DISCOVERY
SCIENCE CENTER

2nd GRADE

2nd Grade Science Content Standards: Physical Sciences

The motion of objects can be observed and measured. As a basis for understanding this concept:

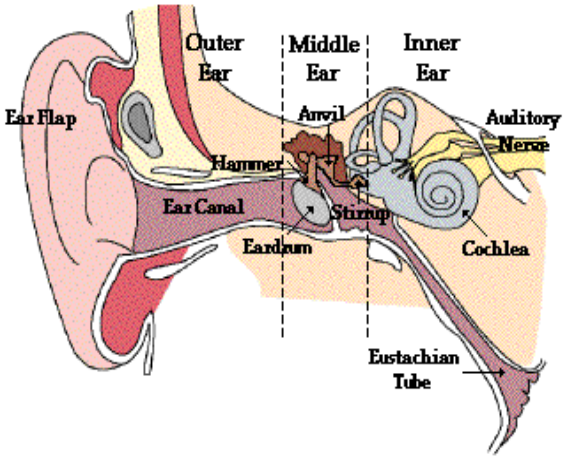
1. G. Students know sound is made by vibrating objects and can be described by its pitch and volume.

The following lessons and background information will focus on understanding that the motion of objects can be observed and measured.

Teachers: Sound

Sound is caused by vibrations moving through the air. To be more specific, sound is essentially a sensation our ears detect when an object produces waves of high and low pressure. Since our ears are so sensitive, our eardrums detect these changes in air pressure and pass a signal (sound) to our brain to interpret.

Sound travels in waves where one vibrating air molecule causes another air molecule to vibrate and so forth. Once vibrating air molecules arrive at the ear, the sound is collected by the external ear and funneled into the ear canal. The first obstacle that the sound waves encounter in the ear is the eardrum, which picks up the sound's vibrations. This vibration is transferred to three tiny ear bones, then to the cochlea, a coiled, liquid-filled tube that is lined with tiny hairs that also pick up the sound waves. These vibrating hairs connect to the auditory nerve that translates the vibrations into electrical impulses, which are then sent to the brain. The brain interprets these impulses as sound. The more waves produced every second, the higher the frequency and consequently, the higher the pitch.



Many animals can hear sounds at much higher frequencies (high pitch) than humans. Healthy young humans can only hear sounds in the range of 20 to 20,000 Hz. Dogs can hear frequencies as high as 40,000 Hz and dolphins can hear frequencies up to at least 100, 000 Hz. In fact, dolphins have the best sense of hearing among all animals. They are able to hear 14 times better than humans.

Some animals like elephants and pigeons can detect sound in the very low frequency range (low pitch). Elephants can hear sound between 1 and 20,000 Hz and pigeons can detect sounds as low as 0.1 Hz. Humans, on the other hand, are unable to hear sounds in the lowest frequency range.

Animals that hunt by sound have remarkable hearing. Some listen for the faint rustling of moving prey while other animals like bats and whales find their way around by listening to echoes that bounce off objects (echolocation). Animals that use echolocation emit high-frequency sound pulses and in turn detect the echoes produced by those sounds. Special ear and brain adaptations enable them to build a three-dimensional picture of their surrounding. Bats, for example, have enlarged earflaps that gather and direct sound towards thin, supersensitive eardrums.

Activity: Matching Sounds

Materials:

- 10 film canisters – you can collect these from any film processing company
- 5 different items (i.e. pennies, beans, rice, marbles, paperclips)
- *Matching Sounds* worksheets
- Pencils

Procedure:

1. Label 5 canisters: 1-5

2. Label another set of 5 canisters: A-E

3. For canisters labeled 1-5, fill each canister with a different item.

4. Fill canisters A-E with the same items but in different order so that canister “1” and canister “A” do not have the same items and so on. For example:

SET 1	SET 2
Canister “1” - pennies	Canister “A” - marbles
Canister “2” - beans	Canister “B” - rice
Canister “3” - rice	Canister “C” - paperclips
Canister “4” - marbles	Canister “D” - pennies
Canister “5” - paperclips	Canister “E” - beans

5. Separate the canisters so that the numbered containers are in one area and the lettered canisters are in another area.

6. Working together as a class, shake container "1", moving slowly through the room.
7. Listen carefully and then shake the lettered canisters to determine which canister is its "sound partner" (which one sounds the same as canister "1"), again moving slowly through the room.

8. Instruct students to record the letter for the sound on their worksheet.

9. After matching all the sound partners, have them guess what objects are in the containers making the sounds.

10. After they have recorded their guesses, open the canisters to see if they matched the sound partners correctly and to discover what objects are making the sounds.

11. You can also set up this activity so every group of 4 students work with their own set of sound canisters with different items from the rest of their classmates.

2nd Grade Science Content Standards: Earth Sciences

Earth is made of materials that have distinct properties and provide resources for human activities.

1. B. Students know smaller rocks come from the breakage and weathering of larger rocks.
   D. Students know that fossils provide evidence about the plants and animals that lived long ago and that scientists learn about the past history of Earth by studying fossils.

2nd Grade Science Content Standards: Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

2. F. Use magnifiers or microscopes to observe and draw descriptions of small objects or small features of objects.
   G. Follow oral instructions for a scientific investigation.

The following lessons and background information will focus on understanding that Earth is made of materials that have distinct properties and provide resources for human activities.

Teachers: Geology – The Study of the Changing Earth

Geology is the study of planet Earth, its rocky exterior, its history, and the processes that act upon it. Not only do geologists seek to understand how the Earth formed and

changed into what it is today, they also try to predict how our planet will behave. An important part of their studies is examining the records provided by rocks.

A rock is a naturally occurring solid consisting of two or more minerals. A **mineral** is a naturally occurring solid that is not living. Rocks are everywhere: in the ground, forming mountains, at the bottom of the oceans. Earth's crust or outer layer is also made mostly of rock.

Depending on how they form, rocks are divided into three main types: **igneous, sedimentary and metamorphic**. Igneous rocks are the primary original material that makes up the Earth's surface. Igneous rocks are made of old rocks that have melted within the Earth to form molten material called **magma**. When it is expelled from volcanoes onto the Earth's surface, it is known as lava. Eventually, magma cools, solidifies and crystallizes to become igneous rocks. This occurs either beneath the Earth's surface or following an eruption of a volcano at the surface. Obsidian and granite are examples of igneous rocks.

Rocks that come into contact with the atmosphere and with water are gradually **weathered**, meaning that rocks are broken down into smaller pieces. Rain, wind, snow, and the freezing and thawing of water can all cause small bits of rock to be worn down from a larger rock. Particles of weathered rock are carried away by wind or water and settle in different places, a process known as **erosion**. In the new location, layers of sediment are formed. Eventually the layers of sediment harden and become compacted or cemented, through a process called **lithification**, to form sedimentary rocks. Limestone and sandstone are examples of sedimentary rocks.

Metamorphic rocks are created when existing rocks are exposed to high temperatures and pressures, and the rock is changed, or **metamorphosed** to form a metamorphic rock. Almost all metamorphism occurs deep in young mountain ranges as rocks are folded and compressed beneath other rocks, all the while exposed to high temperature and pressure. Phyllite and slate are examples of metamorphic rocks.

The rock cycle describes how rocks form and change from one type to another. For example, any type of rock (igneous, sedimentary, or metamorphic) can become metamorphic if it is buried deep enough. Then, if the temperature and pressure become sufficiently high, the rock can melt to form magma and a new igneous rock. The rock cycle is a natural recycling process of Earth material.

Activity: The Rock Cycle

Materials:

- Rock cycle patterns
- Cardstock
- Scissors
- Brads

Procedure:

1. Copy both rock cycle patterns on cardstock.

2. Instruct students to cut out both patterns and the marked rectangles.

3. Attach the patterns together by inserting a brad through the center.

4. Turn the outer pattern to see the definition of each word.

Teachers: Fossils

Fossils are the remains of living things that have been preserved in sedimentary rocks. Fossils range in age microscopic blue-green algae to the remains of animals preserved during the last ice age. A **paleontologist** is a person who studies fossils to learn about life that existed in the past and how life has changed throughout Earth's history. Information can be gathered about what plants and animals existed, how they lived and how they changed over the years. Paleontologists must sometimes compare the fossils of extinct organisms with living organisms to draw conclusions about the nature, behavior, or habits of prehistoric life forms. Fossils that are found grouped together can suggest how an organism interacted as part of a community. Such remains allow paleontologists to determine how closely related fossil organisms are to one another and to living organisms. Paleontology is a mix of biology, geology, ecology, anthropology, archeology and many other sciences.

Things like bones and teeth that are buried in soil sometimes go through a process called **mineralization**. Minerals from the soil seep into small cavities in the bones or teeth then harden to become rock or a fossil. Fossils are most commonly found in limestone, sandstone, and shale. The hard, indigestible skeletons and shells of animals and the woody material of plants are usually preserved best. Fossils of organisms made of soft tissue that decays readily are more rare.

Other fossils are from impressions made by plants or animals. Footprints or other imprints are sometimes filled with sediment that hardens to become a rock, preserving the imprint. Paleontologists have found imprints from leaves, footprints, skin and even feathers. Sometimes, shells from dead animals are filled with sediment that turns to rock forming what is called a cast. The conditions necessary for a fossil to form are very special; very few of the animals that die actually become fossils.

Before paleontologists begin new fieldwork, they first study the geology of the region to determine if it is likely that fossils are present. Sometimes they visit a site that has already been documented.

Paleontologists use a wide range of tools to find and collect fossils, anything from a trowel, chisel or jackhammer; the most common tool is a masonry hammer. Paleontologist may also use brushes to move away loose soil, screens to sift through the soil, magnifiers to look at the fossils, collecting bags to collect the fossils and a notebook and pencil to record what they found and where they found it.

When paleontologists are looking for fossils, they have to be very careful not to destroy any fossils as they dig, or miss any very small fossils. Paleontologists sometimes use dental picks and soft bristled brushes to dig the fossils so they can be sure nothing is destroyed. They also sift all of the soil they dig through screens to make sure no small fossils are missed. Dig sites are often divided into a grid to make it easier to record where fossils were found. Sites are often labeled using a number and letter designation. With letters across the top and numbers down the side, each section would have a designation like B-2. For example:

	A	B	C	D
1				
2				
3				
4				

Paleontologists take field notes as fossils are collected: For each fossil, they record the precise locality, stratigraphic level, and any associated fossils. Each fossil is given a unique identifier (such as a number) that is attached to it so that data recorded from the site can be related to individual fossils. After returning from a trip, paleontologists examine any unidentified fossils more closely.

Although fossils may have survived for many, many years, it may take only a very short time for them to disintegrate once they are exposed. Scientists have a variety of tools at their disposal to slow or halt this disintegration. The method of preservation they select depends on the kinds of minerals in the fossil. In general, stable humidity and temperature and an acid-free environment help protect fossils from decay.

Activity: Digging for Fossils

Materials:

- Large Rubbermaid container or tub (i.e. storage container)
- Soil
- String
- Masking tape
- Sterilized bones from a chicken or turkey (from leftover dinner)
- Gardening trowels or large spoons
- Brushes
- Magnifying glasses
- Small window screens (optional)
- Ziploc bags (to collect fossils)
- Permanent markers
- Small notebooks

- Pencils
- Butcher paper

Procedure:

1. Using soil, bury the bones in a large container to create a dig site.

2. Pass out string and masking tape.

3. Demonstrate how to divide and label the site. Ask students to divide the site by running string across the top of the container and taping the string along the edges.

4. Once the site is divided, have students sketch the entire site in their notebooks.

5. Hand out tools to the students and tell them that they need to carefully excavate their sections and record any fossils they find as well as note where they were found them.

6. When excavation is complete, ask students to try to reassemble the fossil on butcher paper and/or describe what type of environment the site might have been.