Earth Science

Lesson #1: Introduction to Rocks

Time Frame: 1 session of 30 minutes

Learning Standards:

Physical Science: Sort objects by observable properties such as size, shape, color, weight, and texture

Physical Science: Identify objects as solids, liquids or gases

Skills of Inquiry:

Ask questions about objects, organism and events in the environment
Record observations and data with picture, numbers or written statements
Discuss observations with others

Student will be able to:

Draw examples of three kinds of rock, sedimentary, igneous and metamorphic.

Activity:

Gather students together on the floor. Introduce to them three different types of rock and how they are made – sedimentary, igneous and metamorphic. Talk about how sedimentary is in layers that go down over time and then get compressed, how metamorphic rock is made by heat under the earth's surface crunching up the layers, and how igneous rock is made from molten lava. Draw a picture on the white board that introduces the layers of the earth's crust and discuss what the earth is made of.

Next talk about the formation of our valley in Williamstown. Remind the kids that we are surrounded by mountains, and that there were glaciers in the last ice age that receded melting and forming a lake. The lake eventually evaporated and left the valley with mountains around.

The children can then act out a play about the formation of the valley. Have one child be ice, a glacier moving stiffly and slowly, then melting into a lake. Another child can be the sun shining on the lake. The lake evaporates. The weight of the water has pressed down rocks and sand underneath. Rain comes and brings down more rock and sand and the lake fills up.

Ask students to go to the tables. Have examples of each of the three types of rock and magnifying glasses. Ask students to closely examine the rocks and make observations. When done, collect all the samples and pass each child a small rock. (Make sure they don't take the demonstration samples!) Then kids can make "pet rocks" by gluing eyes on a rock and making a face with permanent markers.

Closure:

Ask students to talk about the three kinds of rock and how they are formed.

Assessment: Participation in class discussion and activities

Resources and Materials: Examples of the three kinds of rock – one set for each table, hand lenses, markers, worksheet. A small rock for each child, permanent markers and glue on eyes.

Earth Science

Lesson #2: What are Volcanoes?

Time Frame: 1 session of 30 minutes

Learning Standards:

Physical Science: Recognize that water, rocks, soil and living organisms are found on the earth's surface

Skills of Inquiry:

Ask questions about objects, organism and events in the environment
Record observations and data with picture, numbers or written statements
Discuss observations with others

Student will be able to:

Talk about volcanoes and how they work.

Activity:

Gather students together on the floor. Remind students that last week we talked about rocks and how they are formed, and about the earth's crust. Introduce the idea of volcanoes and how they help to release the pressure of hot magma inside the earth. Talk about the "Ring of Fire" around the Pacific Ocean, and where volcanoes are. Mention Mt. St. Helens, and how mountain chains like the Himalayas have been formed in time. Talk about how some mountain chains are still actively being formed and some are done – inactive. Reassure them that our mountains here are very old and are done being formed. Describe how hot magma travels up through a volcano and erupts as lava and ash.

Have students move to the tables and make their own volcanoes. Create long strands or ropes of clay, coil them around a Dixie cup and pinch them at the top. Each volcano will only be 2-3 inches high. Fill with baking soda, then pour in a mixture of vinegar, red food coloring and a drop or two of dish soap for a bubbly red eruption. Rinse, and they can take home.

Closure:

Ask students to talk how volcanoes are formed and how they work.

Assessment: Participation in class discussion and activities

Resources and Materials: Aluminum tart pan per child, modeling clay 2-3 sticks per child, baking soda, vinegar, red food coloring, dish soap.

Earth Science

Lesson #3: How do Plate Tectonics Work?

Time Frame: 1 session of 30 minutes

Learning Standards:

Physical Science: Recognize that water, rocks, soil and living organisms are found on the earth's surface

Physical Science: Describe the various ways that objects can move, such as in a stright line, zigzag, back and forth, round and round, fast, slow.

Skills of Inquiry:

Ask questions about objects, organism and events in the environment
Record observations and data with picture, numbers or written statements
Discuss observations with others

Student will be able to:

Talk about what the earth is made of and how earthquakes happen.

Activity:

Gather students together on the floor. Remind students that last week we talked about rocks and how they are formed, and about the earth's crust. This week we will talk about how the earth's crust moves. When the earth's crust moves, we call it an earthquake. Earthquakes take place on the edges of what we call tectonic plates. Use the example of a boiled egg. A boiled egg has a crust, the shell. If you crack the shell, you can move the piece of the shell side to side, one over the other or up and down. Use an egg and your hands to demonstrate these types of movement.

Explain that once upon a time, the earth only had one landmass, or continent, that was called Pangaea. This continent began to break up into smaller continents that drifted apart to form our current earth. Use a globe and point out the continents and how they originally fit together.

Ask the children to go to the tables. Give them a copy of the diagram of Pangaea and map of the world. Have them cut apart the continents, place them on a 11 x 14 sheet

of blue construction paper and glue them down in the basic configuration of our world map today.

Closure:

Ask students to talk how the continents were formed and how the earth's crust moves.

Assessment: Participation in class discussion and activities

Resources and Materials: A boiled egg, a globe, scissors for each child, glue sticks, blue construction paper, copies of the map of Pangaea for each child and at least 4 copies of a two dimensional map of the world.

Fossils

Lesson #4: What are Fossils? Let's Dig!

Time Frame: 1 session of 30 minutes

Learning Standards:

Science

Life Science: Evolution and Biodiversity

1) Recognize that fossils provide us with information about living things that inhabited the earth years ago.

Skills of Inquiry

- Ask questions about objects, organisms, and events in the environment.
- Tell about *why* and *what would happen if?*
- Discuss observations with others.

Student will be able to:

1) Describe fossils and explain how paleontologists find and get information from fossils.

Background Information: Fossils are the remains of once living animals and plants (or other types of living things). Fossils may also be evidence of once living things, such as footprints, burrows, or poop. Some fossils found in rocks represent the ancestors of living things that are alive today. When a living thing dies it usually rots away. Sometimes, when the conditions are just right and the remains are buried quickly, the remains of a living thing may form a fossil. The website below provides additional information about paleontology: http://www.ucmp.berkeley.edu/faq.php#paleo

Anticipatory Set: Make a sign for the door of the science lab that says 'Fossil Dig in Progress' and place the pictures provided of paleontologists at work on the science room tables. Ask the students what they observe in the pictures and discuss as a class. Write the world paleontologist on the board and explain that these are pictures of paleontologists at work. Discuss what paleontologists do (study fossils to learn what the earth was like long ago) using information from the pictures provided. Write the word fossils on the board as well and discuss. Fossils are the remains of once living plants or animals.

Activity:

1) Tell the students that today they will do their own fossil dig and pretend to be paleontologists. Give each student a container with sand and dirt. In each container, hide the pieces from a dinosaur puzzle (pop the pieces out the plastic and hide them in the dirt). Using spoons or other tools ask the students to discover what is hidden in their sand.
2) As the students work, tell them that each container has 8-10 pieces and encourage them to find all of the pieces (puzzles contain 8-10 pieces

each). Ask the students about what they find and ask them if they can figure out how the pieces go together (this will be challenging so remind them that paleontologists also have difficulties figuring out how different pieces go together).

3) Give each student a Ziploc bag the put the dinosaur pieces in to take home (students can finish putting the dinosaurs together at home).
4) Ask the students about the process and what they discovered. What did you find in the sand? Why do you think the pieces went together? Was it difficult to put the pieces together? Why or why not?

Closure: Discuss the following ideas and questions with the students. What does a paleontologist do? What are fossils? What can fossils tell us about how the earth used to be?

Assessment: Participation in class discussions and activities

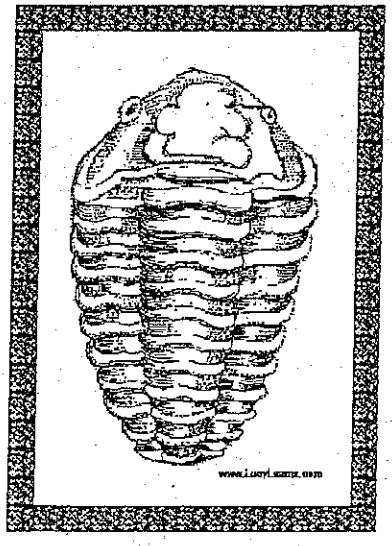
Resources and Materials: Pictures of paleontologists at work, containers with sand/dirt (one for each student), spoons (or other digging tools), dinosaur puzzles (one for each student), Ziploc bags

PREMIUM

FOSSIL

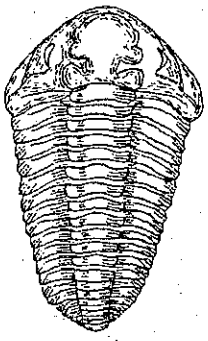
COLLECTION

FEATURING LARGE SIZE SPECIMENS



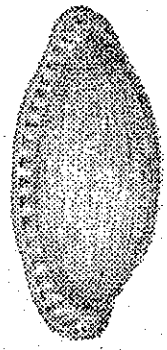
SUPERIOR FOR CLASSROOM DEMOS

1. PHYLUM ARTHROPODA: Trilobite



Trilobites were once one of the most abundant of the marine arthropods. They ranged in size from 1/4" to 27" in length. The forms of various species varied greatly from rather simple forms in the Cambrian period, to very complex forms in the Permian period when they became extinct. These creatures had a well developed mouth and probably had com-pound eyes much like the dragonfly does. Fossils of the ventral surface of the trilobites are rare, but a few have been found. From these it has been discovered that they had several pairs of legs, and were probably bottom feeding scavengers of predators. The fossil in this collection shows the numerous segments and the three prominent lobes. These segments gave the animal flexibility, and a chitinous shell provided protection from predators. One of the principle theories as to why these arthropods became extinct was the development of the jaw in fish which enable them to crack the heavy shell of the trilobite. The trilobite in this set is from the Devonian period over 300 million years ago. Limulus, the horseshoe crab, is thought to be the modern day descendant to the trilobite.

2. PHYLUM PROTOZOA: Foraminifera

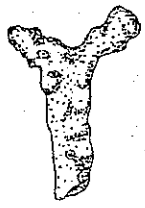


Protozoa are single celled animals. The foraminiferas are one class of protozoa. The word *foraminifera* means "to bear an opening," referring to the oral pore of these single celled protozoans. Forams secrete a protective shell called a "test" which consists of chiton, silica, calcium carbonate, or a complex of these materials. It is this protective shell which has been preserved as a fossil cast of the original creature. When the animal died, the organic parts decomposed and the shell sank to the limy ooze of the ocean floor. Over period of millions of years, it became compressed and cemented into limestone, or in some cases, to chalk. The specimen in this set is called a Fusilinid. The shell you see here was the apartment house for many individual foraminifera. These fossils are often called "rice fossils" because they look like grains of rice. These tiny animals moved about in the ancient seas by means of pseudopodia, which were extended through openings in the "test." Foraminifera have been abundant in the sea since Pre Cambrian times, and for this reason, they are a valuable index fossil in the correlation of rock strata between different localities.

3. PHYLUM COELENTERATA: Horn Coral

The corals are divided into five major classes, three of which are now extinct. The two groups of corals which are still in existence are the octocorals and the hexacorals, which are primary reef builders. The three groups which are extinct are the tabulate corals, the schizocorals, and tetracorals. The fossil horn coral in this set belonged to the tetracorals. This particular specimen was abundant from the Pennsylvanian through the Permian periods. Its average length was about 4", but reached a length of over 12". The horn corals, unlike modern colonial corals, were solitary in nature. Corals are well preserved as fossils due to the fact that coral polyps remove lime from sea water and redeposit it as calcareous shells around themselves. These very rigid shells survive the process of fossilization extremely well and have left a clear record of their evolution since Cambrian times.

4. PHYLUM BRYOZOA: Bryozoans



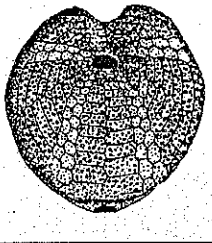
The bryozoans resemble some corals, but are much higher on the evolutionary scale. These tiny animals live in branching or fan-like colonies, which is why they are sometimes called moss animals. Bryozoans have a complete digestive tract which is U-shaped. They also possess an advanced nervous and muscular system. These animals, like the corals, are able to extract lime from sea water and deposit it as a shell around themselves. The shells of the individual animals then become fused into the typical colony shape. Each animal has many tentacles which are used in capturing food. When the animal is feeding, or when danger threatens, the bryozoan is capable of withdrawing into the calcareous shell.

The specimen in this set shows the lacy form after a very large colony was broken up and deposited in fragments in the ooze of the ocean floor, which then hardened into limestone. The bryozoans first appeared in the Ordivician period and are still in existence today. An example of a modern bryozoan is bugula, a common marine moss animal of today.

5. PHYLUM MOLLUSCA: CLASS PELECYPODA: Oyster

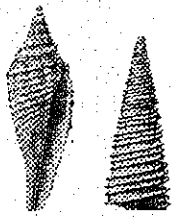
This class of Phylum mollusca includes clams, oysters, scallops, cockles, and mussels. Pelecypod is the Latin word for "hatchet foot" referring to the foot which these animals extend from their shell when feeding or moving about. Pelecypods first appeared in the Ordovician period and are common today in marine and fresh waters. Pelecypods have 2 valves to their shell, and are attached together by a muscular hinge. They come in a wide variety of shapes and sizes. The specimen in this set is an Oyster from the Cretaceous period showing the larger of the two valves.

6. PHYLUM ECHINODERMATA: Sea Urchin



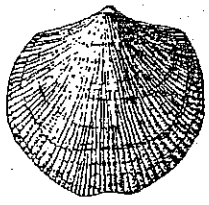
Sea urchins have spiny, flattened, or globular shells composed of fused calcareous plates. The sea urchin has five-fold radial symmetry and a centrally located mouth on the ventral surface of the animal. The specimen in this set is the fossil remnant of a sea urchin shell. The specimen does not exhibit spines because these are held in place by small muscles, and when the animal died the spines are quite visible on the fossil. This particular specimen is from the Jurassic period. Sea urchins first appeared in the Ordovician period and are common and widely diversified today.

7. PHYLUM MOLLUSCA: CLASS GASTROPODA: Gastropod



This specimen is a gastropod that lived during the Cretaceous time. These mollusks have a strong muscular foot which secretes a slimy mucous material protecting the soft body part from desiccation. Gastropods have a single valve which is usually spirally shaped. The slugs have no shell at all. The garden slug is a good example of a non-shelled gastropod. The gastropods first appeared in the fossil record during the Cambrian period and are still common today in the seas and on the land.

8. PHYLUM BRACHIOPODA: Brachiopod

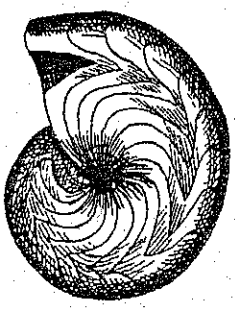


The brachiopods represent one of the most abundant fossil forms. There are about 50 thousand forms of extinct brachiopods, while there are only about 100 species living today. These marine animals consist of two asymmetrical shells or valves, a brachial valve and a pedical valve. The pedical valve has a small opening through which a fleshy stalk called the pedical emerges. The brachiopod is attached to the substrate by means of this fleshy pedical. The brachiopod lives its whole life attached in this manner. The larval form of the brachiopod is mobile however, and this explains its wide distribution. Brachiopods have been abundant since the Cambrian period and are found in wide distribution today.

9. PHYLUM ECHINODERMATA: Crinoid Stem

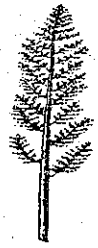
Crinoids, sometimes called sea lilies, are beautiful flower-like echinoderms which became colonies on the sea floor. Other species of crinoids were free-floating and traveled on the underwater currents. The sessile, little attached discs, are called columnals. At the tip of this stalk was a large head composed of numerous plates, and surrounded by many radiating arms which were used in the collection of food. The specimen in this set is a portion of a crinoid stalk. Crinoid heads are rather rare by comparison. In some areas, entire beds of limestone are packed with broken stems. The crinoids first appeared in the fossil record during the Ordovician period, and a few species are still in existence in certain parts of the oceans today. They were most abundant during the Pennsylvanian and Mississippian periods.

10. PHYLUM MOLLUSCA: Cephalopod



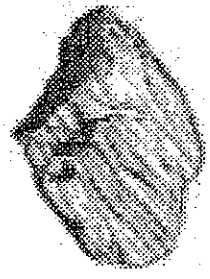
This classification is derived from the Latin and means "head footed." The foot portion of these animals has become modified into a number of tentacles, on which are located powerful suckers. The tentacles are located in a circle around the mouth of these creatures. The eyes are large and well developed. The most common example of these interesting mollusks is the modern day squid which ranges in size from a few inches to giants over forty feet long. The chambered nautilus and the octopus are two modern ancestors of the ancient cephalopod. The cephalopods, as a group, are said to be the most advanced of the invertebrate animals. They were also a source of food for Mosasaurs (aquatic dinosaur-like creatures.) The cephalopods, as a group, were the most advanced of the invertebrate animals. Cephalopods date back as far as the Cambrian period, but were most abundant during the Mesozoic Era, where they reached many feet in diameter.

5. PLANT KINGDOM: Fossil Fern Imprint



This fossil represents only one species of the many thousands of strange plants which flourished during the Pennsylvanian period, sometimes called the "coal age." This was the period when the great coal beds of the earth were laid down. It was a period of huge ferns, 50 feet high, giant dragonflies with 30 inch wingspans and many other bizarre forms. This fossil is a carbon impression of a fern. When the plant decomposed, it left a thin film of carbon, forming an exact impression of the fern in the black mud (now turned to shale). This process of carbonization produced the coal beds of today that we use as a source of fuel.

5. PLANT KINGDOM: Petrified Wood



This fossil is the result of a process called silicification. In this process, the original material, in this case wood, is broken down and the wood cells are subsequently replaced by silica. This process is so gradual and so thorough, that in many cases even the wood's cellular structure is perfectly preserved. In order for this process to occur, special conditions must prevail. As a result, there are only a few areas where petrified trees are found in abundance. The Petrified Forest National Park in Arizona is one such location.

NOTE: For more information about fossils and Paleontology, look for books in your school library.

Station Specimen Information

Specimen 1 Trilobite (Invertebrate: Arthropod)

Notes:

- Trilobites are extinct, and like their living crustacean relatives, have exoskeletons that shed as they grow.
- Many trilobites could roll themselves up like a sow bug for protection. You can see how this is possible by looking at the jointed exoskeleton.
- Trilobites had well developed eyes.

Answers:

1. Accurate, detailed sketch to scale. Include accurate labels on the sketch, including eyes, *cephalon* (head), *thorax* (body), and *pygidium* (tail). Trilobite means "three-lobed" (center, left, and right).
2. It resembles rolly polly bugs, horseshoe crabs, and lobsters.
3. Trilobites were marine, bottom-dwelling scavengers or predators. Their hard exoskeletons protected them from most predators.

Specimen 2 Fish (Vertebrate: Osteichthyes)

Notes:

- These fish lived in an enormous freshwater lake that covered parts of Colorado, Wyoming, and Utah about 40 million years ago.
- Some body parts, such as scales, may be preserved on your specimen. These soft-part remains are examples of carbon film preservation.

Answers:

1. This is a fish. It has most of the characteristics of modern day fish.
2. Accurate, detailed sketch to scale. If the backbone is present, this will clue students to the fact this is a fossil vertebrate.
3. a) The fish dies. b) The fish is buried by sediment before it rots or is scavenged by predators. c) Over time, the bones and scales are replaced with minerals which fossilize the fish.

Specimen 3 Tree (Vascular: Plant)

Notes:

- Patterns of cells preserved in petrified wood can often tell scientists from what kind of tree the wood came.
- Petrified wood is composed of silica (SiO_2), which is the same chemical of which quartz and agate are made.

Answers:

1. This fossil looks like wood from a tree. The clues may be tree rings, wood grain, splintery texture, and/or bark.
2. *Petrify* means to replace organic tissue with minerals while retaining much of the original structure.
3. The wood is completely replaced by silica, the same mineral that makes up quartz and agate. None of the original wood is left.
4. Past climates differed from present ones. Over millions of years, forests gave way to prairies and arid deserts.

Specimen 4 Coral (Invertebrate: Coelenterate)

Notes:

- The community of countless coral organisms that grow over time is called a coral reef.
- Viewing coral with a microscope or hand lens reveals how this animal occupied individual cell-like homes.

Answers:

1. Animal remains make up this fossil. Allow for either answer if students provide reasoning.
2. This fossil is coral.
3. Close study clearly shows the coral's walled structure. This fossil is most like an apartment building. Many organisms live together and share "walls" of their individual homes.
4. You can find animals like these on tropical coral reefs.

Specimen 5 Brachiopod (Invertebrate)

Notes:

- Although they look like pelecypods (clams), brachiopods are different because their top and bottom shells differ, while clams usually have identically shaped top and bottom shells.

Answers:

1. This fossil is a brachiopod. Students may need some hints to distinguish brachiopods from oysters, clams, or other pelecypods.
2. The organism lived attached to the ocean floor. It obtained food by filter feeding.
3. The shells are hard and therefore easily fossilized.
4. Most species of brachiopods are extinct.

Specimen 6 Allosaurus Claw (cast) (Vertebrate)

Notes:

- Real Allosaur claw bones are rare and priceless. A plaster of Paris cast has been included in this collection.
- The claw's groove was probably an adaptation to add surface area for the attachment of the even sharper fingernail-like covering which is usually not fossilized.
- The stubby end is shaped to fit the next toe bone on the foot.
- Students may remember the scene from "Jurassic Park" where Dr. Grant scares the boy with a toe claw.

Answers:

1. Some students may identify this fossil as a tooth belonging to a large predator.
2. The sketches should be side views in order to allow the enhancement in number 3.
3. Many modern day animals have sharp toenails such as eagles and other birds of prey. Cats, bears, and even rodents also have sharp toe claws. All are used for catching and killing food and/or defending themselves against predators.

Specimen 7 Pelecypod (Invertebrate: Mollusk)

Notes:

- Common clams, oysters, mussels, and scallops are pelecypods.
- Pelecypods have two shells that each look similar. This distinguishes them from brachiopods, whose top and bottom shells look different.

Answers:

1. Sketch should include top and bottom shells which look similar but are not symmetrical from left to right.
2. Brachiopods have a similar overall appearance but have different shell symmetries.
3. Clams, oysters, mussels, and scallops are edible pelecypods.
4. Organs and muscles located inside the shell provided feeding, movement, and metabolism.

Specimen 8 Shark Tooth (Vertebrate)

Notes:

- This is an actual tooth from an extinct relative of the Great White Shark.
- Fossil teeth have been found that are almost 20 cm in length, which is nearly the size of your Student Logbook!

Answers:

1. The sketch should be detailed enough to show the serrated edges.
2. This fossil is a shark's tooth (partial).
3. The sketch should show the reconstructed triangular shape of the original tooth. This kind of reconstruction is often used in the earth sciences.
4. The serrated edges (like the serrations on a steak knife) assist in cutting flesh.

Specimen 9 Fern Leaves (Vascular: Plant)

Notes:

- Ferns are one of the earliest forms of land plants.
- Fern leaf impressions are commonly found in shale and coal-bearing sedimentary rocks.
- Fossil ferns indicate paleoenvironments of warm, humid conditions.

Answers:

1. Accurate, detailed sketch to scale. This fossil is from a plant.
2. A relative of this plant living today is the fern.
3. Continental drift has caused once tropical land masses to shift to polar latitudes.
4. Coal is composed of dead plant material from swamps where ferns lived.

Specimen 10 Gastropod (Invertebrate: Mollusk)

Notes:

- Point out the various shell outlines and how their shapes appear to differ depending on how they are oriented in the rock.
- Snails are gastropods.
- Gastropods include slugs, but fossils of slugs are extremely rare as a result of their lack of shells.

Answers:

1. Accurate, detailed sketch to scale.
2. This animal is related to modern day snails. Snails live in both marine and terrestrial environments. The shell provides protection.
3. The specific group is the Gastropods.
4. The stone is hard, it has coiled patterns in it, and it can be fashioned into jewelry and polished stone products.

Specimen 11 Echinoderm (Invertebrate: Echinoid)

Notes:

- Crinoids are nicknamed *sea lilies* even though they are animals.
- Echinoderm fossils are often incomplete portions of the whole organism. Crinoid stem segments are more common than the head or calyx.
- Echinoderm means "spiny-skinned."
- Relatives include starfish, sea urchins, and sand dollars.

Answers:

1. Typically the specimen will be dome-shaped, but the exact shape will depend on the specimen included.
2. Echinoderms usually have a star pattern with five arms or points.
3. The trip would be to a beach or scuba diving location in a shallow ocean habitat.

Specimen 12 Cephalopod (Invertebrate: Mollusk)

Notes:

- The intricate, wavy lines are called sutures. These mark the ends of old chambers that the ammonite has outgrown.
- Coiled cephalopods with intricate sutures are called ammonites.
- The animal that lived inside the shell had tentacles and eyes like modern squid and octopi.
- Chambers help these animals stay buoyant and upright in the water.

Answers:

1. Accurate, detailed sketch to scale. The shell adds segments which are marked by growth lines called sutures.
2 The organism moved by "jet propulsion."
3. This organism is related to the modern squid and octopus.
4. Giant aquatic dinosaurs called *mosasaurs* were predators of ammonites. Fossil ammonites have been found with rows of tooth punctures in the shell.

Fossils

Lesson #5: Making Plant Fossils

Time Frame: 1 session of 30 minutes (and time the next day to observe and discuss the fossils)

Learning Standards:

Science

Life Science: Evolution and Biodiversity

1) Recognize that fossils provide us with information about living things that inhabited the earth years ago.

Skills of Inquiry

- Ask questions about objects, organisms, and events in the environment.
- Tell about *why* and *what would happen if?*
- Discuss observations with others.

Student will be able to:

1) Make a fossil and explain what fossils can tell us about living things from long ago.

Background Information: Fossils are the remains of once living animals and plants (or other types of living things). Fossils may also be evidence of once living things, such as footprints, burrows, or poop. Some fossils found in rocks represent the ancestors of living things that are alive today. When a living thing dies it usually rots away. Sometimes, when the conditions are just right and the remains are buried quickly, the remains of a living thing may form a fossil. For example, if an animal dies and sinks to the sea floor the flesh will rot away and the bones will be buried by sediment (sand, dirt, etc.). Over time, this sediment turns into rock and then the skeleton dissolves (leaving a hollow mould in the rock, the same shape as the bones). Water enters the mould and fills it with minerals. When this rock rises to the surface of the earth again (during a mountain building process or earthquake) the fossil is exposed. This process takes a very long time – thousands of years (sometimes even hundreds of thousands of years).
The website below provides additional information about fossil formation:
http://www.fossilmuseum.net/fossilrecord/fossilization/fossilization.htm

Anticipatory Set: Give each pair of students a fossil to examine (fossils are numbered, attached sheet provides additional information). Provide each student with a magnifying glass and ask the students to make as many observations as possible about their fossil. Ask the student groups to share their observations with the class and review the concept of fossils. Explain that while some of these fossils may look like plants and animals that are alive today, they are remains of living things that no longer live on the earth. Ask the students how they think the fossils were made. Discuss their ideas using the fossils.

Activity:

1) Tell the students that today they will make their own fossil of a plant. Explain that fossils take a long time to form and then come to the surface of the earth where they can be found. The activities in class today will model how some fossils are made.
2) Give each student a ball of clay (can be playdough) and a strip of tag paper (8" x 2" and stapled in the center). Ask the students to roll out the clay until it is about 3 cm thick (or more). Provide the students with rulers if necessary to make this measurement.
3) Tell the students to insert the paper circle into the clay to make a seal. Then, ask the students to choose a part of a plant to use to make a fossil. Ask the students to press the plant part into the clay until an imprint is made and then remove the plant part. Assist students as necessary to make good imprints.
4) An adult can then pour plaster of paris into the mold. Allow the molds to set overnight. Students can discover their fossils the next day in class by removing the circle of paper and clay and observing their fossils. Students may share their fossils with the class as time permits.
5) While the plastic of paris sets ask the students how they think a fossil (like the one they made in class today) might form in nature. Discuss different ideas as a class.

Closure: Discuss the following ideas and questions with the students. What are fossils? What can fossils tell us about how the earth used to be? How are fossils formed?

Assessment: Participation in class discussions and activities

Resources and Materials: Fossils from the box labeled 2-2 (and 2-5), magnifying glasses, playdough, tag paper (8" x 2" and stapled in the center), rulers, plant leaves, stalks, or other plant parts, (make sure the plant parts can make a good imprint), Plaster of paris

Fossils

Lesson #6: Measuring Fossils

Time Frame: 1 session of 30 minutes

Learning Standards:

Science

Life Science: Evolution and Biodiversity

1) Recognize that fossils provide us with information about living things that inhabited the earth years ago.

Skills of Inquiry

- Ask questions about objects, organisms, and events in the environment.
- Make predictions based on observed patterns.
- Name and use simple equipment and tools (e.g., rulers, meter sticks, thermometers, hand lenses, and balances) to gather data and extend the senses.
- Record observations and data with pictures, numbers, or written statements.
- Discuss observations with others.

Student will be able to:

1) Make length predictions and measurements of different objects in centimeters using rulers.

Anticipatory Set: Place a container of 6 cups of different sizes on each table and give each student a ruler. Tell the students that you are looking for the cup that is a specific measurement (length in centimeters). Give the students time to measure the different cup and find the one with the right measurements. Discuss the process as a class and make sure that all of the students at each table and all of the tables came up with the same cup. Do a demonstration of how to make measurements as necessary. Explain that length measures the longest part of an object.

Activity:

1) Tell the students that today they will learn about how to make size measurements so that they can make more specific observations about fossils. Explain that scientists use centimeters to make measurements so that scientists working all over the world can share their observations using the same types of measurements.
2) Pass out the size measurements student worksheet and explain how to complete the worksheet. Working in pairs, ask the students to choose an object, write the name of the object in the chart (or draw a picture), make a guess about the length in centimeters, and make a measurement. Write the names of the different objects students can choose to measure on the board. Place the objects on each table. Assist student groups as necessary in making the measurements.

3) Ask the students about making measurements. Did your guesses get better as you made more measurements? Ask the students to share the measurements they made of the same objects and compare the results. Discuss any discrepancies and model good measuring techniques again in front of the class.

Closure: Discuss the following ideas and questions with the students. Why do scientists need to make measurements? Why do all scientists make measurements in centimeters?

Assessment: Participation in class discussions and activities (student worksheet)

Resources and Materials: Containers of 6 cups of different sizes measured (in centimeters) using a ruler (4 sets), rulers, objects to measure such as leaves, magnifying glasses, beakers, etc. (put sets of objects on each table)

Name:_____ Date:_____

Size Measurements

Object	Guess (in centimeters)	Actual Length (in centimeters)
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm
	_____ cm	_____ cm

Fossils

Lesson #7: Edible Fossils

Time Frame: 1 session of 30 minutes (or more)

Learning Standards:

Science

Life Science: Evolution and Biodiversity

1) Recognize that fossils provide us with information about living things that inhabited the earth years ago.

Skills of Inquiry

- Ask questions about objects, organisms, and events in the environment.
- Tell about *why* and *what would happen if?*
- Record observations and data with pictures, numbers, or written statements.
- Discuss observations with others.

Student will be able to:

1) Make edible fossils and discuss different types of fossils.

Background Information: There are many different types of fossils. Mold fossils are made when a living thing leaves an indent or impression in dirt (or sand) that eventually becomes rock. If minerals fill this mold, then a cast fossil is formed.

Anticipatory Set: Put some different types of fossils on each lab table (from the box labeled 2-5). Ask the students to look at the fossils carefully and think more about how they formed. Discuss the plaster of paris plant fossils that the students made (first they made a mold in the clay and then they made a cast fossil with the plaster of paris). Discuss how different types of fossils may have formed as a class.

Activity:

1) Tell the students that today they will experiment with making different types of fossils in cookie dough. Discuss the materials as a class (including the cookie dough and various types of objects to put in the cookie dough). Explain that students can make imprints in the dough or place actual objects in the dough.
2) Discuss the following ideas as a class. What do the objects represent (dead living things)? What does the cookie dough represent (soft dirt)? What does baking in the oven represent (time, heat, and pressure turning the dirt into rock)?
3) Make sure that all students wash their hands carefully. Then, give each student a paper plate and a piece of sugar cookie dough (try to make all of the pieces roughly the same size). **Note:** Be sure to tell the students that

they will each make a cookie but that they may or may not get the cookie they made back after they bake in the oven.

4) Allow students to experiment with making indents in the cookie dough and placing objects in the cookie dough (on the paper plates). When they are done, pass out the edible fossils student worksheet and ask the students to draw a picture of their cookie and indicate any items that are hidden inside.
5) Place the cookies in the oven to bake. For classes in the first afternoon session the cookies can be delivered to the classroom when they are done baking. For classes in the second afternoon session the cookies can be delivered to the classroom at the end of the day (and the students can observe them the next day in class).
6) Back in the classroom: Wash hands and pass out one cookie to each student. Ask the students to make a drawing of what they discover in their cookie or any strange indents in their cookie. Label these parts as fossils.
7) Students make eat the cookies when they are done. If time permits, students may try to match up the drawing of the cookie they made with the drawing of the baked cookies with fossils (probably by another student).

Closure: Discuss the following ideas and questions with the students. What are fossils? What can fossils tell us about how the earth used to be? How do fossils form? How were the cookies you made like fossils? What parts of the cookies were the fossils? Explain.

Assessment: Participation in class discussions and activities (student worksheet)

Resources and Materials: Boxes of fossils labeled 2-5 (and 2-2), sugar cookie dough, small candy of different types (red hots, gummy bears, M + Ms, skittles, etc.), paper plates, edible fossils student worksheet

Name:_____ Date:_____

Edible Fossils

Draw a picture your cookie before it is baked.

Draw a picture of a cookie after it is baked. Label the fossils.