical instruments make different sounds by plucking the strings.
- The shorter the string, the quicker it vibrates producing a high sound.
- The longer the string, the slower it vibrates producing a low sound.

Let's Review

- Sound is a kind of energy that can be heard.
- A sound is made when things vibrate.
- The vibrating object makes the air around it vibrate.
- Sound vibrations move through the air into your ears and make the eardrums vibrate.
- Volume is how loud or soft a sound is.
- Pitch is how high or low a sound is.

Sound Energy

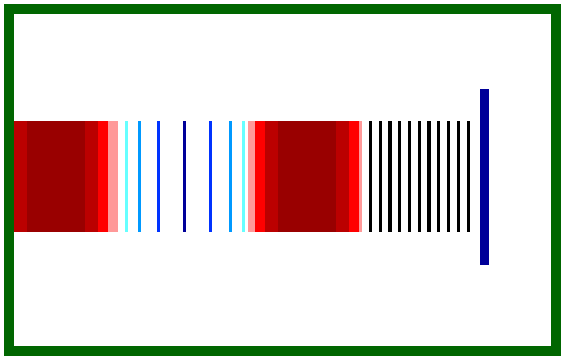
Sound travels on a longitudinal wave:



Notice that sound travels in a spiral form like a slingy☺

Imagine what happens when you drop a stone into a pool of water. Waves ripple out from the spot where the stone entered the water. The way waves move across the water is similar to how **sound waves** travel through the air.

When you speak or shout, your vocal chords **vibrate** . These vibrations travel in all directions through the air as waves. When the waves reach our ears, they make our eardrums vibrate too, so we can hear the words.



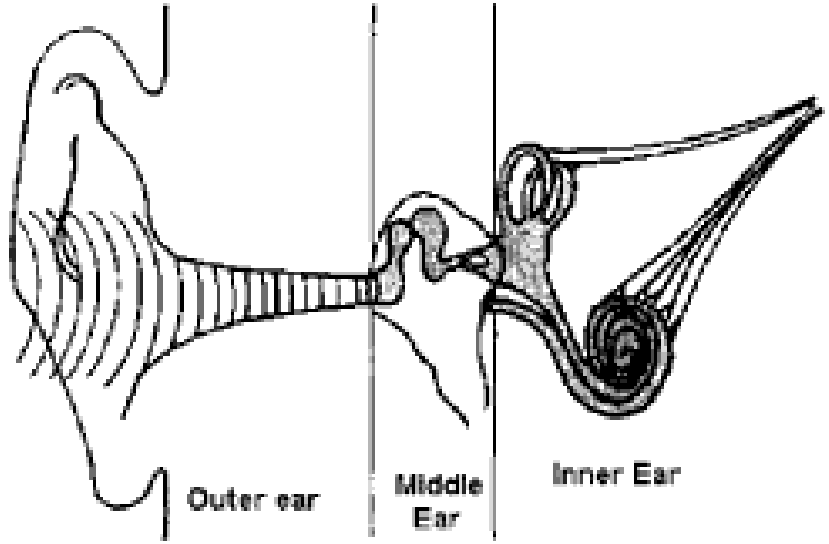
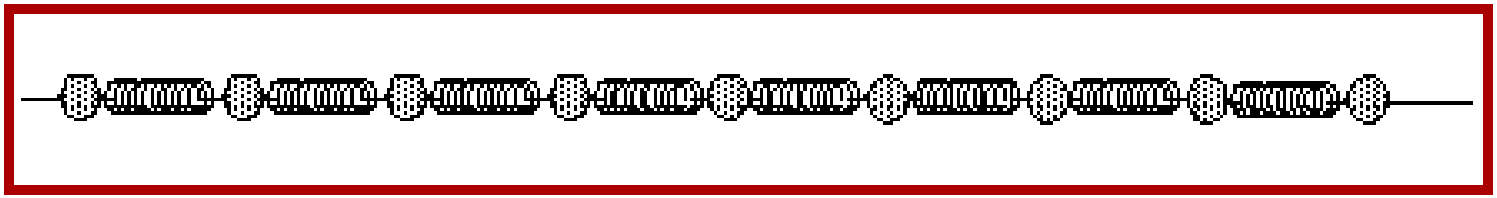


Figure 1. The sections of the ear

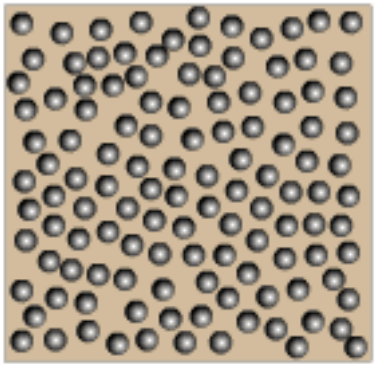
Sound waves travel on a **MEDIUM**:

Any SOLID, LIQUID OR GAS

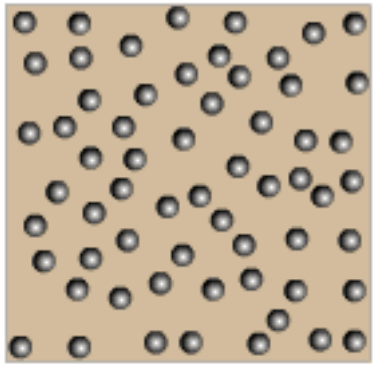
Sound travels by pushing the particles of a substance. The particles push into the particles next to them, and then return to their original position. And the sound continues to travel in this form until it reaches your ear!



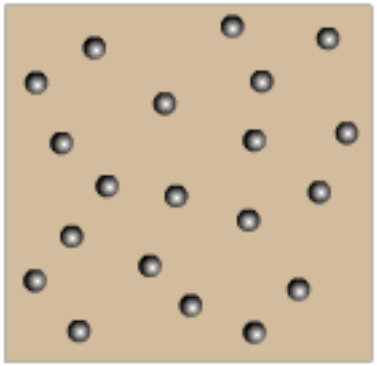
Which state of substance would sound travel through faster?



SOLID



LIQUID

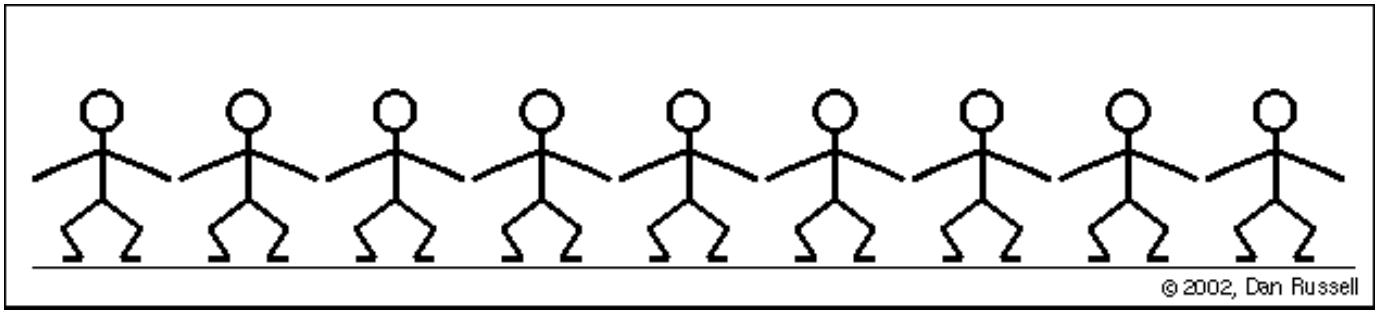


GAS

WHY?

All right, let's practice what we've learned so far…

It's time to let your partner ear it!!



Plus, domino affect

Mediums:

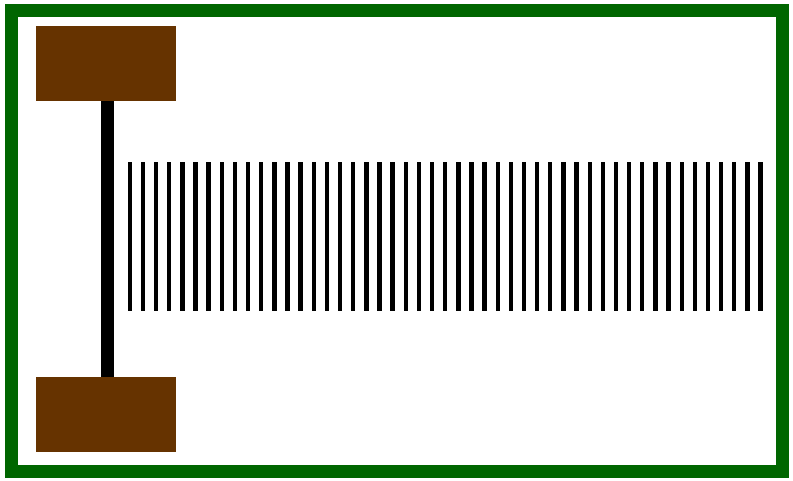
- Sound travels through a solid faster, than through a liquid, which is faster, than through a gas.
  - Our e… …und throug…

Substance	Temp (°C)	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

Compressions and Rarefractions:

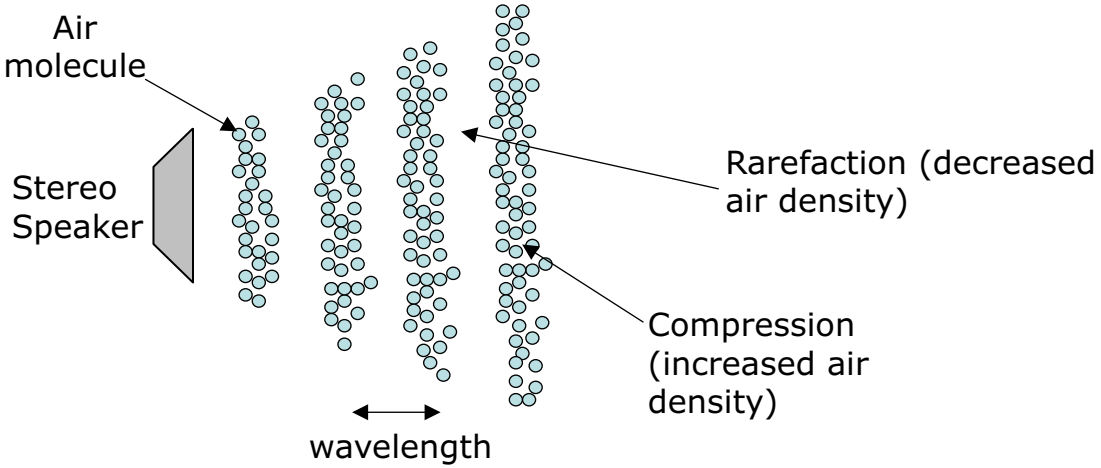
Compressions: area of sound waves where molecules are closer together (E)

Rarefraction: area of sound where molecules are further apart (B)



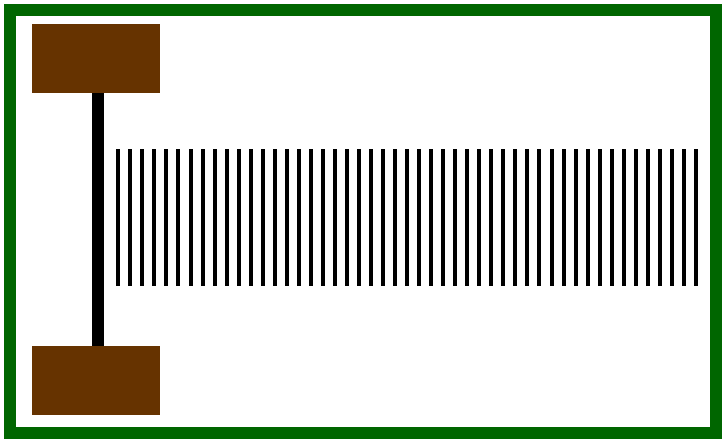
Wavelength:

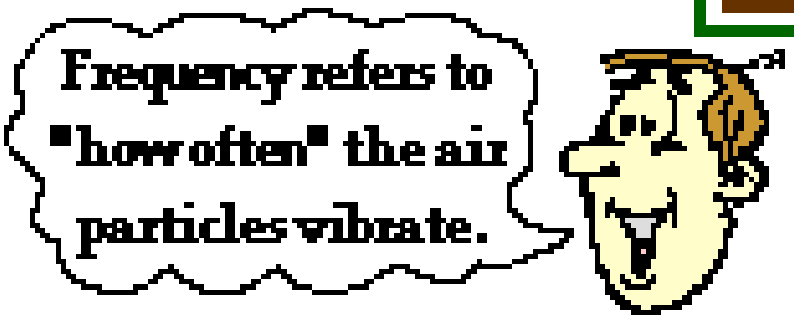
Wavelength: distance from end of compression to the end of the next compression (A)



Frequency:

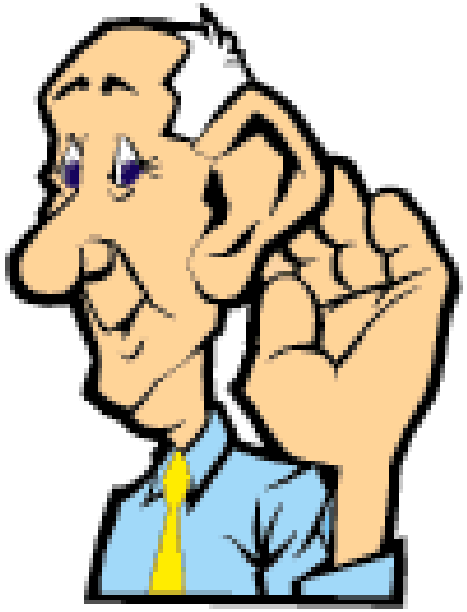
Frequency: the number of waves produced per second (C)





Two other properties that affect sound energy:

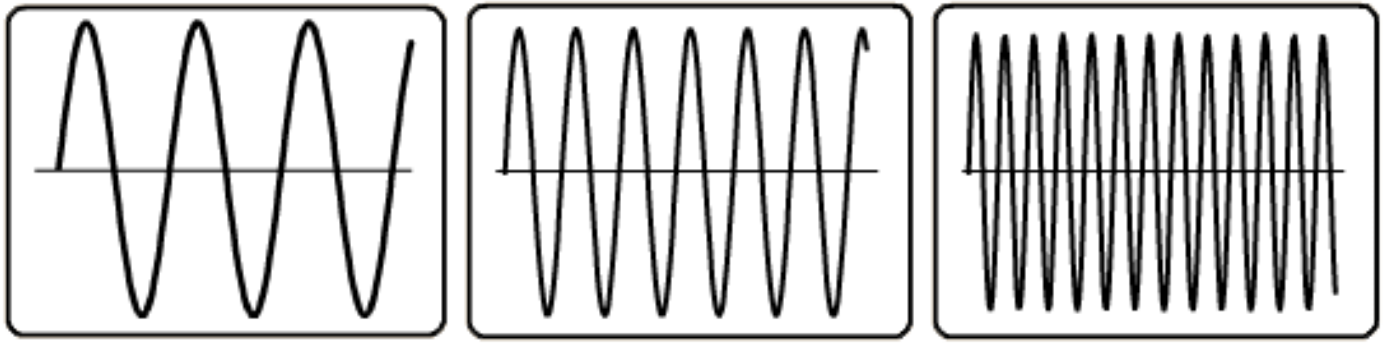
1. Pitch
2. Intensity



PITCH

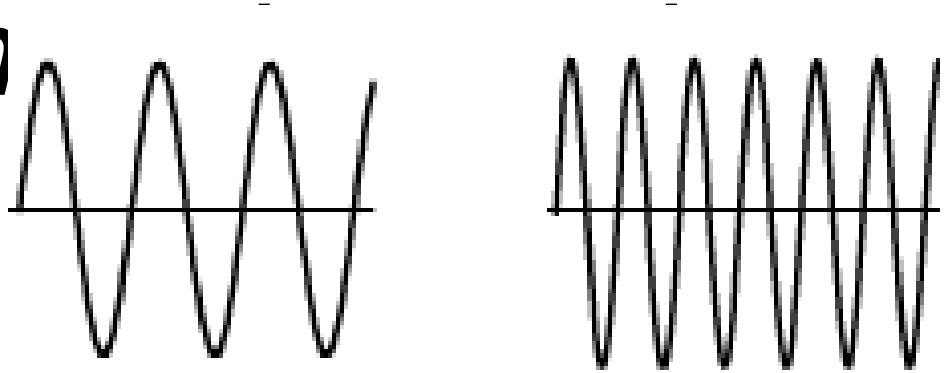
Pitch is the **rate at which the vibrations are produced**.

The higher the frequency, the higher the pitch.



Which picture above would have the lowest pitch? Highest pitch?

The more waves per second (or the higher the frequency), the high



Lower Pitch

Higher Pitch

Intensity

Intensity depends on the **strength, or amplitude, of the vibrations producing the sound**.

If a piano string is struck forcefully the string swings back and forth in a wider arc. The stronger vibration then produces a louder tone since stronger vibrations compress the molecules of the air more forcefully and gives them greater energy, which is interpreted by our ears as a louder sound.

So in conclusion:

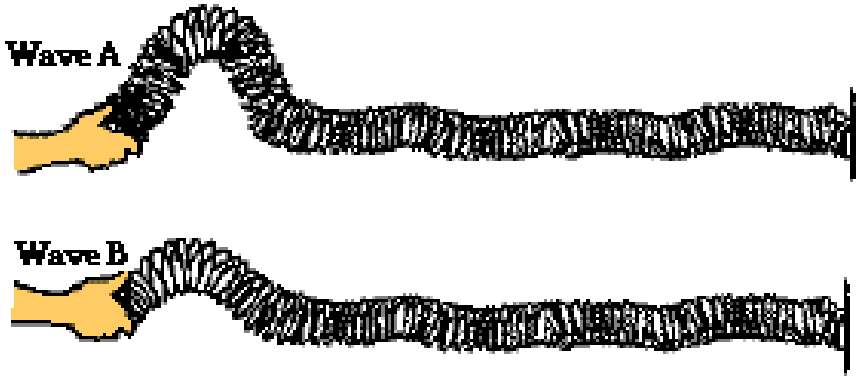
Sound energy travels on a _____ wave. Sound travels through a _____. Sound travels better through a _____ medium, than a _____ medium.

A sound wave is made up of two parts; compressions and rarefractions. The _____ represent areas where the molecules are closer together. Where as, a _____ is where the molecules are further apart.

The distance from the end of one compression to the beginning of the next compression is called the _____. The more waves per second the _____ the frequency. The greater the frequency the _____ the pitch.

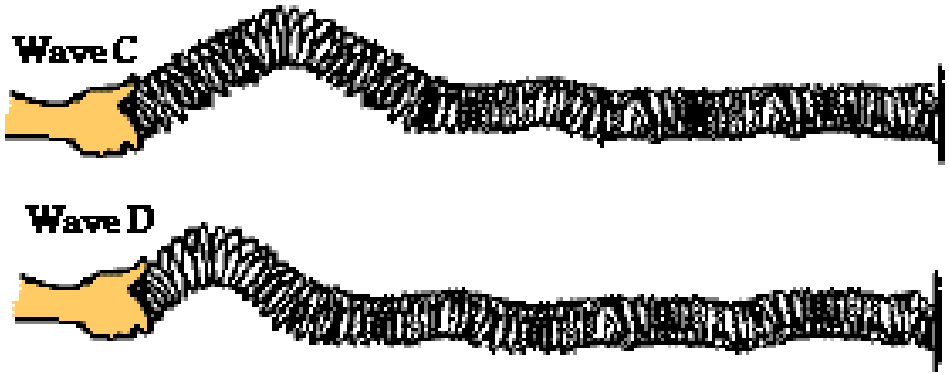
The more force put into the pulse (which starts the sound) the greater the _____ of the sound. Therefore, the sound will be louder.

1. A teacher attaches a slinky to the wall and begins introducing pulses with different amplitudes. Which of the two pulses (A or B) below will travel from the hand to the wall in the least amount of time? Justify your answer.



They reach the wall **at the same time**

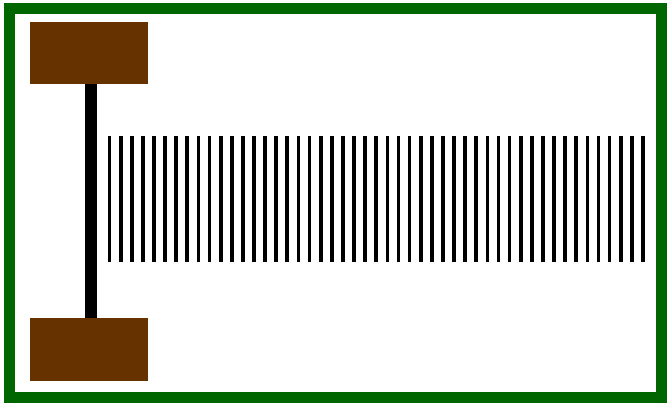
2. The teacher then begins introducing pulses with a different wavelength. Which of the two pulses (C or D) will travel from the hand to the wall in the least amount of time ? Justify your answer.



They reach the wall **at the same time**.

3. Doubling the frequency of a wave source doubles the speed of the waves.

TRUE or **FALSE**:



FALSE!

The speed of a wave is unaffected by changes in the frequency. It is affected by the medium!

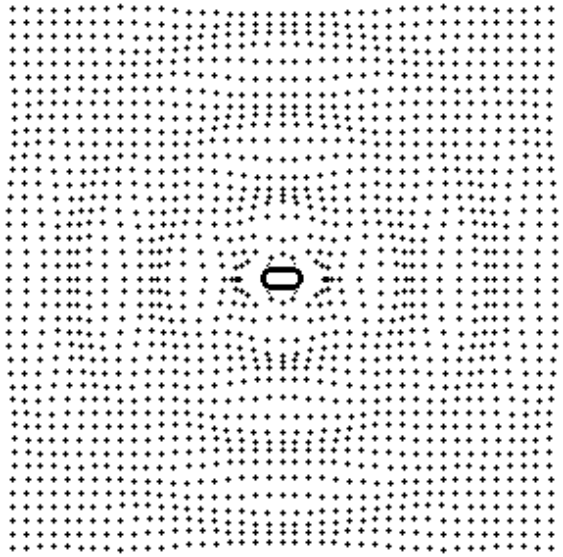
3. Two waves are traveling through the same container of nitrogen gas. Wave A has a wavelength of 1.5 m. Wave B has a wavelength of 4.5 m. The speed of wave B must be _____ the s

a. one-ninth

b. one-third

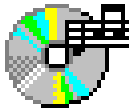
c. the same as

d. three times larger than



Answer: **C**

4. Why do we hear this when a jet flies past us?



- **The closer the jet is to our ears, the closer the wavelengths**. Therefore, we hear a **higher pitch** when the jet is **closer**, and a lower pitch as it moves further away.

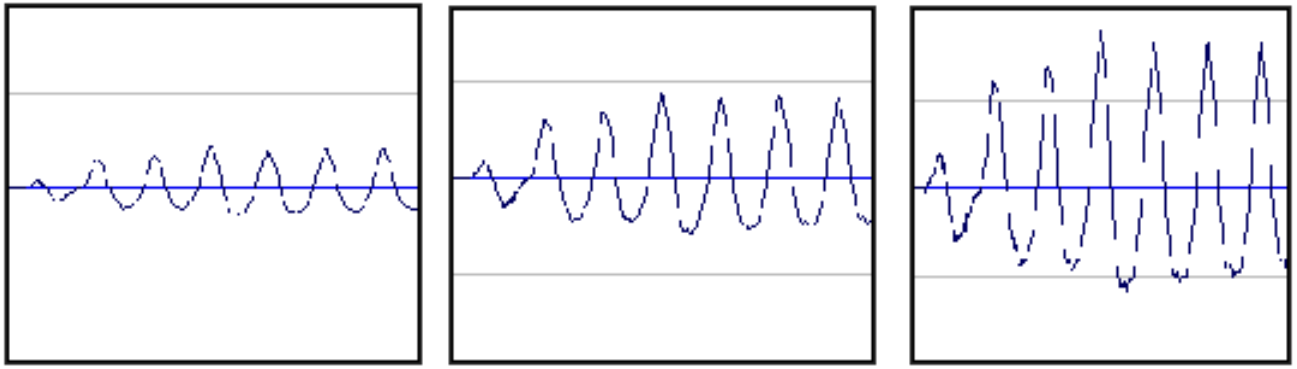
Also, the **closer** the jet the **more intensity**; therefore it seems **louder** to our ears.

5. Label the three pictures below with the following:

a. highest pitch (HP)

b. middle pitch (MP)

c. lowest pitch (LP)



LPMP HP

Congratulations!

- You have learned how sound travels.
- Three Cheers for the Ears!

Resources

- http://images.search.yahoo.com
- http://office.microsoft.com/clipart