EDUCATIONAL
CONCERT SERIES

DETROIT SYMPHONY ORCHESTRA 2017-2018 EDUCATION CONCERT SERIES

TEACHER RESOURCE GUIDE

A SYMPHONY OF SCIENCE:
Teacher's Curriculum Guide Spring 2018

Live from Orchestra Hall

Classroom Edition

Supported by the Mandell and Madeleine Berman Foundation

EDUCATIONAL
CONCERT SERIES

Welcome

to the Educational Concert Series!

The lessons and activities in this resource guide work together with the Educational Concert Series to enable your students to put their ears to good use in the concert hall. They will learn to observe, to describe, and to compare and contrast. They will learn how science relates to music by exploring how sound is produced and how instruments make sound. They will explore the history of different composers and expand their listening skills by exercising the art of listening.

This guide is divided into several units, each including Activities and Extensions. Every teacher can adjust the lesson plans according to their student's background, abilities, and current classroom curriculum. Students can take activities home to work and share with their families. Additionally, we offer recommendations of literature and online resources for various age groups about sound and music.

To make the most of your visit to the Detroit Symphony Orchestra, play the music in this resource guide for your students throughout the school day and complete as many of the lessons in this booklet as you can. We hope you enjoy the lessons, indulge in listening, and most of all, we sincerely hope you have fun at your Educational Concert Series. See you soon!

Debora Kang,
Education Manager

Join us next season!

EDUCATIONAL CONCERT SERIES 2018-2019

- Wednesday, November 28th at 10:30am and 11:45am
- Wednesday, February 27th at 10:30am and 11:45am
- Thursday, February 28th at 10:30am
- Wednesday, May 15th at 10:30am and 11:45am

Live from Orchestra Hall

Classroom Edition

- Wednesday, November 28th at 10:30am and 11:45am
- Wednesday, May 15th at 10:30am and 11:45am

To receive registration information for next season, please e-mail Lucy Alessio at lalessio@dso.org.

Program information will be available in the beginning of the next school year.

Teaching and Learning in the Arts

The Detroit Symphony Orchestra strives to follow key elements of the Common Core by providing a Teacher's Resource Guide to supplement and enhance the viewing of the Educational Concert Series. Through the introduction of orchestral music, they will learn to observe, describe, and to compare and contrast. In collaboration with Michigan Science Center, science and musical connections can be made.

In the course of these lessons, your students will make music, develop musical creativity, learn the history of composers and the source of their works and explore connections with other disciplines.

NATIONAL STANDARDS AND MICHIGAN STANDARDS

NAFME NATIONAL STANDARDS

While the National Association for Music Education (NAfME) has now adopted new core standards, there are many similarities between the content in the "old" standards and the new standards. The most striking difference is the new National Core Arts Standards are easily aligned into Anchor Standards, which are organized in four major areas:

Creating
Performing/Presenting/Producing
Responding
Connecting

No matter which set of standards your specific school system uses, it is easy to align the criteria into these four new categories. Based on feedback from you, the teachers, we are using the four broad areas above to inform the curricular units contained in this resource guide. Specific information about these standards, and the Anchor Standards that fit within these categories can be found at:

▶ *nationalartsstandards.org*

National Standards for music education

1. Singing, alone and with others, a varied repertoire of music.
2. Performing on instruments, alone and with others, a varied repertoire of music.
3. Improvising melodies, variations, and accompaniments.
4. Composing and arranging music within specified guidelines.
5. Reading and notating music.
6. Listening to, analyzing, and describing music.
7. Evaluating music and music performances.
8. Understanding relationships between music, the other arts, and disciplines outside the arts.
9. Understanding music in relation to history and culture.

Michigan Standards for music education

1. All students will apply skills and knowledge to perform in the arts.
2. All students will apply skills and knowledge to create in the arts.
3. All students will analyze, describe and evaluate works of art.
4. All students will understand, analyze, and describe the arts in their historical, social and cultural contexts.
5. All students will recognize, analyze, and describe connections among the arts; between the arts and other disciplines; between the arts and everyday life.

DETROIT SYMPHONY ORCHESTRA
LEONARD SLATKIN *Music Director*

A COMMUNITY-SUPPORTED ORCHESTRA

Leonard Slatkin, Music Director
Jeff Tyzik, Principal Pops Conductor
Neeme Järvi, Music Director Emeritus

EDUCATIONAL CONCERT SERIES:

A Symphony of Science

Wednesday, April 18, 2018 at 10:30 a.m. & 11.45 a.m. in Orchestra Hall
Thursday, April 19, 2018 at 10:30 a.m. in Orchestra Hall

Michelle Merrill, *conductor*
D.J. Oliver, *host*
Charles Gibson, *co-host*

Sergei Prokofiev (1891 - 1953)	*Classical Symphony*, Op. 25 (Symphony No. 1) I. Allegro con brio
Léo Delibes (1836 - 1891)	"Pizzicato" from *Sylvia*, Ballet Suite
Felix Mendelssohn (1809 - 1847)	*The Hebrides Overture*, Op. 26, "Fingal's Cave"
Aaron Copland (1900 - 1990)	Fanfare for the Common Man
Jessie Montgomery	Starburst
Ludwig van Beethoven (1770 - 1827)	Symphony No. 9 in D minor, Op. 125, "Choral" IV. Allegro assai (excerpt)
Sergei Prokofiev (1891 - 1953)	*Classical Symphony*, Op. 25 (Symphony No. 1) IV. Finale: Molto vivace

Detroit Symphony Orchestra

LEONARD SLATKIN, Music Director

Music Directorship endowed by the Kresge Foundation

JEFF TYZIK
Principal Pops Conductor

TERENCE BLANCHARD
Fred A. and Barbara M. Erb Jazz Creative Director Chair

NEEME JÄRVI
Music Director Emeritus

MICHELLE MERRILL
Associate Conductor, Phillip and Lauren Fisher Community Ambassador

FIRST VIOLIN

Yoonshin Song
Concertmaster
Katherine Tuck Chair

Kimberly Kaloyanides Kennedy
Associate Concertmaster
Alan and Marianne Schwartz and Jean Shapero (Shapero Foundation) Chair

Hai-Xin Wu
Assistant Concertmaster
Walker L. Cisler/Detroit Edison Foundation Chair

Jennifer Wey
Assistant Concertmaster

Marguerite Deslippe*

Laurie Landers Goldman*

Rachel Harding Klaus*

Eun Park Lee*

Adrienne Rönmark*

Laura Soto*

Greg Staples*

Jiamin Wang*

Mingzhao Zhou*

SECOND VIOLIN

Sujin Lim
Acting Principal
The Devereaux Family Chair

Adam Stepniewski
Assistant Principal

Ron Fischer*

Will Haapaniemi*
David and Valerie McCammon Chair

Hae Jeong Heidi Han*
David and Valerie McCammon Chair

Sheryl Hwangbo*

Hong-Yi Mo*

Alexandros Sakarellos*

Joseph Striplin*

Marian Tanau*

Jing Zhang*

VIOLA

Eric Nowlin
Principal
Julie and Ed Levy, Jr. Chair

James VanValkenburg
Assistant Principal

Caroline Coade

Hang Su

Glenn Mellow

Shanda Lowery-Sachs

Hart Hollman

Han Zheng

CELLO

Wei Yu
Principal
James C. Gordon Chair

Robert Bergman*

Jeremy Crosmer*

David LeDoux*

Peter McCaffrey*
Joanne Danto and Arnold Weingarden Chair

Haden McKay*

Úna O'Riordan*

Paul Wingert*
Victor and Gale Girolami Chair

Open
Assistant Principal
Dorothy and Herbert Graebner Chair

BASS

Kevin Brown
Principal
Van Dusen Family Chair

Stephen Molina
Assistant Principal

Linton Bodwin

Stephen Edwards

Christopher Hamlen

HARP

Patricia Masri-Fletcher
Principal
Winifred E. Polk Chair

FLUTE

Sharon Sparrow
Acting Principal
Bernard and Eleanor Robertson Chair

Amanda Blaikie
Morton and Brigitte Harris Chair

Jeffery Zook

Open
Principal
Women's Association for the DSO Chair

PICCOLO

Jeffery Zook

OBOE

Alexander Kinmonth
Principal
Jack A. and Aviva Robinson Chair

Sarah Lewis
Maggie Miller Chair

Brian Ventura
Assistant Principal

Monica Fosnaugh

ENGLISH HORN

Monica Fosnaugh
Shari and Craig Morgan Chair

CLARINET

Andrea Levine†
Acting Principal

Jack Walters
PVS Chemicals Inc./Jim and Ann Nicholson Chair

Laurence Liberson
Assistant Principal

Shannon Orme

Ralph Skiano~
Principal
Robert B. Semple Chair

E-FLAT CLARINET

Laurence Liberson

BASS CLARINET

Shannon Orme
Barbara Frankel and Ronald Michalak Chair

BASSOON

Robert Williams
Principal

Victoria King

Michael Ke Ma
Assistant Principal

Marcus Schoon

Alexander Davis
African-American Orchestra Fellow

CONTRABASSOON

Marcus Schoon

HORN

Karl Pituch
Principal

Johanna Yarbrough

Scott Strong

Bryan Kennedy

David Everson
Assistant Principal

Mark Abbott^

TRUMPET

Hunter Eberly
Principal
Lee and Floy Barthel Chair

Kevin Good

Stephen Anderson
Assistant Principal

William Lucas

TROMBONE

Kenneth Thompkins
Principal

David Binder

Randall Hawes

BASS TROMBONE

Randall Hawes

TUBA

Dennis Nulty
Principal

PERCUSSION

Joseph Becker
Principal
Ruth Roby and Alfred R. Glancy III Chair

Andrés Pichardo-Rosenthal
Assistant Principal
William Cody Knicely Chair

James Ritchie

TIMPANI

Jeremy Epp
Principal
Richard and Mona Alonzo Chair

James Ritchie
Assistant Principal

LIBRARIANS

Robert Stiles
Principal

Ethan Allen

PERSONNEL MANAGERS

Heather Hart Rochon
Director of Orchestra Personnel

Patrick Peterson
Manager of Orchestra Personnel

STAGE PERSONNEL

Dennis Rottell
Stage Manager

Steven Kemp
Department Head

Matthew Pons
Department Head

Michael Sarkissian
Department Head

LEGEND

* These members may voluntarily revolve seating within the section on a regular basis

† substitute musician

~ extended leave

^ on sabbatical

Unit 1
Music to Your Ears

From the sweeping melodies of an orchestra to a conversation with your friend, sounds are all around us! It's incredible that every sound begins the same way, through a simple vibration. Discover the source of sound and "see" sound with simple hands-on experiments in this unit. Define how sound is produced, what makes it high or low, and how our ears hear sound. Connect scientific terms to instrument demonstrations from our DSO musicians and musical examples from our A Symphony of Science program. Extend the learning through additional "found sound" experiments, music journals, and response sheets. Discover how music and science go hand-in-hand!

Vassily Kandinsky Fragment 2 for Composition VII 1913 of the Albright-Knox Art Gallery, Buffalo, New York

ACTIVITY 1
THE SOURCE OF SOUNDS

Materials: flexible wooden or plastic ruler

VOCABULARY

frequency: a measure of how often an action or movement is repeated within a certain amount of time. The movement of waves is measured in terms of frequency.

sound wave: a kind of wave that moves because of changes in pressure and density through a substance and carries sound

vibration*:* a fast backward and forward movement along a straight line

pitch*:* in music, the highness or lowness of a sound.

Sounds are created by **vibrations**. Without vibrations, the world would be silent. Some vibrations are easy to see, and others are not so easily visible. To see a vibration produce a sound, pluck the end of a flexible ruler as it is held against a tabletop. (See picture below) Watch and listen to the ruler carefully.

Discuss: *What did you see? What did you hear?*

Vibrations create a series of pulses which travel as **sound waves**. Now, reduce the length of the ruler that's free to vibrate and pluck again.

Discuss: *What happens to the sound? What happens to the sound if you increase the length that's free to vibrate?*

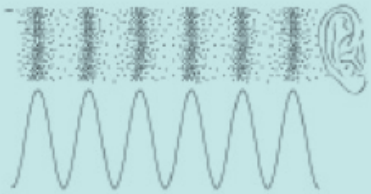
When the ruler is shortened and plucked, it vibrates faster – at a higher **frequency** because there is a shorter distance the vibration must travel**.** The higher frequency results in a higher **pitch**. When the ruler is lengthened and plucked, it vibrates slower, which creates a lower frequency and lower pitch, because there is a longer distance the vibration must travel.

LOWER ELEMENTARY SCIENCE EXTENSION

Experiment with producing vibrations on everyday objects. Strike a cooking pot by its handle with the tines of a table fork. Listen to the sound the lid makes. Are the fork's tines vibrating? How does the sound they make compare with the sound from the lid? Which makes a louder sound? Which produces a higher-pitched sound?

UPPER ELEMENTARY SCIENCE EXTENSION

Complete the Sound, Pitch and Frequency worksheet



WRITING EXTENSION

Begin a music listening journal. Create journals from paper with a cover of construction paper. Students can record vocabulary words and definitions and use the journal to draw in and/or write in to respond to the listening examples.

ACTIVITY 2
LEARNING "PIZZICATO"

Just as you created vibrations by plucking the ruler, the string section in the orchestra, (which includes violin, viola, cello and bass), are all able to play their instruments by plucking their strings, which is a technique called pizzicato. The string players play pizzicato by picking the string of their instrument with one finger and can even play a whole piece using this technique

WATCH on YouTube at https://youtu.be/qe7OiWj7BXk

Meet DSO's Assistant Concertmaster, Jennifer Wey, in this short video as she demonstrates the violin and how to play pizzicato.

Discuss: Plucking the violin, "pizzicato" vs plucking the ruler. *What was similar? What was different? Use words vibration, sound waves, and frequency while discussing.*

Leo Delibes (1836-1891) was a French composer who wrote over 30 ballets, operas and other works for the stage. He developed his interest in music due to his mother, who was a very talented musician. Delibes became an excellent organ player and started taking voice lessons. In 1876, Delibes wrote *Sylvia* which is known to be one of his most notable works. In the movement "Pizzicato" of *Sylvia*, Delibes uses pizzicato in the string section to make the piece feel lighthearted and playful.

Discuss: *What do you think? Does it seem playful to you? What about "Pizzicato" seems playful?*

As students listen, have them trace the shape of the melody (up for high notes and down for low notes) in the air or on paper. By drawing, they'll have a picture to show the high and low pitches from the strings.

LISTEN: "Pizzicato" from *Sylvia,* Ballet Suite by Leo Delibes www.youtube.com/watch?v=HoUxxQIUV7o

Discuss: *Which instruments make up the string family in the orchestra? (refer to page X for reference) How does their size affect the sound they produce? (larger instruments produce the lowest tones)*

INTERESTING FACTS

Why do you see lightning before you hear its thunder? Light travels much faster than sound. The sound of a thunder clap is caused by lightning heating air molecules and pushing them outward, setting up an enormous sound wave.

The loudest natural sound on earth is of an eruption of a volcano.

Did you know there is no sound in space? There are no objects in space for the vibrations to bounce off of.

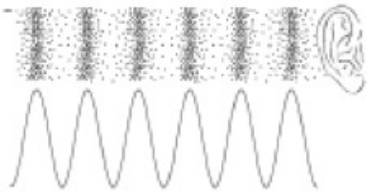
Many animals, like horses, rabbits, giraffes – have muscles that allow them to swivel their ears toward a sound without turning their heads. This is useful when they want to listen for danger. Human ears aren't built for swiveling, but the muscles do exist, and some people can wiggle their ears slightly. Are you one of them?

WATCH on YouTube at www.youtube.com/watch?v=Z9aTvb-Z6t0&index=7&list=RDa-GJm_v3PtA

If you have extra time, have the students watch the ballet performance of "Pizzicato" from *Sylvia* Ballet Suite by Leo Delibes, danced by Marianella Nunez

Sound from a ruler: pitch and frequency

Name:



Sound is the vibration of molecules, that move in waves to our ear.

Draw the experiment:

How does the **pitch** (high or low sound) change with the **length** of the ruler?

Do you see changes in the **vibration frequency**
(how fast the ruler goes up and down) when you change the length of the ruler?

From Sound lesson at www.ingridscience.ca/node/496

ACTIVITY 3
I'M ALL EARS

Materials: Large bowl, Plastic Wrap, Rice

Ask: *How do your ears hear sound?*

We know that sound travels in waves. To see how sound waves affect your eardrum, conduct a simple experiment with your students. Make a "membrane" by covering a large bowl with plastic wrap – stretch it tightly so it's like a drum. Sprinkle some rice onto the plastic wrap. Ask students to take turns clapping their hands close to the plastic wrap.

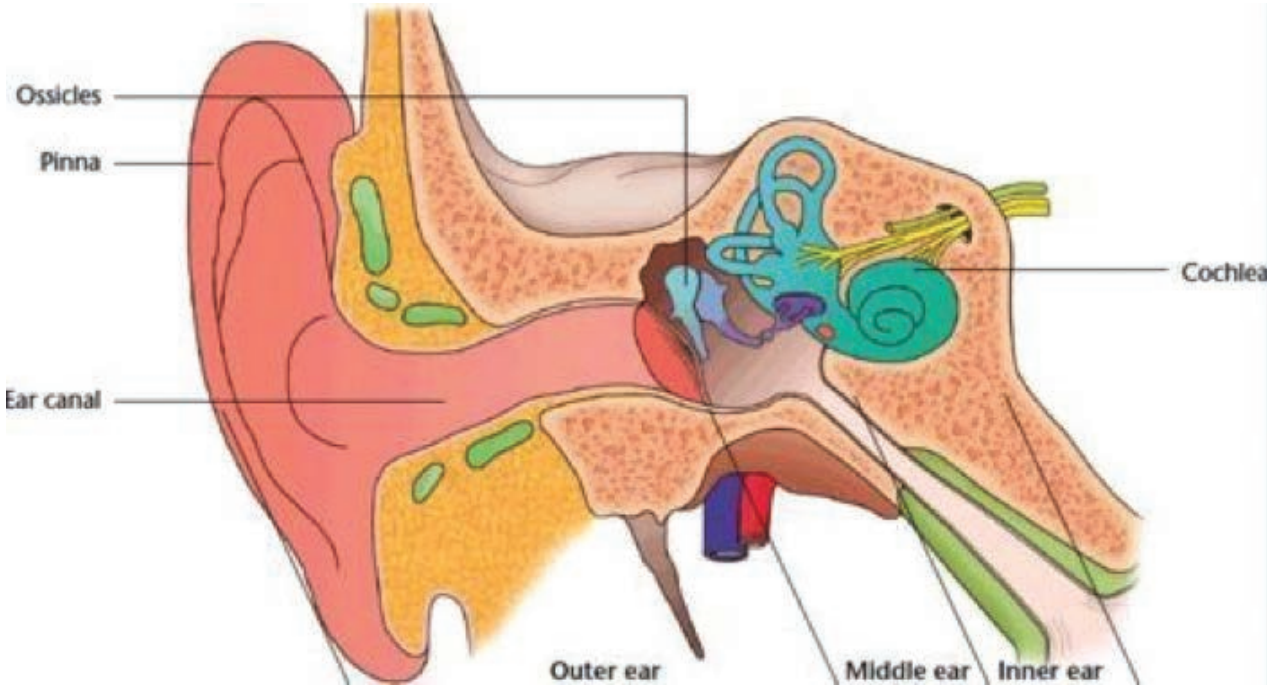
What happens to the rice when you clap your hands? Have students create louder noises (banging a metal pan) – what happens? Can you make the rice move by singing a note near the bowl? Does the pitch of the note you sing make a difference in the way the rice moves? Why?

The rice "jumps" when the plastic wrap vibrates. Sound waves cause the plastic wrap to vibrate, similar to the way that your eardrum vibrates in response to sound. Like the rice, the tiny bones (called ossicles) in the middle ear vibrate in response to vibration in the eardrum. When the ossicles vibrate, it creates movement of the fluid in the inner ear, called the cochlea. Movement of the cochlea creates changes in the hair cells, which send electric signals up the auditory nerve to the brain. The brain interprets these signals as sound.

Can you think of an instrument similar to the bowl with the rice moving on top? The snare drum! The drum head is like our bowl with plastic wrap and the metal snares are like the rice that move when the drum vibrates.

WATCH on YouTube at https://youtu.be/YG3NRw2pLCM

Meet DSO Percussionist, Andres Pichardo-Rosenthal, modeling the snare drum with and without the snares down. Do the snares move in response to sounds in the room besides the drum being hit?
Our eardrums vibrate in response to sound waves, just like the snares and the rice jumped from the drum head and the plastic wrap vibrating.



ACTIVITY 4
WRITING MUSIC WITHOUT SOUND

Ludwig van Beethoven is considered one of the most important figures in the history of music. Beethoven was born in 1770 in Germany and was recognized as a musical prodigy. He wrote countless pieces for voice and instruments that many of you may be familiar with already. Although he was a very successful musician and composer, his personal life was a struggle against deafness, especially during the last 10 years of his life (which is when most of his important works were composed). Around the age of 26, Beethoven began to hear buzzing and ringing in his ears. He tried to keep this a secret, fearing his career would be ruined if anyone found out. Beethoven revealed in a heart-wrenching 1801 letter to his friend Franz Wegeler, "I must confess that I lead a miserable life. For almost two years I have ceased to attend any social functions, just because I find it impossible to say to people: I am deaf. If I had any other profession, I might be able to cope with my infirmity; but in my profession it is a terrible handicap."

Written by Beethoven, dated July 1st, 1801

Beethoven's Symphony No. 9 was completed in 1824 and remains his most towering achievement. It is said that he wrote this symphony while completely deaf. But how was he able to write without hearing sound? Because Beethoven had been listening and studying music for some time, he used his imagination of what the music should sound like and wrote them down. Some even say that because Beethoven had to rely purely on imagination of his music, he was able to create more freely than ever before!

As you listen to the final movement of Beethoven's 9th Symphony, listen for the melody and try to follow along with your hands. When the pitch goes up, make your hands go up. Sway your body back and forth and follow the beat. Close your eyes and listen to what Beethoven wanted you to hear.

LISTEN: Symphony No. 9 in D minor, Op. 125 IV. Allegro assai (excerpt)
https://youtu.be/fT7si9jAw-g

LOWER ELEMENTARY LISTENING EXTENSION

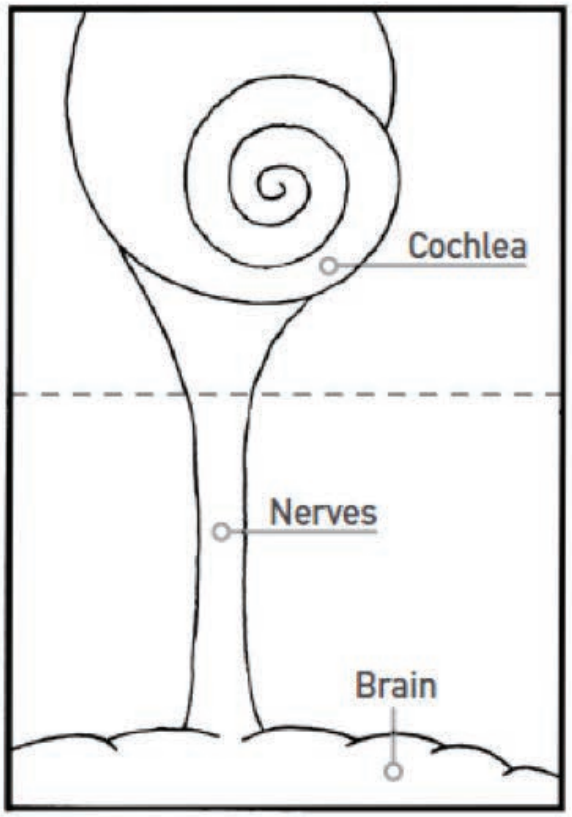
Play "Name That Sound". Students put their heads down while their teacher or a student makes 3-5 sounds. Be creative and use items you use every day! Can students identify what they heard?

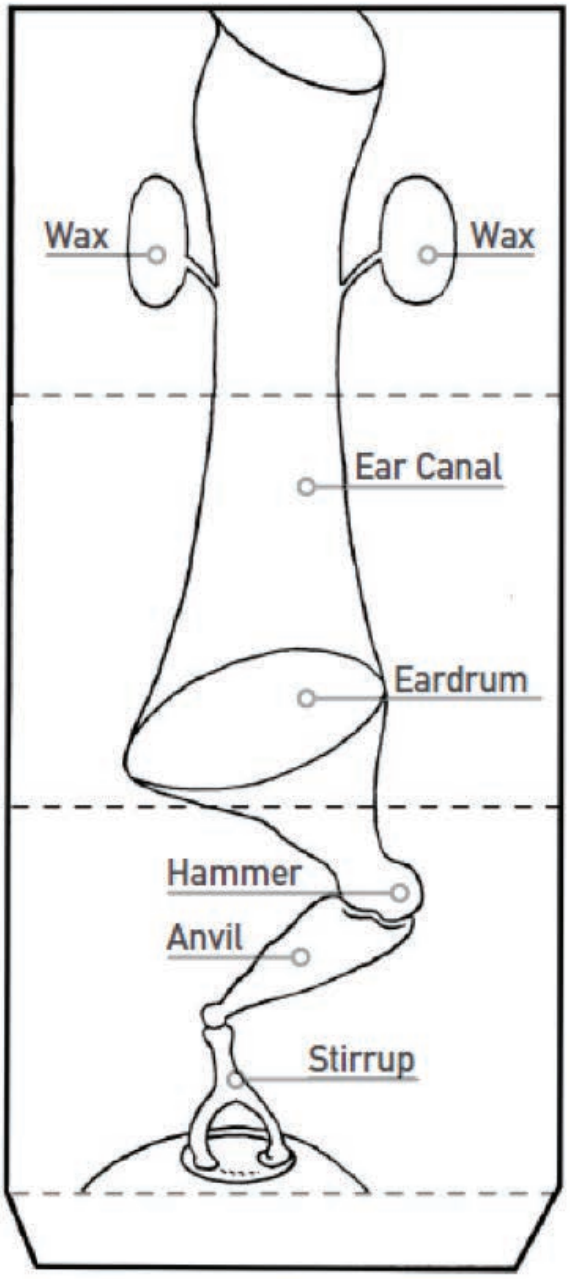
UPPER ELEMENTARY EXTENSION

Construct a 3D example of the ear using the "I'm All Ears" worksheet.

I'm All Ears

Construct a mini-model of the ear. Cut out the three diagram pieces and tape them together to make one long strip. Fold the strip along the dotted lines so that the ear is facing outward.

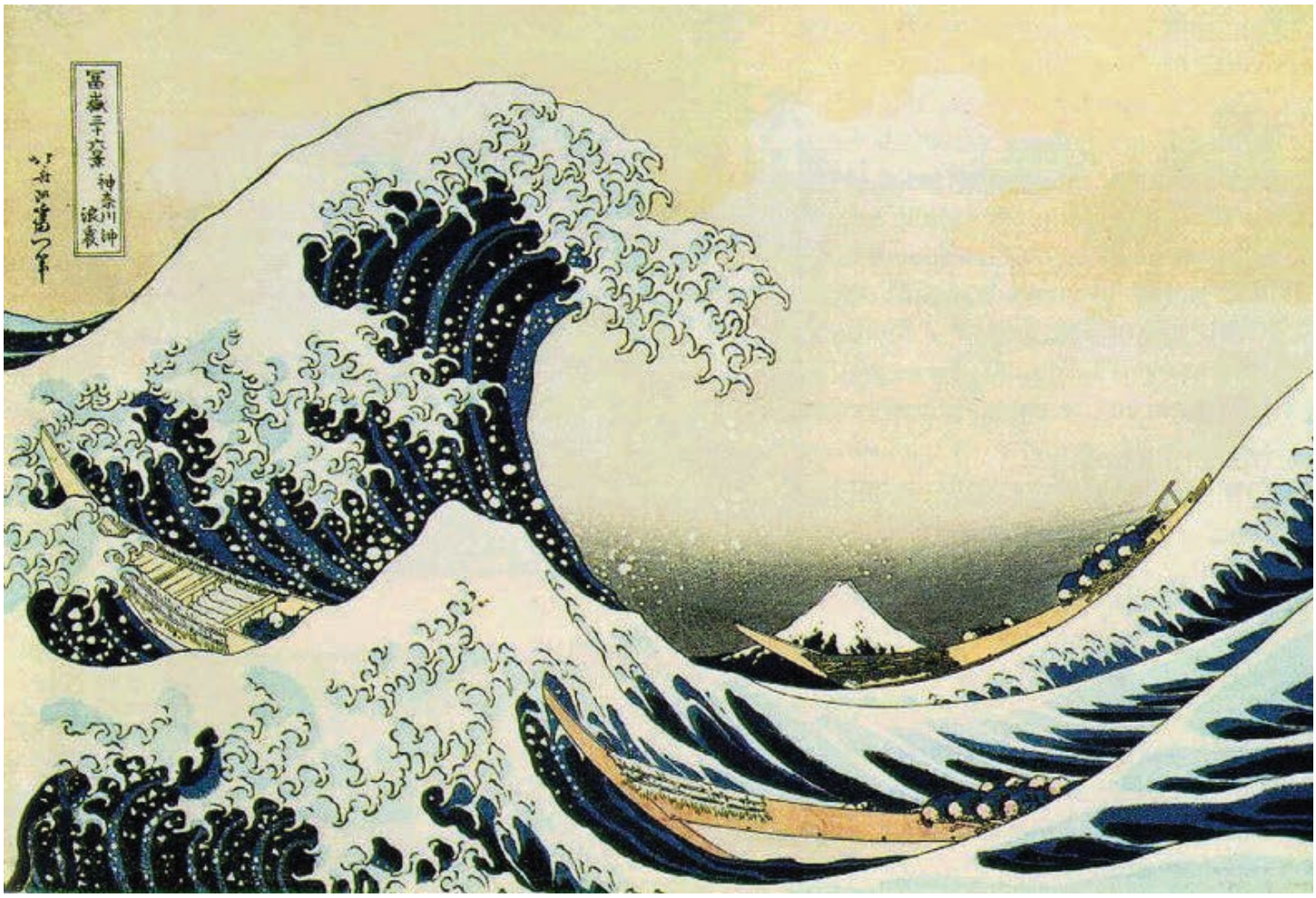




Unit 2
Felix Mendelssohn's Roaring Sea

Like the restless sea, music can churn with intensity or glimmer with calm. Just as waves vary in the sea, sound waves vary in intensity. Felix Mendelssohn captured the roaring sea and howling winds in his piece "The Hebrides Overture". In this unit, students will study characteristics through art, music, and science. Discover how musicians vary dynamics to create captivating melodies. Respond to Mendelssohn's stormy piece by drawing a wave inspired by Hokusai's painting, "The Great Wave".

LOOK at the image of Hokusai's "The Great Wave". *What is the mood created with the waves? What is happening in the painting? What is going to happen?*



ACTIVITY 1
MAKING WAVES

Materials: slinky

VOCABULARY:

amplitude – the extent of a back-and-forth movement (as of a pendulum) measured from the midpoint to an extreme

dynamics – volume in music

forte – Italian for loud in music

piano – Italian for soft in music

Discuss: *Where do we see waves or examples of wavelike motion*? (Some examples include: waves washing up on a sandy shore, circles rippling out from a stone dropped in water, a duck shaking its tail, a stadium wave, a slinky, and an arm waving hello/goodbye). *Thinking about what you already know about waves, how would you describe them?*

Sound waves can be described through both how quickly they vibrate (frequency) and how much energy they carry. **Amplitude** describes the energy in a sound wave. Waves with less energy have smaller amplitudes and produce quieter sounds. Waves with more energy have bigger amplitudes and produce louder sounds. The volume (loudness and softness) of a sound depends on the amplitude of the vibrations. The musical term for volume is **dynamics.** The Italian word "Forte" describes a loud sound and "Piano" means a quiet sound.

Below is an example of dynamics written in a musical score. The "F" in the beginning represents "Forte" and "P" represents "Piano.

Excerpt from "Starburst" by Jessie Montgomery

Using a Slinky, demonstrate frequency and amplitude in a sound wave. Allow two students to hold either end of the slinky and take turns pushing to create a wave. Create a low frequency wave with a slinky by moving it slowly, and create a high frequency wave by moving it rapidly. Students can try to simulate what high and low amplitude waves look like with their slinky by using greater force for bigger amplitude.

WRITING EXTENSION

Record and define vocabulary words. Draw what the Slinky would look like if it was a sound wave with a loud sound. Draw a second wave to demonstrate a quieter sound.

ACTIVITY 2
EXPLORING MENDELSSOHN'S SEA AND "THE GREAT WAVE"

German born composer Felix Mendelssohn was a musical prodigy. He started composing at age 10 and within two years, he had composed five symphonies and two operas! Mendelssohn loved to travel, which inspired some of his best music – his "Scottish" and "Italian" symphonies. When Felix Mendelsohn traveled to a remote cave off the Scottish coast, called Fingal's Cave, he put his impressions from his exploration into music, capturing the air of hushed mystery, dark mists and a restless sea. He used loud and soft sounds, or amplitudes, to create a mysterious and brooding piece.

As you listen to the sounds created though varied amplitudes (dynamics), create a response in your music listening journal. Either write a short story based on what might happen at Fingal's Cave, or what is happening in "The Great Wave" or create your own drawing of great waves inspired by Felix Mendelssohn's *The Hebrides Overture*. Share responses as a class and what from the piece stood out.

LISTEN: *The Hebrides Overture,* Op. 26, "The Fingal's Cave" by Felix Mendelssohn

www.youtube.com/watch?v=zcogD-hHEYs

LITERACY EXTENSION

Read The Great Wave: A Children's Book inspired by Hokusai.

MUSIC EXTENSION

Debussy was inspired by Hokusai's painting "The Great Wave" to create a piece capturing the sea, which resulted in "La Mer". Listen to "La Mer" by Claude Debussy. What similarities exist with Mendelssohn's Hebrides Overture? What is different? What moods are created with each piece?

UNIT 3
The Orchestra

Musicians produce amazingly different sounds in the orchestra, yet are able to listen and blend together into one powerful, unified sound. With the basics of sound production defined, students will explore and discover the different sounds of the orchestra by learning more about the instruments and how they are played. Your students can work together to create a class instrument and extend the learning to make individual instruments that can perform two pitches. Play these homemade instruments to model scientific sound terms.

ACTIVITY 1
THE ART OF LISTENING

How we perceive a piece of music is affected by what we pay attention to as we listen. How we see our world and our surroundings are also affected by what we focus on. Choose one thing in your classroom to find and observe. Guide your students to focus on a specific color or shape. Have the students share some of the things they find. Discuss: *Did you find anything that you noticed for the first time? How did the 'focus' help you see your findings?* Repeat this exercise with a different focus.

This exercise can be applied to listening as well. Some of the different focuses we can use while listening to music include: dynamics (volume), pitch (high and low), tempo (speed), rhythm, melody, mood, etc. Concentrating on the focuses may help you be better engaged at listening to music. Let's give it a try.

LISTEN: *Classical Symphony,* Op. 25 (Symphony No. 1) I. Allegro con brio by Sergei Prokofiev
www.youtube.com/watch?v=NOwbuuebmCU

LISTEN: *Classical Symphony,* Op. 25 (Symphony No. 1) IV. Finale: Molto Vivace by Sergei Prokofiev
www.youtube.com/watch?v=co-gL6pskwQ

Have the students choose one thing to focus on while listening to the recordings. Students should try to listen for this element and see where the focus leads. Split your students up into groups and task each group with a focus element. Allow time for the students to discuss their observations. When listening to the piece for the second time, what new things did the students notice? You can repeat this activity with any of the pieces in the Teacher Resource Guide.

WATCH on YouTube at https://youtu.be/Db0K1CI8Uz0

Meet DSO Musician Kenneth Thompkins, Principal Trombone, describe his instrument. Discover what instrument family the trombone is a part of and how the it produces sound!

EXTENSION

Invite your class to take this exercise home to try with their families. Have the students share with their parents and siblings on their new listening skills. They can use any type of music they'd like! They'll be surprised on all the new discoveries even in music that is already familiar to them!

ACTIVITY 2
INSTRUMENT INVENTION

Materials: 8 mason jars, jug of water, 3 metal spoons

With your students, create musical instruments and discover how instruments make sound up close.

Water Xylophone

Using glass mason jars, fill 8 mason jars with water and take turns filling glasses to find 8 different pitches that move from low to high. Test the pitch of each jar by tapping a spoon on the glass. As the class builds the water xylophone, discuss scientific vocabulary: What is vibrating? Does a higher frequency mean more or less water?

WRITING EXTENSION

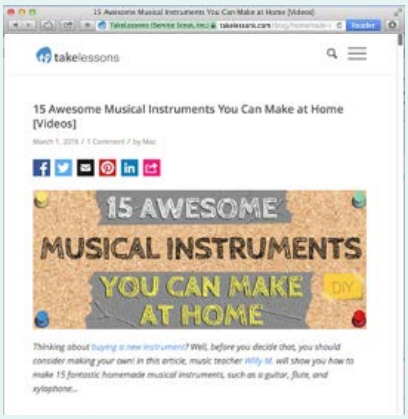
Explore and learn about the string, woodwind, brass and percussion families. Descriptions can be found on pg. 24-25 in this guide. Have the students write down their new findings. Have the students share in their journals what instrument they'd like to learn, and why? Do you have a question for a member of the orchestra? E-mail your questions to clintern@dso.org.

ART AND MUSIC EXTENSION

Music teachers may want to build the water xylophone to match a major scale, or with pitches that students can match on the recorder. Try a duet!

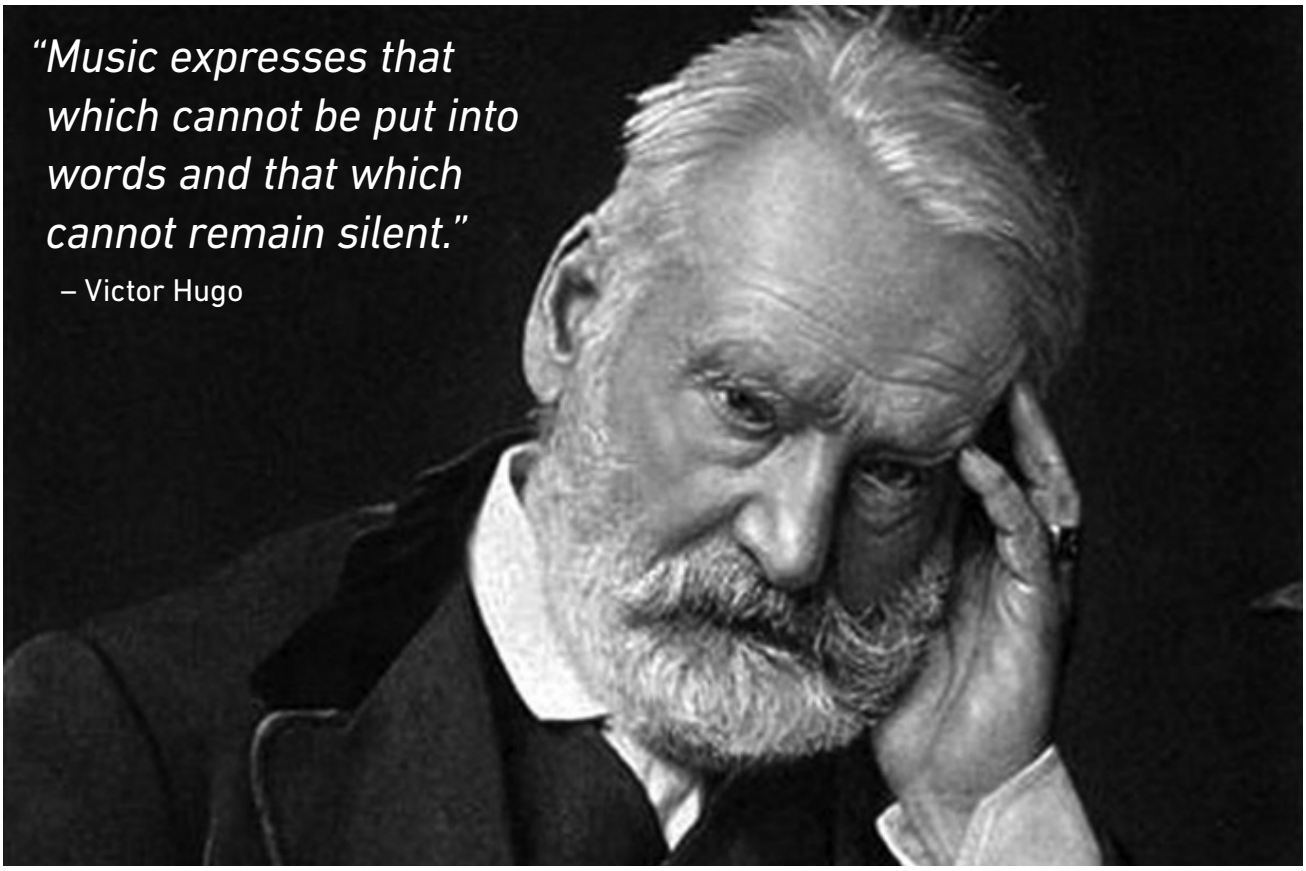
FAMILY PROJECT

Students can make their own instruments from materials at home. Define what instrument family it falls under and produce at least two pitches on the instrument.



For tutorials, visit https://takelessons.com/blog/homemade-musical-instruments-z15

UNIT 4
Making Waves of Change



Science happens when something changes. Air molecules are pushed around to cause vibrations which make sounds waves. What positive changes can you create in your own life, neighborhood, community that will cause vibrations and make waves? Discover how long melody lines of the trumpet in Copland's *Fanfare for the Common Man* affect the full piece. Create a mural as a class based on the galactic piece "Starburst", by Jessie Montgomery. Students are lead through thought-provoking questions on how one student can create a positive change for good, as well as work with others to make an even bigger impact.

ACTIVITY 1
A FANFARE FOR ALL

Each of us has the power for change. If you want change, be the change. Something big always begins with a small change. *What change do you see a need for? Why? What can you do to make that happen?*

75 years ago, an American composer, Aaron Copland, wrote a piece called *Fanfare for the Common Man.* This piece was written during World War II. Millions of men and women were enlisted in the military. Food and fuel were rationed. Businesses, factories, and workers stopped making cars and many consumer goods instead manufactured aircraft, tanks, guns, bullets, and bombs for the war. Even school kids helped in collecting scrap metal, rubber, and other materials needed for the war effort. Aaron Copland wrote this piece and titled it *Fanfare for the Common Man,* which was inspired by Henry Wallace, Vice-President of the United States during Franklin D. Roosevelt's third term. Wallace once said in a speech that the twentieth century was "the century of the common man."

Fanfare for the Common Man has been played at the Olympic games, Presidential Inaugurations, and other important events. As you listen to Copland's "Fanfare", which instrument is prominent and carries the main melody? How does this one instrument shape the piece? Why do you think this piece was chosen to be a theme song for the Olympics?

LISTEN: *Fanfare for the Common Man* by Aaron Copland
www.youtube.com/watch?v=4NjssV8UuVA

ACTIVITY 2
WORKING TOGETHER TO MAKE A DIFFERENCE

Imagine the night sky. What do you see? Starburst is the rapid formation of large numbers of new stars in a galaxy at a rate high enough to alter the structure of the galaxy significantly. When you join in partnership with others, your change can make an even greater difference, like a starburst, and you can alter your community significantly! Listen to the descriptive, moving music of Jessie Montgomery. What stood out to you in the music? How does the music sound like a starburst?

Jessie Montgomery is a living composer, born in 1981, composed a piece call "Starburst". She wanted her piece to capture the imagery of rapidly changing musical colors. Montgomery adds, "Exploding gestures are juxtaposed with gentle fleeting melodies in an attempt to create a multidimensional soundscape."

As you listen to Starburst, imagine the explosions and the creation of a new galaxy. Use large mural paper to create a classroom "starburst" mural – everyone coming together like a starburst to create a new artwork. Draw the mural as you listen to the music. Paper can be taped to the floor or to the wall to make it accessible to many students at the same time.

LISTEN: Starburst by Jessie Montgomery
www.youtube.com/watch?v=o2ctje9-IPE&t=42s

Discussion: What is one thing your classroom could do as a team to alter your school like starburst? How can you make that change together?

WATCH

Learn more about how stars are born by watching this video on YouTube
www.youtube.com/watch?v=80eMTnnLjhs

HOW TO HAVE A GREAT DAY AT ORCHESTRA HALL

Attending or viewing a concert is an exciting experience. If you are watching live at Orchestra Hall, or live via webcast, the following guidelines will help make this event more enjoyable for you and other viewers.

Before the concert:

- Be sure to turn off any electronic devices.
- Use the restroom before the performance begins so you don't miss any of the music or disturb other listeners.

On Stage:

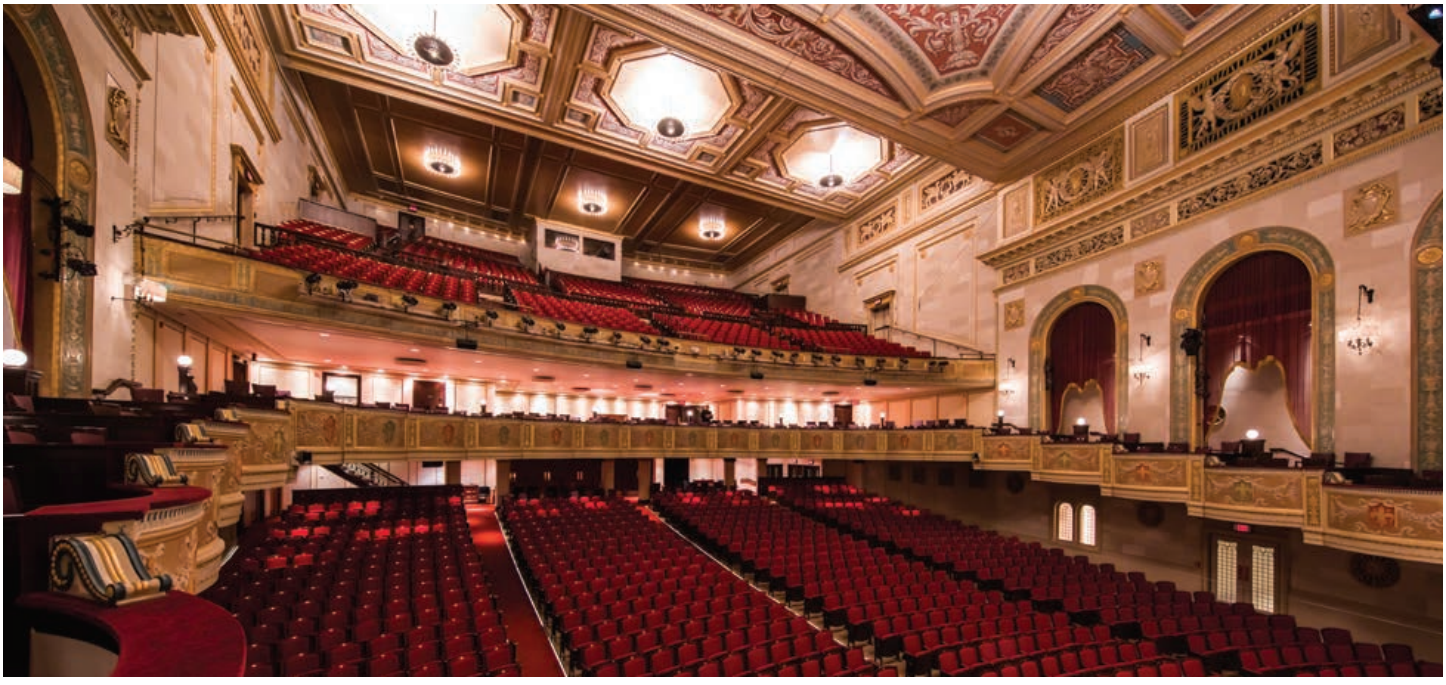
- The orchestra will start to gather on stage and will begin to warm up.
- The concertmaster – the violinist who sits in the first seat on the conductor's left hand side – will enter last. When you see him/her enter, quiet down right away. The orchestra will begin to tune their instruments. It's quite a magical sound and a tradition to the start of an orchestra concert.
- Next, the conductor will walk on the stage.
- How do you know when a piece ends? Watch the conductor. When he/she turns around toward the audience, then that piece is finished and you can show your appreciation by applauding.

Groups at Orchestra Hall:

- Ushers will show your group where to sit. Your teachers and chaperones will sit with you.
- Settle right in and get comfortable. Take off your coats and put it under your seat.
- If you get separated from your group, ask an usher to help you.

What to listen for:

- Observe and watch the conductor and see whether you can guess which instruments will play by where the conductor is looking or pointing.
- See you if you can name the instruments that are playing.
- Listen for melodies that you learned in your classroom.
- Choose a favorite moment in the music to share with a friend or family about later.



MEET THE CONDUCTOR

Michelle Merrill

Rapidly rising conductor Michelle Merrill currently serves as the Associate Conductor of the Detroit Symphony Orchestra where she also carries the title of Phillip and Lauren Fisher Community Ambassador. A passionate and dynamic artist, Ms. Merrill was named as one of Hour Detroit Magazine's 3 Cultural Organization Leaders to Watch, and was recently profiled by the Ford Motor Co. for their website fordbetterworld.org. She is also a recipient of a 2016 Solti Foundation U.S. Career Assistance Award.

Recent and upcoming engagements include the Toronto Symphony Orchestra, Jacksonville Symphony, Toledo Symphony Orchestra, Louisiana Philharmonic, Symphoria (Syracuse), Sacramento Philharmonic & Opera, Boise Philharmonic, Orlando Philharmonic, New Music Detroit, and the Northeastern Pennsylvania Philharmonic, where she formerly served as Assistant Conductor before coming to Detroit. As the Associate Conductor of the Detroit Symphony Orchestra, she helps plan and conduct over 30 concerts per season, including the renowned educational webcasts, which have reached over 100,000 students to date in classrooms throughout the nation. Ms. Merrill also gives pre-concert lectures, leads adult music education seminars, engages with students in and around Metro Detroit, speaks on behalf of the DSO throughout the community, and participates in hosting Live from Orchestra Hall, the DSO's free concert webcast that launched in 2011 and is now watched in more than 100 countries. She made her classical subscription debut with the DSO in April 2016.

In March of 2014, Ms. Merrill stepped in on short notice with the Meadows Symphony Orchestra for their performance of Shostakovich's Symphony No. 4, which music critic Scott Cantrell of the Dallas Morning News described as "stunning" and later named to his list of Top Ten Classical Performances of 2014. She was awarded in 2013 the prestigious Ansbacher Conducting Fellowship by members of the Vienna Philharmonic and the American Austrian Foundation, which enabled her to be in residence at the world-renowned Salzburg Festival. Recent praise came from her classical debut with the DSO conducting Beethoven's Symphony No. 6: "from the off this was a heavenly 'Pastoral'...Merrill (conducting from memory) certainly has an ear for focused inner parts, and her meaningful flexibility was welcome...There was something reassuringly old-world about this performance (reminding of but not emulating such views of the music as Böhm, Boult and Klemperer) yet with a New World bloom that trod freshly-mown grass and also looked skywards..."

A strong advocate of new music, Ms. Merrill recently conducted the world-premiere performance of Gabriela Lena Frank's "Walkabout: Concerto for Orchestra" with the Detroit Symphony Orchestra. She also worked with composer Gabriela Lena Frank and soprano Jessica Rivera in 2015 on Frank's work "La Centinela y la Paloma" (The Keeper and the Dove), as a part of numerous community programs related to the Diego Rivera and Frida Kahlo exhibition at the Detroit Institute of Arts. This past fall, Ms. Merrill collaborated with New Music Detroit for their annual marathon Strange Beautiful Music 9, which featured David Lang's "are you experienced?" and the world-premiere of Andrew Harrison's "Hum" based on the poetry of Detroit native Jamal May. In June 2015, she made her debut at the St. Augustine Music Festival conducting the world-premiere performance of Piotr Szewcyzk's "St. Augustine Suite" which was written in honor of that city's 450th anniversary. The highly praised performance was later featured nationwide on NPR's "Performance Today." Additionally, her work in the 2011-12 season with Voices of Change, Dallas' professional contemporary music ensemble, was part of a program later named as one of Dallas Morning News critic Scott Cantrell's Top Ten Classical Performances of 2011.

Born in Dallas, TX, Ms. Merrill studied conducting with Dr. Paul C. Phillips at Southern Methodist University's Meadows School of the Arts, where she holds a Master of Music Degree in conducting and a Bachelor of Music in performance. Apart from music, she loves cooking, running, hiking, and spending time outdoors with her husband, Steve Merrill, who serves as the principal percussionist of the Jacksonville Symphony.

MEET THE HOST

DJ Oliver

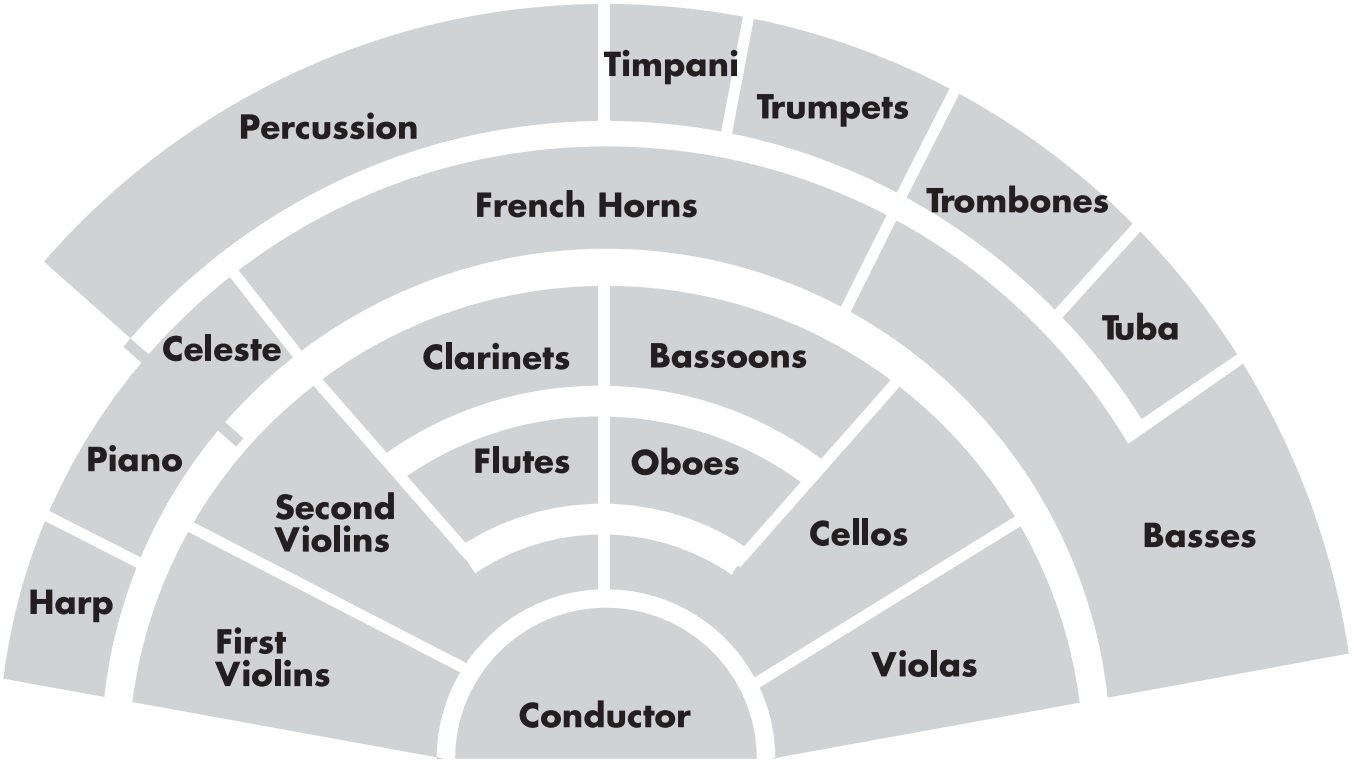
A Detroit native, D.J. Oliver attended Wayne State University and received a Bachelor's of Fine Arts. D.J. has worked as a lead performer for Carnival and Norwegian Cruise Lines. In addition to his theatre and live performances, D.J. has booked many Commercials and Industrials films as well TV shows. His most recent credit was on the ABC show Detroit 187. He currently hosts the Detroit Public Television Series "Detroit Performs." D.J. is thankful and humble to return to the DSO.

MEET THE CO-HOST

Charles Gibson

Charles Gibson is an experienced museum professional, informal educator and dynamic public speaker with a passion for teaching science. He developed and oversees the Traveling Science and ECHO (Distance Learning) programs at the Michigan Science Center (MiSci) that impacts over 90,000 people annually. Highlighted during a talk at TEDxDetroit 2015, he uses large-scale demonstrations that often explode and creates memorable experiences that drive curious minds into the STEM career pipeline. He is heavily involved in innovative program development that expands the reach of MiSci and engages new audiences.

ORCHESTRA SEATING CHART



INSTRUMENTS OF THE ORCHESTRA

STRING FAMILY

The strings have made up the backbone of the western orchestra for more than three hundred years. The four major instruments in the string family, the violin, the viola, the cello and the double bass, are built the same way. The instruments are made of many pieces of wood, which are glued — never nailed — together. The bodies of the instruments are hollow, making them a resonating box for sound. Four strings made of animal gut, nylon, or steel are wrapped around pegs at one end of the instrument and attached to a tailpiece at the other. They are stretched tightly across a bridge to produce their assigned pitches. The body of the violin alone consists of over 70 parts that must be put together by a master craftsman.

The **violin** is the smallest member of the string family and is known for its extraordinary musical versatility. Its versatility along with its four-octave range has inspired composers to write extensively for the instrument. It is played with a bow and held under the chin. It plays the highest notes and is recognized by its beautiful singing tone.

The **viola** is slightly bigger than the violin and is also played with a bow and held under the chin. The sound of the viola can be distinguished from that of the violin because of its darker, warmer and richer tone qualities.

The **cello** is also played with a bow. Unlike the violin or viola, it is too large to be placed on the shoulder, so it is played sitting down, resting on its "end pin." Because of its size and the thickness of its strings, the cello can produce beautiful, rich deep tones.

The **double bass** is the largest and lowest-pitched bowed string instrument and must be played standing up. In orchestras and other musical ensembles it has a rather special role — it is often given the job of being the "foundation of the orchestra."

One of the oldest instruments, the **harp** dates back as early as 3500 BC. The modern concert harp typically has 47 strings and is six feet tall. It has pedals around its base that allows the performer to alter the pitch of the strings so different notes be played on the same string. Smaller harps, and even lyres, are still used today in the performance of folk music around the world.

WOODWIND FAMILY

The woodwind family got its name because they were originally all made of wood (the flute is now made of metal) and air, or wind, is needed to play them. Woodwind instruments make sounds in three different ways. The flute makes a sound by blowing air through an opening in the head joint. The clarinet uses a single reed, made of one piece of cane, to produce sound. When air is blown against the reed, which is attached to a mouthpiece, it vibrates to make sound. The oboe and bassoon use a double reed, or two pieces of cane vibrating against each other, to make a sound.

The **flute** was originally made of wood. It has no reed and sound is produced when air is blown against a hole in the headjoint (opening). This sends vibrations into the attached tube to produce sound. A shorter version of a flute, about half of its size, is called a piccolo. It plays the highest notes of all of the woodwinds.

The **oboe** is smaller than the clarinet and uses a double reed. It is made of a hard wood and has metal keys. The oboe is responsible for tuning the orchestra before each concert.

A larger version of the oboe, called the **English horn,** is frequently used in the orchestra. Like the oboe, it has a double reed and uses many of the same fingerings. The instrument has a slightly lower range than the oboe.

The **clarinet** looks much a like an oboe — made of a hard wood, with metal keys. The difference is that the clarinet uses a single reed. The clarinet comes in different sizes. The standard Bb clarinet is just over 2 feet long.

The **bassoon** uses a double reed and is about four times the size of an oboe. If the curved tubes in the bassoon were straightened, it would be about nine feet long! The bassoon sounds in the tenor and bass registers.

The **contrabassoon** is a larger version of the bassoon that can play many of the same notes as a bassoon, but sounds them one **octave** lower.

BRASS FAMILY

Brass Family instruments produce their sound when the player buzzes his/her lips while blowing air through a metal, cup-shaped mouthpiece. The mouthpiece connects to a length of brass tubing that ends in a bell. The smaller instruments have less tubing and produce a higher sound. The bigger instruments have more tubing, which produces a lower sound. Most of the brass instruments have valves, which open up different lengths of tubing, changing the pitch. The members of the brass family are the loudest in the orchestra and can trace their ancestry back to herald trumpets, hunting horns and military bugles.

The **trumpet** plays the highest notes in the brass family. Some types of trumpet-like instruments were some of the earliest human artifacts! Trumpets come in many different sizes and keys.

The **horn** consists of up to 18 feet of narrow tubing wound into a circle. It evolved from 16th century hunting horns.

The **trombone** is played with a mouthpiece, larger than the trumpet, and shortening or lengthening a large slide controls pitch. Its sound is lower than a trumpet but higher than a tuba. The trombone has about nine feet of tubing!

The **tuba** is the lowest in the brass family and can have up to 18 feet of tubing! It is played by buzzing one's lips into a mouthpiece. Along with the string bass, it helps provide a foundation for the orchestra.

PERCUSSION FAMILY

The instruments in the percussion family are played by being struck, shaken, or scraped. There are two types of percussion instruments, tuned and untuned. The tuned notes play specific pitches, like the timpani. The untuned produce a sound with an indefinite pitch, like the cymbals. Percussion instruments add much color, variety and excitement to the orchestra. Drums are among the earliest instruments. Their ancestors can be found in Africa, Asia, the Americas, Europe and the Middle East.

The **snare drum** has two drumheads, one on the top and one on the bottom. Bands of metal wires are pulled across the bottom head to produce a buzzing or snapping sound when the drum is struck, giving it a rattling sound. The snare is an untuned instrument and is played using a variety of techniques.

The **bass drum** is built like a snare drum but without the metal snares. It is a very big instrument and produces a very low sound. The mallet is usually large and covered with a soft material, like sheep's wool or felt. The bass drum has been with the orchestra since 1782.

Cymbals are two large, metal discs that can be played by crashing one against the other or by hitting or scraping one or both with sticks or mallets. Cymbals come in different sizes and can produce a large variety of sound effects. Cymbals are an untuned percussion instrument.

The **timpani**, often called a kettledrum because of its looks, has a pedal mechanism which allows the musician to adjust the tension of the drumhead. This allows it to play different pitches. The timpani helps the orchestra with harmony, melody and rhythm. Most often, there are four timpani tuned to different pitches, played by one person.

In addition, in contemporary music, virtually anything can be used as a percussion instrument, including water glasses, scrap metal, car horns, and much more! Virtually anything that is struck with mallets or one's hands or body, whether pitched or unpitched, is considered a percussion instrument.

Perhaps the most recognizable and popular musical instrument, you might think the **piano** would belong to the string family, but it is actually a member of the percussion family because of how the instrument creates sound. The piano has a keyboard with 88 keys — the black and white bars you see — and each key is attached to a small, felt covered hammer. When a key is pressed, the hammer pops up and strikes the strings, which then vibrate creating specific pitches.

LITERATURE RESOURCES

Sounds All Around

(Let's-Read-and-Find-Out Science 1)

By Wendy Pfeffer and Holly Keller

Sounds are all around us. Clap your hands, snap your fingers: You're making sounds. Read and find out how people and animals use different kinds of sounds to communicate.

Oscar and the Bat: A Book About Sound

(Start with Science)

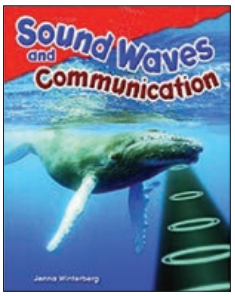
By Geoff Waring

When Oscar hears a blackbird singing in the meadow, Bat swoops in to talk to him about sound. A sudden thunderstorm and a visiting cow give Oscar lots of opportunities to learn about sounds that are loud or soft, near or far, deep or high.
Back matter includes an index and supplemental activities.

Sound Waves and Communication

(Science Readers: Content and Literacy)

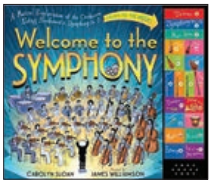
By Jenna Winterberg and Teacher Created Materials



Sound waves are all around us creating a multitude of different frequencies. Some we can hear, and some we cannot hear. Discover the ways in which animals, insects, and birds communicate through sound as well as how sound is beneficial for other uses — even if we can't hear it! High-interest, informational text paired with vibrant images and photos, intriguing facts, and a helpful glossary and index will keep readers engaged from cover to cover. A "Think Like a Scientist" activity that supports STEM instruction is included at the end of the book for students to apply what they've learned about sound.

Welcome to the Symphony

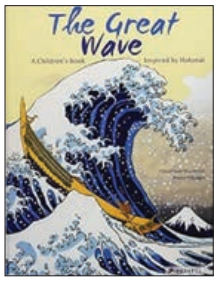
By Carolyn Sloan and James Williamson



Using one of the most famous works in classical music—Beethoven's Fifth Symphony—here is the perfect way to introduce a young child to the world of classical music. This charming and interactive picture book with its panel of 19 sound buttons is like a ticket to a concert hall, taking readers on a journey from the exciting first moment when the musicians begin tuning up to the end of the first movement (attention newcomers: don't clap yet!). At each step of the way, readers learn the basics of classical music and the orchestra: What is a conductor? What is a symphony? Who was Beethoven? The different aspects of music: melody, harmony, tempo, theme. And the families of instruments—strings, woodwinds, brass, and percussion.

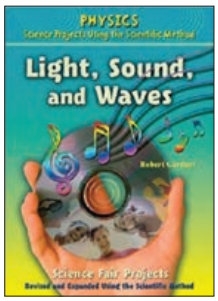
The Great Wave: A Children's Book Inspired by Hokusai

By Veronique Massenot and Bruno Pilorget



Hokusai's classic woodcut of a majestic wave becomes the starting point for a storybook children will want to read again and again.
On a stormy winter's day, a baby boy, Naoki, is swept into a fisherman's boat by a great wave. Years pass, but still Naoki does not grow. Must he return to the ocean in order to become a young man? The answer arrives in the form of a mythic fish. Japanese artist Hokusai is one of the world's most celebrated printmakers. His famous woodcut, "The Great Wave," epitomizes the artist's characteristic techniques and themes. In this children's book, the artist's masterpiece is the genesis for a simple but compelling story, beautifully illustrated in pictures that recall Hokusai's brilliant use of detail, perspective and color. A stunning reproduction of the woodcut itself is featured in the book, supplemented by information about the artist and his work. At once modern and classic, The Great Wave introduces young readers to a beloved artist and his timeless portrayals of nature and transformation.

Light, Sound, and Waves Science Fair Projects



By Robert Gardner

How are sounds produced? Does light travel in a specific path? Are all shadows black? Using easy-to-find materials and the scientific method, you can learn the answers to these questions and more. If you are interested in competing in science fairs, the book contains lots of great suggestions and ideas for further experiments.

Waves of Light and Scound

By Shirley Duke

Expanding on our popular Let s Explore Science series, this book focuses on light and sound. Every day, waves bring light and sound. A wave is a disturbance that travels through matter or space. Students will learn about electromagnetic and mechanical waves, the properties of waves and sound, pitch, amplitude, and the electromagnetic spectrum, as well as how all these things affect the products we use and even us as humans! This book will allow students to apply scientific ideas to design, test, and refine a device that converts energy from one form to another."

Story of the Orchestra

By Robert Levine and Meredith Hamilton

Eye-catching illustrations and an accompanying 70-minute CD make this an exciting and educational introduction to the world of classical music-from composers and music history to the instruments of the orchestra-for elementary age children (and parents, too!).

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