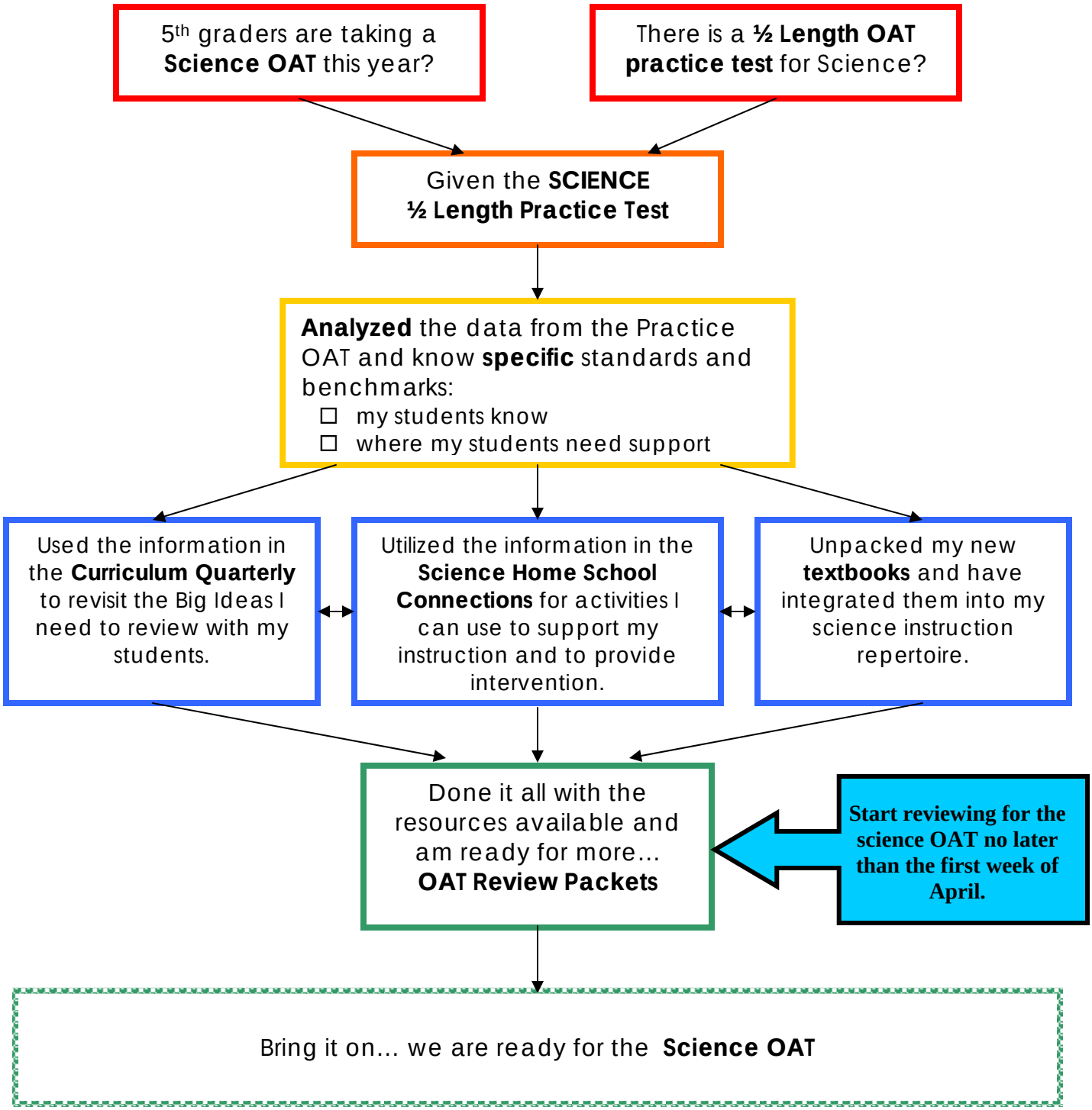
Ohio Achievement Test

Grade 5 Science

Review Booklet

5TH GRADE TEACHERS

Count down to the Science OAT.... **The Flow**



Ohio Achievement Test
5th Grade Science
May 2, 2007
In a NUTSHELL

Grade Band 3-4-5
22 Benchmarks
99 GLIs

Ohio Achievement Test
38 Questions for 48 Points.
32 multiple-choice
4 short-answer items
2 extended-response items

Breakdown of the Ohio Half-Length Science Achievement Practice Test

3 Questions from 3rd Grade GLIs
9 Questions from 4th Grade GLIs
7 Questions from 5th Grade GLIs

Breakdown

Science & Technology, Scientific Inquiry and Scientific Ways of Knowing	10-14 points.
Earth & Space Science	10-14 points.
Life Science	10-14 points.
Physical Science	10-14 points.

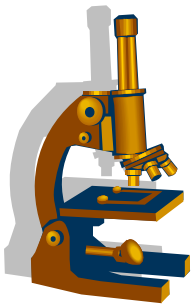
Cognitive Demand
The cognitive demand, **reasoning**, **evaluation procedures**, **understanding concepts** or **analyzing problems**, is determined on the basis of what the item asks of the student.

The Ohio Achievement Test will NOT cover all the GLIs annually. It will only focus on the grade band 3-4-5 Benchmarks. The OAT will be on a 3 year cycle in order to cover all 99 GLIs.

Resources that clarify the Science standards
CPS OAT Gr. 5 Science Review
Ohio Department of Education
IMS Lessons
OAT Practice Test Materials
www.ohiorc.org
Bookshelf

Student Name: _____

Ohio
Achievement Test
Grade
5



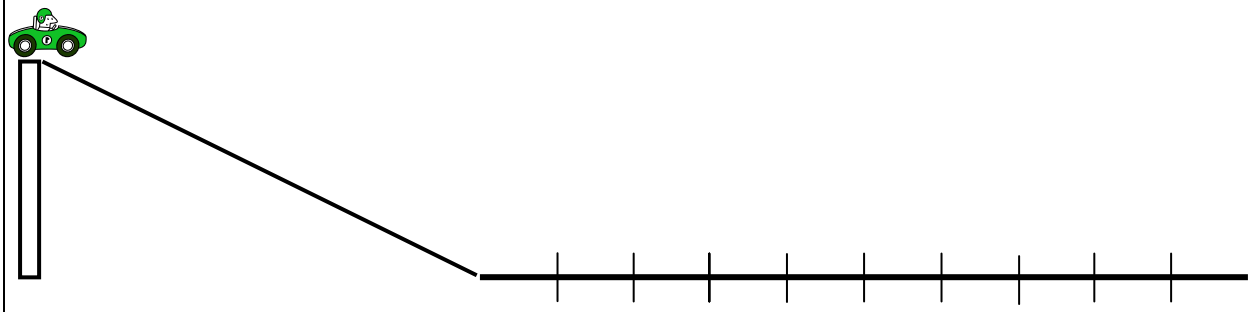
Science
Half-Length Practice Test

Teacher Answer Document
2006-2007

S Science — Teacher Answer Key

		Standard.Benchmark.Grade.Indicator
1.	(A) (B) (C) **(D)**	**ES.D.4.3**
2.	**(A)** (B) (C) (D)	**PS.B.4.3**
3.	(A) (B) **(C)** (D)	**LS.B.3.2**
4.	(A) (B) **(C)** (D)	**LS.A.4.5**
5.	**(A)** (B) (C) (D)	**ES.A.5.1**
6.	(A) **(B)** (C) (D)	**PS.D.4.5**

7. Write your response to question 7 in the space below. **SI.A.5.1**



2 Points: The response draws or describes a way to set up this investigation so that the force starting the motion is constant and draws or describes a method for collecting data to support the hypothesis.
1 Point: The response draws or describes a way to set up the investigation so that the force starting the motion is constant; **- or –** draws or describes a method for collecting data to support hypothesis.
0 Points: The response fails to demonstrate any understanding of how the student can test the hypothesis or collect data. The response does not meet the criteria required to earn 1 point. The response indicates inadequate or no understanding of the task and/or the idea or concept needed to answer the question.

Student Sample Answer 2 Points: The student can set up a ramp with the car on top. At the bottom of the ramp would be a track for the car to run on, and next tot the track could be a tape measure to measure how far it will go.
Student **Sample Answer** 1 Point: Take the same car with different size wheels and measure the length it goes.
Student **Sample Answer** 0 Point:

Size of wheels	Length Traveled

Standard.Benchmark.Grade.Indicator

8. Ⓐ **Ⓑ** Ⓒ Ⓓ **ST.B.3.4**

9. Ⓐ Ⓑ Ⓒ **Ⓓ** **SI.A.5.1**

10. Ⓐ Ⓑ Ⓒ **Ⓓ** **SWK.C.4.4**

11. Write your response to question 11 in the space below. **ES.B.4.8**

2 Points: The response correctly identifies one natural process that could have helped shape the canyon and correctly describes evidence of that process from the picture of the canyon and river.

1 Point: The response only demonstrates partial understanding of who natural processes changes Earth's surface. The response correctly identifies one process but does not describe evidence from the picture related to that process;

OR

correctly describes evidence of a change but does not identify a process that could have caused the change.

OR

correctly identifies a naturally process that can form canyons with a description of evidence of the process that is not specific to the canyon shown.

0 Point: The response fails to demonstrate any understanding of how natural processes change Earth's surface. The response does not meet the criteria required to earn 1 point. The response indicates inadequate or no understanding of the task and/or the idea or concept needed to answer the question.

Student Sample Answer 2 Points: I think on natural process was a landslide because of the curved slope by the rocks, the rock could have been in a rock slide.

Student Sample Answer 1 Point: It could have been wind if it blew very hard.

Student Sample Answer 0 Point: The rock helped out a lot with the process because with the rock the water through the river smoother.

S Science

		Standard.Benchmark.Grade.Indicator
12.	Ⓐ Ⓑ **Ⓒ** Ⓓ	**SWK.B.3.1**
13.	Ⓐ **Ⓑ** Ⓒ Ⓓ	**PS.A.4.1**
14.	Ⓐ Ⓑ Ⓒ **Ⓓ**	**PS.E.5.3**
15.	Ⓐ Ⓑ **Ⓒ** Ⓓ	**ST.A.4.1**
16.	Ⓐ **Ⓑ** Ⓒ Ⓓ	**SI.A.4.1**
17.	Ⓐ Ⓑ **Ⓒ** Ⓓ	**PS.D.5.2**
18.	Ⓐ Ⓑ Ⓒ **Ⓓ**	**ES.A.5.2**

Standard.Benchmark.Grade.Indicator

19. Write your response to question 19 in the space below. **LS.B.5.3**

4 Points: The response provides a complete food web drawing, which includes four combinations of organisms. The food web uses the names of four organisms and shows all relationships among the organisms identified. The arrows are drawn in the correct direction to show the organization and flow of energy among the organisms.
3 Points: The response shows an essential understanding of the task by showing food web organism names for all organisms, but it includes one category of mistakes.
The categories of mistakes include:

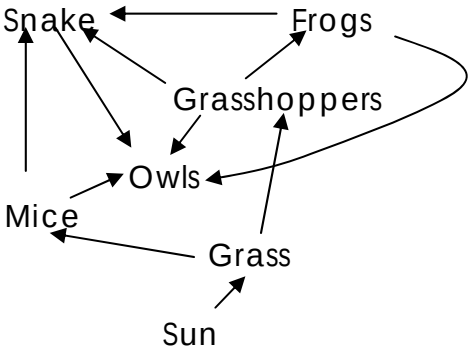
- Omission of arrow;
- Arrow(s) pointing in the wrong direction;
- Arrow(s) between two organisms that do not share a feeding relationship;
- Conflicting arrow (e.g., two-headed arrows, two arrows pointing in both directions between two organisms).

2 Points: The response shows a partial understanding of the task by providing some evidence of understanding two food chains. The response names four organisms, but it includes an omission and one other category of mistakes OR provides a perfectly correct food chain composed of more than two organisms.

1 Point: The response omits significant aspects of the food web, showing a limited understanding of the task by showing one food chain in the web. The response provides a correct feeding relationship between two organisms (the feeding relationship does not have to begin with a producer) OR an incorrect food chain with three or more organisms.

0 Point: The response fail to demonstrate any understanding of the feeding relationships among organisms. The response does not meet the criteria required to earn 1 point. The response indicates inadequate or no understanding of the task and/or the idea or concept needed to answer the item.

Student 4 Point



S

#_____. Write your response in the space below.

Earth and Space Science

Columbus Public Schools

Benchmark & GLI
Earth and Space Science
A: Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.
Grade 3
No indicators present.
Grade 4
No indicators present.
Grade 5
1. Describe how night and day are caused by Earth's rotation.
2. Explain that earth is one of several plants to orbit the sun.
3. Describe the characteristics of Earth and its orbit about the sun.
4. Explain that stars are like the sun, some being smaller and some larger, but so far away that they look like points of light.

Vocabulary:
atmosphere: the air that surrounds Earth
axis: an imaginary line that passes from the North Pole to the South Pole through Earth's center.
comets: a large chunk of ice and dust that orbits the sun.
day: the amount of time it take the earth to revolve once on it's axis, (24 hours).
elliptical: a flatten circle, the pass the earth takes around the sun.
gravity: the force that pulls objects towards each other.
hemisphere: the northern or southern half of the earth.
lunar eclipse: occurs when the earth blocks sunlight from reaching the mopn
night: occurs on the side of the earth that is facing away from the sun.
orbit: the path that one object in space takes around another object in space.
planets: a celestial body that does not produced its own light, is larger than an asteroid, and is illuminated by light from a star, such as the sun, around which it revolves. (Mercury, Venus Earth, Marcs, Jupiter, Saturn, Uranus, Neptune.)
revolution: on complete trip of a planet around the sun.
rotation: the spinning of a planet or moon on its axis.
b occurs when the moon blocks sunlight from reaching the earth.
sphere: a 3-dimensional figure made up of all points that are equally distant from a point called the center. The earth is similar in shape.
star: an object in space that produces its own heat and light. Earth's star is also the sun.

Key Concepts

- Day and night are caused by the Earth's **rotation** around the Earth's **axis**.
- When light from the Sun strikes the Earth's surface, **day** is experienced.
- The side of the Earth on which the Sun's light does not shine, experiences **night**.
- The Earth rotates on its axis completing one rotation every 24 hours.
- The Sun appears to rise in the east and set in the west. This is due to the Earth's rotation is clockwise.
- As the Earth rotates, the Sun and stars appear to move across the sky.
- As the Earth rotates it turns into the light from the Sun and daytime begins.
- As the Earth continues to rotate out of the Sun's light, night time begins.
- The changing position of the Sun in the sky may be used to tell the time such as when using a sundial.
- The Earth is one of many planets that orbit the sun.
- The Sun is the nearest star to the Earth.
- The Earth is the third planet from the sun.
- Our solar system contains the sun and all objects that travel around it, which includes **planets**, **comets**, and more.
- The Sun's **gravity** holds the moving object in an orbit.
- ¾ of the Earth's surfaces is covered by a layer of water [some of it is frozen].
- The Earth has a think blanket of air called the **atmosphere**.
- The Earth takes an **elliptical** orbit around the sun.
- The Earth's axis is tilted at an angle of 23.5 degrees, which is why the Earth has seasons (spring, summer, fall, winter). The **hemisphere** of the earth that is tilted towards, in that hemisphere, it is summer.
- The Earth is shaped like a **sphere**.
- **Stars** are like the sun, some are smaller or larger.
- The gravitational force between the Earth and Moon causes tides.
- The moon phases include: new moon, waxing cresent, 1st quarter, waxing gibbous, full moon, waning gibbous, 3rd quarter or last quarter, waning cresent.

1	2	3	4	5	6	7	8
New Moon	Waxing Crescent	First Quarter	Waxing Gibbous	Full Moon	Waning Gibbous	Last Quarter	Waning Crescent

- It takes approximately 28 days for the moon to complete all the phases.
- **Solar Eclipses** occurs when the moons shadow falls on the earth (Sun-moon-earth).
- **Lunar Eclipse** occurs when the earth shadow falls on the moon (Sun-earth-moon).

Suggested Activities:

- Use the Earth Science Key Concepts Cards for a game of Jeopardy, Bingo, or Partner Activity.
- Simulate the path of the sun with a flashlight with a sample flag pole to show how the shadow would look at 5pm. Make predictions at different periods of the day (morning, afternoon, evening).
- Use a globe and a flashlight to simulate the rotation of the earth on it's axis to show night and day.
- Use a globe and a flashlight to simulate the seasons, which will explain why the north and south poles have different seasons (opposite seasons.)
- View the phases of the moon on: http://aa.usno.navy.mil/faq/docs/moon_phases.html
- On United Steaming View (all these videos have been view and have blackline masters/worksheets.
- Spin Around the Solar System, A: Moon Dance Worksheets available.

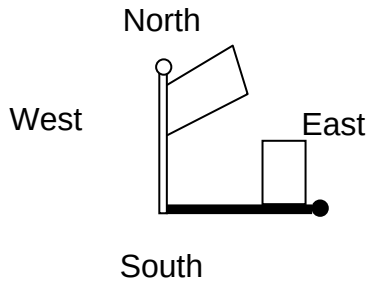
Earth and Space Science Benchmark A: Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.

Questions:

1. In many ways, Earth is like other planets in the solar system.
   In which way is Earth different?
   a. Earth has a moon.
   b. Earth orbits the sun.
   c. Earth has many mountains
   d. Earth has lots of water.

2. Which diagram shows the flagpole at 5:00 p.m. on a summer day?

a.



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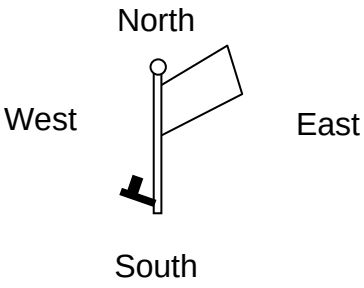

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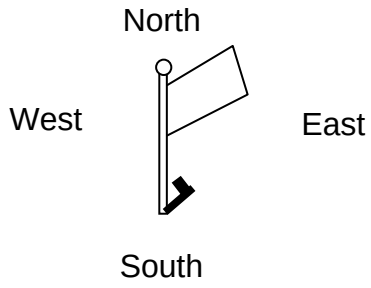
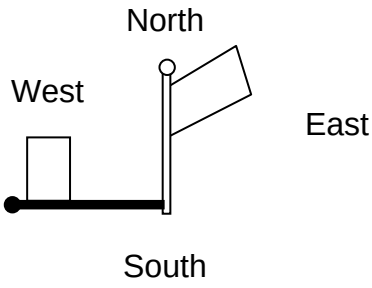


d.



3. Explain why the North and South poles do not have the same season.

4. How are the earth and moon alike?
   a. Both have liquid water.
   b. Both have satellites.
   c. Both are rocky and dense.
   d. Both have a thick atmosphere

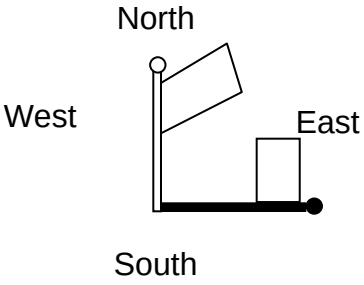
5. Which of these causes season changes on Earth?
   a. Earth's orbit and tilt
   b. The shape of the sun's orbit
   c. The changing shape of Earth's orbit
   d. Earth's position in relation to the moon

Earth and Space Science Benchmark A: Explain the characteristics, cycles and patterns involving Earth and its place in the solar system.

Answers

1. In many ways, Earth is like other planets in the solar system.
   In which way is Earth different?
   a. Earth has a moon.
   b. Earth orbits the sun.
   c. Earth has many mountains
   d. Earth has lots of water. *

2. Which diagram shows the flagpole at 5:00 p.m. on a summer day?
   A.



3. Explain why the North and South poles do not have the same season. (2pts)

The Earth's axis is tilted at an angle of 23.5 degrees which is why the Earth has seasons (spring, summer, fall, winter). The hemisphere of the earth that is tilted towards in that hemisphere it is summer. The hemisphere that is tilted away in that hemisphere it is winter.

4. How are the earth and moon alike?
   a. Both have liquid water.
   b. Both have satellites.
   c. Both are rocky and dense. *
   d. Both have a thick atmosphere

5. Which of these causes season changes on Earth?
   a. Earth's orbit and tilt. *
   b. The shape of the sun's orbit.
   c. The changing shape of Earth's orbit.
   d. Earth's position in relation to the moon.

Earth and Space Science

Benchmark & GLI
Earth and Space Science
B: Summarize the processes that shape Earth's surface and describe evidence of those processes.
Grade 3
No indicators present for this benchmark.
Grade 4
8. Describe how wind, water and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas producing characteristic landforms (e.g., dunes, deltas and glacial moraines).
9. Identify and describe how freezing, thawing and plant growth reshape the land surface by causing the weathering of rock.
10. Describe evidence of changes on Earth's surface in terms of slow processes (e.g., erosion, weathering, mountain building and deposition) and rapid processes (e.g. volcanic eruptions, earthquakes and landslides).
Grade 5
No indicators present for this benchmark.

Vocabulary:
bedrock: solid rock that lies under layers of soil and sediment, which has not been eroded.
deltas: a large flat area of land at the mouth of a river.
dunes: a hill of sand that is deposited by the wind.
earthquakes: a shaking of Earth's crust caused by rock slabs moving against each other deep below Earth's crust.
erosion: the movement of weathered materials by water, wind, or ice.
fossil: the remains or traces of an organism that lived long ago.
glacial moraines: consists of soils formed over sandy glacial till
horizon: the line where Earth and sky appear to meet. Also, layers of soil with distinct properties.
humus: decayin plant and animal material in soil.
igneous rock: rock that formed from cooled magma or lava.
landslides: the sudden downhill movement of a huge mass of rock, soil, and mud.
lava: melted rock that flows out of the ground onto Earth's surface.
magma: melted rock below Earth's surface.
metamorphic rock: rock that formed when another kind of rock was subjected to pressure and heated deep inside Earth's crust.
minerals: a solid natural material that has a crystal form and its own set of properties.
mountain building:
rock cycle: the process of rocks changing into other kinds of rocks.
sedimentary rock: rock that formed when sediments were pressed and cemented together.
sediments: bits of rock, soil, sand, shells, and the remains of organisms.
soil: a material made of tiny pieces of rock, minerals, and decaying plant and animal matter.
top soil: upper layer of soil, often the richest in plant nutrients.
volcanoes: a mountain built up from hardened lava, rocks, and ash that erupted out of Earth.
weathering: the breaking down and wearing away of rock.

Key Concepts

- The Earth's surface is reshaped by **erosion** (wind, water and ice).
- A sand dune can be as small as an anthill or as tall as a skyscraper. Sand dunes are built up by the wind. Once the sand has been picked up by the wind, it will go wherever the wind carries it.
- A **delta** is a triangular shaped landform. As sediments are carried in the river they are deposited into oceans, seas, deserts, or lake, and continue outward till it creates a triangular shape landform.
- **Glacial Moraines** are a result of a glacier moving and the movement of debris like rocks and boulders, often referred to as till.
- Earth's land surface can be reshaped by later freezing in cracks to break up the surface, ice melting creating rivers and streams, and plants growing in cracks and separating the surface of the Earth.
- **Weathering** is a process of breaking (wearing) down rocks and minerals by nature.
- **Erosion** occurs when sediment is moved my wind, water, or ice. This can cause sediments to become packed in layers forming sedimentary rock. Fossils are often found in sedimentary rock since they caught in between each layer.
- Land is created by volcanic eruption. A volcano erupts when there is an opening on the Earth's surface. During volcanic eruption magma raises till it leave the earth's surfaces which cool and forms new land. Lava is a liquid rock above the Earth's surface. Magma is liquid rock below the Earth's surface. (Fast change)
- **Igneous rocks** are formed by magma and lava; this is the most common type of rock.
- **Sedimentary rocks** are formed when sediments are deposited in rivers, lakes and oceans and form layers.
- **Metamorphic rocks** are formed from igneous, sedimentary, or metamorphic rocks that undergo a tremendous amount of heat and pressure and change into a different rock
- The earth's surface is broken into seven large and many small moving plates. These plates, each about 50 miles thick, move relative to one another an average of a few inches a year. Three types of movement are recognized at the boundaries between plates: convergent, divergent and transform-fault.
- **Earthquakes** occur when the tectonic plates move.

Suggested Activities

Create an erosion lab: http://teacher.scholastic.com/dirt/erosion/lab.htm
Stream table: http://www.springfield.k12.il.us/movie/landforms/standard.html
On United Steaming View (all these videos have been view and have blackline masters/worksheets.
Geologist's Notebook: Why Land Goes Up and Down. Worksheets available and how to make a volcano activity.
Junior Geologist: How Does the Land Wear Down? This also has activities that would represent erosion and weathering.
Junior Geologist: How Does the Land Build Up? Worksheets available.

Earth and Space Science Benchmark B: Summarize the processes that shape Earth's surface and describe evidence of those processes.

Questions:

1. The picture shows evidence that different natural processes shape the canyon over time.

   Identify one natural process that could have helped shaped the canyon in the picture and describe evidence of this process. (2 points)

2. Weathering is caused by
   a. decomposers
   b. wind, water, and plants
   c. sedimentary rock
   d. fossils

3. Earthquakes occur when
   a. only when eruptions of volcanoes
   b. plates build up energy
   c. plates slip pass each other
   d. plates are still

Earth and Space Science Benchmark B: Summarize the processes that shape Earth's surface and describe evidence of those processes.

Answers

1. Identify one natural process that could have helped shaped the canyon in the picture and describe evidence of this process. (2 pts.)

Weathering is a process of breaking (wearing) down rocks and minerals by nature. The river is flowing and wearing away at the rock. You can see evidence of this weathering since layers of rock are exposed.

2. Weathering is caused by
   a. decomposers
   b. wind, water, and plants *
   c. sedimentary rock
   d. fossils

3. Earthquakes occur when
   a. only when eruptions of volcanoes
   b. plates build up energy
   c. plates slip pass each other *
   d. plates are still

Earth and Space Science – Rocks & Soil

This Benchmark is broken up into two sections. (rocks & soil / renewable & non-renewable resources)

Benchmark & GLI
Earth and Space Science
C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.
Grade 3
1. Compare distinct properties of rocks (e.g., color, layering and texture).
2. Observe and investigate that rocks are often found inlayers.
3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.
4. Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals).
5. Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth).
6. Investigate that soils are often found in layers and can be different from place to place.
Grade 4
No indicators present for this benchmark for this benchmark.
Grade 5
5. Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely.
6. Investigate ways Earth's renewable resources can be maintained.

Vocabulary:
fossil: the remains or traces of an organism that lived long ago.
hardness: the stability of a mineral to resist being scratched.
igneous rock: rock that formed from cooled magma or lava.
luster: the way that a mineral's surface reflects light.
metamorphic rock: rock that formed when another kind of rock was subjected to pressure and heated deep inside Earth's crust.
minerals: a solid natural material that has a crystal form and its own set of properties.
rocks: a solid mixture of minerals that was formed in Earth's crust.
sedimentary rock: rock that formed when sediments were pressed and cemented together.
sediments: bits of rock, soil, sand, shells, and the remains of organisms.
soil: a material made of tiny pieces of rock, minerals, and decaying plant and animal matter.

Key Concepts

- **Properties of rock** include the rock's color, layering, texture, hardness, luster.
- Rocks are made up of minerals.
- Smaller rocks are the result of weathering and erosion.
- **Sediments** are solid fragments of inorganic or organic material that come from the weathering of rock and are carried and deposited by wind, water, or ice.
- Sediments are often found in layers at the bottom of river, lakes, and ocean. These layers of rock are called sedimentary rock.
- Sedimentary rock form from weathering and erosion of rock into sediments, the sediments undergo squeezing and cementing.

- Fossils are often found in sedimentary rock.
- The three kinds of rock are igneous, sedimentary, and metamorphic rock.
- Igneous is the most common rock, formed from magma or lava.
- Metamorphic rock
- The **Moh's hardness scale** identifies how hard a rock is. Talc is the softest rock, with the harness of 1, and Diamond is the hardest rock with a hardness of 10.
- To determine how hard a rock is you will need to do a streak test.
- **Soil** covers much of the land on Earth. It is made up of minerals (rock, sand, clay, silt), air, water, and organic (plant and animal) material.
- **Soil Formation:** Soil is formed slowly as rock (the parent material) erodes into tiny pieces near the Earth's surface. Organic matter decays and mixes with inorganic material (rock particles, minerals and water) to form soil.
- **Soil is made up in layers:**
  - **Humus:** The top layer is leaf litter and humus (decomposed organic matter).
  - **Topsoil:** this contains humus (decomposed organic matter) mixed with mineral particles. Seeds can germinate and plants can grow in this layer.
  - **Eluviation (leaching):** Light in color. It is made up mostly of sand and silt, having lost most of its minerals and clay as water drips through the soil (in the process of eluviation).
  - **subsoil:** It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that it receives from layers above it when mineralized water drips from the soil above.
  - **regolith**: consists of slightly broken-up bedrock. Plant roots do not penetrate into this layer; very little organic material is found in this layer.
  - **bedrock:** unweathered rock
- **The 6 main properties of soil include:**
  - Soil Texture (size)
  - Soil Structure (what is in it)
  - Soil Consistency/Soil Strength
  - Soil Color
  - Soil Permeability
  - Soil Temperature

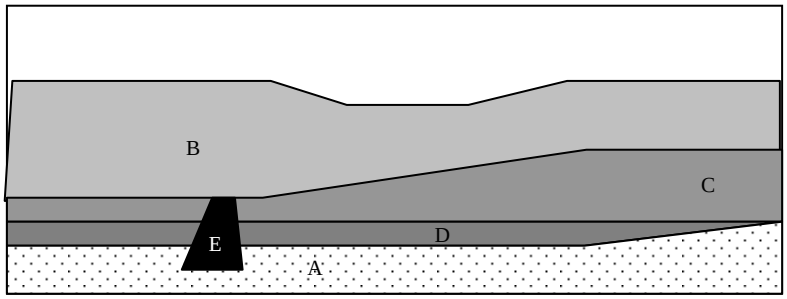
Suggested Activities

United Streaming: Geologist's Notebook: Three Rocks. Worksheets available.
Digging Through Earth

Earth and Space Science Benchmark C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

Questions:

1. The contour map below shows several layers of the Earth. Which layer on the contour map shown below is oldest? What most likely caused layer E to form the way it did?



2. What is a test used to determine the hardness of a mineral is the
   a. luster test
   b. streak test
   c. color test
   d. scratch test

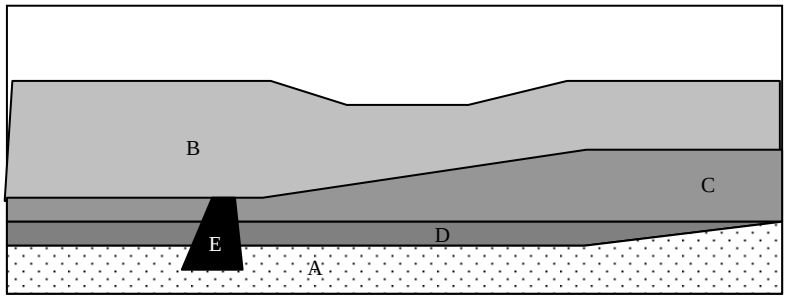
3. How are metamorphic rocks formed?
   a. melting
   b. weather and erosion
   c. heat and pressure (heating and squeezing)
   d. squeezing and cementing

4. What is a test used to determine the hardness of a mineral is the
   a. luster test
   b. streak test
   c. color test
   d. scratch test

Earth and Space Science Benchmark C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

Answers

1. The contour map below shows several layers of the Earth. Which layer on the contour map shown below is oldest? What most likely caused layer E to form the way it did?



Layer A is the oldest since it is on the bottom and formed first. Layer E may have form after C from a volcano.

2. What is a test used to determine the hardness of a mineral is the
   a. luster test
   b. streak test *
   c. color test
   d. scratch test

3. How are metamorphic rocks formed?
   a. melting
   b. weather and erosion
   c. heat and pressure (heating and squeezing) *
   d. squeezing and cementing

4. What is a test used to determine the hardness of a mineral is the
   a. luster test
   b. streak test *
   c. color test
   d. scratch test

Earth and Space Science - *Renewable & Non-renewable*

Benchmark & GLI
Earth and Space Science
C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.
Grade 3
1. Compare distinct properties of rocks (e.g., color, layering and texture).
2. Observe and investigate that rocks are often found inlayers.
3. Describe that smaller rocks come from the breakdown of larger rocks through the actions of plants and weather.
4. Observe and describe the composition of soil (e.g., small pieces of rock and decomposed pieces of plants and animals, and products of plants and animals).
5. Investigate the properties of soil (e.g., color, texture, capacity to retain water, ability to support plant growth).
6. Investigate that soils are often found in layers and can be different from place to place.
Grade 4
No indicators present.
Grade 5
5. Explain how the supply of many non-renewable resources is limited and can be extended through reducing, reusing and recycling but cannot be extended indefinitely.
6. Investigate ways Earth's renewable resources can be maintained.

Vocabulary:
alternative energy source: energy sources which are not based on the burning of fossil fuels or the splitting of atoms such as solar, wind power, geothermal, tides, and hydroelectric.
depletion: to have less
fossil fuel: a fuel (such as coal, oil or natural gas) that is formed in Earth from plant or animal remains.
non-renewable: resources that nature cannot replace quickly enough to meet people's needs.
pollution: a substance that, when added to the environment causes the environment to be harmful or unfit for living things.
recycle: processing waste items so the material they are made of can be used to make new items.
reduce: limit the materials people use
renewable resources: resources that nature produces again and again.
reuse: use materials over and over again.

Key Concepts

- Non-renewable resources like coal, petroleum and natural gas, are limited.
- Fossil Fuels are formed from the remains of plants and animals. These plants and animals decayed and have been preserved in the earth's crust by pressure, bacterial processes and heat. It takes millions of years for these organisms to chemically change into fossil fuels.
- Renewable resources can be considered, plants, animals, water, and air.
- Renewable resources can be maintained by keeping our water and air clean, and protecting our wildlife and tree's.
- Pollution is anything that makes the environment unclean or unhealthy. Often times these are things done by humans. When fossil fuels are burned it creates air pollution.

When chemicals are used and are released in the environment, it also pollutes the land and water.

- Conservation is how we protect and preserve our natural resources.
- To help conserve our non-renewable resources we need to reduce, reuse, and recycle.
- Depletion is the amount of something available becomes less. For example, our oil supply is less, as we continue to use it we will eventually run out since it is a non-renewable resource.
- Alternative energy resources are ways we try to find energy resources that will use the least amount of natural resources and creating the least amount of pollution.

Suggested Activities

- Go to www.unitedstreaming.com: Reducing, Reusing, and Recycling: Environmental Concerns
- http://www.harcourtschool.com/menus/science/grade5_oh.html: go over Groundwater Pollution and Waste Not

<u>Earth and Space Science Benchmark C</u>: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

Questions:

1. It rained early in the morning. A student sees a puddle of water on the sidewalk when she travels to school. The water in the puddle is gone when she travels home. What happened to the water in the picture?
   b. It melted.
   c. It condensed.
   d. It evaporated.
   e. It froze.

2. Troy gives his jacket to his younger brother. What kid of conservation is this?
   a. Recycleing
   b. Reducing
   c. Reselling
   d. Reusing

3. What causes acid rain?
   a. air polllution
   b. drought
   c. sewage
   d. water pollution.

4. Why is water pollution at a factory that's far from the ocean a threat to the ocean?

Earth and Space Science Benchmark C: Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

Answers:

1. It rained early in the morning. A student sees a puddle of water on the sidewalk when she travels to school. The water in the puddle is gone when she travels home. What happened to the water in the picture?
   a. It melted.
   b. It condensed. *
   c. It evaporated.
   d. It froze.

2. Troy gives his jacket to his younger brother. What kid of conservation is this?
   a. Recycling
   b. Reducing
   c. Reselling
   d. Reusing *

3. What causes acid rain?
   a. air pollution *
   b. drought
   c. sewage
   d. water pollution.

4. Why is water pollution at a factory that's far from the ocean a threat to the ocean?

Pollution in water can travel through steams and rivers and eventually end up in the ocean.

Earth and Space Science

Benchmark & GLI
Earth and Space Science
D: Analyze weather and changes that occur over a period of time.
Grade 3
No indicators present for this benchmark.
Grade 4
1. Explain that air surrounds us, takes up space, moves around us as wind, and may be measured using barometric pressure.
2. Identify how water exists in the air in different forms (e.g., in clouds, fog, rain, snow and hail).
3. Investigate how water changes from one state to another (e.g., freezing, melting, condensation and evaporation).
4. Describe weather by measurable quantities such as temperature, wind direction, wind speed, precipitation and barometric pressure.
5. Record local weather information on a calendar or map and describe changes over a period of time (e.g., barometric pressure, temperature, precipitation symbols and cloud conditions).
6. Trace how weather patterns generally move from west to east in the United States.
7. Describe the weather which accompanies cumulus, cumulonimbus, cirrus and stratus clouds.
Grade 5
No indicators present for this benchmark.

Vocabulary:
air: the mixture of gases that surrounds Earth.
barometer: a weather instrument that measures air pressure (also known as the barometric pressure).
clouds: a mass of water droplets or ice crystals that have clumped together in the atmosphere.
condensation: the process of changing from a gas to a liquid.
cumulonimbus clouds: a huge vertical cloud that can produce a thunderstorm.
cumulus clouds: a puffy, white cloud with a flat bottom. (Fair weather cloud)
evaporation: the process of changing from a liquid to a gas.
fog: a layered cloud that forms close to the ground.
forms of water: (Frozen, melting, condensation, evaporation, water vapor)
freeze: to change from a liquid to a solid when temperature drops.
rain gauge: a weather instrument that measures rainfall.
status clouds: a flat, gray layered cloud that covers the sky.
temperature: the average speed of the particles in a substance.
water vapor: the gas state of water.
wind: moving air.

Key Concepts

- **Air** is a colorless, odorless, tasteless, gaseous mixture, mainly nitrogen (approximately 78 percent) and oxygen (approximately 21 percent) with lesser amounts of argon, carbon dioxide, hydrogen, neon, helium, and other gases.
- **Air** has weight and takes up space.
- **Meteorologists:** person who studies the Earth's atmosphere. They use computers, weather stations all over the world, satellites, balloons, and weather planes that record data from high in the atmosphere.
- **Air pressure**: is made up of molecules and atoms that have mass. Air has mass. The properties of air are; mass, pressure, density.
- Falling air pressure is usually an indication of an approaching storm. Rising air pressure usually indicates the weather is clearing.
- **A barometer** is an instrument that measures changes in air pressure.
- **Altitude,** or elevation, is the distance above sea level.
- Air pressure decreases as the altitude increases. The density of the air decreases also. Air pressure is highest at sea level and lowest at the tops of mountains. Low density of air makes it difficult to breathe because of the reduced oxygen in each cubic meter of air.
- **Wind –** is the horizontal movement of air over the earth's surface. Winds are described by their direction and speed. The name of a wind is the direction the wind is coming from.
- Wind blows from areas of high pressure to areas of low pressure. The uneven heating and cooling of the earth's surface and atmosphere, causes changes in air pressure.
- Wind direction can be measured with a wind vane and wind speed can be measured with an **anemometer**. Wind-chill factor is the increased cooling in air temperature caused by the wind.
- **Air temperature** affects the weather more than any thing else. Temperatures change during the day and night because of the energy (heat), given off by the sun. Temperatures also change with the seasons because the tilt of the earth changes. The angle of the sun's rays striking the earth changes also. The more direct the rays are, the warmer the air temperature.
- **The water cycle** moves water from the oceans, lakes, and streams into the air. The stages of the water cycle are; evaporation, condensation, precipitation, run-off, and percolation.
- **Evaporation** is the process that changes water molecules in liquid water to water vapor, as it escapes into the air. Clouds form when water vapor in the air becomes liquid water or ice crystals.
- **Condensation** is the process by which molecules of water vapor in the air become liquid water.
- **Precipitation** is all forms of water that fall from clouds and reaches the earth's surface. The types of precipitation include; rain, freezing rain, sleet, hail, and snow.
- Rain is measured using a **rain gauge**, which is an open-ended tube, marked in centimeters, used to collect rainfall. Too much rain, or a heavy downpour, will run off the land into bodies of water. A slow rain will allow water to percolate or be absorbed into the land.
- **Weather changes over time** can be predicted using barometric pressure, temperature, precipitation symbols, and cloud conditions.

- **Clouds** can give a good indication of the current weather and help meteorologists predict future weather. Clouds are made of water droplets. The same system developed about 200 years ago by an English, amateur meteorologist, is still used today to classify clouds.
    a. Cumulus clouds – puffy clouds – look like cotton balls or cotton candy. They are seen on sunny days – called 'fair weather' clouds. They can grow to become thunderheads (cumulonimbus)
    b. Cirrus clouds - wispy tails rising upward, usually scattered. They form high in the atmosphere, where it is very cold and the pressure is low. They are made up of ice instead of water droplets. They usually indicate a snowfall.
    c. Stratus clouds – layered or flat clouds. Most hang low in the sky. They can be dark gray. Stratus clouds usually produce rain.

Suggested Activities

Weather web site: http://www.rcn27.dial.pipex.com/cloudsrus/activities.html

Make your own weather station and collect data:

http://www.miamisci.org/hurricane/weatherstation.html

<u>Earth and Space Benchmark D:</u> Analyze weather and changes that occur over a period of time.

Questions:

1. During the water cycle, water that is stored on Earth turns from a liquid to a gas known as water vapor. The water vapor cools to form clouds. When the water vapor reaches a certain temperature, the water vapor turns back into a liquid and falls to the ground. What are the names of the three stages in the water cycle?

2. Angel noticed that a puddle in his driveway was gone the next day. What change took place?
   a. Melting
   b. Evaporation
   c. Condensation
   d. Freezing

3. Your town is in a high pressure area. Which of the following most likely describes the weather?
   a. cloudy
   b. sunny
   c. rainy
   d. snowing

4. The meteorologist announces Ohio's weather is warm and sunny for Sunday and Monday. The meteorologist continues to explain that a cold front will pass through Indian on Monday. Predict what Ohio's weather will be on Tuesday.
   a. Warm and sunny
   b. Warm and rainy
   c. Cooler and rainy
   d. Cooler and sunny

5. What type of weather will this cloud most likely produce?
   a. Rain with lightening
   b. Sunny and warm
   c. Fair
   d. Warm and breezy

<u>Earth and Space Benchmark D:</u> Analyze weather and changes that occur over a period of time.

Answers:

1. During the water cycle, water that is stored on Earth turns from a liquid to a gas known as water vapor. The water vapor cools to form clouds. When the water vapor reaches a certain temperature, the water vapor turns back into a liquid and falls to the ground. What are the names of the three stages in the water cycle?

During the water cycle the sun heats the liquid water on earth and evaporates the water into water vapor. The water vapor condenses (cools) to form clouds. As more moisture collects in the cloud the water grow, and fall out of the sky as precipitation. As the precipitation fall (rain, hail, sleet, or snow) it eventually flows as surface runoff or it is absorbed as groundwater.

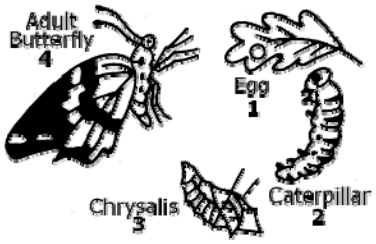
2. Angel noticed that a puddle in his driveway was gone the next day. What change took place?
    a. Melting
    b. Evaporation *
    c. Condensation
    d. Freezing

3. Your town is in a high pressure area. Which of the following most likely describes the weather?
    a. Cloudy
    b. Sunny *
    c. Rainy
    d. snowing

4. The meteorologist announces Ohio's weather is warm and sunny for Sunday and Monday. The meteorologist continues to explain that a cold front will pass through Indian on Monday. Predict what Ohio's weather will be on Tuesday.
    a. Warm and sunny
    b. Warm and rainy
    c. Cooler and rainy *
    d. Cooler and sunny

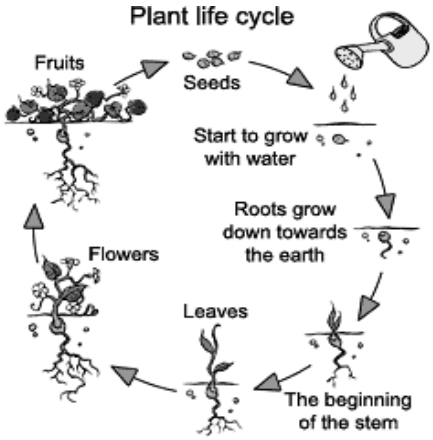
5. What type of weather will this cloud most likely produce?
    a. Rain with lightening *
    b. Sunny and warm
    c. Fair
    d. Warm and breezy

Life Cycles



Life Science

Columbus Public Schools



Benchmark & GLI

Life Science

A: Differentiate between the life cycles of different plants and animals.

Grade 3

1. Compare the life cycles of different animals including birth to adulthood, reproduction and death (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).

Grade 4

1. Compare the life cycle of different plants including germination, maturity, reproduction and death.

5. Describe how organisms interact with one another in various ways (e.g., many plants depend on animals for carrying pollen or dispersing seeds.

Grade 5

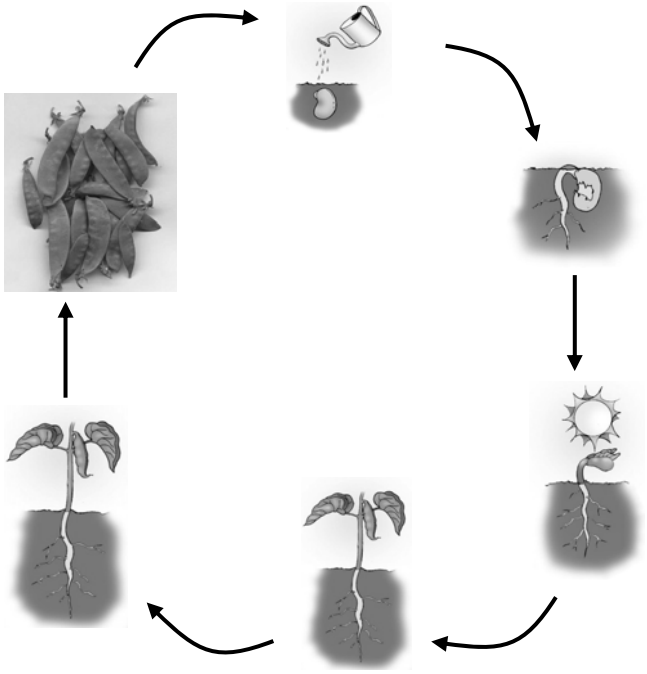
No indicators present for this benchmark.

Vocabulary:

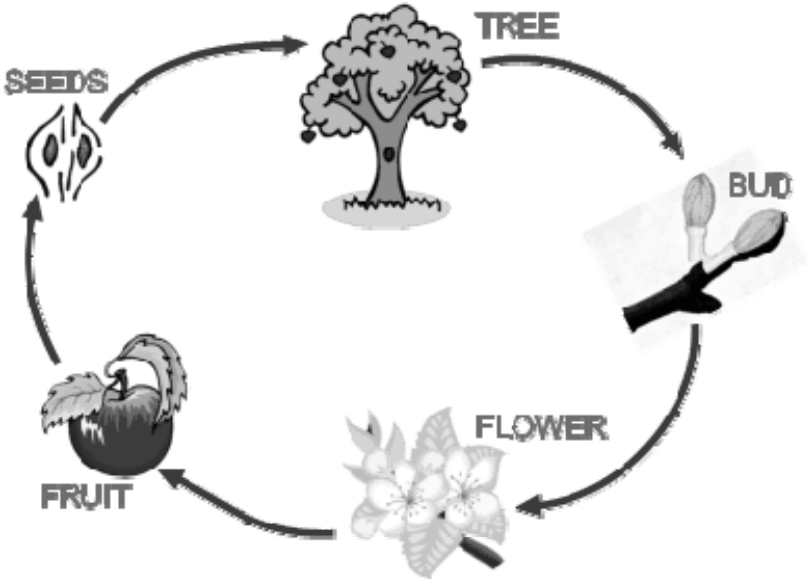
Plants

flower: the part where seeds are made in many kinds of plants
fruit: a structure that grows from a flower and contains seeds
germination: the sprouting of a plant from a seed
leaf: the plant organ where photosynthesis occurs to make food for the plant.
ovary: a plant or animal structure in which egg cells develop
petals: colorful, sweet-smelling parts of a flower that attract insects.
pistil: a long tube that grows up from the ovary in a flower
pollen: a powdery material in flowers that contains sperm cells
pollination: the transfer of pollen from the stamens to the pistil of a flower
roots: plant structures that hold a plant in place and take in water and nutrients from the soil.
seed: a structure produced by a plant that contains a tiny undeveloped plant and a supply of food for the plant.
stamens: the male part that produces pollen in a flower
stem: the part of a plant that holds the leaves up to sunlight and moves water, nutrients and food through the plant.

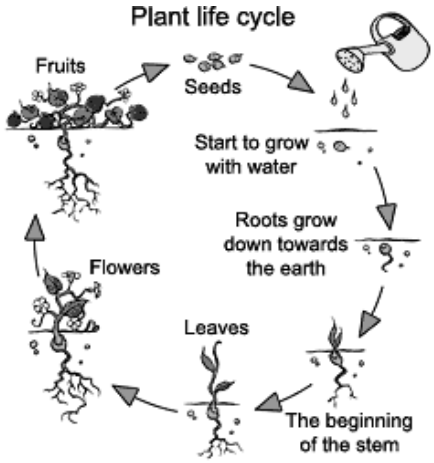
The Life Cycle of a Bean Plant



The Life Cycle of an Apple Tree



Plant Life Cycles



- A plant's life cycle includes all of the stages in the growth and development of a plant in its life time.
- **Pollination, Fertilization, Development of Fruit, Dispersal of the Seed, Germination.**
- The life cycle can begins with a **seed** that contains a very small plant inside called an embryo.
- When growing begins, **germination** takes place. Temperature, moisture and other conditions must be just right. A sprouted seed is called a **seedling**.
- After a few leaves grow, the young plant begins to make its own food through a process known as **photosynthesis.**
- Once the plant is large enough, it produces **flowers** which are structures that help a plant reproduce.
- After the flower is pollinated, it develops into a **fruit** that contains and protects seeds.
- The fruit ripens and the seeds are released. The cycle then begins again.
- Annuals complete their life cycle in 1 year. (peas and beans)
- Biennials complete their life cycle in 2 years. (carrots, turnips)
- Perennials may complete their life cycle in 3 years. (daisy, bamboo)

Suggested Activities:

- Research the life cycle of a dragonfly, an ant, and a beetle. Illustrate each stage of their life cycle.
- Research the life cycle of a plant. Soak some lima beans in water. Dissect a bean and observe the tiny plant, or embryo, inside. Use the other beans to plant in soil or in a large zip-closing bag with a wet paper towel. Keep a journal of the changes in your plant..
- Practice life cycles on http://teams.lacoe.edu/documentation/classrooms/judi/life/activities/cycles/life_cycles.html

Vocabulary:

Animals

adult: the mature stage in an animal.

amphibian: an animal that has a backbone and lives in water when it is young and on land when it is an adult

chrysalis: the pupa stage of a butterfly, this occurs before the caterpillar becomes of an adult.

complete metamorphosis: is when an animal, usually an insect, goes through several very different stages as it grows up. The stages include egg, larva, pupa, adult

egg: a stage in the life cycle of many organisms

exoskeleton: the hard outer covering that protects an animal's soft body parts inside.

incomplete metamorphosis: A life cycle of certain insects, such as crickets and grasshoppers, characterized by the absence of a pupa stage between the immature and adult stages. The stages are egg, nymph and adult.

larva: The newly hatched, wingless, often wormlike form of many insects before metamorphosis.

life cycle: the stages of growth and development that an organism goes through in its lifetime.

metamorphosis: the changes in form that some insects go through during their life cycle.

nymph: The larval form of certain insects, such as crickets and grasshoppers, usually resembling the adult form but smaller and lacking fully developed wings

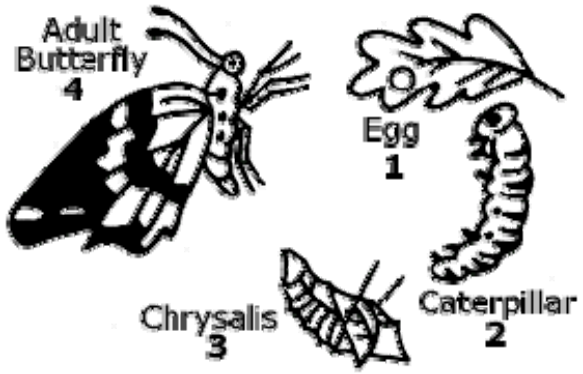
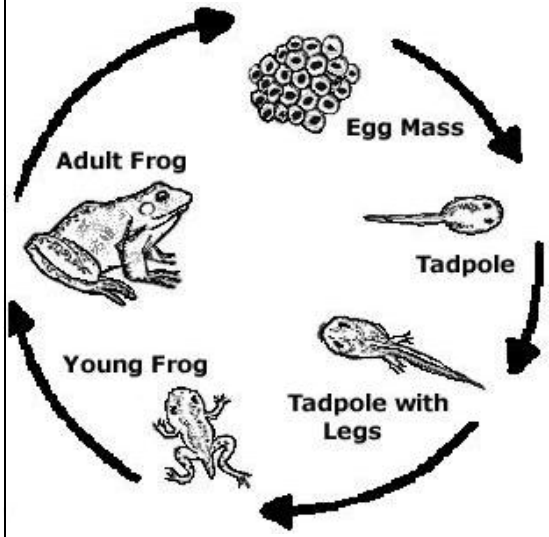
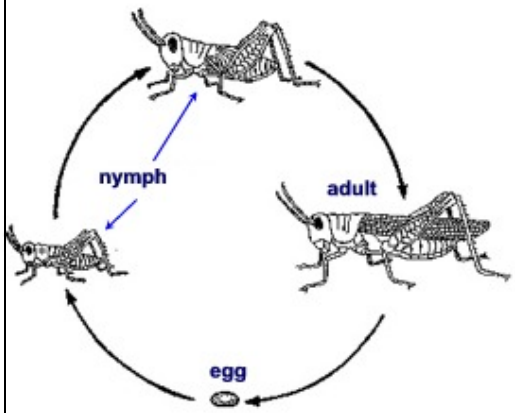
pupa: the stage in the life cycle of some insects when the organism changes from a larva to an adult.

reproduce: the process of making more organisms of the same kind

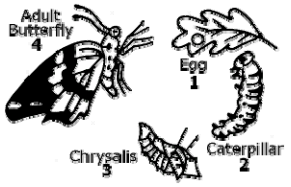
tadpole: The limbless aquatic larva of a frog or toad, having gills and a long flat tail. A tadpoles are also known as a polliwog.

Complete Metamorphosis (Animal Life Cycles)

Animal Life Cycle

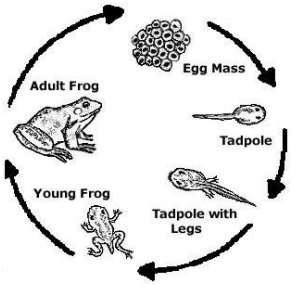
Butterfly Life Cycle	Frog Life Cycle	Grasshopper Life Cycle
		

- In **complete metamorphosis**, the newborn does not look like the adult. Examples include butterflies, bees, ants, flies, and moths.
- The 4 stages are: **egg**, **larva**, **pupa** (chrysalis or cocoon), and **adult**.



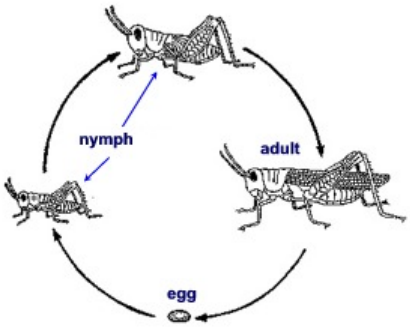
- The butterfly starts as an egg and hatches into a larva that eats and grows shedding its exoskeleton several times. When growth is finished, it forms a hard case called a pupa (chrysalis). The butterfly develops inside the pupa, and hatches from it.

- The frog's eggs develop into tadpoles. A tadpole breathes with gills and eats plants in the pond. The tadpole gradually develops complete gills and lungs, and grows legs. As an adult, the frog is able to breathe on land, while the tadpole can only survive in water. The tail is absorbed into the body as the little frog grows.



Incomplete Metamorphosis (Animal Life Cycles)

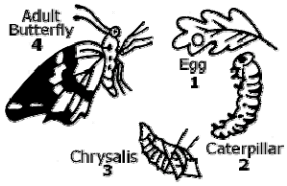
- **Incomplete metamorphosis** involves 3 stages of development. The newborn looks like a small adult but does not have all the structures of an adult.
- The 3 stages are: **egg** – laid on plant leaves or stems; **nymph** – the smaller adult hatched from the egg; **adult** – develops from the nymph.
- The grasshopper is an example of incomplete metamorphosis. The tiny grasshopper that hatches from a fertilized egg is called a nymph. It looks like a miniature adult grasshopper, except that it has no wings or reproductive organs. As it grows, it sheds its exoskeleton (its hard, outer shell) several times and gradually develops wings and reproductive organs.



Suggested Activities:

- Research the life cycle of a dragonfly, an ant and a beetle. Illustrate each stage of their life cycle.
- Research the life cycle of a plant. Soak some lima beans in water. Dissect a bean and observe the tiny plant, or embryo, inside. Use the other beans to plant in soil or in a large zip-closing bag with a wet paper towel. Keep a journal of the changes in your plant.
- Practice life cycles on http://teams.lacoe.edu/documentation/classrooms/judi/life/activities/cycles/life_cycles.html

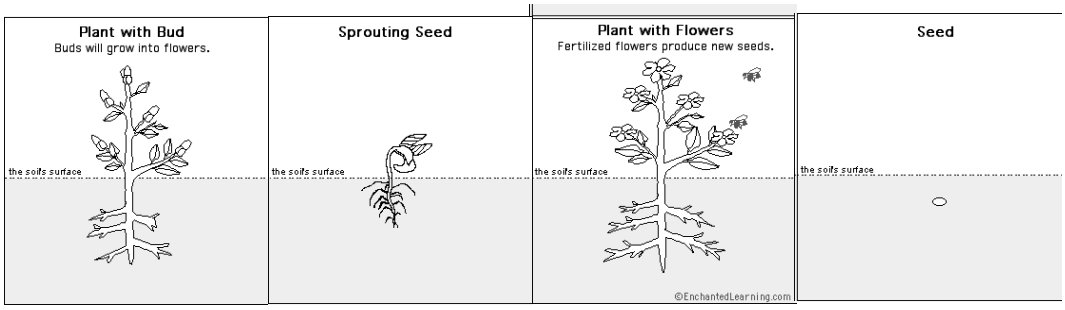
Student Questions:



1. At which stage of its life cycle is a butterfly able to produce offspring?
   a. Larva
   b. Adult
   c. Egg
   d. Pupa

2. What stage is present in complete metamorphosis but not in incomplete metamorphosis?
   a. Larva
   b. Nymph
   c. Adult
   d. Egg

3. Label the life cycle pictures 1-4 in order of its life cycle. Write your answer in the boxes below:



4. Bees carry pollen from flower to flower. Squirrels carry seeds in their fur around the neighborhood. Butterflies sip nectar then lay their eggs on the plant.

   What conclusion can you make about how the animals and plants help each other?

Teacher answer key:

1. At which stage of its life cycle is a butterfly able to produce offspring?

   a. larva

   b. adult *

   c. egg

   d. pupa

2. What stage is present in complete metamorphosis but not in incomplete metamorphosis?

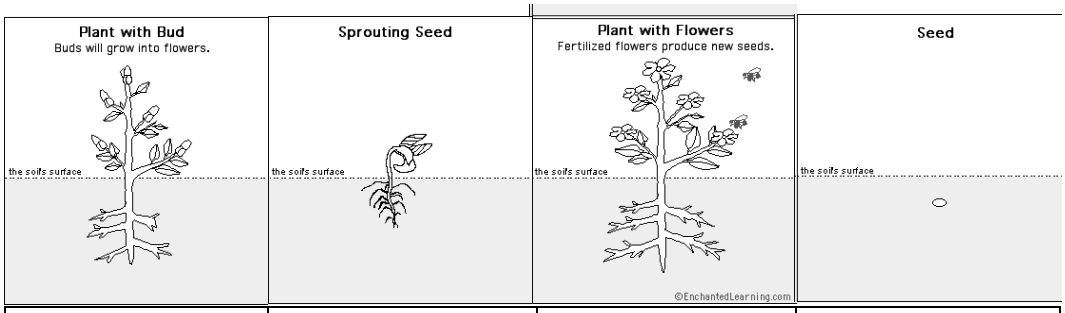
   a. larva *

   b. nymph

   c. adult

   d. egg

3. Label the life cycle pictures 1-4 in order of its life cycle. Write your answer in the boxes below:



3	2	4	1

4. Bees carry pollen from flower to flower. Squirrels carry seeds in their fur around the neighborhood. Butterflies sip nectar then lay their eggs on the plant's leaves.

   What conclusion can you make about how the animals and plants help each other? (2 points)

Points	Student Response
2	The response correctly concludes that animals carry seeds around in their fur or bowels and disperses them away from the parent plant AND concludes that plants provide food for animals.
1	The response concludes that animals carry seeds around in their fur or bowels and disperses them away from the parent plant OR concludes that plants provide food for animals.
0	The response shows no scientific understanding of the task.

Animal & Plant Structures

Life Science

Benchmark & GLI
Life Science
Benchmark B
B: Analyze plants and animals structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.
Grade 3 – Animal structure
2. Relate animal structures to their specific survival functions (e.g., obtaining food, escaping or hiding from enemies).
3. Classify animals according to their characteristics (e.g., body coverings and body structure)
Grade 4 – Plant structure
2. Relate plant structures to their specific functions (e.g., growth, survival and reproduction).
3. Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, roots and stems).
Grade 5 – Animal and plant
1. Describe the role of producers in the transfer of energy entering ecosystems as sunlight to chemical energy through photosynthesis.
2. Explain how almost all kinds of animals' food can be traced back to plants.
3. Trace the organization of simple food chains and food webs.

Vocabulary

Animals

adult: the mature stage in an animal.

amphibian: an animal that begins life in the water and moves onto land as an adult.

behavioral adaptations: are the things organisms do to survive. For example, bird calls and migration are behavioral adaptations.

bird: an animal that has feathers, two legs, and wings.

chrysalis: the pupa stage of a butterfly, this occurs before the caterpillar becomes of an adult.

complete metamorphosis: a life cycle of an animal, usually an insect, goes through several very different stages as it grows up. The stages include egg, larva, pupa, adult

egg: a stage in the life cycle of many organisms

exoskeleton: the hard outer covering that protects an animal's inside soft body parts

fish: an animal that lives its entire life in water

gills: body parts that take in oxygen from the water.

incomplete metamorphosis: A life cycle of certain insects, such as crickets and grasshoppers, characterized by the absence of a pupa stage between the immature and adult stages. The stages are egg, nymph and adult.

inherit: to have a trait passed on from the parents of the organism.

larva: the stage of complete metamorphosis after an organism hatches from its egg.

life cycle: the changes that happen to an animal during its life.

mammal: an animal that has hair or fur.

metamorphosis: a series of changes in appearance that some organisms go through.

nymph: The larval form of certain insects, such as crickets and grasshoppers, usually resembling the adult form but smaller and lacking fully developed wings

oxygen: a gas that people need to live and plants give off into the air.

pupa: the stage of complete metamorphosis when an organism is wrapped in a cocoon.
reproduce: the process of making more organisms of the same kind
reptile: a land animal that has dry covered with scales.
scales: a small, thin, flat plate that helps protect an animal.
structural adaptations: are physical features of an organism like the bill on a bird or the fur on a bear
tadpole: The limbless aquatic larva of a frog or toad, having gills and a long flat tail. Tadpoles are also known as a polliwogs.

SHAPE	TYPE	ADAPTATION
	Cracker	Seed eaters like sparrows and cardinals have short, thick conical bills for cracking seed.
	Shredder	Birds of prey like hawks and owls have sharp, curved bills for tearing meat.
	Chisel	Woodpeckers have bills that are long and chisel-like for boring into wood to eat insects.
	Probe	Hummingbird bills are long and slender for probing flowers for nectar.
	Strainer	Some ducks have long, flat bills that strain small plants and animals from the water.
	Spear	Birds like herons and kingfishers have spear-like bills adapted for fishing.
	Tweezer	Insect eaters like warblers have thin, pointed bills.
	Swiss Army Knife	Crows have a multi-purpose bill that allows them to eat fruit, seeds, insects, fish, and other animals.

SHAPE	TYPE	ADAPTATION
	Grasping	Raptors like Osprey use their large curved claws to snatch fish from the water.
	Scratching	Pheasants and other birds that scratch the soil for food have nail-like toes.
	Swimming	Ducks and other webbed lined swimming birds use their feet like paddles.
	Perching	Robins have a long back toe, which lets them grab a perch tightly.
	Running	Many fast-running birds have three toes rather than four.
	Climbing	A woodpecker's hind toes enable it to climb without falling backward.

- Large Eye: allow more light in so that animals can see better in the dark (owl).
- Large Ears: able to capture sound waves and hear better (bat)
- Long thin nose: warms air before entering the lungs (humans)
- Gills takes oxygen from the water (fish).

Suggested Activities

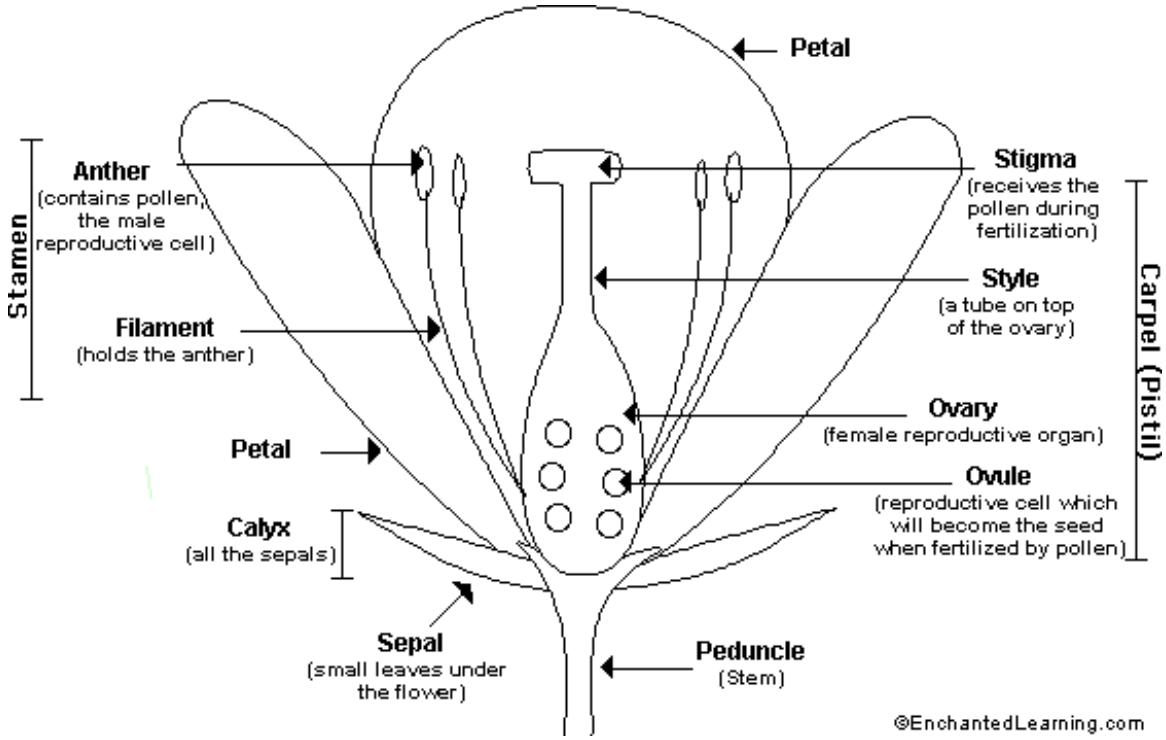
When using website pages please have discussions with your students.

- Great site on body structures and their use. http://www.uen.org/utahlink/activities/view_activity.cgi?activity_id=4750
- Bird Adaptation: http://www.normanbirdsanctuary.org/beak_adaptations.shtml
- Animal Adaptation: http://library.thinkquest.org/J001644F/default.htm
- This web site provides information about different animals and ask questions for students to answers: http://www.uen.org/utahlink/activities/view_activity.cgi?activity_id=4750
- Structural and Behavioral Adaptations: Have the student take the quiz and print their score.: http://www.nhptv.org/natureworks/nwep1.htm

Vocabulary:

Plants

angiosperm: flowering plant that has seeds protected by fruits.
classify: to group things that are alike
extinction: the dying out of an entire species.
flower: the parts are a stamen, a pistil, petals and sepals
fossil: the remains of once-living things that have been preserved by petrified or by leaving different kinds of imprints.
fruit: a structure that grows from a flower and contains seeds
germination: the sprouting of a plant from a seed
leaf: a plant structure that grows from the stem
nonvascular: without vessels. Non-vascular plants do not have tubes to transport materials.
ovary: a plant or animal structure in which egg cells develop
petals: colorful, sweet-smelling parts of a flower that attract insects.
phloem:
photosynthesis: the production of plant sugar in the chloroplast cells of the leaf
pistil: the female flower part with ovary, style and stigma that produce ovule or seeds
pollen: a powdery material in flowers that contains sperm cells
pollination: the transfer of pollen from the stamens to the pistil of a flower
roots: plant structures that hold a plant in place and take in water and nutrients from the soil.
seed: a structure produced in the pistil that contains a tiny undeveloped plant (embryo) and a supply of food for the embryo.
spore:
stamen: the male part with anther and filament that produces pollen
stem: the part of a plant that holds the leaves up to sunlight and contains tubes which move water, nutrients and food through the plant.
vascular: having vessels. Vascular plants have tubes that transport food and water to different parts of the plant
vascular tissue: tissue that supports plants and caries water and food.
xylem: vascular tissue that carries water and nutrients from roots to every part of a plant


Petal
Anther
(contains pollen, the male reproductive cell)
Stamen
Filament
(holds the anther)
Stigma
(receives the pollen during fertilization)
Style
(a tube on top of the ovary)
Carpel (Pistil)
Ovary
(female reproductive organ)
Petal
Ovule
(reproductive cell which will become the seed when fertilized by pollen)
Calyx
(all the sepals)
Sepal
(small leaves under the flower)
Peduncle
(Stem)
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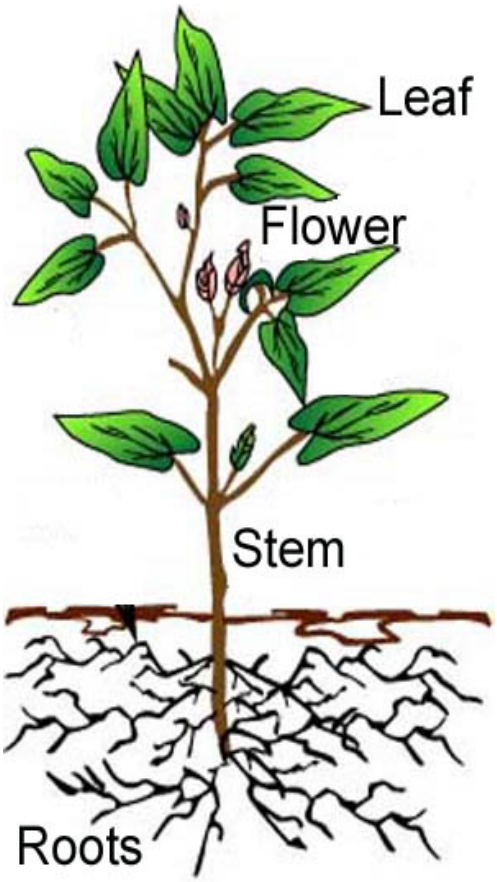

Leaf
Flower
Stem
Roots

Plant Facts

- Roots: plant structures that hold a plant in place and take in water and nutrients from the soil. (Long vertical roots enabling a plant to reach water sources beneath the soil)
- Stem: the part of a plant that holds the leaves up to sunlight and contains tubes which move water, nutrients and food through the plant.
- Flower: the parts are a stamen, a pistil, petals and sepals; these parts are responsible for the reproduction of the plants. Animals aid in the pollination of plants.
- Leaf: a plant structure that grows from the stem. Photosynthesis takes place in the leaf, this is where the plant takes in carbon dioxide and releases oxygen. (Waxy leaf prevent water transpiration.)
-

Suggested Activities:

View different websites and have students complete the web quest:

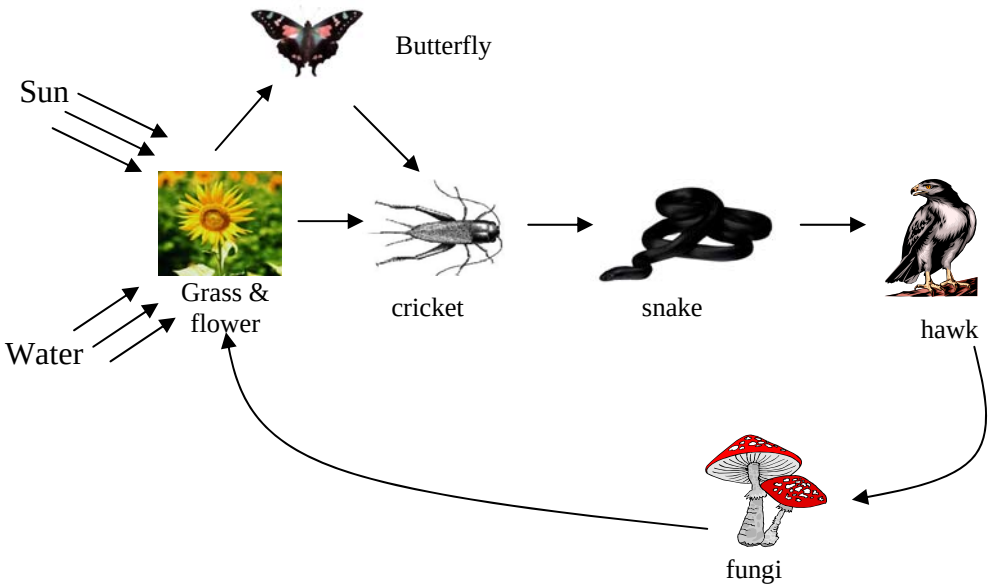
- sdces.sdstate.edu/brown/beghort**plantparts**guide.pdf
- http://www.webinstituteforteachers.org/~agrosenheider/myparts.htm - print results
- http://www.urbanext.uiuc.edu/gpe/case1/c1m1app.html
- http://its.guilford.k12.nc.us/webquests/plantquest/index.htm
- http://www.todaysteacher.com/PartsIsParts.htm

<u>Life Science Benchmark B:</u> Analyze plants and animals structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

<u>Questions:</u>

1. Where do plants get their energy?
    a. Animals
    b. Sun
    c. Flowers
    d. Soil

2. In a food web, what do we call organisms that change energy from the sun into food energy?
    a. Consumers
    b. Decomposers
    c. Producers
    d. Scavengers



Use the food chain diagram above to answer the questions 3, 4, 5, 6, 7, 8.

3. Which organism is a producer?
    a. Flower
    b. Cricket
    c. Fungi
    d. Butterfly

4. Which organism is a carnivore?
    a. Flower
    b. Fungi
    c. Snake
    d. Grass

5. Which organism is a decomposer?
    b. Flower
    c. Cricket
    d. Fungi
    e. Butterfly

6. Which organism is an omnivore?
    a. Flower
    b. Cricket
    c. Snake
    d. Butterfly

Use the food chain diagram on the previous page to answer the questions 7.

7. Which organism is a herbivore?
    a. Flower
    b. Cricket
    c. Fungi
    d. Butterfly

8. Your neighbor wants to widen his drive way. In order to do this, he must cut down an apple tree that is in the way.

    Analyze the impact the wider driveway will have on organisms that live in the apple tree ecosystem? (2 pt.)

<u>Life Science Benchmark B:</u> Analyze plants and animals structures and functions needed for survival and describe the flow of energy through a system that all organisms use to survive.

<u>Answers:</u>

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   a. Animals
   b. Sun *
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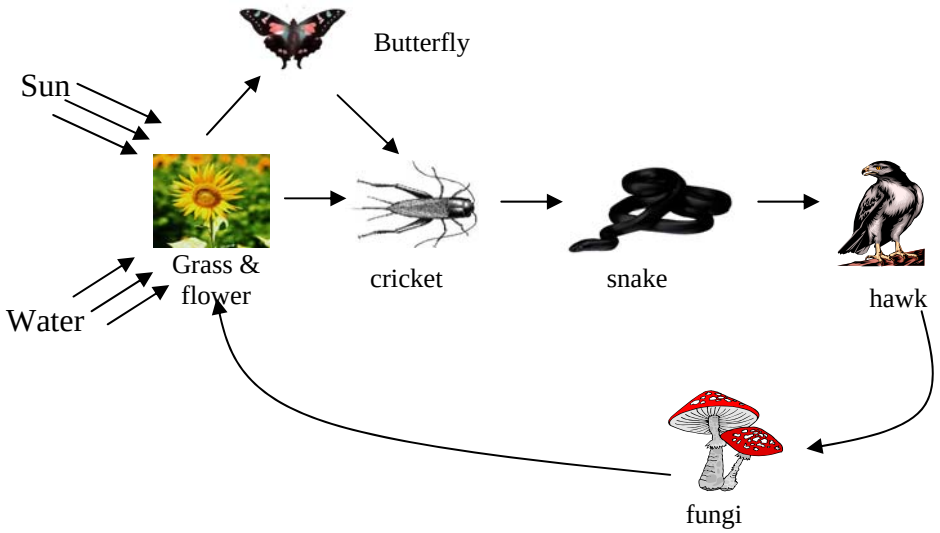

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    Analyze the impact the wider driveway will have on organisms that live in the apple tree ecosystem? (2 pt.)

When the neighbor cuts down the apple tree he is destroying some animal's habitat. Animals, like squirrels and birds, that live in the tree would loose their home. Animals that eat the apples would loose a food source.

Animal & Plant Survival

Life Science

Benchmark & GLI
Life Science
Benchmark C
C: Compare changes in an organism's ecosystem/habitat that affect its survival
Grade 3
4. Use examples to explain that extinct organisms may resemble organisms that are alive today.
5. Observe and explore how fossils provide evidence about animals that lived long ago and the nature of the environment at that time.
6. Describe how changes in an organism's habitat are sometimes beneficial and sometimes harmful.
Grade 4
4. Observe and explore that fossils provide evidence about plants that lived long ago and the nature of the environment at that time.
Grade 5
4. Summarize that organisms can survive only in ecosystems in which their needs can be met. The world has different ecosystems and distinct ecosystems support the lives of different types of organisms.
5. Support how an organism's patterns of behavior are related to the nature of that organism's ecosystem, including the kinds and numbers of other organisms present, the availability of food and resources, and the changing physical characteristics of the ecosystem.
6. Analyze how all organisms, including humans, cause changes in their ecosystems and how these changes can be beneficial, neutral or detrimental.

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Vocabulary continued:

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reptile: a land animal that has dry covered with scales.
scales: a small, thin, flat plate that helps protect an animal.
tadpole: The limbless aquatic larva of a frog or toad, having gills and a long flat tail. Tadpoles are also known as a polliwogs.

Key concepts

- Fossils are ancient traces or remains of once-living things.
- There are few plant fossils than animal fossils since plants are soft and easily destroyed.

- Most fossils are found in sedimentary rock. Sedimentary rock form in layers, which allow for the deposition of animal and plant remains to fill in between each layer.
- It can take millions of years for an animal to become a fossil.
- Scientist look at the remains of plants and animals and compare them with the bones of animals they know and leaves of plants they know. The scientist is able to hypothesis based on their knowledge of today's animal and plants.
- Organisms can only live where the organisms needs are met (shelter, food, water, and air).
- The environment is made up of living (biotic: plants and animals) and non living (abiotic: air, water, sunlight, and soil).
- It is beneficial for an animal and plant to be able to live in more than one kind of ecosystem in the event that the ecosystem changes, the plant and animal hve a better chance of survival.
- Abiotic factors affect an ecosystem. When amount of air, water, sunlight, and soil changes the plants growth in that area also changes, which results in a change in the soil nutrients, and it changes what kinds of animals can live in that ecosystem..
- People can change the ecosystem in a positive way by planting trees, creating wetlands, and reducing pollution.
- People can change the ecosystem in a negative way by clearing land (causing erosion), polluting the water, air, or soil.

Suggested Activities:

- United streaming: Fossil Life: An Introduction, TLC Elementary School: Prehistoric Earth,
- Make a fossil using modeling clay, seashell, petroleum jelly, and white glue. Coat the clay with petroleum jelly, press the seashell into the clay and remove carefully, fill the imprint with glue, let the glue harden. Try this with other objects and have students try to hypothesis what the fossil is and tell about the environment of the fossil.
- Have student observe a trilobite and describe what animals it resembles and explain why.
- United streaming: Please review before showing to students, many times you only need to show segments.Creature Features: Space for Everyone, Creature Features: All Part of a Whole, Creature Features: Adaptation, Creature Features: Changes to Environment, Creature Features: Creatures in Trouble, Creature Features: Keeping an Eye on Creatures, Exploring the Diversity of Life: A World of Difference, Exploring the Diversity of Life: Act with the Facts, Exploring the Diversity of Life: Don't Be Part of the Problem,
- Create a 6 terrarium let it have time to grow. Have students think of 3 things that would be a detriment to the terrarium and 3 things that would safely benefit the terrarium. How do each affect the ecosystem? What would happen if animals were involved?

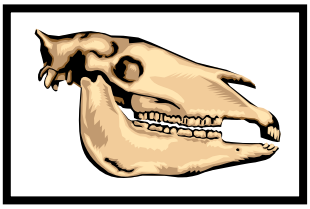
<u>Life Science Benchmark C:</u> Compare changes in an organism's ecosystem/habitat that affect its survival

<u>Questions:</u>

1. Why are there more animal fossils then plant fossils?
   a. Animals eat plants.
   b. Plants are smaller than animals.
   c. Plants have softer body parts than animals.
   d. There were more ancient animals than ancient plants.

2. In which kind of rock are most fossils found?
   a. Igneous
   b. Sedimentary
   c. Metamorphic
   d. Volcanic

3. If scientist found this fossil, what could they infer?



   a. This animal eats meat.
   b. This animal eats plants
   c. This animal lived in the desert.
   d. This animal lived in the artic.

4. How are an elephant and a mammoth alike?
   a. Both are extinct.
   b. Both have tusks.
   c. Both have shaggy fur.
   d. Both live in a warm climate.

5. Katie lawn is an ecosystem. It includes grass, soil, are, insects, earthworms, and birds, Katie wants her grass to be green and decides to add fertilizer. Katie wants her grass to be the best and decides to put more fertilizer on then the directions recommends. Explain which parts of the ecosystem will change?

6. A landfill closes and is covered with soil, plants, and trees. What is this an example of
    a. Biotic factors
    b. Erosion
    c. Habitat restoration
    d. Pollution

7. Oil drips from cars onto a parking lot. Then rain washes it into a pond where fish get sick and die. What is this an example of?
    a. Adaptation
    b. Pollution
    c. Population
    d. restoration

<u>Life Science Benchmark C:</u> Compare changes in an organism's ecosystem/habitat that affect its survival

<u>Answers:</u>

1. Why are there more animal fossils then plant fossils?
   a. Animals eat plants.
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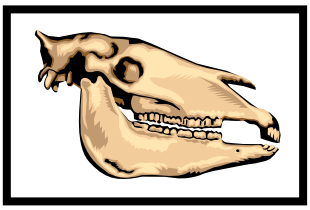

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<u>All parts of the ecosystem will change. When Katie decides to add fertilizer to her grass she is polluting the ground.</u>

6. A landfill closes and is covered with soil, plants, and trees. What is this an example of
   a. biotic factors
   b. erosion
   c. habitat restoration *
   d. pollution

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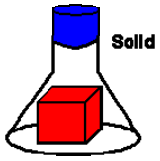
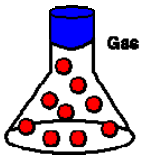
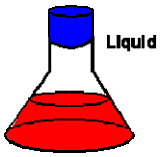
Physical Science
Columbus
Public Schools







Benchmark & GLI
Physical Science
Benchmark A
A: Compare the characteristics of simple physical and chemical changes.
Grade 3
No indicators present for this benchmark.
Grade 4
1. Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to another and the change is reversible).
2. Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, vinegar and baking soda).
Grade 5
No indicators present for this benchmark.

Vocabulary:
chemical change: a change that produces a new substance (iron nail oxidizes to create rust)
matter: material or "stuff" that everything is made of
physical change: a change from one form of matter to another form of matter without turning into a new substance (ice melting).
state of matter a form that matter can take - solid, liquid, or gas.

Key Concepts:

Physical Change

- A **physical change** is a change in size, shape, color or state of matter.
- A **physical change** is a process that does not change the chemical make-up of a substance.
- After a **physical change**, substances have the same properties as they had before the physical change: freezing popsicles, rain condensing from clouds, clothes drying in a dryer, mixing a milkshake, slicing bread, making chocolate milk, cutting a piece of paper, painting on paper and making lemonade.

Chemical Change

- A **chemical change** is a process that does change the chemical make-up of a substance.
- After a **chemical change**, new substances are formed with new properties.
- Examples of **chemical changes** include: baking a cake, burning a candle, striking a match, cooking an egg, garbage rotting, the iron on a bicycle rusting, an old log decomposing, plants using or releasing oxygen, toast getting crisp and brown, food digesting and mold growing on bread.

Suggested Activities:

- To illustrate a physical change, list 10 words which describe a pencil. Break the pencil into two pieces and describe 4 ways in which the pencil has changed physically.
- To illustrate both a physical and chemical change: think about cooking an egg in a pan of water. Look at the pan of water, describe its properties. Look at an egg, describe its properties. Have an adult fill a pan with tap water, bring to a boil, place an egg into the boiling water, turn the heat to warm to cook the egg for 3 minutes. Open up the egg and describe its properties. Classify the following as a chemical or physical change: the water changing temperature is a physical change and cooking the egg is a chemical change.
- United Streaming: Changes in the Properties of Matter: Physical and Chemical, Matter and Its Properties: Changes In Matter.

Physical Science Benchmark A: Compare the characteristics of simple physical and chemical changes.

Questions:

1. The grill cook lit some charcoal in a grill. A person observed as the charcoal got hotter, produced smoke, and turned whitish gray in color. Write whether the observations of the charcoal were chemical or physical and describe your reasoning.

2. Air is released from a bicycle tire. What physical change does the tire go through?
    a. It gets hotter
    b. It changes shape
    c. It loses its color
    d. It takes up more space

3. Which of the following actions causes only a physical change and not a chemical change?
    a. burning a match
    b. baking a cake
    c. a rusting car
    d. tearing a tissue

4. Which of the following describes a chemical change taking place in an apple?
    a. An apple turns brown where someone took bites of it.
    b. An apple's skin is red and yellow.
    c. An apple is cut into pieces.
    d. An apple shrivels as it loses water

<u>Physical Science Benchmark A:</u> Compare the characteristics of simple physical and chemical changes.

<u>Answers:</u>

1. The grill cook lit some charcoal in a grill. A person observed as the charcoal got hotter, produced smoke, and turned whitish gray in color. Write whether the observations of the charcoal were chemical or physical and describe your reasoning.

The burning charcoal represents a chemical change because new chemical properties are being formed such as smoke and heat.

2. Air is released from a bicycle tire. What physical change does the tire go through?
   a. It gets hotter
   b. It changes shape *
   c. It loses its color
   d. It takes up more space

3. Which of the following actions causes only a physical change and not a chemical change?
   a. burning a match
   b. baking a cake
   c. a rusting car
   d. tearing a tissue *

4. Which of the following describes a chemical change taking place in an apple?
   a. An apple turns brown where someone took bites of it. *
   b. An apple's skin is red and yellow.
   c. An apple is cut into pieces.
   d. An apple shrivels as it loses water

Physical Science

Benchmark & GLI
Physical Science
Benchmark B
B: Identify and describe the physical properties of matter in its various states.
Grade 3
No indicators present for this benchmark.
Grade 4
3. Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects (e.g., paper, glass, plastic and metal).
4. Explain that matter has different states (e.g., solid, liquid and gas) and that each state has distinct physical properties
Grade 5
No indicators present for this benchmark.

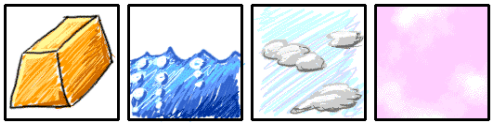
Vocabulary:
gas: a state of matter in which the substance has no definite shape and no definite volume
liquid: a state of matter in which the substance has a definite volume but takes the shape of its container.
mass: the amount of matter in an object or substance.
matter: the material, or "stuff" that everything is made of.
physical change: a change from one form to another form without turning into a new substance.
physical property: a property that can be observed, measured, or changed without changing the substance itself.
solid: a state of matter in which the substance has a definite shape and a definite volume.
state of matter: a form that matter can take – solid, liquid, or gas.

Key Concepts:
Physical Properties of Matter

- All matter has physical properties that can be used to separate or sort a group of objects**.** **Physical properties** are those that can be observed without changing the make-up, or identity, of the matter. Clay can be bent or flattened when squeezed. Squeezing changes the shape of the clay but doesn't change what the clay is made of.
- Some **physical properties** of matter include: mass, weight, color, shape, size, odor and hardness.

States of Matter

- **Matter** is the material that makes up all things in the universe. All matter has mass and takes up space.
- **Mass** is the amount of matter in an object.
- There are three states of matter: solids, liquids and gases.
- **Solids** have a definite size and shape.
- **Liquids** have a definite size but no definite shape
- **Gases** have no definite size or shape.
- **Phase changes** are physical changes that include melting, freezing, condensation and evaporation. Phase changes require the addition of thermal energy or heat (melting and evaporation) and the subtraction of thermal energy or heat (condensation and freezing).



<u>Suggested Activities:</u>

- To illustrate physical properties have the students sort clean recyclables: paper, glass, metal and plastic containers. List 10 words which describe the properties of each of the four sorted piles. A Venn diagram or chart might help the students organize the data.
- Explain the different phases of water. Add ice to a glass of tap water. What happens to the ice? It melts making the tap water colder. The cold glass causes water vapor in the air to condense on the outside of the glass. Placing water into a freezer causes the water to freeze into a solid. Water evaporates due to the addition of thermal energy when it is heated. Draw and label a diagram illustrating these processes.
- There are lots of ways to describe objects. Describe the physical properties of a banana as fully as you can. What does it feel like, smell like and look like? How can you separate different types of bananas?

Physical Science Benchmark B: Identify and describe the physical properties of matter in its various states.

Questions:

1. Which words are used to describe the states of matter?
    a. reflective, refractive, magnetic
    b. dense, loose, tight
    c. solid, liquid, gas
    d. chemical, electrical, solar

2. A substance is clear and has no definite shape or volume. Which of the following could it be?
    a. the water in a cup
    b. a clear plastic bag
    c. the air inside a room
    d. a piece of glass in a door

3. A manufacturer of baseball bats is looking for a new source of wood for bats. Which of the following properties is most important in selecting the right wood?
    a. color
    b. hardness
    c. texture
    d. mass

4. After opening the steamy bathroom door, Tina's eyeglasses fogged up. Describe and explain how the properties of water changed when it hit Tina's glasses.

Physical Science Benchmark B: Identify and describe the physical properties of matter in its various states.

Answers:

1. Which words are used to describe the states of matter?
    a. reflective, refractive, magnetic
    b. dense, loose, tight
    c. solid, liquid, gas *
    d. chemical, electrical, solar

2. A substance is clear and has no definite shape or shape. Which of the following could it be?
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    a. color
    b. hardness *
    c. texture
    d. mass

4. After opening the steamy bathroom door, Tina's eyeglasses fogged up. Describe and explain how the properties of water changed when it hit Tina's glasses.

The hot water from the shower changes from a liquid to water vapor (evaporation); the water vapor in the air changes back into a liquid on the eyeglasses (condensation).

Benchmark & GLI
Physical Science
Benchmark C
C: Describe the forces that directly affect objects and their motion.
Grade 3
1. Describe an objects position by locating it relative to another object or the background.
2. Describe an objects motion by tracing and measuring its position over time.
3. Identify contact / non-contact forces that affect motion of an object (e.g., gravity, magnetism and collision).
4. Predict the changes when an object experiences a force (e.g., a push or pull, weight and friction).
Grade 4
No indicators present for this benchmark
Grade 5
No indicators present for this benchmark.

Vocabulary:
attract: pull toward
collision: come together
contact force: must touch an object before something can happen
force: a push or pull
friction: a force between two surfaces rubbing against each other; friction works against motion.
gravity: the force that pulls objects towards each other.
magnets: an object that attracts iron and a few other magnetic materials.
motion: a change in the position of an object.
non-contact force: objects move with out touching (magnets and gravity).
position: is the location of an object.
repel: push away, such as two N end of magnets
speed: the distance an object moves per unit of time, such as mile per hour.
weight: a measure of the pull of gravity on an object on Earth

Key Concepts:
Forces

- **Force** is a push or a pull.
- **Position** is the location of an object.
- A force can make an object start moving, stop moving, change speed or change direction.

Contact Forces

Friction

- **Friction** is a force that works against motion. It is produced when two objects rub against each other.
- Two rough surfaces, i.e., sandpaper, produce more friction than two smooth surfaces, i.e., ice. A bicycle tire and concrete have more friction than a bicycle tire and ice.
- The motion of objects can be changed by the amount of friction acting upon them.

Key Concepts: (Continued). . . .

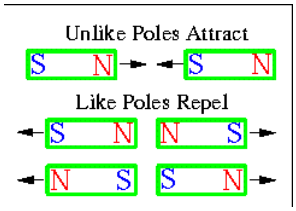
Collision

- Contact forces must touch an object before they can make something happen.

Non-contact Force

Magnetism

- **Magnets** create a push or pull force without contact
- Unlike poles **attract**, or pull toward, each other.
- Like poles **repel**, or push away from, each other.



Gravity

- The pull of **gravity** on an object is that object's **weight** on Earth.
- **Gravity** is a force that pulls everything towards the center of the earth.
- **Gravity** is at work when you drop a book or when leaves fall from a tree.

Motion

- An object is in **motion** if it changes position.
- **Motion** happens over a period of time, i.e., seconds, minutes, hours, days, etc.
- Motion is described in terms of distance, direction, speed and velocity.
- Objects move in different ways from one place to another.
- To describe an object's **position**, you compare it to the position of other objects, i.e., in front of, beside, etc.
- **Speed** is how fast an object moves over a certain distance, i.e., feet per second.
- The amount of change in position and motion is related to the strength of the push or the pull.

Suggested Activities:

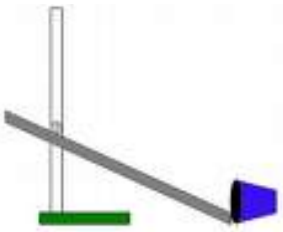
- Roll a marble **down** a ruler from different heights. Observe and measure the distance the marble travels. Record each trial on a chart or a table. Draw conclusions from the data. Is there a direct relationship between the height of the ramp and the distance the marble rolls? Use the data to develop a graph. Write a statement that describes how the distance on the floor changed when the height of the ramp changed.
- Try the experiment from above again but change the surface the marble rolls across from tile to carpet or visa versa. How does changing the amount of friction affect the motion of the ball?
- Roll a marble **up** a ruler from different heights. Observe and measure the distance the marble travels up the ruler. Record each trial on a chart or a table. Draw conclusions from the data. Is there a direct relationship between the height of the ramp and the distance the marble rolls? Use the data to develop a graph. Write a statement that describes how the distance on the ruler changed when the height of the ramp changed.

<u>Physical Science Benchmark C:</u> Describe the forces that directly affect objects and their motion.

<u>Questions:</u>

1. Alena threw a ball up in the air. The ball rose to the porch ceiling and then fell to the ground. How can Alena describe how high the ball went in the air without measuring?
    a. The ball went as high as an airplane.
    b. The ball went as high as the porch ceiling.
    c. The ball went as high as the tree.
    d. The ball went as high as the sky.
2. Two magnets are attracted to one another and are pulled together. Which of the following is true?
    a. Magnets always pull towards each other.
    b. Both north poles are near each other.
    c. Both south poles are near each other.
    d. One North Pole and one South Pole are near each other.
3. Which of the following produces the greatest amount of friction when they are rubbed together with equal force?
    a. a sled and ice
    b. sandpaper and wood
    c. sandpaper and metal
    d. tires and ice
4. A creaky door hinge will stop squeaking if the hinges are greased. Explain how the creaking of the door is affected by adding grease. Use the term *friction* in your response.

5. A student conducts an experiment as set up in the diagram. The student rolls a marble down a ramp. The marble hits the cup and moves the cup forward. The student raises the ramp higher and repeats the experiment. This time the cup moves farther. Explain at least two forces at work in this experiment.



<u>Physical Science Benchmark C:</u> Describe the forces that directly affect objects and their motion.

Answers:

1. Alena threw a ball up in the air. The ball rose to the porch ceiling and then fell to the ground. How can Alena describe how high the ball went in the air without measuring?
    a. The ball went as high as an airplane.
    b. The ball went as high as the porch ceiling.
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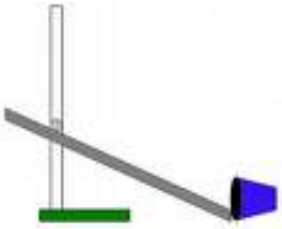
2. Two magnets are attracted to one another and are pulled together. Which of the following is true?
    a. Magnets always pull towards each other.
    b. Both north poles are near each other.
    c. Both south poles are near each other.
    d. One north pole and one south pole are near each other. *

3. Which of the following produces the greatest amount of friction when they are rubbed together with forces that are equal
    a. a sled and ice.
    b. sandpaper and wood. *
    c. sandpaper and metal.
    d. tires and ice.

4. A creaky door hinge will stop squeaking if the hinges are greased. Explain how the creaking of the door is affected by adding grease. Use the term *friction* in your response.

When the grease is added to the door hinge, the friction between the hinge parts is decreased or reduced. Decreasing friction allows the door to move without squeaking.

5. A student conducts an experiment as set up in the diagram. The student rolls a marble down a ramp. The marble hits the cup and moves the cup forward. The student raises the ramp higher and repeats the experiment. This time the cup moves farther. Explain at least two forces at work in this experiment.



Gravity is at work causing the marble to roll downward on the ramp. Friction is at work at the marble rubs against the ramp and the inside of the cup. This friction opposes the motion of the marble and causes the marble to go slower. Friction also is happening as the cup rubs against the table. A collision force is at work as the marble hits the bottom of the cup. This causes the cup to move in the same direction as the ball because the ball is in motion and the cup is at rest.

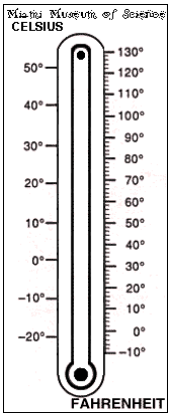
Physical Science

Benchmark & GLI
Physical Science
Benchmark D
D: Summarize the way changes in temperature can be produced and thermal energy transferred.
Grade 3
No indicators present for this benchmark.
Grade 4
5. Compare ways the temperature of an object can be changed (e.g., rubbing, heating and bending of metal)
Grade 5
1. Define temperature as the measure of thermal energy and describe the way it is measured.
2. Trace how thermal energy can be transfer from one object to another by conduction.

Vocabulary:
conduction: the movement of thermal energy between objects that touch each other.
conductor: a material that allows heat energy or electricity to pass through it easily
heat: thermal energy transferred from an object at a higher temperature to one at a lower temperature
insulator: a material that does not let thermal energy pass through it easily.
temperature: the average speed of particles in a substance.
thermal energy: the kinetic energy of moving particles in a substance, also called heat energy.

Key Concepts:

Temperature



- Temperature is a measure of the average energy of moving molecules.
- **Temperature** is a measure of thermal, or heat, energy. Put more simply, temperature is a measure of how cool or warm things are.
- There are two scales used to measure temperature, Fahrenheit and Celsius. The Fahrenheit scale is used in the United States. On this scale, water freezes at a temperature of 32 degrees, (32°F), and boils at 212 degrees,(212°F).
- The Celsius scale is used by the rest of the world, as well as, scientists and mathematicians. On this scale, water freezes at a temperature of 0 degrees, (0°C), and boils at a temperature of 100 degrees (100°C).

Heat and Thermal Energy

- All matter is made of particles called atoms and molecules that are constantly moving.
- **Thermal energy** is the amount of energy in the atoms and molecules.
- **Heat** is thermal energy transferred from an object at a higher temperature to one at a lower temperature.
- **Thermal energy** will usually flow from an object with higher temperature to an object with a lower temperature.

Conduction

- Heat moves from one object or substance to another in one of 3 ways: conduction, convection or radiation (only conduction will be examined at elementary level).
- **Conduction** is the transfer of thermal energy (heat) when two substances come in contact with each other.
- **Conduction** can occur in an object as heat is transferred from the warmer part of the object to the cooler part of the object.

  Think of a pan with a metal handle. Initially, when the pan is heated the handle is cool, however, as heat continues to be applied, the handle of the pan might begin to heat up. The contents of the pan will begin to heat up, as well. This is an example of conduction.

  Holding a cup of hot chocolate is an example of conduction, as the heat moves from the cup to your hand. As long as you hold the cup of hot chocolate, energy is transferred until the temperatures of the cup and your hand are equal.

- **Conductors** are substances that transfer thermal energy. Some materials are better conductors than others. Copper, iron, silver and water are good conductors of thermal energy (heat).
- **Insulators** are substances that reduce the transfer of thermal energy (heat). Examples include: fur, Styrofoam, wool and plastic.

Suggested Activities:

- A girl ice skating on a cold winter day says, "This cold is seeping through my gloves and chilling my fingers to the bone!" Her friend claims this is not possible. Her friend says that cold doesn't travel into a warmer place. Write a small paragraph explaining who was right.
- Add a metal, wooden and plastic spoon to a cup of hot water. Wait about 1 minute explain any differences in the temperature of the handles. Use the term conduction in your explanation.
- Put your hands on your cheeks to feel their temperature. Rub your hands together to make them feel warmer. Put your hands back on your cheeks to feel if your hands have changed temperature.
- Use a metal pants hanger for this activity. Remove the paper roll at the bottom. Put the metal hanger in the refrigerator for 10 minutes. Take it out and bend it for 20-30 seconds. Feel the metal with your fingers or your wrist. Compare the temperature of the hanger when it came out of the refrigerator and after you bent it for ½ a minute.
- Describe how blowing on your soup changes the soup's temperature. Describe how blowing on your hands changes their temperature. How does blowing cool your soup and warm your hands?

Physical Science Benchmark D: Summarize the way changes in temperature can be produced and thermal energy transferred.

Questions:

1. Which of the following statements explains why a piece of cold butter softens when it comes in contact with warm toast?
    a. The thermal energy of the toast increases and the thermal energy of the butter decreases.
    b. The thermal energy of the toast decreases and the thermal energy of the butter increases.
    c. The thermal energy of the toast and the butter remain the same.
    d. The thermal energy of the toast and the butter decreases.

2. A hotdog is cooking over an open fire stuck on a metal hanger. The person holding the hanger notices the handle feels warmer as the hotdog is cooking. Using words and/or pictures, trace how thermal energy transfers from one object to another.

3. Explain how the kids used conduction to change the temperature of their chili. Karla made her chili cooler. Peter made his chili warmer.

4. Mark volunteered to bring in a piece of wire from home. Mark's teacher asked him to bend the bar back and fourth. What has changed due to the bending of the metal?
    a. the color of the wire
    b. the size of the wire
    c. the weight of the wire
    d. the temperature of the wire

Physical Science Benchmark D: Summarize the way changes in temperature can be produced and thermal energy transferred.

Answers:

1. Which of the following statements explains why a piece of cold butter softens when it comes in contact with warm toast?
    a. The thermal energy of the toast increases and the thermal energy of the butter decreases.
    b. The thermal energy of the toast decreases and the thermal energy of the butter increases. *
    c. The thermal energy of the toast and the butter remain the same.
    d. The thermal energy of the toast and the butter decreases.

2. A hotdog is cooking over an open fire stuck on a metal hanger. The person holding the hanger notices the handle feels warmer as the hotdog is cooking. Using words and/or pictures, trace how thermal energy transfers from one object to another.

Thermal energy transfers from the fire to the hot dog
Thermal energy transfers from the metal hanger to the person's hand

3. Explain how the kids used conduction to change the temperature of their chili. Karla made her chili cooler. Peter made his chili warmer.

Conduction can be used to change temperature, i.e., to make cooler or warmer. Karla could put her chili in the refrigerator to make it cooler. Peter could put his chili in a pan and warm it on the stove OR put it in the microwave.

4. Mark volunteered to bring in a piece of wire from home. Mark's teacher asked him to bend the bar back and fourth. What has changed due to the bending of the metal?
    a. the color of the wire
    b. the size of the wire
    c. the weight of the wire
    d. the temperature of the wire

Physical Science

Benchmark & GLI
Physical Science
Benchmark E
E: Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic forces.
Grade 3
No indicators present for this benchmark.
Grade 4
No indicators present for this benchmark.
Grade 5
3. Describe that electrical current in a circuit can produce thermal energy, light, sound and / or magnetic forces.
4. Trace how electrical current travels by creating a simple electrical circuit that will light a bulb.

Vocabulary:
circuit: a complete path of conductors that an electric current can flow through.
closed circuit (complete circuit): an unbroken path formed by electrical conductors
conductors: a material that allows electrical current to pass through it easily
current: a constant flow of electrons through a conductor.
electricity: general term for the interaction of electric changes
electromagnet: a temporary magnet created by a flow of electric current around an iron bar.
insulators: a material that does not let heat energy or electricity pass through it easily.
open circuit (incomplete circuit): electrons can not flow in a path through the circuit

Key Concepts:

Electricity

- Electricity is a form of energy.
- Electrical current is the type of electricity most often used.
- Electrical current can flow or move.
- Electric current flows through conductors.

Electric Circuits

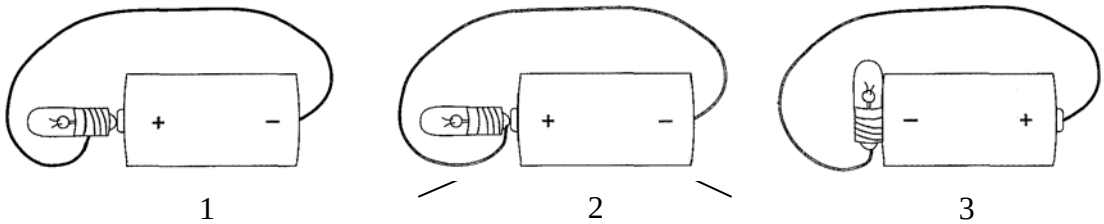
- A closed circuit is an unbroken path formed by electrical conductors.
- Electric current must have an uninterrupted loop of electrical conductors – called a closed or complete circuit.
- When the loop is broken, electricity is unable to flow. This is called an open or incomplete circuit.
- Electric current in a circuit can produce thermal energy (heat), light, sound and magnetic forces.
- A light bulb has two parts – the threads (base) and the tip (bottom of bulb). Both parts must be used in order to complete the circuit.

Closed Circuits

- In picture 1 below, the electricity flows from the battery (+) to the tip of the bulb to the threads (base) of the bulb and to the bottom of the battery (-) making a complete or closed circuit.
- In picture 3, the flow moves from the top of the battery (+) to the tip of the bulb to the threads (base) of the bulb and back to the battery (-).

Opened Circuit

- In picture 2, the threads (base) of the bulb is not involved in the path creating an open or incomplete circuit.



1 2 3

Conductors and Insulators

- Electric conductors allow electricity to flow through them easily. Examples include all metals and water.
- Electrical insulators do not allow electricity to flow through easily. Examples include plastic, rock, wood, glass, cloth, air and rubber.

Electromagnetism

- An electromagnet is a coil of copper wire around an iron core with electric current flowing through it.
- Magnetism and electricity are closely related. An electric current produces a magnetic field and a change in a magnetic field can produce an electric current.
- Electromagnets are found in many things in a house, such as electric motors, televisions, telephones and doorbells.

Suggested Activities:

- Create opened and closed circuits with batteries, bulbs and copper wire.
- Investigate 3 types of electric wall sockets and plugs, i.e., 2 prongs, 3 prongs and GFCI (ground fault circuit interrupter). Why do parents put covers over electric wall sockets?
- Create a jot list of electric appliance and electronics which will create light, sound or thermal energy.
- Take apart an old door bell or small motor to find the electromagnet.
- United Streaming: topic – electromagnets – for video
  Dr. Dad's PH3: Episode 3: Electromagnetism

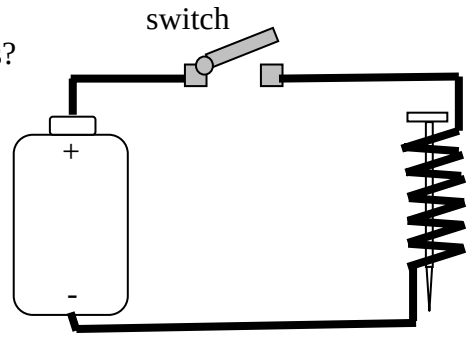
Physical Science Benchmark E: Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic force.

Questions:

1. Electric currents produce magnetic fields. When electricity passes through wire wrapped around an iron object, such as a nail, the magnetic field causes tiny particles in the iron to line up in the same direction as the field. This creates an electromagnet. Describe what happens to the strength of the magnets as the number of coils increase.
    a. The strength of the magnet gets weaker.
    b. The strength of the magnet gets shorter.
    c. The strength of the magnet gets stronger.
    d. The strength of the magnet gets longer.

2. Draw a simple circuit that will light a bulb. Use a bulb, a piece of wire and a battery. Trace the path of the electric current.

3. What happens to the nail when this switch is closes?
    a. gives off light
    b. makes a buzz sound
    c. begins to vibrates
    d. becomes an electromagnet

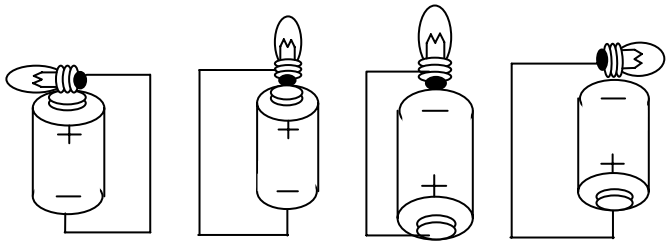


Physical Science Benchmark E: Trace how electrical energy flows through a simple electrical circuit and describe how the electrical energy can produce thermal energy, light, sound and magnetic force.

2. Electricity passes through wire wrapped around and iron object, such as a nail, the magnetic field causes tiny particles in the iron to line up in the same direction as the field. This creates an electromagnet. Describe what happens to the strength of the magnets as the number of coils increase.
    a. The strength of the magnet gets weaker.
    b. The strength of the magnet gets shorter.
    c. The strength of the magnet gets stronger.
    d. The strength of the magnet gets longer.

2. Draw a simple circuit that will light a bulb. Use a bulb, a piece of wire and a battery. Trace the path of the electric current.

Students should draw one of the following to illustrate a complete circuit. In each example, the tip of the bulb should touch either the wire or the cell (battery). The threads (base) should touch either the wire or the cell (battery). The wire should touch the battery at one end and either the tip or the threads (base) of the bulb.



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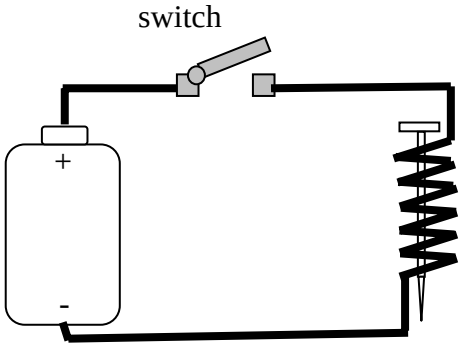
    d. becomes an electromagnet *



Physical Science

Benchmark & GLI
Physical Science
Benchmark F
F: Describe the properties of light and sound energy
Grade 3
No indicators present for this benchmark.
Grade 4
No indicators present for this benchmark.
Grade 5
5. **Explore and summarize observations of the transmission, bending (refraction) and reflection of light.**
6. Describe and summarize observations of the transmission, reflection, and absorption of sound.
7. Describe that changing the rate of vibration can vary the pitch of a sound.

Vocabulary
light: a form of energy that travels in waves, in straight line and can move through space
medium: a type of matter (solid, liquid, or gas).
opaque: light can not pass through this material, the light is reflected or absorbed (book)
reflection: the bouncing back of light rays from a substance
refraction: the change in direction of a wave when it moves into a new medium which causes it to travel at a different speed.
translucent: light can partially pass through this material (waxed paper)
transparent: light rays can pass through this material (clear glass)

Key Concepts:

Reflection of Light

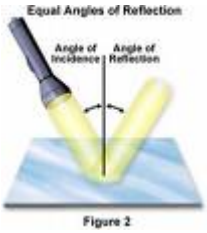
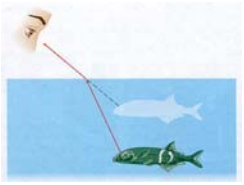


Figure 2

- We see objects because of light.
- Light travels in straight lines.
- Light can be **reflected, refracted** or **absorbed**.
- Light waves are reflected at predictable angles.
- The angle at which light strikes a **mirror** is the same size as the angle of the light reflecting from the mirror. (see angle of incidence and angle of reflection)

Refraction of Light



- Light moves faster through air than it moves through water.
- Light moves faster through water than it moves through glass.
- **Refraction** is the change in direction of a wave when it moves into a new medium which causes it to travel at a different speed. Light can be refracted at the boundary between materials.
- A **convex lens** is a lens with at least on surface curving outwards.
- **A concave lens** is a lens with at least on surface curving inwards.

Transmission of Light

- **Transmission** is the passing of light through an object. Different objects and different materials transmit light differently.
- Objects can be transparent, translucent or opaque.
- A **transparent** material allows nearly all of the light to pass straight through. (e.g., clear glass, clear plastic)
- A **translucent** material allows some light through but some light is scattered in all directions by particles within the matter. (e.g., tissue paper, frosted glass)
- An **opaque** object allows no light to pass through. All light is either reflected or absorbed by the material. (e.g., chair, door, book)
- An opaque object casts a shadow on the side of the object opposite to the light.

Suggested Activities:

- **Catch A Sunbeam -** Materials: flashlight and 3 mirrors. Shine a flashlight onto a mirror and use another mirror to reflect the light from the first mirror. Continue with additional mirrors. What determines the direction of the light beam reflecting from a mirror? Is the reflection angle predictable? Draw a picture showing the light angles.
- **A Broken Pencil? -** Materials: pencil and glass of water. Put a pencil in a glass of water. Observe the pencil and sketch what you observe. Explain your observations.
- **Transparent, Translucent or Opaque? –** Shine a flashlight on a variety of objects. Observe the path of the light. Classify the objects as translucent, transparent or opaque.

Light

Physical Science Benchmark F: Describe the properties of light and sound energy.

Questions:

1. A student places a pencil inside a glass of water. The student observes that the pencil looks broken. Explain how light affects what you see when light rays pass through the glass and the water to the pencil.

2. Classify the following materials as transparent, opaque or translucent. Describe whether light passes through each kind of material: clear plastic bag, clear glass cup, aluminum foil, waxed paper, sunglasses, tissue paper and a brick wall.

Transparent	Opaque	Translucent

3. Describe how the reflection of light is different from the refraction of light.

Light

Physical Science Benchmark F: Describe the properties of light and sound energy.

Answers to Questions:

1. A student places a pencil inside a glass of water. The student observes that the pencil looks bent. Explain how light affects what you see when light rays pass through the glass to the pencil.

When light passes through the glass of water to the pencil the pencil looks bent. This bending of light as it passes from air through water is called refraction. Light moves faster through air than it does through water and moves faster through water than it moves through glass. To bend light must strike a surface at an angle. It does not bend if it goes straight in. The light bends or refracts at the boundary between the two materials.

2. Classify the following materials as transparent, opaque, or translucent and describe whether light passes through each kind of material: clear plastic bag, clear glass cup, aluminum foil, waxed paper, sunglasses, tissue paper and a brick wall.

Transparent	Opaque	Translucent
clear plastic bag **clear glass cup** **sunglasses**	**aluminum foil** **brick wall**	**waxed paper** **tissue paper**

Light passes through transparent materials with little disturbance and objects can be seen clearly through them. All light is completely absorbed by the opaque materials and objects cannot be seen through them. Some light passes through translucent materials as it bounces in many different directions and objects appear blurry through them.

3. Describe how the reflection of light is different from the refraction of light.

Reflection happens when light strikes an opaque surface that it cannot go through and bounces off. Refraction happens when light moves from one substance to another and changes the direction of a wave when it moves into a new medium which causes it to travel at a different speed.

Physical Science

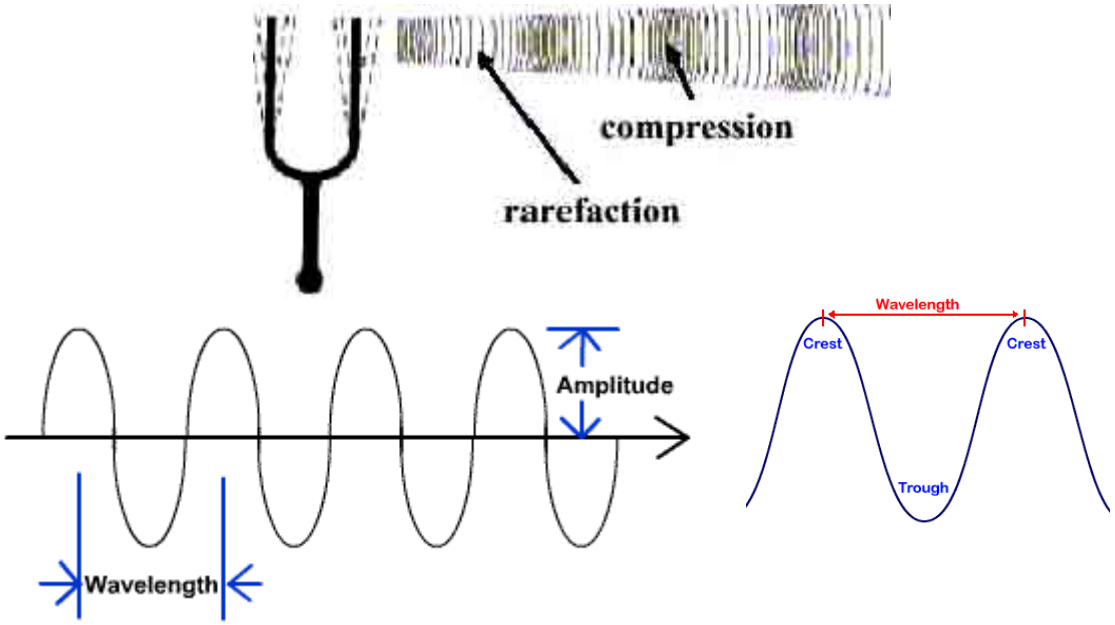
Benchmark & GLI
Physical Science
Benchmark F
F: Describe the properties of light and sound energy
Grade 3
No indicators present for this benchmark.
Grade 4
No indicators present for this benchmark.
Grade 5
5. Explore and summarize observations of the transmission, bending (refraction) and reflection of light.
6. Describe and summarize observations of the transmission, reflection, and absorption of sound.
7. Describe that changing the rate of vibration can vary the pitch of a sound.

Vocabulary
amplitude: total distance a wave moves from its resting position
absorption: sound waves can be absorbed by materials
compression: occurs when sound waves are close together, opposite of rarefaction
echo: sound reflects off a surface
frequency: the number of sound waves produced in a certain amount of time
hertz: frequency is measured in hertz (Hz). One hertz is equal to one waver per second.
matter: the material that all objects and substances are made of; anything that has mass and takes up space (solid, liquid, or gas)
medium: matter that a wave travels through.
oscilloscope: instrument used to measure vibrations, vibrations appear as images
pitch: how high or low a sound is, determined by the sound's frequency
rarefaction: sound wave that are spread apart, opposite of compression
reflection: bouncing back of a sound wave from a surface
sound: energy that travels through matter as mechanical waves and can be heard by the ear
transmission: sending sound energy from on point to another
vacuum: a space completely empty of matter
vibration: back and forth move movement

<u>Key Concepts:</u>
Sound

- Sound is produced whenever an object **vibrates**.
- Sound transfers energy away from the vibrating objects. It needs a medium through which to travel.
- Sound travels through these mediums: solids, liquids and gases.
- Sound travels in waves away from the source.
- Sound cannot travel in a vacuum - in space, no-one can hear you scream!
- Sound travels fastest through solids because the molecules in solids are close together.
- Sound can **reflect** from the surface of an object. This is called an **echo**.
- Sound travels slower than light. You see lightning before you hear thunder.
- Resonance is when the air in the sound box of a guitar starts to vibrate along with the strings.

- The bigger the vibration, the greater the **amplitude** of the waves and the louder the sound.
- The smaller the vibration, the lesser the amplitude of the waves and the softer the sound.
- Big vibrations transfer more energy than small vibrations, so they are louder.
- An oscilloscope is an instrument used to measure vibrations. Vibrations are shown as images on the screen similar to a TV.
- The pitch of a sound depends upon the **frequency of the vibrations** that cause it. (More vibrations = higher pitch)
- Frequency is measured in hertz (pronounced "hurts"), with the symbol Hz.



Sound Summary

	Amplitude		**Frequency**	
	Small	**Big**	**Low**	**High**
Sounds like	Quiet	Loud	Low pitch	High pitch
Example	Whispering	Shouting	Man talking	Child talking

Suggested Activities:

- http://library.thinkquest.org/19537/?tqskip1=1
- http://www.bbc.co.uk/schools/scienceclips/ages/9_10/science_9_10.shtml
- http://www.bbc.co.uk/schools/revisewise/science/physical/index.shtml
- Place a tuning fork in water to see the vibrations splash the water.
- Cut the neck off a balloon. Cover a soup can with the bottom of the balloon and secure the balloon with a rubber band. Place salt and pepper on the balloon. Strike the tuning fork on your heel and place it near (not touching) the salt and pepper. The vibrations from the tuning fork will make the salt and pepper bounce. Explain why the salt and pepper moved/
- Take two long pieces of yarn. Tie it to a hanger (not on the hook, on the 2 corners away from the hook). Place the yarn over each ear. Gently tap the hanger on the side of a table. The wire hanger will vibrate, then transmit vibration to the string and the ear.

- Use a 2 cups, string and tape (if needed) to make a telephone. Try different materials. Plastic cups give the students the best transmission of sound
- Discuss the way sound reflects (1) as a car drives down the street with the bass on full blast. You can hear it bouncing off the houses. OR (2) when you sing in the bathroom or shower, your voice sounds very loud and full.

Sound

<u>Physical Science Benchmark F:</u> Describe the properties of light and sound energy

Questions:

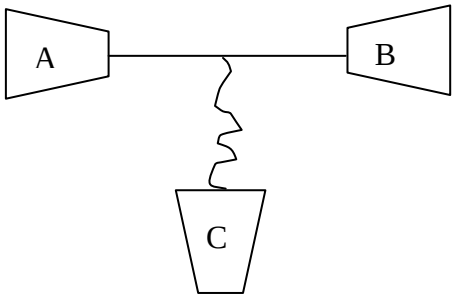
1. Sound travels fastest through which of the following?
   a. solid
   b. liquid
   c. gas
   d. space

2. How does the buzzing sound travel from an alarm clock to your ear?

3. What kind of energy is produced when a student beats a drum?
   a. light
   b. sound
   c. electrical
   d. potential

4. The pitch of sound is controlled by
   a. The number of the vibrations produced.
   b. The loudness or softness of the sound.
   c. The length of time that the sound lasts.
   d. The direction from which the sound comes.

5. While making a telephone in science class, Joe wanted to try and make a three way call. Look at the image on the right. Explain which parts of the telephone works or does not work. Were all 3 students able to hear each other?



Sound

<u>Physical Science Benchmark F:</u> Describe the properties of light and sound energy

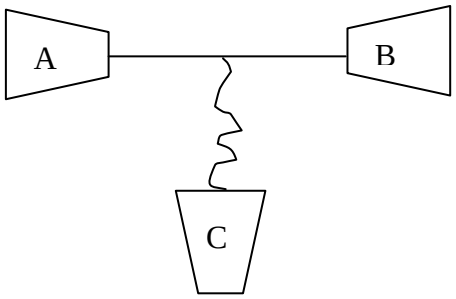
Answers:

1. Sound travels fastest through which of the following?
   a. solid *
   b. liquid
   c. gas
   d. space

2. What kind of energy is produced when a student beats a drum?
   a. light
   b. sound *
   c. electrical
   d. potential

3. The pitch of sound is controlled by
   a. The number of the vibrations produced. *
   b. The loudness or softness of the sound.
   c. The length of time that the sound lasts.
   d. The direction from which the sound comes.

4. While making a telephone in science class, Joe wanted to try and make a three way call. Explain which parts of the telephone works or does not work.



Cup A to B with the string that is tight will work best since that string can vibrate. The string coming from cup C will not work since that string is loose and can not vibrate. Sound can occur if something can vibrate.

experiment	inquiry
forceps	investigation
formulate	scientific method
hypothesis	variable
infer	erosion

To seek information by questioning.

A test done to see if a hypothesis is correct or not.

A study that a scientist does.

A tool used to pick up and hold on to objects.

An organized plan that scientists use to conduct a study.

To come up with.

The one thing in a science inquiry or experiment that can change.

A possible answer to a question that can be tested to see if it is correct.

The movement of weathered rock and soil.

To draw a conclusion about something.

glacier	sedimentary rock
igneous rock	weathering
metamorphic rock	clay
mineral	conservation
rock	humus

Rock made when materials settle into layers and get squeezed until they harden into rock.

A huge sheet or block of ice

The process of breaking down rocks into smaller pieces.

Rock that was melted and then cooled and hardened.

Soil with very, very tiny grains of rock.

Rock that has been changed by temperature and pressure.

The saving of resources by using them wisely.

A solid object found in nature that has never been alive.

The part of soil made up of broken down parts of dead plants and animal.

A naturally formed solid made of one or more minerals.

loam	renewable resources
nonrenewable resources	resource
pollution	reusable resource
recycle	reuse
reduce	sand

A resource that can be replaced during a human lifetime.

Soil that is a mixture of humus, sand, silt and clay.

A material that is found in nature and that is used by living things.

A resource that cannot be replaced during a human lifetime.

A resource that can be used again and again.

Any harmful material in the environment.

To use again.

To use a resource by breaking it down and making a new product.

Soil with grains of rock that you can see with your eyes.

To use less of a resource.

silt	inherit
amphibian	larva
bird	life cycle
fish	mammal
gills	metamorphosis

To have a trait passed on from the parents of the organism.

Soil with grains of rock that are too small to see with your eyes.

The stage of complete metamorphosis after an organism hatches from its egg.

An animal that begins life in the water and moves onto land as an adult.

The changes that happen to an animal or plant during its life.

An animal that has feathers, two legs and wings.

An animal that has hair or fur.

An animal that lives its entire life in water.

A series of changes in appearance and body plan that some organisms go through.

Body parts that take in oxygen from the water.

oxygen	fossil
pupa	adaptation
reptile	camouflage
scales	community
extinction	desert

The remains or traces of a living thing that died long ago.

A gas that people, animals and plants need to live and plants give off into the air.

Any trait that helps a plant or a animal survive.

The stage of complete metamorphosis when an organism is wrapped in a cocoon or chrysalis.

Colors, patterns and shapes that disguise an animal and help it hide.

A land animal that has dry skin covered with scales.

All populations of organisms that live in an ecosystem at the same time.

Small, thin, flat plates that help protect an animal.

An ecosystem that is very dry.

The death of all the members of a certain group of organisms.

ecosystem	hibernate
environment	instinct
forest	migrate
grassland	mimicry
habitat	population

To go into a sleeplike state for winter.

The interaction of a community of organisms with their environment.

A behavior an animal knows without being taught.

The things, both living and nonliving, that surround a organism.

To travel from one place to another and back again.

An ecosystem in which many trees grow.

Imitating the look of another animal.

A dry, often flat area of land that is hot in the summer and cold in the winter. The main plants found in this ecosystem are grasses.

A group of organisms of the same kind that live in the same place.

The place where a population lives in an ecosystem.

crest	speed
distance	trough
force	waves
gravity	wavelength
motion	weight

The distance an object moves in a certain period of time.

The highest point of a wave.

The lowest point of a wave.

How far one location is from another.

A disturbance that travels through matter or space.

A push or pull.

The distance from one point of one wave to the same point on the next wave.

A force that pulls two objects towards each other.

A measure of the force of gravity on an object.

A change of position.

pan balance	observation
experiment	scientific method
hypothesis	spring scale
inference	standard measure
microscope	air mass

Information from your senses.

A tool that measures mass.

A way scientists find out how things work and affect each other.

A test of a hypothesis.

A tool that measures forces, such as weight.

A statement of what you think will happen and why.

An accepted measurement.

An untested conclusion based on your observations.

A large body of air that has a similar temperature and moisture level.

A tool that makes an object look several times bigger than it is.

anemometer	hail
barometer	hurricane
cold front	land breeze
condensation	precipitation
evaporation	rain

Round pieces of ice formed when frozen rain is coated with water and refreezes.

A weather instrument that measures wind speed.

A large tropical storm that has winds of at least 74 miles per hour.

A weather instrument used to measure air pressure.

A breeze that moves from the land to the sea.

The boundary where a cold air mass moves under a war air mass.

Water that falls to Earth.

The process by which a gas changes into a liquid.

Precipitation that is liquid water.

The process by which a liquid changes into a gas.

rain shadow	warm front
sea breeze	water cycle
sleet	deposition
snow	earthquake
tornado	fossil

The boundary where a warm air mass moves over a cold air mass.

The area on the side of a mountain range that gets little rain or cloud cover.

The movement of water from the surface of Earth into the air and back again.

A breeze that moves from the water to the land.

The dropping of bits of rock and soil by a river as it flows.

Precipitation made when rain falls through freezing-cold air and turns to ice.

The shaking of Earth’s surface caused by movement of rock in crust.

Precipitation caused when water vapor turns directly into ice and forms ice crystals.

The remains or traces of a pant or animal that lived long ago.

A fast-spinning spiral of wind that touches the ground.

fossil record	volcano
glacier	angiosperm
landform	classify
mountain	extinction
topography	fossil

A mountain that forms as lava flows through a crack onto Earth’s surface.

The information about Earth’s history that is contained in fossils.

A flowering pant that has seeds protected by fruit.

A large, moving mass of ice.

To group things that are alike.

A natural feature on Earth’s surface.

The dying out of an entire species.

An area that is much higher than land around it.

The remains of once-living things that have been preserved by being petrified or by leaving different kinds of imprints.

The shape of landforms in an area.

germinate	spore
gymnosperm	vascular
nonvascular	vascular tissue
phloem	xylem
photosynthesis	abiotic

A single reproductive cell that can grow into a new plant.

To sprout.

Having vessels. Vascular plants have tubes that transport food and water to different parts of the plant.

A plant that produces naked seeds.

Tissue that supports plants and carries water and food.

Without vessels. Nonvascular plants do not have tubes to transport materials.

Vascular tissue that carries water and nutrients from roots to every part of the plant.

Vascular tissue that carries food from leaves to all plant cells.

Describes a nonliving part of an ecosystem.

The process by which a plant makes food.

food web	population
habitat	predator
herbivore	prey
niche	producer
omnivore	density

All the individuals of the same kind living in the same ecosystem.

A group of food chains that overlap.

A consumer that eats prey.

An environment that meets the needs of an organism.

Consumers that are eaten by predators.

An animal that eats only plants, or producers.

A living thing, such as a plant, that can make its own food.

The role of an organism in its habitat.

The measure of how closely packed matter is in an object.

An animal that eats both plants and other animals.

gas	solid
liquid	solubility
mass	solution
matter	states of matter
mixture	suspension

The state of matter that has a definite shape and a definite volume.

The state of matter that does not have a definite shape or volume.

The measure of how much of a material will dissolve in another material.

The state of matter that has a definite volume but no definite shape.

A mixture in which two or more substances are mixed completely.

The amount of matter in an object.

One of the three forms (solid, liquid, and gas) that matter can exist.

Anything that has mass and takes up space.

A kind of mixture in which particles of one ingredient are floating in another ingredient.

A blending of two types of matter that are not chemically combined.

volume	chemical reaction
atom	compound
change of state	element
chemical change	chemical property
physical change	physical property

A chemical change.

The amount of space an object takes up.

A substance made of two or more different elements that have combined chemically.

The smallest unit of an element that has all the properties of that element.

A substance made up of only one kind of atom.

A physical change that occurs when matter changes from one state to another, such as from a liquid to a gas.

A property that involves how a substance interacts with other substances.

A reaction or change in a substance, produced by chemical means, that results in a different substance.

A trait that involves a substance by itself.

A change in matter from one form to another that doesn’t result in a different substance.

balance	scientific method
experiment	axis
inquiry	constellation
investigation	crater
microscope	eclipse

A series of steps that scientists use when performing an experiment.

A tool that measures the amount of matter in an object (the object's mass)

An imaginary line that passes through Earth's center and its North and South Poles

A procedure carried out under controlled conditions to test a hypothesis

A pattern of stars, named after a mythological or religious figure, an object, or an animal

An organized way to gather information and answer questions.

A bowl-shaped, low area on the surface of a planet or moon.

A procedure carried out to gather data about an object or event.

An event that occurs when one object in space passes through the shadow of another object in space

A tool that makes small objects appear larger.

equator	planet
galaxy	refraction
moon	revolve
moon phases	rotate
orbit	solar system

A body that revolves around a star.

An imaginary line around Earth, equally distant from the North and South Poles.

The change in direction of a light wave when it moves into a new medium which causes the wave to change speed.

A large system of stars held together by mutual gravitation and isolated in space.

To travel in a close path around something.

Any natural body that revolves around a planet.

To spin on an axis.

Shapes the moon seems to have as it orbits Earth.

A star and all the planets and other objects that revolve around it.

The path one body takes in space as it revolves around another body.

star	pollution
sun	renewable resources
universe	carnivore
conservation	chlorophyll
nonrenewable resources	consumer

Any changes to the natural environment that can harm living organisms.

A huge ball of very hot gases in space.

A resource that can be replaced within a human lifetime.

The star at the center of our solar system.

An animal that eats other animals; also called a secondary-level consumer.

Everything that exists, including such things as stars, planets, gas, dust, black holes and energy.

A green pigment that allows a plant to absorb the sun’s light energy.

The preserving or protecting of natural resources.

An animal that eats plants, other animals or both.

A resource that cannot be replaced within a human’s lifetime.

decomposer	herbivore
ecosystem	photosynthesis
energy pyramid	producer
food chain	transpiration
food web	acid rain

An animal that eats only producers.

A consumer that obtains food energy by breaking down the remains of dead plants and animals.

The process in which plants make food by using water from the soil, carbon dioxide from the air and energy from sunlight.

A community of organisms and the environment in which they live.

A living thing, such as a plant, that makes its own food.

A diagram that shows how much food energy is passed from each level in a food chain to the next level.

The loss of water from a leaf through the stomata.

The transfer of food energy between organisms in an ecosystem.

A mixture that falls to Earth of rain and acids from air pollution.

A diagram that shows the relationships between different food chains in an ecosystem.

adaptation	habitat
community	pollution
competition	population
conservation	predator
extinction	prey

An area where an organism can find everything it needs to survive.

A trait or characteristic that helps an organism survive.

A waste product that damages an ecosystem.

A group of populations that live together.

A group of organisms of one kind that live in one location.

A struggle among populations that need to get a certain amount of food, water and shelter to survive.

An animal that kills and eats other animals.

The practice of saving resources.

An animal that is eaten by a predator.

The death of all the organisms of a species.

reclamation	intertidal zone
succession	near-shore zone
symbiosis	open-ocean zone
climate zone	chemical energy
estuary	conduction

The area at the ocean's edge where waves lap the shore and the tides rise and fall.

The process of cleaning and restoring a damaged ecosystem.

The area of the ocean with calm water that extends from the intertidal zone out to water that are about 180 m (about 600 ft) deep.

A gradual change in the kind of organisms living in an ecosystem.

The area of the ocean that is very deep and not close to land.

A relationship between different kinds of organisms.

Energy that can be released by a chemical reaction.

A region in which yearly patterns of temperature, rainfall and the amount of sunlight are similar throughout.

The transfer of heat from one object directly to another.

A place where a freshwater river empties into an ocean.

conservation	fossil
convection	heat
electric energy	kinetic energy
energy	light
energy transfer	mechanical energy

The remains or traces of past life, found in sedimentary rock.

The use of less of something to make the supply last longer.

The transfer of thermal energy between objects with different temperatures.

The transfer of heat through the movement of a gas or a liquid.

The energy of motion.

Energy that comes from an electric current.

Radiation that we can see.

The ability to cause changes in matter.

The combination of all the kinetic and potential energy that something has

Movement of energy from one place or object to another.

nonrenewable resource	renewable resource
pollution	solar energy
potential energy	system
radiation	conductor
reflection	current electricity

A resource that can be replaced within a reasonable amount of time.

A resource that, once used, cannot be replaced in a reasonable amount of time.

Energy that comes from the sun.

Anything that dirties or harms the environment.

A group of separate elements that work together to accomplish something.

The energy an object has because of its condition or position.

A material that carries electricity well.

The transfer of energy by means of waves that move through matter and space.

A kind of kinetic energy that flows as an electric current.

The bouncing of heat or light off an object.

electric circuit	parallel circuit
electric current	series circuit
electricity	static electricity
electromagnet	concave lens
insulator	convex lens

An electric circuit that has more than one path for the current to follow.

The path an electric current follows.

An electric circuit in which the current has only one path to follow.

The flow of electrons.

The buildup of charges of an object.

A form of energy produced by moving electrons.

A lens that is thicker at the edges than it is at the center.

A magnet made by coiling a wire around a piece of iron and running electric current through the wire.

A lens that is thicker at the center than it is at the edges.

A material that does not conduct electricity well.

frequency	translucent
opaque	transparent
pitch	vibration
reflection	volume
refraction	

Allowing only some light to pass through

The number of vibrations per second.

Allowing light to pass through.

Not allowing light to pass through.

A back-and-forth movement of matter

How high or low a sound is.

The loudness of a sound

The bouncing of light off a surface.

The change in direction of a light wave when it moves into a new medium which causes the wave to change speed.