TELUS WORLD of SCIENCE Edmonton

RUEBEN'S TUBE LESSON PLAN

Description

Learn about pitch, volume and how sound travels.

Curriculum Fit

Grade 3, Topic D: Hearing and Sound
3-9 Describe the nature of sound, and demonstrate methods for producing and controlling sound.

Specific Learner Expectations

1. Identify examples of vibration
2. Recognize that sound is the result of vibration; and demonstrate that the larger the vibration, the louder the sound
4. .Recognize that pitch is the result of differences in the rate of vibration, and differences in the rate of vibration, and predict how a change in the rate of vibration will affect a sound
5. Demonstrate a variety of ways of producing sounds; e.g., by striking an empty glass, by blowing air into a bottle, by constructing and using a device that involves vibrating strings.
6. Use sound-producing devices that the student has constructed to demonstrate methods for controlling the loudness, pitch and quality of sound produced.
7. Identify examples that show that sound can travel through a variety of materials, including solids, liquids and air, and that sound travels in all directions.
12. Construct and evaluate different kinds of soundproofing and sound-amplifying devices.

Key Terms

- *Vibrations:* A shaking movement
  Sound: Vibrations received by our ears that our brain processes as sound
- *Pitch:* How high or low a sound is (think: high squeaky sound vs low growling sound)
- *Volume*: The softness or loudness of a sound
- *Amplify:* Make a sound louder
- *Sound-proof:* Will block sounds

Introduction

When you listen to your favourite music, hear birds singing, or hear a car horn, all these sounds reach your ears in the exact same way – as vibrations traveling through the air.

When the vibrations enter your ears, they are processed by the brain as sound. In this lesson on *Vibrations of Sound* you will explore vibrations, discover different ways of producing sound, test how sound travels through the 3 states of matter and create devices that will either amplify or block sound.

Activity One: Jumping Salt

Goal: Seeing salt jump from the vibrations produced by sounds.

Materials:

- 1 metal bowl
- Cling wrap
- Salt
- Speaker or CD player

Instructions:

1. Cover the metal bowl with cling wrap.
2. Sprinkle a light layer of salt on the plastic wrap. If you put too much salt the experiment will not work as well.
3. Once the salt is on, take your speaker or player and turn on sounds or music. Bring it close to the salt (but do not touch the bowl or plastic wrap) and watch the salt dance. It will move because the vibrations the sound is producing will vibrate the salt.

TIP: Experiment with loud sounds versus soft sounds, and high sounds versus low sounds, to see differences in the salt's vibration.

Activity Two: Experimenting with Sound Production

Goal: Discover different ways to produce sounds.

Materials:

- 1 empty pop bottle
- Several glasses of varying heights
- 1 thick rubber band

Instructions:

1. Blow over the top of the empty bottle to hear the sound it produces.
2. Line up the glasses in a row from shortest to tallest, and with a spoon tap each glass once. Listen to the difference in sound between the glasses.
3. Next, fill each glass half-full with water, and then with a spoon tap each glass once more. Does filling the glass half-full with water result in a different sound?
4. Stretch out the rubber band with the help of adult. Flick the band with your finger and

hear the sound it produces.

TIP: As you can see, there are many ways to produce sound that do not involve speaking or musical instruments—try to discover other ways to make sound on your own!

Activity Three: Sound Traveling Through the States of Matter

Goal: Discover through which state of matter (solid, liquid or gas) sound travels best.

Materials:

- 1 metal bowl filled almost to the top with water
- 2 metal spoons
- 1 coat hanger
- 2 long pieces of string.

Instructions:

1. With the bowl filled with water in front of you, put the two spoons into the bowl, under the water, and hit them together.
2. Listen to the sound they produce. This is the sound traveling through air to you from the water.
3. Next, put your ear directly against the metal bowl and hit the spoons together again (get a brother or sister or grown-up to help you with this step otherwise)! Listen to the sound of the spoons when your ear is against the bowl. This is the sound traveling through a liquid (water) to your ear.
4. Could you hear the sound better through the air or through water (when your ear was against the bowl)?
5. Tie one string to each end of the coat hanger. Get a grown-up to help you with tying the string if necessary. Watch a video demonstration here:

   https://www.youtube.com/watch?v=I91LMMJgwiU&feature=emb_logo

6. Hold one string in each hand, and bounce the hanger on the floor. Listen to the sound it produces. The sound you hear has traveled through the air to your ears. Next, hold the strings between two fingers on each hand, and press the fingers holding the string against your ears.
7. Now lean down, still holding the string, and bounce the hanger on the floor. Listen to the sound it produces. This time the sound has traveled through a solid (the hanger and strings) to your ears.
8. Did you hear the sound better when it traveled through the air to your ears or when it traveled through the solids (the hanger and strings) to your ears?

TIP: For the first experiment, you should hear the sound better when your ear is against the bowl. Sound travels better through a liquid (water) than a gas (air). For the second experiment, you should hear the sound better when you are holding the strings to your ears. Sound travels

better through a solid (the hanger and strings) than through a gas (the air).

Activity Four: Creating Sound-proofing and Sound-amplifying Devices

Goal: Learn what materials will block sound from traveling and which materials help sound travel better.

Materials:

- An alarm or phone or music box
- Any materials like cardboard boxes, paper, pillows, blankets, etc. that your parents allow you to use

Instructions:

1. Find items in your house that you think will be sound-proof. This means they will block sound. Once you've gathered your items, create something that will fit your phone or alarm in the middle and then can be closed. Once you're finished building, turn on music on the phone and put it in the middle of your creation. If you cannot hear the sound, or it is quieter, you have created something sound-proof!
2. Find items in your house that would help amplify sound. This means they will make sounds louder. Once you've gathered your items, create something that will fit your phone or alarm inside and then can be closed. Once you're finished building, turn on the music on the phone and put it into the middle of your creation. If the music or alarm becomes even louder, you have created a sound-amplifier!

Discussion Questions

1. What part of a guitar amplifies the sound?

2. Why should you not tap on the glass of an aquarium?

3. Why does sound travel better through solids than liquids or gases? List the questions here.

Assessment

1. How is sound produced?

2. What is the pitch of a sound? Give examples

3. What is volume of a sound? Give examples

4. Does sound travel best in air, liquid or solid materials?

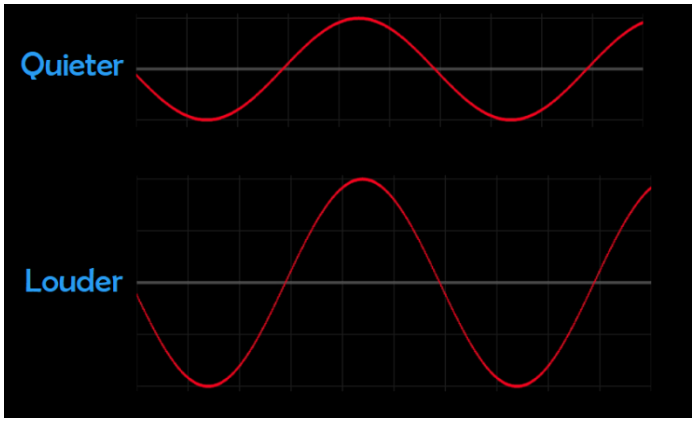
Background Information

Sound

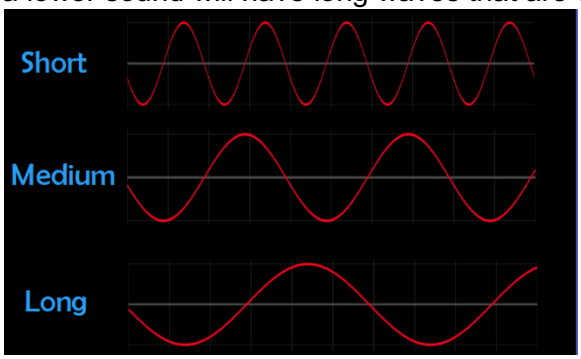
Is all around us and has several different names: noise, music, talking etc.
All sounds made the same way – through vibrations – our ears sense these vibrations

What is sound?
Sound is energy that comes from vibrations
Sounds we hear are caused when an object (noise maker) makes the molecules in the air vibrate
Put your hand to your throat and start humming. What do you feel?
Sound travels in waves (not up and down like the beach) rather as compression waves
The distance between waves are wavelengths that have an amplitude, peak and trough – Think of a slinky
Sound waves travel as ripples of squeezed air – they move back and forth in the direction that the sound is travelling
Air is made up of particles and these carry sound – a sound source vibrates the particles that are around it – these particles vibrate those around them and this continues until it gets to your ear
Sound can travel more than just air – it can travel through various mediums such as: solid, liquid, gas

What is volume?
Aspect of sound
Volume – based on size of the vibration
Loudness is measured in decibels
Louder sound = taller sound wave (higher amplitude)
Large vibration – wave has a lot of energy and pressure hitting your ears more intense (loud sound)
Quieter sound = shorter sound wave (lower amplitude)
Small vibration - wave does not have a lot of energy and pressure hitting ears is slight (quiet sound)
This image shows how the amplitude (height) of a quiet sound wave is shorter than the amplitude (height) of a loud sound wave



What is Pitch?
Aspect of sound
Pitch – the rate at which vibrations are produced, the frequency of a sound is what your ear understands as pitch
Frequency – how fast the sound wave is oscillating
Example: guitar with big heavy string will vibrate slowly and create a low sound, a thinner lighter string will vibrate faster and create a high sound or pitch
Make voice high and squeaky for high pitch, deep for low pitch to show the difference
Measured in Hertz (Hz) - cycles per second
Higher pitch – waves travel closer together – higher frequency
Lower pitch – waves travel further apart – lower frequency
This image shows the waves associated with different pitches of sound. A high sound will have many short waves following each other closely (seen at the top of the image) whereas a lower sound will have long waves that are coming further apart (bottom of the image).



This can be provided by bullet points, like this.