Alabama Symphony Orchestra

The

GREAT ORCHESTRA EXPERIMENT

Where Science Meets the Symphony!

Supplemental Teacher Guide

MUSICAL CONVERSATION

to have with your students before you attend "The Great Orchestra Experiment!"

Let's explore how each instrument family in the orchestra makes its sound!

THE STRING FAMILY

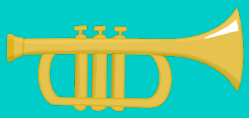
String instruments all produce sound in the same way. The violin is the smallest and nimblest of them all while the viola is a bit larger with a slightly deeper voice! The cello is like the gentle giant of the family with its long graceful neck and deep, resonant tones, and the double bass is the tallest of them all with a grand/mighty voice producing deep, thunderous tones. In all of these family members, when you pluck the strings or draw a bow across the strings, they **vibrate**. These vibrations travel through the instrument and make the air around it move, creating the beautiful sounds we hear.

WOODWINDS

Woodwind instruments, such as flutes, clarinets, bassoons, and oboes use air to produce sound either by vibrating a small piece of wood on the mouthpiece or blowing air through an opening. When the air travels through these instruments, the air inside wiggles and bounces around. These vibrations turn into beautiful musical notes!

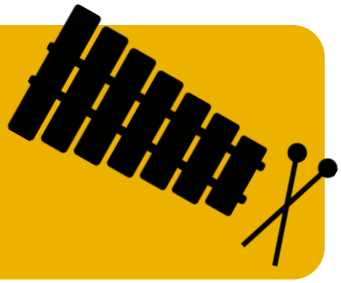
BRASS

Brass instruments, like trumpets, horns, trombones, and the tuba are like giant megaphones! When you buzz your lips into the mouthpiece, the air vibrates and makes the metal tube vibrate too. The shape of the tube helps turn those vibrations into rich, powerful sounds.



PERCUSSION

Percussion instruments come in many different forms! These instruments make sound when you hit, shake, or strike them. Whether drums, tambourines, or xylophones, each percussion instrument has its own way of making a noise.



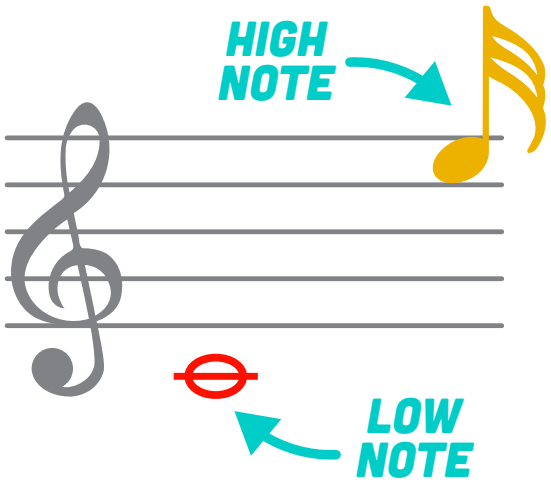
MUSIC NOTES

Imagine music notes are like different kinds of colorful building blocks. Each note is a special block with its own size and shape, and they all work together to make a beautiful music picture!

PITCH

Imagine you are on a playground with a set of swings. Some people swing high and some swing low. Pitch in music is a bit like how high or low those swings go. When you listen to music, think about how the notes may be placed high or low depending on what they sound like. Just like on the playground, these pitches create a fun and exciting musical adventure!

Photo Credit: Cottonbro Studio



LET'S EXPLORE THE IDEAS OF PIANO (P) AND FORTE (F) IN MUSIC IN A FUN WAY!

Photo Credit: Jeffrey Czum

PIANO (SOFT)

Imagine you're whispering a secret to a friend. When music is played piano, it's like whispering—soft and gentle. It's the kind of sound you'd hear when you're being very quiet, like a soft breeze or the gentle patter of rain. The notes are played softly so they don't jump out too loud, making the music calm and soothing.

Photo Credit: Pixabay

FORTE (LOUD)

Now, imagine you're shouting to your friend from across the playground. When music is played forte, it's like shouting—strong and loud. It's the kind of sound that grabs your attention, like the roar of a lion or a big drum beating. The notes are played loudly to fill the room with lots of energy and excitement.

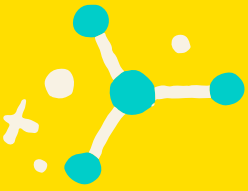
So, piano and forte are like two different ways to talk through music—one softly and one loudly. Just like how you can change the way you speak depending on what you want to say, musicians use piano and forte to add different feelings and moods to their music!

THERMAL ENERGY

Thermal is a fancy word for "heat" and this energy is produced when a rise in temperature causes atoms and molecules to move very fast and bump into one another.

Thermal energy is generated by the increased movement of atoms and molecules. We can take advantage of thermal energy properties to create electrical and heat energy for our home.
Some countries can use the heat from the earth to power their homes or communities. This is called **geothermal energy**. At a geothermal power plant, hot water or steam is pulled from the earth and used to turn a turbine, which turns a generator to create electricity. Most communities that can access geothermal power are located on or near seismically active fault lines.

In solar heating systems, we can use energy from the sun to heat our homes. In an active solar heating system, solar energy can be used to heat a liquid or air, which is then pumped through tubes in the home. The heat from the fluids in these tubes will radiate into the rooms of the home. In a passive solar heating system, homes are designed so that sunlight enters through south-facing windows and can heat the masonry (brick, stone, or tile) inside the home. Heat will radiate off the masonry to heat the home throughout the day. Homes designed with passive solar heating in mind may also have longer roof overhangs in order to block the angle of summer sunlight, which can help keep the home cool.



DID YOU KNOW?

The largest geothermal power plant in the world is located north of San Francisco, California! (Power Technology)

HYDRO POWER

Hydropower or water power, is the use of water to produce electricity or power machines.

Photo Credit: Frans van Heerden

In **hydropower**, moving or falling water turns a turbine, which then turns a generator to create electricity.

The most common way to generate electricity from hydropower is by constructing a dam across a river. The dam contains large turbines that are like giant wheels. The water from the river flow falls onto the spokes of the wheel and causes it to turn, which then turns a generator to create electricity. Dams rely on the stored potential energy in the water held behind the dam, called a reservoir. The water reservoir created by a dam can also be used for recreation, like boating and fishing, and as a water source for agricultural, industrial, commercial, and household use in the local community.Hydropower is a reliable source of energy because it is powered by gravity, which is always present.

DID YOU KNOW?

Every lake in Alabama (except Lake Jackson in south Alabama) was created by the construction of a dam! (Alabama Wildlife Federation)
Hydropower plants generate 7% of Alabama's total electricity! (Alabama Power)

WIND POWER

Wind is the movement of air and can range from light breezes to natural hazards such as tornadoes that can pack wind speeds of up to 300mph.

In **wind power**, moving air turns a turbine, which then turns a generator to create electricity. The most common way to generate electricity from wind power is by constructing a wind turbine. The wind moves the spokes of the turbine and causes them to turn, which turns a generator housed in the top of the wind turbine. Wind turbines can be built on land or in the ocean. Most wind farms are found in the middle of the United States, where wind speeds can be faster and more consistent due to the open plains. In some locations, the land under the wind turbines can be used for grazing livestock or growing crops.

Photo Credit: Kervin Edward Lara

DID YOU KNOW?

Most wind turbines on land are almost as tall or taller than the Statue of Liberty! (US Department of Energy)

ELECTRIC POWER

Lightning occurs when electrons or negative charges in the bottom of a cloud attract to protons or positive charges in the ground. A single stroke of lightning can heat the air around it to 54,000°F! This extreme heating causes the air to expand explosively fast creating a shock wave that turns into a booming sound known as THUNDER!

Electric power is created by agitating the electrons around atoms. When the electrons start to move in a stream from one atom to another, this creates electricity. This is what happens in a generator. The generator is usually connected to a turbine. When the turbine spins, the generator spins and creates a flow of electrons, which is how we get electricity.

Different forms of energy spin the turbine and generator in different ways. At power plants that are powered by coal or natural gas, the coal or natural gas is burned to heat water. As the water boils, it creates steam, which turns a turbine and then turns a generator to create electricity. At a nuclear power plant, the heat from the nuclear fission process inside the plant is used to create steam, which then turns a turbine and a generator. Renewable energy sources can also rely on a spinning turbine and generator, such as wind moving the blades of a wind turbine and water flowing over a turbine in a dam.

Photo Credit: Andre Furtado

DID YOU KNOW?

Natural gas is the most common energy source for electricity generation in the state of Alabama! (US Energy Information Administration)
Browns Ferry Nuclear Plant, located near Athens, AL, is the second largest nuclear power plant in the United States! (Tennessee Valley Authority)

SOLAR POWER

Solar technology can capture the sun's radiation and turn it into useful forms of energy.

In **solar power**, photovoltaic (PV) cells are used to capture the energy of the sun and turn it into electricity. The PV cells are made up of silicon. When light from the sun hits the silicon in the PV cells, the electrons in the silicon atoms start to move around, and this stream of electrons makes the electrical current used to power the home or community. Photovoltaic cells can be connected together to make solar panels. Solar panels can be installed on the roofs of homes or other buildings, or they can be installed on large patches of land as a "**solar farm**".

Most of the solar farms in the United States are located in western states, such as Texas, Arizona, Nevada, and California. These states have a high number of sunny days each year and can effectively capture solar energy to power communities in these areas.

Photo Credit: Tom Fisk

DID YOU KNOW?

Alabama has a few small solar farms, including one located in Cherokee, AL, and it produces enough electricity to power over **32,000 homes**!
(Solar Industries Energy Association)
Electricity generated from solar panels can be stored in a large battery so that homes can continue to use solar power at night or on cloudy days!
(US Department of Energy)

KINETIC ENERGY

Kinetic Energy is energy in motion! When something is moving, that means it has kinetic energy. The faster it moves, the more kinetic energy it has!

Photo Credit: Athena Sandrini

Most energy generation relies on the conversion of **kinetic energy** into electrical energy. This is accomplished by using steam, wind, or water to turn a turbine, which then turns a generator to create a stream of electrons to produce electricity.

Some examples of kinetic energy include a bicycle riding through the street or a roller coaster car racing down a hill. Can you think of some other examples of kinetic energy? Remember, everything has kinetic energy- even atoms!

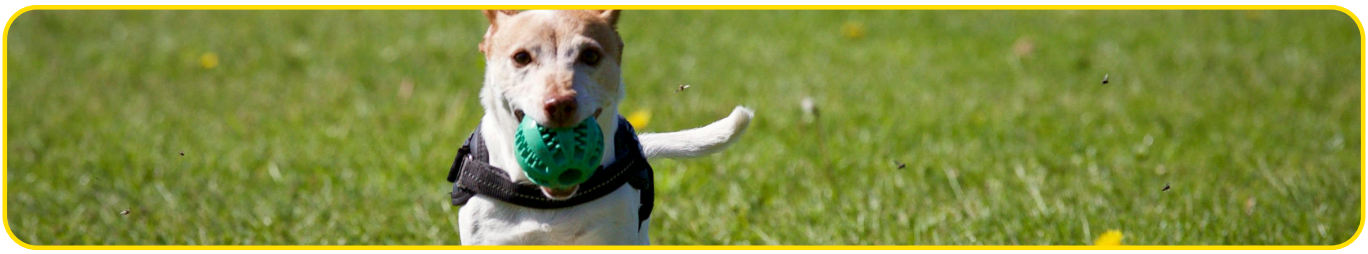


Photo Credit: Matthias Zomer

YOU'VE GOT A FRIEND IN ME

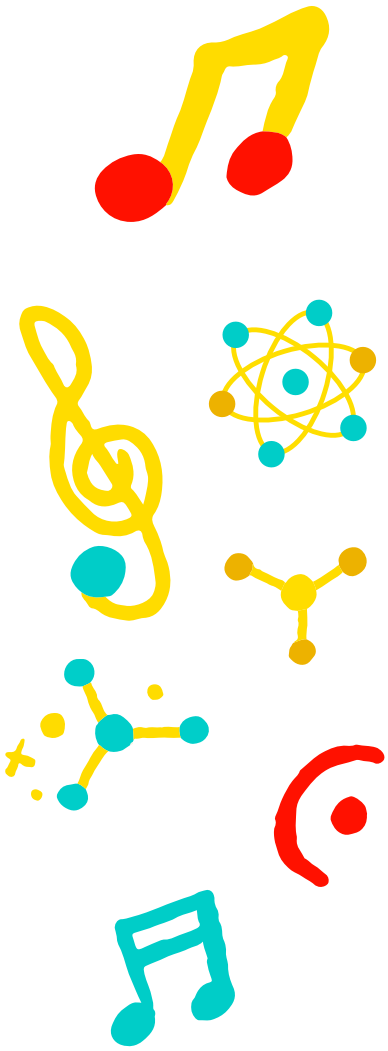
Sing-along Lyrics | *Music and Lyrics by Randy Newman*

You've got a friend in me.
You've got a friend in me.
When the road looks rough ahead
And you're miles and miles
From your nice warm bed,
You just remember what your old pal said.
Boy, you've got a friend in me.
Yeah, you've got a friend in me.

You've got a friend in me.
You've got a friend in me.
You got troubles, then I've got 'em too.
There isn't anything I wouldn't do for you.
We stick together we can see it through,
Cause you've got a friend in me.
Yeah, you've got a friend in me.

Some other folks might be
A little bit smarter than I am,
Bigger and stronger too, Maybe.
But none of them will ever love you
The way I do, it's me and you, boy.

And as the years go by
Our friendship will never die
You're gonna see it's our destiny
You've got a friend in me
You've got a friend in me
You've got a friend in me



ACKNOWLEDGEMENTS

This teacher guide is meant to supplement the education Young People's Concert, "The Great Orchestra Experiment!" It was written by Kelly Gronemeyer and Maria Wilson and designed by Candace Neal.

KELLY GRONEMEYER

Kelly Gronemeyer is a science teacher at John Carroll Catholic High School in Birmingham, AL, where she has taught Anatomy and Physiology for 12 years. She also teaches AP Environmental Science and has been an AP reader for the AP Environmental Science exam for three years. Kelly also serves as the colorguard director for the JCCHS Marching Band.

After graduating from Muscle Shoals High School, she attended Birmingham-Southern College, where she earned her B.S. in Biology and her Alabama teaching certificate. She also has an M.S. in Biology from John Carroll University in Cleveland, OH, where she focused on amphibians and tropical ecology. Outside of the classroom, Kelly loves to spend her time cooking and eating food, going on walks and hikes in the Birmingham area, and snuggling with her two pets: Sebastian (cat) and Biscuit (dog).

The Great Orchestra Experiment is an interactive concert that engages all the senses as students experience the orchestra through the lens of science, technology, engineering, and math! Commissioned by the Alabama Symphony Orchestra, written by Candace Neal with musical repertoire selected by Maestro Chris Confessore, prepare to go full STEAM ahead with The Great Orchestra Experiment!

World Premiere: November 7, 2024 at Samford University's Wright Center