5th Grade - Grading Period 4 Overview

Ohio’s New Learning Standards

☐ The solar system includes the sun and all celestial bodies that orbit the Sun. Each planet in the solar system has unique characteristics.

Clear Learning Targets

"I can…”

1. _____ evaluate the characteristics of a planet as it relates to distance from the Sun, size, composition, and movement.

2. _____ design and construct a relative scaled-model that can demonstrate the planet size in relationship to the Sun and the Earth.

3. _____ compare and contrast the physical characteristics of meteoroids, meteors, asteroids, and comets

4. _____ describe the effects of meteoroids on the Earth’s surface.

5. _____ follow a laboratory procedure and work collaboratively within a group using appropriate scientific tools.

6. _____ work individually, with a partner, and as a team to test a scientific concept, change a variable, and record the experimental outcome.

7. _____ use the engineering design cycle to develop a solution with a predictable outcome.
<table>
<thead>
<tr>
<th>Essential Vocabulary/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)</td>
</tr>
<tr>
<td>Asteroid</td>
</tr>
<tr>
<td>Atmosphere</td>
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<tr>
<td>Celestial bodies</td>
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<tr>
<td>Comet</td>
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<tr>
<td>Craters</td>
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<tr>
<td>Gravity</td>
</tr>
<tr>
<td>Pluto - Dwarf Planet</td>
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</table>
5th Grade Science Unit: Out of this World

Unit Snapshot

Topic: Cycles and Patterns in the Solar System

Duration: 18 days

Grade Level: 5

Summary

Students will explore the difference in size, composition, movement and distance from the Sun for the eight planets. The unit allows students to gain a deeper understanding of comets, meteors, and asteroids.

CLEAR LEARNING TARGETS

“I can” statements

_____ evaluate the characteristics of a planet as it relates to distance from the Sun, size, composition, and movement.

_____ design and construct a relative scaled-model that can demonstrate the planet size in relationship to the Sun and the Earth.

_____ compare and contrast the physical characteristics of meteoroids, meteors, asteroids, and comets.

_____ describe the effects of meteoroids on the Earth’s surface.

Activity Highlights and Suggested Timeframe

Engagement: Watch www.discoveryed.com video, The Magic School Bus: Gets Lost in Space. Students will create and construct a relative scaled model that can demonstrate each planet’s size and distance in relationship from the Sun and Earth.

Days 3-4 (teachers may extend the lesson by doing more research)

Exploration: Small groups of students will be assigned a planet to research facts for the solar system model they created in the Engage. Conduct the investigation called Crater Collision that models the impact of meteoroids or meteorites on celestial bodies. (A crater on the moon is caused by meteoroids. A crater on the Earth is caused by meteorites.)

Explanation: Students will engage in reading informational texts, watching video clips, discussions and taking notes related to characteristics of planets, asteroids, meteors and comets. Complete Anticipation Guide, comparison worksheet and the reading comprehension worksheet.

Days 10-16

Elaboration: Smart Exchange SmartBoard activity called Solar System by Melissa Love. Complete choice board activities.

Day 17 and ongoing

Evaluation: A teacher-created short cycle assessment will be administered at the end of the unit to assess all clear learning targets.

Day 18

Extension/Intervention: Based on the results of the short-cycle assessments, facilitate extension and/or intervention activities.
NEW LEARNING STANDARDS:
5.ESS.1 The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.
- The distance from the sun, size, composition and movement of each planet are unique.
- Planets revolve around the sun in elliptical orbits.
- Some of the planets have moons and/or debris that orbit them.
- Comets, asteroids and meteoroids orbit the sun.

Note 1: The shape of Earth's orbit is nearly circular (also true for other planets). Many graphics that illustrate the orbit overemphasize the elliptical shape, leading to the misconception regarding seasonal change being related to how close Earth is to the sun. The discussion of planet characteristics should be at an introductory level for this grade.

SCIENTIFIC INQUIRY and APPLICATION PRACTICES:
During the years of grades K-12, all students must use the following scientific inquiry and application practices with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas:
- Identify questions that can be answered through scientific investigations
- Use appropriate mathematics, tools and techniques to gather data and information
- Analyze and interpret data; Develop descriptions, models, explanations and predictions
- Think critically and logically to connect evidence and explanations
- Recognize and analyze alternative explanations and predictions

COMMON CORE STATE STANDARDS for LITERACY in SCIENCE:
- See 5th grade ELA Standards for; Reading Standards for Informational Text, Writing Standards and Speaking and Listening Standards

*For more information: http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

STUDENT KNOWLEDGE:

Prior Concepts Related to Surface of Earth
PreK-2: The moon, sun and stars can be observed at different times of the day or night. The observable shape of the moon changes throughout the month, the sun's position in the sky changes in a single day and from day to day and the sun is the principal source of energy. Earth's atmosphere is discussed.
Grades 3-4: All objects are made of matter and light is a form of energy. Earth's surface is discussed and gravitational forces are introduced.

Future Application of Concepts
Grades 6-8: The interior and exterior composition of Earth, Earth's unique atmosphere, light waves, electromagnetic waves, interactions between the Earth, moon and sun, and gravitational forces are explored in more depth.
High School: Galaxies, stars and the universe are studied in the physical sciences.
**MATERIALS:**

**Engage**
- computer for video
- for the model: butcher paper, white paper, scissors, crayons, tape, rulers, the teacher sheet for sizes and distances

**Explore**
- planet research: planet resource pages (in curriculum guide) or the library books, computers for internet, planet facts worksheet, crayons, tape
- meteorite experiment: flour, pie tin, 3 marbles, meter sticks, rulers, lab worksheets

**Explain**
- each student needs an Anticipation Guide, Comets, Asteroids and Meteors Comparison worksheet and Reading Comprehension worksheet
- chart paper and sticky notes for students' questions
- planet resource pages or computer
  - computer for discovery education video, *Space School: Pluto*
- Meteor, Comet and Asteroid resource pages, computer for discovery education videos:
  - *What are Asteroids, Meteors and Comets*,
  - *Other Heavenly Bodies: Asteroids, Meteors and Comets*
  - *Craters*
  - *Cosmic Collisions on the Moon*
- computer for The Life of a Meteorite video
  [www.kidsastronomy.com/meteorites.htm](http://www.kidsastronomy.com/meteorites.htm)

**Elaborate**
- computer for SmartBoard Exchange lesson, *Solar System* by Melissa Love
- choice board and templates
- may need computers, variety of paper, crayons/colored pencils/markers, index cards, other supplies the students may ask for to create their game

**VOCABULARY:**

**Primary**
- 8 Planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)
- Asteroid
- Comet
- Gravity
- Gravity/gravitational attraction
- Meteor
- Meteorite
- Meteoroid
- Orbit
- Physical characteristics
- Pluto - Dwarf Planet
- Solar System

**Secondary**
- Atmosphere
- Celestial bodies
- Craters
- Impact
| **SAFETY** | • Handle all science equipment and materials appropriately according to teacher directions.  
• Be respectful of other student's experiments/projects. |
| **ADVANCED PREPARATION** | • Watch the videos from [www.Discovery.com](http://www.Discovery.com)  
• Provide library books available for all planets so students can conduct research. (Students need the books for Exploration and Elaboration.) Gather all materials for Crater Collision experiment. Copy all reading material.  
• Bookmark all websites the students may use during the unit.  
• Log in or sign up for Smart Exchange to view and use SmartBoard lessons. |

**Objective:** To spark student's interest in the Solar System by watching a video and creating a model.

### What is the teacher doing? Video (Day 1)
- Watch Discovery ed video, *The Magic School Bus: Gets Lost in Space* (29:08 min.)

### Solar System Model (Day 2)
- Create a relative scaled solar system. Teacher will provide a butcher paper "solar system" about 62" long taped on the wall of the hallway. The teacher can have the Sun already posted on the paper. Assign groups of students to cut out each planet and place on the paper according to the provided directions.  
- Consider using the following mnemonic device to help students learn the planetary order: *My Very Excellent Mother Just Served Us Nachos* (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)

### What are the students doing? Video (Day 1)
1. Students will begin learning about the Solar System while watching the video.

### Solar System Model (Day 2)
2. Students will be in groups to create a relative scaled model of the solar system according to teacher directions. (They will add planet facts during Explore.)

### Objective: Groups of students will complete a planet fact sheet to accompany the relative scaled model solar system poster. Students will conduct investigations that model the impact of meteoroids or meteorites on celestial bodies. (A crater on the moon is caused by meteoroids. A crater on the Earth is caused by meteorites.)

### What is the teacher doing? Planet Facts (Day 3)
- Have students get into the same planet groups from the Engage activity. Distribute the resource page for their planet and the Planet Facts worksheet. They will complete the Planet Facts worksheet and tape it to the "solar system" model under their planet.

### What are the students doing? Planet Facts (Day 3)
1. Students will read the resource page, library books or internet sites to complete the Planet Facts worksheet and color the planet. Tape facts under the planet on the model.
Suggestions: Teacher may want to laminate Planet Facts worksheets. During the Explain section of this unit the students will need to read all of the planet resource pages, so the teacher may want to copy all pages for Explore and reuse them during the Explain section of this unit.

**Crater Collision (Day 4)**
- Gather materials for Crater Collision experiment: 3 marbles, flour, pie tin, goggles, lab worksheets, meter sticks and rulers. The experiment can either be teacher demonstrated or student performed. Prior to the experiment, explain expectations and rules for completing this activity. In order to measure the crater, the teacher will need to explain diameter.

**Crater Collision (Day 4)**
2. Complete the Crater Collision experiment. Be sure to use centimeters when measuring height of drop and when measuring diameter. It is very important to drop the marble with the same force for each trial.

**Objective**: Students will read informational texts and watch video clips to gather information about planets, asteroids, meteors and comets. Students will complete an Anticipation Guide, comparison worksheet and reading comprehension worksheet.

**Explained (5 days)**

(What products could the students develop and share? How will students share what they have learned? What can be done at this point to identify and address misconceptions?)

<table>
<thead>
<tr>
<th>What is the teacher doing?</th>
<th>What are the students doing?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comets, Asteroids, and Meteoroids (Days 5-9)</strong></td>
<td><strong>Comets, Asteroids, and Meteoroids (Days 5-9)</strong></td>
</tr>
<tr>
<td>- Before reading, distribute the Anticipation Guide for Comets, Asteroids and Meteors. Students need to complete the BEFORE section. Collect Anticipation Guides to be used at the end of the Explain part of the unit.</td>
<td>1. Complete the BEFORE section of the Anticipation Guide.</td>
</tr>
<tr>
<td>- Copy and distribute the provided resource pages in this guide. The teacher may have students take turns reading the material or read in table groups.</td>
<td>2. The students should take turns reading aloud and asking inquiring questions about the material. Underline important information or take notes on the material. Students may want to use sticky notes to write down questions they have while reading. Place the questions on a class chart. The teacher can address the questions throughout the reading.</td>
</tr>
<tr>
<td>- To explain Pluto’s dwarf status watch discovery ed video, <em>Space School: Pluto</em> (4:26 min.)</td>
<td></td>
</tr>
<tr>
<td>- Have students fill in the Comets, Asteroids and Meteors Comparison worksheet and the Reading Comprehension worksheet as they read the resource pages.</td>
<td>3. Students will complete the worksheets as they read the related material.</td>
</tr>
</tbody>
</table>
- Watch the video, *The Life of a Meteorite* (1:19 min.)
  [http://www.kidsastronomy.com/meteorites.htm](http://www.kidsastronomy.com/meteorites.htm)

Suggestions: Teacher may want to have students take notes as they read or underline important information. Hang a chart paper on the wall for students to write questions as they read. The teacher can address the questions as they go through the readings and videos.

- Distribute the Anticipation Guides and have students complete the AFTER section. Collect for a formative assessment grade.

4. Complete the AFTER section of the Anticipation Guide.

**Objective**: Students will show their knowledge through the SmartBoard lesson and choice board activities.

**What is the teacher doing?**

**SMARTBoard Activity (Day 10)**

- Facilitate the Smart Exchange SMARTBoard activity, Solar System by Melissa Love. Teachers will need to be a member of Smart Exchange or join for free. [www.exchange.smarttech.com](http://www.exchange.smarttech.com)

**Choice Board (Day 11-16)**

- Choice Board Activities
  - The choice board contains 10 activities. They are worth 1 point, 3 points and 5 points. The goal is to have the students complete 10 points worth of activities. However, the teacher may choose to use the choice board in a different way. The teacher can have students complete as many projects as time will allow. Students may complete some projects as individuals, teams of 2 or table groups.

**What are the students doing?**

(Day 10)

1. Students will be participating in the SMARTBoard lesson.

**Choice Board (Day 11-16)**

2. Work on choice board activities.
**Objective:** Students can show their knowledge through formative assessments throughout the lesson and show their cumulative knowledge with summative assessments.

<table>
<thead>
<tr>
<th>Formatte</th>
<th>Summative</th>
</tr>
</thead>
<tbody>
<tr>
<td>How will you measure learning as it occurs?</td>
<td>What evidence of learning will demonstrate to you that a student has met the learning objectives?</td>
</tr>
<tr>
<td>1. Explore- the group’s planet research for the model solar system.</td>
<td>1. Elaborate- choice board activities</td>
</tr>
<tr>
<td>2. Explore- the investigation lab to measure impact of meteorites.</td>
<td>2. Use the Study Guide questions provided at the end of the unit to create an assessment.</td>
</tr>
<tr>
<td>3. Explain- note taking and discussions throughout the reading.</td>
<td></td>
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</tbody>
</table>

**EVALUATE**
(1 day and on-going)
(What opportunities will students have to express their thinking? When will students reflect on what they have learned? How will you measure learning as it occurs? What evidence of student learning will you be looking for and/or collecting?)

<table>
<thead>
<tr>
<th>EXTENSION/INTERVENTION</th>
<th>INTERVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1 day or as needed)</td>
<td>1. Crossword puzzle using vocabulary from the unit.</td>
</tr>
<tr>
<td></td>
<td>2. The choice board activities can be used for intervention or extension.</td>
</tr>
<tr>
<td></td>
<td>3. Planet cards, a matching game.</td>
</tr>
<tr>
<td>1. Research 2 planets and complete a Venn Diagram.</td>
<td></td>
</tr>
<tr>
<td>2. The choice board activities can be used for intervention or extension.</td>
<td></td>
</tr>
<tr>
<td>3. Students create a matching game to extend their knowledge of Earth and Space science.</td>
<td></td>
</tr>
</tbody>
</table>

**COMMON MISCONCEPTIONS**
Common misconceptions about cycles and patterns in the Solar System at this grade level include:

- Meteors (shooting stars) are real stars. (Meteors are meteoroids burning up as they enter Earth's atmosphere.)
- Meteoroids will have the same impact on the moon that meteorites have on Earth. (Meteoroids will have a greater impact on the moon due to the lack of atmosphere on the moon.)
- Meteorites and meteoroids are all meteors. (Meteoroids, meteorites and meteors are all smaller forms of asteroids. A Meteoroid is a small body moving in the Solar System before it enters Earth's atmosphere. As that small body enters Earth's atmosphere, it is a meteor. A meteorite is what remains from the meteor and has landed on the Earth.)
- Living in outer space is an idea of the future. (Astronauts are living and surviving on the International Space Station.)
- We could do everything on the other planets that we do here on Earth. (Based on resources and differences in gravity, life would be very different.)
- Pluto is a planet. (Pluto is now considered a dwarf planet due to its characteristics.)
- The Planets are evenly spaced. (The terrestrial planets are closer together, whereas the gas giants are farther apart.)
**Differntiation**

Lower-level:
- Consider differentiating grouping to meet the needs of individual students when completing the planet facts sheet for the relative scaled model or choice board activities.
- Consider providing trade books or other appropriate reading-level materials for students to use for the research activities.

Higher-Level:
- Have students complete a Venn Diagram comparing more than 1 planet.
- Students can extend the choice board activities by completing more than required.
- The following website is a link to practice online tests. [http://www.linkstolearning.com/links/Ohio/ohio_schools.htm](http://www.linkstolearning.com/links/Ohio/ohio_schools.htm)

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at ODE.

**Additional Resources**

Websites:
- [www.nasa.gov/education](http://www.nasa.gov/education) - Information and related materials
- [http://amazing-space.stsci.edu/resources/explorations/](http://amazing-space.stsci.edu/resources/explorations/) - on-line explorations
- [http://www.bobthealien.co.uk/solar.htm](http://www.bobthealien.co.uk/solar.htm) Bob the Alien's tour of the Solar System has information about the Solar System written in student friendly language.

**Discovery Ed: Unitedstreaming.com**
- The Magic School Bus: Gets Lost in Space (29:08 minutes)
- The Planets (5:36 minutes)
- All About Comets (2:13 minutes)
- Asteroids and Meteoroids (3:29 minutes)
- Real World Science: Our Solar System (18:39 minutes)
<table>
<thead>
<tr>
<th>Video</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science is Elementary: What's in Space: Stars and Planets</td>
<td>18:19 minutes</td>
</tr>
<tr>
<td>Space School: Pluto</td>
<td>4:26 minutes</td>
</tr>
<tr>
<td>Science Lab: Our Solar System (game)</td>
<td></td>
</tr>
<tr>
<td>Our Solar System: The Inner Planets</td>
<td>29:16</td>
</tr>
<tr>
<td>Our Solar System: The Outer Planets</td>
<td>30:07</td>
</tr>
</tbody>
</table>

**Smart Exchange Lessons:**
- Solar System by Melissa Love
- Solar System submitted by LadyLiz2012
- Space Objects submitted by Billyernst

**Literature:**
Name_______________________________________________

Making a Model of the Solar System

(Taken from www.scholastic.com/teachers/lesson-plan/making-models-solar-system by Ruth Manna)

**Objective:** Create the relative-size model of the solar system for the hallway.
Students will create the model of each planet during the Engage part of the unit. Students will
research facts about the planets to add to the model during Explore.

**Materials:** butcher paper, white paper, scissors, crayons, tape, rulers, planet information sheets,
textbook

**Procedure:**
1. To represent outer space, roll out 62 inches of butcher paper, any color will do. 2.
Divide the students into 8 groups, 1 for each planet.
3. Each group needs white paper to cut out the planet according to the given dimensions.
Leave the planets white until research has been completed during the Explore part of the unit.

<table>
<thead>
<tr>
<th>Planets</th>
<th>Diameter (distance across the sphere passing through the center)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>1½&quot;3</td>
</tr>
<tr>
<td>Venus</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>Earth</td>
<td>4&quot;2</td>
</tr>
<tr>
<td>Mars</td>
<td>44 ¼&quot;</td>
</tr>
<tr>
<td>Jupiter</td>
<td>37&quot;16</td>
</tr>
<tr>
<td>Saturn</td>
<td>15 ½&quot;</td>
</tr>
<tr>
<td>Uranus</td>
<td></td>
</tr>
<tr>
<td>Neptune</td>
<td></td>
</tr>
</tbody>
</table>

4. The teacher will need to create a Sun to go on one end of the butcher paper.
5. After students have created the planets correctly they need to place them on the butcher paper.
The distance is not to scale it is just to show how spread out the solar system really is. Each group
needs to place/tape their planet a given distance from the sun.

<table>
<thead>
<tr>
<th>Planets</th>
<th>Distance from the Sun</th>
</tr>
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<tbody>
<tr>
<td>Mercury</td>
<td>1&quot;</td>
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<tr>
<td>Earth</td>
<td>2&quot;3</td>
</tr>
<tr>
<td>Mars</td>
<td>11 ½&quot;</td>
</tr>
<tr>
<td>Jupiter</td>
<td>19&quot;</td>
</tr>
<tr>
<td>Saturn</td>
<td>38&quot;</td>
</tr>
<tr>
<td>Uranus</td>
<td>60&quot;</td>
</tr>
<tr>
<td>Neptune</td>
<td></td>
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</tbody>
</table>

picture below is from http://esiforexplor.blogspot.com/2012/04/candy-solar-systems.html

If you would like to read the information online, the Information and pictures were taken from http://www.manatee.k12.fl.us/sites/elementary/samoset/psgb3ex.htm
Our Solar System is made up of eight planets, their moons, and our Sun. The planets and their moons revolve around, or orbit the Sun. The orbits are not round. They are elliptical (E-lip-tih-cul). Elliptical means egg-shaped.

Mercury is the planet closest to the Sun. It is not, however, very close, since it is 36 million miles, or 58 million kilometers away from the Sun!

Like all the other planets Mercury orbits around the Sun. A year on Mercury lasts for only 88 days. The Earth's orbit lasts for 365 days, 1 year. Because Mercury goes around the Sun so quickly, the planet was named after the messenger of the Roman Gods. The messenger Mercury, or Hermes as the Greeks knew him, is usually shown as having wings on his helmet or on his sandals. When Mercury orbits the Sun, it travels 36 million miles in the 88 days of the orbit. It moves at a speed of 107,372 miles an hour! Unlike the Earth and most other planets Mercury turns very slowly on its axis, taking 59 days to complete the turn from day to night.

Mercury’s sunny side has a temperature rising to 400° Celsius or 750° Fahrenheit. Compare this to a warm summer's day in London, when the temperature might be 80° Fahrenheit or 26° Celsius. Mercury's dark side, however, is very cold indeed, with the temperature going down to -200° Celsius or -328° Fahrenheit. Mercury has no atmosphere around it to protect it from the Sun or to retain any heat when it rotates on its axis. Mercury's distance from the Earth is 57 million miles.

Mercury has no moons.

Mercury is quite a small planet. Its diameter, the distance right round its middle, is only 3100 miles. The diameter of the Earth is 7926 miles.

The surface of Mercury is covered with craters and completely dry. There is no possibility of life on Mercury. Mercury is one of five planets that can be seen without using a telescope, Mercury, Venus, Mars, Jupiter and Saturn. When you look at the sky at night, the planets do not twinkle in the way that stars do. Mercury is not very easy to see, but it can be seen low in the west just after sunset or in the east just before dawn.

About once every ten or fifteen years Mercury can be seen crossing the Sun. At this point its orbit has come between the Sun and the Earth. This event is known as a transit. When watching any event near the Sun a proper filter must be used to protect the sight. With this filter Mercury can be seen as a tiny black dot slowly passing across the Sun. Mercury information from http://www.planetsforkids.org/planet-mercury.html
Venus is the second planet from the Sun. It is one of the four inner planets. These planets are Mercury, Venus, Earth and Mars. The inner planets are also called the rocky planets, because they are made of rocks.

Venus is sometimes called the "Evening Star" and the "Morning Star". It is very bright. You can see it at sunset and sunrise. It is so bright it looks like a star, but it does not twinkle.

Venus spins very slowly. One "day" on Venus is longer than one year on Venus!!! It takes Venus 243 days to spin around its axis one time. This means that one Venus day is 243 "Earth Days" long. Venus orbits, or goes around the sun, in only 225 days! This means one Venus year is 225 days long!!!

Venus is different from all the other planets because it spins "backwards" on its axis.

Astronomers call Venus Earth's "sister planet" because it is about the same size as Earth. Its gravity is also about the same as Earth's gravity. This means you would weigh about the same amount on Venus and on Earth. Venus, however, is very different from Earth.

Earth has big oceans and a lot of water vapor in the air. Earth has clouds made of water vapor. Earth has an atmosphere made of gases called oxygen and nitrogen. Our atmosphere also has a little bit of carbon dioxide and other gases in it. Venus has no oceans. Its atmosphere is made mostly of carbon dioxide. There is almost no water vapor in its air. Venus is totally covered by clouds made of acid. (sulfuric acid) The clouds cover the whole surface of Venus. They let sunlight in, but do not let heat out. This makes Venus very, very hot. It is even hotter than Mercury which is closer to the sun! The temperature on the surface of Venus is about 900 degrees Fahrenheit! That is nine times as hot as a 100 degree day on Earth!

Like Mercury, the surface of Venus is covered with craters made by meteoroids. There are also many volcanoes on Venus. The volcanoes are not active anymore, which means they do not erupt. This picture shows Maat Mons, one of Venus’s volcanoes.
Earth is the third planet from the Sun. It is the largest of the four inner planets. These planets are Mercury, Venus, Earth and Mars. The inner planets are also called the rocky planets, because they are made of rocks.

Earth is often called the "Water Planet" because it is the only planet in our solar system which has liquid water on its surface. About 70% of the surface of Earth is covered by water! The other part of Earth is made up of continents and islands which have different landforms on them. Examples of landforms are mountains, and plains. Because Earth has so much water, plants and animals can live on Earth.

Earth spins very quickly compared to other planets. It only takes Earth 24 hours to spin around its axis one time. One Earth day is 24 hours long!!! Earth orbits the sun in 365 days! This makes one Earth year 365 days long!!!

Earth has big oceans and a lot of water vapor in the air. Earth has clouds made of water vapor. Earth has an atmosphere with a lot of oxygen in it for us to breathe. The rest of our "air" is made up of nitrogen, carbon dioxide and other gases.

Earth is the only planet in our solar system which has all the conditions that are needed for animals, plants, and humans to live on it. There is plenty of water for them to drink, and/or live in. Earth has air which plants and animals can breathe. The temperature on Earth is just right for plants, animals, and humans. Different parts of Earth have different temperatures, but plants, animals, and humans can live in almost all areas of Earth.

Like the other inner planets, Earth has volcanoes. Earth's volcanoes are different from those on other planets, because they still erupt. Scientists think that there may be volcanoes on other planets and moons in our solar system that may still be active. They are still studying this.

Earth has one moon which we call "The Moon". Its surface has many craters on it from where meteoroids have hit it. It has many volcanoes on it which do not erupt anymore. We can see the moon at night without using a telescope. It is the closest space object to our planet.
Mars is the fourth planet from the Sun. It is the last of the four inner planets. These planets are Mercury, Venus, Earth and Mars.

Mars is often called the "Red Planet" because of the color.

Here is a picture of "Twin Peaks" on the surface of Mars. You can see that the surface is rocky and sandy looking. The picture was taken on July 4th, 1997 by the Mars Pathfinder's camera. The "peaks" are the hills in the back of the picture. They are about 100 feet tall.

Mars spins very quickly compared to other planets. It only takes Earth 24 hours to spin around its axis one time. Mars spins around on its axis in 24 hours and 36 minutes. This means that the Martian Day is about half an hour longer than ours! One Mars Day is about 24 and one half hours long. Mars has a very long year. It is about 687 Earth days long! That is almost twice as long as one year on Earth.

Mars has an atmosphere, but it is different than Earth's. Our atmosphere is made up of oxygen (which we breathe), nitrogen, carbon dioxide and other gases. Earth has a lot of water vapor in the air. Mars has "air" made up mostly of carbon dioxide. Other important gases in the air of Mars are nitrogen and oxygen. There is much less oxygen in the air of Mars than we have on Earth. We would not be able to breathe the air on Mars. Mars has water vapor in the air, but Earth has four times as much. Mars has weather, but it is different than Earth's. Scientists have pictures of clouds on Mars. The clouds are made of water vapor. Scientists do not know if it ever rains on Mars. They do know Mars has winds and very big dust storms.
Jupiter is the fifth planet from the sun. It is the largest planet in the solar system and it is the largest of the outer planets. The outer planets are: Jupiter, Saturn, Uranus and Neptune. Jupiter, Saturn, Uranus, and Neptune are called "gas giants" because they are mostly made of gases and are very large.

Jupiter is named after the Roman "King of the gods". Jupiter was the leader of the made-up gods that the Romans who lived long, long ago believed in. The planet is named Jupiter because it is so big!

Jupiter is mostly made of a gas called hydrogen. Its atmosphere has three layers of clouds in it. The first layer of clouds is made of ammonia. Ammonia is the stinky stuff that is used to clean floors and is found in spray-cleaners like window cleaners. The second layer of clouds is made of ammonia and sulfur. Sulfur is the material found on the head of a match that makes it light. The third layer of clouds is made of water vapor. Jupiter has a lot of storms in its atmosphere. The spot in this picture is a storm on Jupiter. Scientists call this Jupiter's red spot. It is a storm which has been going on for about 300 years!!! It is 2 times as big as our whole planet Earth. This storm is like a giant hurricane. It has winds that blow as fast as 270 miles per hour!! The Red Spot is the biggest storm in the Solar system.

An interesting fact about Jupiter is that it has rings. Here is a picture from NASA showing Jupiter's rings. Some of Jupiter's moons are found in its rings. Jupiter has at least 16 moons and maybe more!!
Saturn is the second of the outer planets. It is also the second largest planet in our solar system. Because it is so big people can see it without a telescope. The ancient Greeks and Romans saw it and named it Saturn. In 1610, Galileo discovered it had "lumps" on each side when he looked at it through his telescope. In 1655, another scientist named Christian Huygens, made a better telescope than Galileo had. He discovered Saturn had rings!

Saturn is made mostly of hydrogen and helium. On Earth these are usually gases. In fact, helium is the gas used to blow up balloons that float. On Saturn, hydrogen and helium are liquids! Saturn has weather and storms. Scientists think these are mostly wind storms. The storm is the bright yellow and blue patches in the middle of Saturn. Saturn is yellow, because there is a lot of sulfur in its atmosphere.

Saturn is so big, has rings and so many moons that it is called a "system". This picture shows Saturn and 6 of its 18 moons! The rings are made up of pieces of rocks and ice. These pieces can be as small as a pebble or as big as a building. The rings get their pretty colors because the sun shines on them from far away. Sometimes after it rains on Earth, we see a rainbow. This is because there are many tiny drops of water in the air. These drops are too small to fall as rain. The sun shines on the tiny drops and reflects off making a rainbow. Saturn's rings are made of dust and ice pieces. The sun reflects off these and makes rainbow colors.

Saturn spins very quickly on its axis. One day on Saturn is only 10 hours long. A year on Saturn is very long. It is 29 1/2 Earth years long. This means you would be 30 years old on Earth and 1 year old on Saturn.
Uranus is the seventh planet from the Sun. It is the third of the outer planets. Like Saturn and Jupiter, Uranus has a very short day. One day on Uranus is only 17 hours long. A year on Uranus is VERY long. One Uranus year is 84 Earth years! It takes Uranus 84 years to orbit the Sun one time! That means Uranus goes all the way around the sun ONCE in our lifetime!

Uranus has more moons than any other planet in our solar system. So far, 20 moons have been discovered! 18 of these are "for sures". The other 2 are still being studied to make sure they are moons. This picture shows Uranus and some of its moons. You can see that Uranus has rings like Saturn and Jupiter. They are not colorful or easy to see. Uranus' rings are very thin.

Uranus was first seen by a scientist named William Herschel in 1781, about 5 years after America declared its independence from Great Britain. Herschel wanted to name Uranus after King George III, who was the king of England at that time. Other scientists didn't like this, so they named it after another made-up Roman and Greek god like all the other planets.

Uranus is made of methane ice. Methane is usually a gas on Earth, but it is so cold on Uranus that it is frozen into ice. Uranus's atmosphere is mostly made of methane gas. There are so many clouds made of methane in the atmosphere, that they cover the whole planet. Uranus looks bluish-green because its atmosphere is made of methane. Weather on Uranus is mostly winds that move through the atmosphere. Winds on Uranus can blow up to about 320 miles an hour!!

An odd fact about Uranus is that it "lies on its side." The axis is perpendicular to the Sun so it rotates north and south. Some people say Uranus spins on its side. Here is a picture that shows this. Uranus sort of looks like a ball that got squished in the middle.
Neptune is the eighth planet from the Sun and the fourth of the outer planets. Like Uranus, Neptune is a blue color because its atmosphere is mainly made of methane gas. Neptune's day is about the same length as Uranus'. It is 17 hours long. One year on Neptune is 165 Earth years - about twice as long as Uranus' year! It takes Neptune 165 years to circle around the sun once because it is so far away.

Neptune has some interesting features. Jupiter has the "Great Red Spot" that looks like an eye. Neptune has a "Great Dark Spot". Jupiter's spot is really a storm. Scientists think that Neptune's spot is a hole in its atmosphere! Like Uranus, Neptune's atmosphere is mostly made of methane gas. Neptune also has bands of thin white clouds that look like stripes. The cloud patterns change as Neptune spins on its axis.

Neptune has 8 moons. The biggest one is Triton. Here is a picture from NASA showing Triton and Neptune. Neptune is much, much bigger than Triton. Triton looks bigger in this picture because the picture was taken closer to Triton than it was to Neptune.
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<td><img src="https://marchild.gsfc.nasa.gov" alt="Picture of Uranus" /></td>
<td><img src="https://cosmicelk.com" alt="Picture of Neptune" /></td>
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Pictures from Marchild.gsfc.nasa.gov and Cosmic Elk
Crater Collisions

ESSENTIAL QUESTION: How do meteoroids and meteorites affect celestial bodies upon impact?

Hypothesis: Write your hypothesis on a post-it note and display it on the board.

Experimental Procedure:
1. Put on safety goggles/glasses. Drop 3 marbles into the pie tin from the 30cm height.
2. Choose a crater. Measure in centimeters the diameter and the depth of the crater using your ruler. Record the information on the Data Collection Chart. Draw a picture of the crater.
3. Remove the marbles.
4. Smooth out the flour/soil.
5. Repeat steps 4-6 using the heights of 50 cm and 90 cm.

Optional:
Drop a marble into the pie tin using some force. Record the measurements.
Throw a marble into the pie tin so that it strikes the surface at an angel. Record the resulting measurements.

Data Collection Chart

<table>
<thead>
<tr>
<th>Type of Meteoroid/Meteorite Strike</th>
<th>Depth of Crater</th>
<th>Diameter of Crater Drawing of Crater</th>
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<tbody>
<tr>
<td>30 cm</td>
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<tr>
<td>50 cm</td>
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<tr>
<td>90 cm</td>
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Optional: Graph your data.
Post-Lab:

1. Describe any crater differences when the marbles were dropped from different heights?
______________________________________________________________________________________
______________________________________________________________________________________
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2. What other factors may affect the size of a crater?
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3. How do meteorites affect the surface of the Earth?
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4. Describe what would happen if a meteoroid were to hit the moon?
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ESSENTIAL QUESTION: How do meteoroids and meteorites affect celestial bodies upon impact?

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<td>90 cm</td>
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Answers will vary
Optional: Graph your data.
Name _______________________________

Post-Lab:

1. Describe any crater differences when the marbles were dropped from different heights?

   The craters became deeper and larger in diameter as the height at which the marble was dropped increased.

2. What other factors may affect the size of a crater?

   Other factors that affect the size of the crater might include:
   - speed at which the meteoroid is traveling
   - size of the meteoroid
   - type of surface that is hit (rock)
   - shape of the meteoroid
   - the mass of the meteoroid

3. How do meteorites affect the surface of the Earth?

   Meteorites cause circular craters to form on most surfaces in various sizes and shapes.

4. Describe what would happen if a meteoroid were to hit the moon?

   Since the moon does not contain a very large atmosphere, meteoroids would not slow down or burn up in the moon's atmosphere before hitting the surface. Therefore, the impact would be greater on the moon than on Earth.
Anticipation Guide  
Comets, Asteroids, Meteors

Before we begin learning about Comets, Asteroids, and Meteors, read the following statements and decide if you Agree or Disagree with each statement. After you read, go back and look at your responses. Decide if you are going to keep your original answer or change your decision. Circle the answer you feel is correct after reading.

<table>
<thead>
<tr>
<th>Before</th>
<th>1. Comets are always visible.</th>
<th>After</th>
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<tbody>
<tr>
<td>Agree</td>
<td>Disagree</td>
<td>Agree</td>
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<table>
<thead>
<tr>
<th>Before</th>
<th>2. A comet's orbit is a very long narrow ellipse.</th>
<th>After</th>
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</thead>
<tbody>
<tr>
<td>Agree</td>
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<tr>
<th>Before</th>
<th>3. Comets sometimes have a tail of dust and gas.</th>
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<tbody>
<tr>
<td>Agree</td>
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<thead>
<tr>
<th>Before</th>
<th>4. A comet is made of solid rock.</th>
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<tbody>
<tr>
<td>Agree</td>
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<tr>
<th>Before</th>
<th>5. Asteroids revolve around Earth in an area known as the asteroid belt.</th>
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<tbody>
<tr>
<td>Agree</td>
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<tr>
<th>Before</th>
<th>6. Asteroids are mostly solid rock.</th>
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<tr>
<th>Before</th>
<th>7. Meteoroids are mostly made up of ice.</th>
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<tr>
<th>Before</th>
<th>8. Meteoroids usually come from comets or asteroids.</th>
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<tr>
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<th>Before</th>
<th>9. A &quot;shooting star&quot; occurs when a star burns out while traveling across the night sky.</th>
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<td>Agree</td>
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<tr>
<th>Before</th>
<th>10. Meteorites fall all over Earth.</th>
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<tbody>
<tr>
<td>Agree</td>
<td>Disagree</td>
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**TEACHER KEY - Anticipation Guide**
**Comets, Asteroids, & Meteors**

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<td>8.</td>
<td>Agree</td>
<td>Disagree</td>
<td>Agree</td>
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<tr>
<td>9.</td>
<td>Agree</td>
<td>Disagree</td>
<td>Agree</td>
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<tr>
<td>10.</td>
<td>Agree</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
</tbody>
</table>
Asteroids

Between 1801 and 1807, astronomers discovered four small objects between Mars and Jupiter. Over the next 80 years, they found 300 more. These objects, called asteroids, are too small and too numerous to be considered full-fledged planets. Asteroids are left over material from the formation of the solar system. These materials were never incorporated into a planet because of their proximity to Jupiter's strong gravity. Asteroids are made of rock and metal and are similar to comets, but do not have a visible coma (fuzzy outline and tail). Most asteroids revolve around the sun between the orbits of Mars and Jupiter. This region of the solar system is known as the asteroid belt.

The asteroid belt is divided into an inner belt and an outer belt. The inner belt, which is made up of asteroids that are within 250 million miles (402 million km) of the Sun, contains asteroids that are made of metals. The outer belt, which includes asteroids 250 million miles (402 million km) beyond the Sun, consists of rocky asteroids. These asteroids appear darker than the asteroids of the inner belt, and are rich in carbon. While most asteroids can be found in the Asteroid Belt, others are in unique orbits far from the Asteroid Belt. It is currently thought that at least 5,000 asteroids cross the Earth's orbit, some coming very close.
An asteroid hit Earth 65 million years ago. It exploded, making a crater 200 kilometers in diameter in the Yucatan Peninsula of Mexico. The explosion probably started huge fires that destroyed much of Earth's forests and grass. Scientists hypothesize that this caused the extinction of many types of animals, including dinosaurs. Don't worry though, asteroids and comets only hit the Earth every 100 million years or so.
Comets

You can think of a comet as a dirty "snowball" about the size of an Earth mountain. Comets are chunks of ice and dust and small rocky particles whose orbits are usually very long, narrow ellipses. Comets come from two places: The Kuiper Belt and the Oort Cloud.

Imagine a place far, far away at the very edge of the Solar System. A place where millions of comets can be seen swishing around in every direction. These icy comets are orbiting the Sun in two different places, both of which are very distant. One place is called the Oort cloud, and the other is called the Kuiper Belt. A comet will spend billions of years in the Kuiper Belt or Oort Cloud. Sometimes two comets will come very close to each other, or even crash into one another. When this happens the comets change directions. Sometimes their new path will bring them into the Inner Solar System.

This is when a comet begins to shine. Up until now the comet has been among millions of others exactly the same, but as they approach the warmer Inner Solar System they begin to melt leaving behind magnificent tails. Unfortunately, comets don't live very long once they enter the warmer part of the Solar System. Just like a snowman melts in the summer, comets melt in the Inner Solar System. After several thousand years they melt down to a little bit of ice and dust, not nearly enough to leave a tail. Some even melt away completely.
Many people think that a comet's tail is always following behind it, but actually the coma, or tail, can either be behind the comet or in front of it. Which way the tail is pointing depends on where the Sun is. That's right, the Sun's heat and radiation produce a wind called the Solar Wind, as a comet gets close to the Sun it begins to melt. The gas and dust that melt off are blown away from the Sun by the solar winds. So if a comet is traveling towards the Sun then the tail will follow behind, but if the comet is traveling away from the Sun the tail will be in front of the comet.

The English astronomer Edmond Hailey was very interested in a comet that he saw in 1682. He was told that a similar comet had appeared in 1531 and 1607. Using the laws of gravity, he realized he could predict when the comet would appear again. Halley suggested they were actually the same comet. He calculated that this comet appeared about every 76 years and predicted that it would reappear in 1758. When his prediction came true, the comet was named Hailey's Comet.
You have probably heard of a shooting or falling star, but have you ever seen one? If you have ever spent any amount of time looking up at the night sky, then you probably have - a flash of light streaking high above through the darkness for just a moment, disappearing just as quickly as it appeared. Do you know what a shooting star is? Their names are a little misleading and this causes some people to think that these fast moving trails of light really are stars that have fallen out of the sky. However, this is not true. Our Sun is a star, our closest star, and the other stars are many, many miles away (it would take more than your lifetime to travel to them!) and since they are much bigger than a shooting star, they are certainly not responsible. If you are still not sure of the answer, then you might be surprised to learn that shooting stars are just tiny bits of dust entering the Earth's atmosphere from space. Tiny particles, like grains of sand or pebbles on a beach, crash into the atmosphere at amazingly fast speeds. The light that you see is the heat of the air around them as they fly into the atmosphere and burn up.

Occasionally, however, the piece of rock can be big enough so that it does not all burn up while entering the atmosphere and it will hit the ground. We call these meteorites. While they are flying through the atmosphere as shooting stars we call them meteors, and while they are in space we call them meteoroids. A whopping 38,000 meteorites have been found on Earth so far, from all over the world, but most are found in the hot desert or in freezing cold Antarctica.
There are three main types of meteorites: stony, iron and stony-iron. A lot of them have been smashed off from very large chunks of rock, called asteroids, in collisions before eventually finding their way to our planet. Iron meteorites, for example, are bits of metal iron cores of large asteroids that were once hot enough to have melted, causing all of their iron to sink to the center. Stony meteorites look most like the stones that you find on Earth and come from the outer layer of asteroids. Stony-iron meteorites are a mixture of the two.
What are asteroids?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Why didn't asteroids form into one of the planets?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Asteroids are made out of _____________ and ______________ and are similar to __________________________.

Where are asteroids located in our solar system?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Describe and explain how the asteroid belt is divided. Use each side of the table for each part of the belt.
Describe the effect of the asteroid that hit Earth 65 million years ago.

_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

What are comets?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

What causes the comet to form a tail?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

What causes a comet's tail to follow the comet or be in front of the comet?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

___________________________ are found in space. They become _______________________________ while they are flying through the atmosphere. They become _______________________________ when they hit the earth.

Meteorites are found all over the world, but most are found in the __________________________ and __________________________.

Describe the 3 types of meteorites. Use the table below to organize your information.

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
What are asteroids?

*Asteroids are left over material from the formation of the solar system. They are made of rock and metal.*

Why didn't asteroids form into one of the planets?  
*Asteroids did not form into one of the planets because they are too close to Jupiter's strong gravity.*

Asteroids are made out of **rock** and **metal** and are similar to **comets**.

Where are asteroids located in our solar system?  
*Most asteroids are found revolving around the sun between the orbit of Mars and Jupiter.*

Describe and explain how the asteroid belt is divided. Use each side of the table for each part of the belt.

<table>
<thead>
<tr>
<th>Inner Belt</th>
<th>Outer Belt</th>
</tr>
</thead>
</table>
| **Asteroids are within 250 million miles of the sun.**  
**These include asteroids that are made of metals** | **Asteroids that are 250 million beyond the sun.**  
**These contain rocky asteroids**  
**They are darker than the inner belt asteroids and are rich in carbon** |
Describe the effect of the asteroid that hit Earth 65 million years ago.

The asteroid exploded creating a crater 200 kilometers in diameter in the Yucatan Peninsula of Mexico. The explosion started huge fires destroying forest and grass. It also may have caused the extinction of many types of animals, including dinosaurs.

What are comets?
Comets are chunks of ice and dust and small rocky particles.

What causes the comet to form a tail?
The comet's tail forms when they approach the warmer Inner Solar System and they begin to melt.

What causes a comet's tail to follow the comet or be in front of the comet?
It depends on where the sun is. If a comet is traveling towards the Sun then the tail will follow behind, but if the comet is traveling away from the Sun the tail will be in front of the comet.

Meteoroids are found in space. They become Meteors while they are flying through the atmosphere. They become Meteorites when they hit the earth.

Meteorites are found all over the world, but most are found in the desert and Antarctica.

Describe the 3 types of meteorites. Use the table below to organize your information.

<table>
<thead>
<tr>
<th>stony</th>
<th>iron</th>
<th>stony-iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>these look like most stones that you find on Earth Come from the outer layer of asteroids.</td>
<td>bits of metal iron cores of large asteroids iron sinks to the center</td>
<td>these are a mixture of iron and stony asteroids</td>
</tr>
</tbody>
</table>
# Comets, Asteroids, and Meteors Comparison

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Comet</th>
<th>Asteroid</th>
<th>Meteor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appears as a streak in the sky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frozen ball of dust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is visible in our sky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Made up of rock and metals</td>
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<td></td>
<td></td>
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<tr>
<td>Orbits the Sun</td>
<td></td>
<td></td>
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<tr>
<td>Orbits the Sun between Jupiter and Mars</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Often called &quot;Shooting Stars.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usually burns up in the Earth's atmosphere</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


## Teacher Key - Comets, Asteroids, and Meteors Comparison

<table>
<thead>
<tr>
<th></th>
<th>Comet</th>
<th>Asteroid</th>
<th>Meteor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appears as a streak in the sky</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Frozen ball of dust</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Is visible in our sky</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Made up of rock and metals</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Orbits the Sun</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Orbits the Sun between Jupiter and Mars</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Often called &quot;Shooting Stars.&quot;</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Usually burns up in the Earth's atmosphere</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
### Choice Board 3

<table>
<thead>
<tr>
<th>1 point activities</th>
<th>5 point activities</th>
<th>5 point activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>#1 Create a crossword puzzle</strong> using at least 10 words from the Earth and Space unit. You need to create an answer document to accompany your puzzle and clues. <em>(This is NOT a word search.)</em></td>
<td><strong>#5 Create trading cards</strong> for the sun, 8 planets, comet, asteroid and meteor. Use the template to make your cards.</td>
<td><strong>#8 Create an Earth and Space game</strong> for other students to play. You can create a jeopardy game with answers and questions or a board game with directions and an answer key. Game must include factual questions and answers.</td>
</tr>
<tr>
<td><strong>#2 Intergalactic Interview</strong> Interview beings from another planet. In your interview you must include at least 5 facts about that planet. You may write the interview in paragraphs or use the reporter template.</td>
<td><strong>#6 Write about a current space discovery</strong>. The paper needs to be one page and in your own words. <em>(do not copy)</em> Internet sites you may use: <a href="http://www.news.discovery.com/space">www.news.discovery.com/space</a> <a href="http://www.nasa.gov">www.nasa.gov</a></td>
<td><strong>#9 Planet research paper</strong> Conduct more thorough research for one of the planets. The paper needs to be 2 pages and in your own words. The paper must include new information learned about your planet.</td>
</tr>
<tr>
<td><strong>#3 Acrostic poem</strong> Create an acrostic poem using one of the following words: universe, solar system, planets, outer space. Each letter must contain facts learned from the Earth and Space unit.</td>
<td><strong>#7 The life of a meteoroid</strong> Pretend you are a meteoroid. Write a description of a meteoroid as it becomes a meteor and then turns into a meteorite. Write your description in 1st person.</td>
<td><strong>#10 Create a PowerPoint</strong> about the Solar System. You must have at least 8 slides. You may include: planets, asteroids, meteor, comets, moon, asteroid belt, sun.</td>
</tr>
<tr>
<td><strong>#4 Create a poem or rap</strong> to explain a part of the Solar System to a younger student. You must include at least 5 facts learned from the Earth and Space unit.</td>
<td>Name- I completed numbers:</td>
<td></td>
</tr>
</tbody>
</table>
The choice board can be used in different ways:
1. Have the students complete activities that add up to 10 points. 2. Have the students select 1 activity from each column.
3. Choose another point value for the students to complete.
4. Students may create their own activity. You may determine the point value.

Templates are included for:
#2 the intergalactic interview
#3 acrostic poems papers (space for decorating)
#5 trading cards
#6 note taking paper for current space discovery
#7 final draft paper for the life of meteoroid
#8 checklist for creating a game
#9 note taking paper for planet research paper
Name ____________________________________
Intergalactic Interview

Directions: Pretend you are a reporter interviewing a being that lives on one of the planets. Create questions and answers that include at least 5 facts about the planet.

Reporter:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Interviewee:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Reporter:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Interviewee:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Reporter:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________

Interviewee:
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
Acrostic Poem

Universe

U ______________________________________________

N ______________________________________________

I ______________________________________________

V ______________________________________________

E ______________________________________________

R ______________________________________________

S ______________________________________________

E ______________________________________________
Name _____________________________________

Acrostic Poem

Solar System

S ____________________________________________________

O ___________________________________________________

L ____________________________________________________

A ____________________________________________________

R ____________________________________________________

http://www.dragoart.com/tuts/3666/1/1/how-to-draw-the-solar-system.htm

S ____________________________________________________

Y ____________________________________________________

S ____________________________________________________

T ____________________________________________________

E ____________________________________________________

M ____________________________________________________
Acrostic Poem

Planets

P ____________________________
L ____________________________
A ____________________________
N ____________________________
E ____________________________
T ____________________________
S ____________________________
Outer Space

O ______________________________________________________

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T ____________________________________________________

E ____________________________________________________

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S ____________________________________________________

P ____________________________________________________

A ____________________________________________________

C ____________________________________________________

E ____________________________________________________
**Trading Card Templates**

Cut out the cards for each celestial body in space. The front of the card should include the name and a picture. You may draw the picture or print a picture from the internet. (Shrink the picture to make sure it fits on the card.) The back of the trading card should include accurate information.

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mercury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of the Sun: ____________________</td>
<td>Size: ____________________</td>
</tr>
<tr>
<td>The Sun is made of: _______________</td>
<td>Temperature:_______________</td>
</tr>
<tr>
<td>The distance from the Sun to Earth: ____________________</td>
<td>Length of time it takes for 1 day: ____________________</td>
</tr>
<tr>
<td>Sun facts:_________________________</td>
<td>Length of time it takes to orbit the Sun: ____________________</td>
</tr>
<tr>
<td>___________________________________</td>
<td>The planet is made of: _______________</td>
</tr>
<tr>
<td>___________________________________</td>
<td># of Moons: _______________</td>
</tr>
<tr>
<td>___________________________________</td>
<td>Planet facts: ____________________</td>
</tr>
</tbody>
</table>

49
<table>
<thead>
<tr>
<th>Planet</th>
<th>Size:</th>
<th>Temperature:</th>
<th>Length of time it takes for 1 day:</th>
<th>Length of time it takes to orbit the Sun:</th>
<th>The planet is made of:</th>
<th># of Moons:</th>
<th>Planet facts:</th>
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<tbody>
<tr>
<td>Venus</td>
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<tr>
<td>Earth</td>
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<td>Planet</td>
<td>Size:</td>
<td>Temperature:</td>
<td>Length of time it takes for 1 day:</td>
<td>Length of time it takes to orbit the Sun:</td>
<td>The planet is made of:</td>
<td># of Moons:</td>
<td>Planet facts:</td>
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<tr>
<td>Mars</td>
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<td>Jupiter</td>
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<tr>
<td><strong>Saturn</strong></td>
<td><strong>Uranus</strong></td>
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<td>Length of time it takes to orbit the Sun:</td>
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<td>The planet is made of: ________________</td>
<td>The planet is made of: ________________</td>
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<td># of Moons: ________________</td>
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<td>Planet facts: ________________</td>
<td>Planet facts: ________________</td>
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<tr>
<td>Neptune</td>
<td>Comets</td>
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<tr>
<td>Size: __________________________</td>
<td>Description: ____________________</td>
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<tr>
<td>Temperature: ____________________</td>
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<td>Length of time it takes for 1 day:</td>
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<tr>
<td>Length of time it takes to orbit the Sun:</td>
<td>________________________________</td>
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<tr>
<td>The planet is made of: __________</td>
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<td># of Moons: _____________________</td>
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<td>Planet facts: __________________</td>
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<tr>
<td>Famous Comets: __________________</td>
<td>Size: __________________________</td>
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<tr>
<td>Why are we able to see comets on Earth?</td>
<td>Famous Comets: __________________</td>
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<tr>
<td>Interesting information:</td>
<td>Why are we able to see comets on Earth?</td>
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</tbody>
</table>
### Asteroids

**Description:**


# of asteroids discovered:


Where are they found in space and why?


Where have asteroids landed on Earth?


### Meteors

**Definition of meteor:**


**Definition of meteoroid:**


**Definition of meteorite:**


# of meteorites found on Earth:


Where have meteorites been found?


Interesting information:


Interesting information:


Interesting information:


Interesting information:


Interesting information:
When taking notes put the information in your own words. Do not copy directly from the information you are reading. Notes should also be in note form not complete sentences.

Website used___________________________________

Date of discovery___________________________

What is the discovery?
______________________________________________________________________________________
______________________________________________________________________________________

What are facts or information pertaining to the discovery?
• __________________________________________________________________________________
  __________________________________________________________________________________
• __________________________________________________________________________________
  __________________________________________________________________________________
• __________________________________________________________________________________
  __________________________________________________________________________________
• __________________________________________________________________________________
  __________________________________________________________________________________
• __________________________________________________________________________________
  __________________________________________________________________________________
• __________________________________________________________________________________
  __________________________________________________________________________________
  ____________________________________________

What is the significance of this discovery?
______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________

Now that you have your information, write a one page paper about your current space discovery. Staple this paper to your final draft.


Name ____________________________________________

Life of a Meteoroid

_____________________________________________________________________________

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_____________________________________________________________________________
I included directions for the game.

My questions are accurate and I can prove where I learned the information (facts).

I have an accurate answer key for the questions.

I have at least 15 questions and answers.

I created all pieces for the game. Example: jeopardy board, index card questions, game board, game pieces, game cards, etc.
When taking notes put the information in your own words. Do not copy directly from the information you are reading. Notes should also be in note form, not complete sentences.

Sources used
•
•
•
•

Planet ______________________________

Basic information about the planet (information from your reading material)
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

New information about the planet
•
____________________________________________________________________________________
•
____________________________________________________________________________________
•
____________________________________________________________________________________
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____________________________________________________________________________________
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____________________________________________________________________________________
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____________________________________________________________________________________
•
____________________________________________________________________________________

Now that you have your information, write a two page paper about the planet.
Across
3. any of the large bodies that revolve around the Sun in the solar system
5. once considered a planet, now considered a dwarf planet
9. the path of an object as it revolves around another object in space
11. a chunk of rock or dust in space
13. the largest of the 8 planets
15. once a meteoroid, now that it passes through the atmosphere and hits the Earth's surface it is called ____
16. a streak of light in the sky produced by the burning of a meteoroid in Earth's atmosphere
17. inner planet known as Earth's sister planet

Down
1. the planet farthest from the Sun in the solar system
2. the 7th planet from the Sun, its axis is perpendicular to the orbit around the Sun (rotates on its side)
4. rocky objects revolving around the Sun that are too small and numerous to be called planets
6. the planet closest to the Sun
7. a loose collection of ice, dust and small rocky particles, typically with a long, narrow orbit of the Sun
8. an outer planet known for the rings
10. a force that pulls objects toward each other
12. the 3rd planet from the Sun
14. known as the red planet, the 4th planet from the Sun
15. natural satellite(s) that revolves around a planet
Across
3. any of the large bodies that revolve around the Sun in the solar system __________
5. once considered a planet, now considered a dwarf planet __________
9. the path of an object as it revolves around another object in space __________
11. a chunk of rock or dust in space __________
13. the largest of the 8 planets __________
15. once a meteoroid, now that it passes through the atmosphere and hits the Earth’s surface it is called __________
16. a streak of light in the sky produced by the burning of a meteoroid in Earth's atmosphere __________
17. inner planet known as Earth's sister planet __________

Down
1. the planet farthest from the Sun in the solar system __________
2. the 7th planet from the Sun, its axis is perpendicular to the orbit around the Sun (rotates on its side) __________
4. rocky objects revolving around the Sun that are too small and numerous to be called planets __________
6. the planet closest to the Sun __________
7. a loose collection of ice, dust and small rocky particles, typically with a long, narrow orbit of the Sun __________
8. an outer planet known for the rings __________
10. a force that pulls objects toward each other __________
12. the 3rd planet from the Sun __________
14. known as the red planet, the 4th planet from the Sun __________
15. natural satellite(s) that revolves around a planet __________
**Planet Matching Cards**

Direction: Cut out the cards. Match the planet with the information card. Then, put the planets in their correct order from the sun.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venus</td>
<td>This planet is closest to the Sun.</td>
</tr>
<tr>
<td>Jupiter</td>
<td>This planet is the hottest.</td>
</tr>
<tr>
<td>Mars</td>
<td>This is the 3&lt;sup&gt;rd&lt;/sup&gt; planet from the Sun and the only known planet to support life.</td>
</tr>
<tr>
<td>Saturn</td>
<td>Scientists have explored this planet with Rovers.</td>
</tr>
<tr>
<td>Mercury</td>
<td>This planet is known for its famous rings of ice and dust.</td>
</tr>
<tr>
<td>Neptune</td>
<td>This planet has an axis that is pointing towards the Sun.</td>
</tr>
<tr>
<td>Uranus</td>
<td>This is the largest planet and known for the Giant Red Spot.</td>
</tr>
<tr>
<td>Earth</td>
<td>This planet is 8&lt;sup&gt;th&lt;/sup&gt; from the Sun and appears blue in color.</td>
</tr>
</tbody>
</table>
Space Study Guide Questions

1. What objects make up the Solar System?

2. What object is at the center of the Solar System?

3. Which planets are the inner planets?

4. Describe the inner planets. (characteristics)

5. What separates the inner planets from the outer planets?

6. Which planets are the outer planets?

7. Describe the outer planets. (characteristics)

8. Which planet is the largest?

9. Which planet is the hottest?

10. Which planet is closest to the Sun?

11. Which planet is famous for its rings of dust and ice?

12. Which planet has an axis that is perpendicular to the Sun and spins North/South?

13. Which planet is known as the "Red Planet?"

14. There are _____ planets.

15. Which planet has a swirling storm known as the Red Spot?

16. Which planet is farthest from the Sun?

17. Which planets have more than 1 moon?
**Space Study Guide Questions**

The teacher can use these questions to create a test using multiple choice, short answer and extended response questions.

1. What objects make up the Solar System?
   *Some objects in the Solar System: Sun, 8 planets, moons, asteroids, comets, meteoroids*

2. What object is at the center of the Solar System?
   *Sun*

3. Which planets are the inner planets?
   *Mercury, Venus, Earth, Mars*

4. Describe the inner planets. (characteristics)
   *They are smaller, rocky planets compared to the outer planets. They are all closer to the Sun and fairly similar in size.*

5. What separates the inner planets from the outer planets?
   *The asteroid belt*

6. Which planets are the outer planets?
   *Jupiter, Saturn, Uranus, Neptune*

7. Describe the outer planets. (characteristics)
   *Known as gas giants. They are huge in size compared to the inner planets. They do not have a solid surface. They are gaseous, mostly made of hydrogen and helium. All 4 outer planets have rings and moons.*

8. Which planet is the largest?
   *Jupiter*

9. Which planet is the hottest?
   *Venus*

10. Which planet is closest to the Sun?
    *Mercury*

11. Which planet is famous for its rings of dust and ice?
    *Saturn*

12. Which planet has an axis that is perpendicular to the Sun and spins North/South?
    *Uranus*

13. Which planet is known as the "Red Planet?"
    *Mars*

14. There are ______ planets.
    *8*

15. Which planet has a swirling storm known as the Red Spot?
    *Jupiter*

16. Which planet is farthest from the Sun?
    *Neptune*

17. Which planets have more than 1 moon?
    *See chart*
<table>
<thead>
<tr>
<th>PLANET</th>
<th>MOONS</th>
<th>MOON NAMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td>1</td>
<td>Moon</td>
</tr>
<tr>
<td>Mars</td>
<td>2</td>
<td>Phobos, Deimos</td>
</tr>
<tr>
<td>Saturn</td>
<td>33</td>
<td>Titan, Rhea, Iapetus, Dione, Tethys, Enceladus, Mimas, Hyperion, Prometheus, Pandora, Phoebe, Janus, Epimetheus, Helene, Telesto, Calypso, Atlas, Pan, Ymir, Paaliaq, Siarnaq, Tarvos, Kiviuq, Ijiraq, Thrym, Skadi, Mundilfari, Erriapo, Albiorix, Suttung, plus others yet to receive names</td>
</tr>
<tr>
<td>Uranus</td>
<td>27</td>
<td>Cordelia, Ophelia, Bianca, Cressida, Desdemona, Juliet, Portia, Rosalind, Belinda, Puck, Miranda, Ariel, Umbriel, Titania, Oberon, Caliban, Sycorax, Prospero, Setebos, Stephano, Trinculo, plus others yet to receive names</td>
</tr>
<tr>
<td>Neptune</td>
<td>13</td>
<td>Triton, Nereid, Naiad, Thalassa, Despina, Galatea, Larissa, Proteus, plus others yet to receive names</td>
</tr>
</tbody>
</table>
Topic: Scientific Process

Grade Level: 5

Duration: 11 days

Summary:
The following activity allows students to develop scientific and engineering process skills. Students will explore cause and effect as they change a variable during scientific investigations. Students will use technology and develop team building skills. Lab safety rules will be developed for each classroom. Students will use problem-solving skills to create a solution to an engineering design challenge.

NEW LEARNING STANDARDS:
Grade 5: Designing Technological/Engineering Solutions using Science Concepts.

SCIENTIFIC INQUIRY and APPLICATION PRACTICES:
During the years of grades K-12, all students must use the following scientific inquiry and application practices with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas:

• Asking questions (for science) and defining problems (for engineering) that guide scientific investigations
• Developing descriptions, models, explanations and predictions.
• Planning and carrying out investigations
• Constructing explanations (for science) and designing solutions (for engineering) that conclude scientific investigations
• Using appropriate mathematics, tools, and techniques to gather data/information, and analyze and interpret data
• Engaging in argument from evidence
• Obtaining, evaluating, and communicating scientific procedures and explanations

MATERIALS:

- Eggs
- Ziploc bags for eggs
- Tape
- Scissors
- White glue
- Paper
- Yarn
- Plastic wrap
- Plastic bags
- Newspapers

- Cotton balls
- Pipe cleaners
- String
- Pencils
- Craft Sticks (popsicle sticks)
- Sheets of paper
- Rubber bands
- Foil
- Old boxes
- Cardboard tubes
<table>
<thead>
<tr>
<th>TITLE</th>
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<tbody>
<tr>
<td>EGG DROP</td>
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</tbody>
</table>

**SAFETY**
- Scissors and supplies are the primary source of danger in this activity. Be sure students use proper caution.
- If dropping from something like a 2nd story window, be sure to maintain proper supervision of students near the window. For greatest safety on higher drops, the teacher should drop the egg.
- Be sure the drop location remains clear for quite a distance, especially on a windy day. The eggs could harm someone and raw eggs are messy and unsanitary.
- Place the eggs in a Ziploc bag before the design process begins to ensure easy clean-up.

**ADVANCED PREPARATION**
- Purchase or gather a variety of materials for students to use for their design. You may need to double the number of eggs per group.
- Copy all student related materials.
- Discuss with principal where the egg drops may take place in the building.
- Make sure there are enough computers with internet access for the groups to complete research.
- Teacher may want to put together multiple copies of the Daily Engineering Notebook for students to use every day of the design lesson.

**Objective:**
The objective is to give students the opportunity to design and test an egg drop device. The device and its contents represent a care package that must be safely delivered to people in a disaster area with no road access.

**What is the teacher doing?**

**(Day 1)**
- Read *Egg Drop* by Mini Grey. The nursery rhyme, *Humpty Dumpty* can also be read to the class.
- The teacher may want to watch the YouTube videos showing how the egg drop may be successful. Do not show the videos to the students before they design their own egg protectors.
  - *Egg Drop* by Intenseheat, 2:20 min.
  - *Drop an egg without breaking it?!* by EVA Hikari Horaki’s Physics Classroom, 11:04 min.

**(Day 2)**
- Teacher may want to put together multiple copies of the Daily Engineering Notebook for students to use every day of the design lesson.
  - Organize students into...

**What are the students doing?**

**(Day 1)**
1. Students are listening to the book and/or nursery rhyme.

**(Day 2)**
2. Students will need to accept their challenge to create an egg protector. Using the computer and working as a team they will research different packaging materials.
   Students need to write on their Student Handout and Daily Engineering...
groups of 3 or 4. The teacher will need to read the *considerations* part of the lesson to the students. The challenge is to design a device to deliver an egg, representing disaster relief supplies, safely to people in a disaster area with no road access. Their mission is to help the military deliver disaster relief items from a helicopter to stranded citizens. The students will need to begin researching different packing materials to discover what makes a good insulator for their egg.

(Day 3)

- Have materials set out in the room for students to consider using for their design. Walk around to give guidance to the groups and make sure they are staying on task with the worksheets.

(Days 4-6)

- Facilitate as students build their egg protectors. Suggestion: Before students begin building the egg protector, they should place the egg in a Ziploc bag. This will help to ensure an easier clean-up.

- When students are ready for the short distance drop, monitor the force of the drop. Suggestion: In order to monitor all drops, teacher may want to have one chair in the front of the room for everyone to use for the short distance drop.

- Facilitate as students gently disassemble the egg protector to evaluate the

Notebook every day they work on the design challenge.

(Day 3)

3. As a team, students will study the materials available and discuss other materials they may want to bring from home for their design. Use the Student Handout to brainstorm the material list, draw the design and write a paragraph explaining why they feel their design will protect the egg. Complete the Daily Engineering Notebook every day.

(Days 4-6)

4. Place the egg in a Ziploc bag before building the egg protector. Create the egg protector.

5. Test the egg protector from the short distance drop. Be sure to measure the height of the drop and explain on the worksheets what happened.

6. Gently disassemble the egg protector to see if the egg survived the short egg distance drop. Write the results on the
<table>
<thead>
<tr>
<th><strong>(Days 7-8)</strong></th>
<th>Facilitate as students make design changes to their egg protector and begin redesigning for the short distance drop again.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When students are ready for the short distance drop, monitor the force of the drop. Suggestion: In order to monitor all drops, teacher may want to have one chair in the front of the room for everyone to use for the short distance drop.</td>
</tr>
<tr>
<td></td>
<td>Facilitate as students gently disassemble the egg protector to evaluate the what</td>
</tr>
<tr>
<td><strong>(Days 9-10)</strong></td>
<td>Facilitate as students make design changes to their egg protector and reconstruct for the high distance drop.</td>
</tr>
<tr>
<td></td>
<td>Teacher may want to drop all egg protectors for the high distance drop. The drops may take place from the 2nd floor balcony of the school, the roof, the top of a ladder or from the top of the teacher's desk.</td>
</tr>
<tr>
<td><strong>(Day 11)</strong></td>
<td>Have students independently complete the Science Exploration Report.</td>
</tr>
</tbody>
</table>

**Student Handout.** Discuss changes that need to be made with the group.

Complete the Daily Engineering Notebook every day.

**(Days 7-8)**

7. As a group, evaluate the egg protector and write down/draw the changes that need to be made for the short distance drop to be successful. Make your final egg protector. Fill out the Student Handout page and Daily Engineering Notebook.

8. Test the egg protector from the short distance drop again.

9. Gently disassemble the egg protector to see if the egg survived the drop. Write the results on the Student egg Handout. Discuss what worked, needs to be fixed or changed and redesign the egg protector for the high distance drop.

**(Days 9-10)**

10. Reconstruct the egg protector for the high distance drop.

11. Retest your egg protector from the high distance drop. Use the Student Handout to record your results. Complete the Daily Engineering Notebook.

**(Day 11)**

5th Grade Thinking Like a 21st Century Scientist and Engineer Design Challenge "Egg Drop"

Teacher Notes:
Read with your class Egg Drop by: Mini Grey.
You could also read the nursery rhyme, Humpty Dumpty.
These stories grab students' interest so they will want to protect the egg.
Videos can be found on YouTube to show teachers a few examples of the egg drop. Please do not show the students the videos before completing their own engineering designs.

• Egg Drop by Intenseheat, 2:20 min. http://www.youtube.com/watch?v=zjlbgY-C79Y
• Drop an egg without breaking it?! http://www.youtube.com/watch?v=1f9ZHiJjkJkU by EVA Hikari Horak's Physics Classroom, 11:04 min.

Considerations:
Explain to the class that they will design, build and test a device to protect and accurately deliver a dropped egg. The device and its contents represent a care package that must be safely delivered to people in a disaster area with no road access.
Their mission is to help the military deliver disaster relief items from a helicopter to stranded citizens.

Students will need to do research on different packaging materials to discover what makes a good insulator for their egg. They will need to brainstorm ideas with their group, draw the design and write a materials list. Groups will need to defend their materials and design choices. Groups will need to test their egg protector from a short drop distance and make appropriate changes before dropping from a higher teacher determined height. Short distance drop example: standing on a chair.
Higher distance drop examples: top of a ladder, roof of the school, from the balcony of the second floor of the school or the top of the teacher's desk.

Materials: (possible to change as students will test many ideas):

<table>
<thead>
<tr>
<th>Eggs</th>
<th>Cotton balls</th>
<th>Rubber bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ziploc bags for eggs</td>
<td>Pipe cleaners</td>
<td>Foil</td>
</tr>
<tr>
<td>Tape</td>
<td>String</td>
<td>Plastic wrap</td>
</tr>
<tr>
<td>Scissors</td>
<td>Pencils</td>
<td>Plastic bags</td>
</tr>
<tr>
<td>White glue</td>
<td>Craft Sticks (popsicle)</td>
<td>Newspapers</td>
</tr>
<tr>
<td>Paper</td>
<td>sticks</td>
<td>Old boxes</td>
</tr>
<tr>
<td>Yarn</td>
<td>Sheets of paper</td>
<td>Cardboard tubes</td>
</tr>
</tbody>
</table>
Building the Designs:
Pass out the handouts. Read through it once together. Reassure the students that all of the tasks are not meant to be completed in one day. Scientists and engineers are required to document all of their thoughts and designs so that others can repeat their steps. That is how science is different from trial and error guesswork. Scientists test things to see how or why they work. Engineers take what the scientists have learned in a lab and apply it to real world situations when presented with a problem.

As the students begin to brainstorm materials remind them of what you have available and what they may have to bring in for themselves.

Make sure that the students fully design and document what they are doing on the "daily engineering notebook." This step needs to be completed before they actually pick up tools to make something. This is an engineering process skill.

The challenge for students is to design a device to deliver an egg, representing disaster relief supplies, safely to people in a disaster area with no road access. Their mission is to help the military deliver disaster relief items from a helicopter to stranded citizens.

Students need to remember throughout the entire process they need to be documenting what they do each day in their daily engineering notebook.
1. Students will need to do research on different packaging materials to discover what makes a good insulator for their egg.
2. They will need to brainstorm ideas with their group, draw the design and write a materials list.
3. The group will need to write a paragraph explaining why they chose their materials and why do they think their design will work.
4. Build the egg protector.
5. Test the egg protector from a short drop distance. Example: standing on a chair.
6. Evaluate the design to see if any changes need to be made. Make the changes and drop the egg from a teacher determined height. Example: top of a ladder, roof of the school, from the balcony of the second floor of the school or from the top of the teacher's desk.

The teacher will need to monitor the students as they work, assist with ideas and talk students through difficulties as they solve the problem.
5th Grade Design Challenge "EGG DROP" Student Handout

What would happen if the military could not get supplies to citizens after a disaster in the town?

Your mission is to help the military deliver disaster relief items from a helicopter to stranded citizens. The military and the town's people are all depending on you and your team of world class engineers to find a way to drop supplies safely to the citizens.

Research what materials make good insulators for your egg. Below is a website students may find useful. 

http://www.ehow.com/about_5422616_purpose-packaging.html

In your own words describe why packaging is important.

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

Now it is time to do some SCIENCE!!

**Brainstorm** a list of materials you can use to build your egg protector. Remember the egg is representing the disaster relief supplies and it is very important they land unharmed. You may want to take in consideration the size, weight and shape of your egg.

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________
Design your egg protector. Draw a picture and label materials. (Hypothesis)

Write a paragraph explaining your materials and how they will protect the egg. Be sure to write why you think your egg will survive the drop.
Test the egg protector you have created by dropping the egg from the short distance drop. Measure the height of the drop. Explain what happened? (Experiment)

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________

Evaluate your egg protector. Do you need to make any changes? Redesign your egg protector. Sketch your improved design below. Label (diagram) each part and explain how it will protect the egg based on the science testing you did earlier. (Engineering)
Make your final egg protector based on your final sketch.

Test your egg protector.

What worked?

____________________________________________________________

____________________________________________________________

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____________________________________________________________

____________________________________________________________

What needs fixed or changed?

____________________________________________________________

____________________________________________________________

____________________________________________________________

____________________________________________________________

Redesign your egg protector. Show each change and explain the improvement.
Retest your egg protector from the higher distance drop. How did the new design work? Do you need to make changes?
Daily Engineering Notebook

Name _________________________________________

Day __________ of the Engineering Challenge.

What phase of the design cycle were you using today?
Explain what you did for the design challenge today?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Draw a picture of how you contributed.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Describe 3 things you learned about science or engineering from what you did today.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
<table>
<thead>
<tr>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What stays the same every time you do the experiment?</strong></td>
</tr>
<tr>
<td><strong>What is the ONE thing that you changed?</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title of Experiment:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What did you observe?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Write a Hypothesis that can be tested. (If __________, then __________.)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Write down the steps of your Experiment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a table below to record experimental findings (attach pages as needed)</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Do your results support or disprove your hypothesis? What conclusions can you think of based on your results?</td>
</tr>
<tr>
<td>How will you communicate your results?</td>
</tr>
</tbody>
</table>
Summary:
The following activities allow students to develop scientific and engineering process skills. Students will explore cause and effect as they change a variable during scientific investigations. Students will use technology and develop team building skills. Lab safety rules will be developed for each classroom. Students will use problem-solving skills to create a solution to an engineering design challenge.

NEW LEARNING STANDARDS:
Grade 5: Designing Technological/Engineering Solutions using Science Concepts.

SCIENTIFIC INQUIRY and APPLICATION PRACTICES:
During the years of grades K-12, all students must use the following scientific inquiry and application practices with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas:

- Asking questions (for science) and defining problems (for engineering) that guide scientific investigations
- Developing descriptions, models, explanations and predictions.
- Planning and carrying out investigations
- Constructing explanations (for science) and designing solutions (for engineering) that conclude scientific investigations
- Using appropriate mathematics, tools, and techniques to gather data/information, and analyze and interpret data
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating scientific procedures and explanations

MATERIALS:

<table>
<thead>
<tr>
<th>Hay or long grass</th>
<th>Tape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>Bags</td>
</tr>
<tr>
<td>Pipe cleaners</td>
<td>Plastic wrap</td>
</tr>
<tr>
<td>LEGO's</td>
<td>Construction paper</td>
</tr>
<tr>
<td>Sugar cubes</td>
<td>Cardboard</td>
</tr>
<tr>
<td>Wire</td>
<td>Cotton balls</td>
</tr>
<tr>
<td>Small stones</td>
<td>Pieces of wood Fan</td>
</tr>
<tr>
<td>Craft Sticks</td>
<td>or hairdryer</td>
</tr>
<tr>
<td>String or yarn</td>
<td>Sand</td>
</tr>
<tr>
<td>Glue</td>
<td>Water</td>
</tr>
<tr>
<td>Dirt/Mud</td>
<td>Ice cubes</td>
</tr>
<tr>
<td>Twist ties</td>
<td>Measuring Cups</td>
</tr>
<tr>
<td>TITLE</td>
<td>Which house is best for me?</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------</td>
</tr>
</tbody>
</table>
| SAFETY | - Scissors and supplies are the primary source of danger in this activity. Be sure students use proper caution.  
- Teacher may want to test the group’s structures with the fan and Hair dryer for electricity safety. Teacher may want to test all structures for accuracy. |
| ADVANCED PREPARATION | - Purchase or gather a variety of materials for students to use for their design. (fan, hairdryer, sand, ice cubes, water, measuring cups)  
- Copy all student related materials.  
- Make sure there are enough computers with internet access for the groups to complete research.  
- Teacher may want to put together multiple copies of the Daily Engineering Notebook for students to use every day of the design lesson. |
| Objective: | The objective is to give students the opportunity to design and test a house to withstand the harsh conditions of a given climate. |
| What is the teacher doing? |
| (Day 1) | - Read aloud a version of *The Three Little Pigs*. Discuss the structural designs of the houses. Discuss that civil and environmental engineers are involved in designing structures.  
(Days 2-3) | - Explain the design challenge to the students. The challenge for students is to design a structure that will be able to withstand the harsh conditions of a given climate. The structure will be tested for durability in appropriate climate conditions. (rain, snow, wind, heat) See the teacher notes. Pass out the 5th grade design challenge “Build a Structure” student handout sheet and the Daily Engineering Notebook. The teacher may want to put together multiple copies of the Daily Engineering Notebook for students to use every day of |
| What are the students doing? |
| (Day 1) | 1. Students will listen to the read aloud and discuss what the three houses were made of and why some houses remain standing and others did not remain standing.  
(Days 2-3) | 2. Students read the 5th grade design challenge “Build a Structure” student handout sheet and begin their Daily Engineering Notebook. Students will answer the first two questions on the student handout. |
the design lesson.

Suggestions for grouping students:
Let students read all handout material and decide which structure they would like to build. Group students according to their choices.
Group students and assign a specific structure.
Group students, have them read all material and agree on a structure to build.

- Pass out handouts for students to read about all four structures. Teacher may want to allow students to further research different climate structures either online or in the library.

(Day 4)
- Have materials set out in the room for students to consider using for their design. Walk around to give guidance to the groups as they brainstorm how to build their structure. Make sure they are staying on task with the worksheets and labeling their drawing. The teacher should ask inquiring questions to justify student thinking and material choices.

(Days 5-6)
- Facilitate as students build their structure.

(Day 7)
- Assist in testing the structures. For hot climate structures, place an ice cube inside the structure and apply heat by using a hair dryer for one minute. Hold the hair dryer 1 foot away from the structure. To be successful the ice cube must stay in solid form.

For a windy climate structure, simulate wind by holding a fan or a hair dryer 1 foot away from the structure.

3. Students need to read the handout material about all four climates. The teacher will decide how the groups are formed and which house structure they will build. The teacher may allow time for further research.

(Day 4)
4. As a team, students will study the materials available and discuss other materials they want to bring from home for their design. Complete brainstorming questions on the Student Handout and Daily Engineering Notebook. Sketch your structure and label all materials you will be using.

(Day 5-6)

(Day 7)
6. Test the structure. Complete the Student Handout to explain what happened to the structure. As a group, discuss changes that need to be made to the structure. Complete the Daily Engineering Notebook.
away from the structure. To be successful the structure must remain completely intact.

For a wet climate structure, place a piece of tissue inside the structure. Pour 1 cup of water on top of the structure. To be successful the tissue must remain dry.

For a cold/snowy climate structure, pour 1 cup of sand every 30 seconds for 2 minutes on the structure. To be successful the structure must remain completely intact.

<table>
<thead>
<tr>
<th>(Day 8)</th>
<th>(Day 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Facilitate as students make design changes to their structures. Make sure students are revising the structure based on the new drawing from yesterday.</td>
<td>• Have students independently complete the Science Exploration Report.</td>
</tr>
<tr>
<td>• Assist in testing the structures.</td>
<td></td>
</tr>
</tbody>
</table>

7. Rebuild structure according to revised drawing from yesterday. Test the structure again. Use the Student Handout to record the results. Complete the Daily Engineering Notebook.

8. Students independently complete the Science Exploration Report.
Teacher Notes:
Read with your class a version of *The Three Little Pigs*.

Discuss the problem that the book addresses concerning the structure that the three pigs built. Discuss that civil and environmental engineers are involved in designing structures. When they build structures they need to take into account the climate and type of land where they are building to ensure that the type of structure chosen will suit the environment.

Considerations:
Tell the class that it is their mission to build a structure that will be able to withstand the harsh conditions of a given climate. The engineers have gone on strike! Everyone is trying to build their own structures with very little success. You have been given the responsibility of building a structure that will protect people from the harsh conditions of their climate. The United States is counting on you!

Students will need to research a specific climate and the type of structure that is built in that climate. This research can be completed by reading the information provided in this lesson. Teacher may want to let students further research different climate structures either online or in the library. (Online resources are difficult to find for elementary students.)

Materials: (possible to change as students will test many ideas):

<table>
<thead>
<tr>
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<td>construction paper</td>
<td>cardboard</td>
<td>cotton balls</td>
<td>pieces of wood</td>
</tr>
<tr>
<td>tape</td>
<td>dirt/mud</td>
<td>twist ties</td>
<td></td>
</tr>
</tbody>
</table>
Building the Designs:
Pass out the handouts. Read through it once together. Reassure the students that all of the tasks are not meant to be completed in one day. Scientists and engineers are required to document all of their thoughts and designs so that others can repeat their steps. That is how science is different from trial and error guesswork. Scientists test things to see how or why they work. Engineers take what the scientists have learned in a lab and apply it to real world situations when presented with a problem.

As the students begin to brainstorm materials remind them of what you have available and what they may have to bring in for themselves.

Make sure that the students fully design and document what they are doing on the "daily engineering notebook." This step needs to be completed before they actually pick up tools to make something. This is an engineering process skill.

The challenge for students is to design a structure that will be able to withstand the harsh conditions of a given climate. Explain to students that the structures will be tested for durability in appropriate climate conditions. (rain, snow, wind, heat)

Suggestions for grouping students:
1. Let students read all handout material and decide which structure they would like to build. Group students according to their choice.
2. Group students and assign a specific structure.
3. Group students, have them read all material and agree on a structure to build.

The teacher will need to monitor the students as they work, assist with ideas, talk students through difficulties as they solve the problem of which house to build.

First, students will research the different building materials and designs used to build houses that can withstand a specific climate. Second, students will write about what type of building materials and structures are used in that climate and why. Third, brainstorm ideas about building a structure to withstand the harsh conditions of that climate. Fourth, students will draw a diagram and label their design. Fifth, students will create and then test their design. Sixth, students will evaluate their design to see if any changes need to be made, make the new design and then test the structure again.
How would you build a structure that will be able to withstand the harsh conditions of a given climate?

Your mission is to protect the people in the United States from the conditions of the climate where they live.

1. Research the different building materials and designs used to build houses that can withstand a specific climate.
2. Write about what type of building materials and structures are used in that climate and why.
3. Brainstorm ideas about building a structure to withstand the harsh conditions of that climate.
4. Draw and label a diagram of your design.
5. Create and then test your design.
6. Evaluate your design and see if any changes need to be made. Make the new design and test your structure again.
What is your assigned climate and why does climate impact house design?

Research your climate and create a list of what type of building materials and structures are used in that climate and why.
**Brainstorm** a list of at least 5 things you could test to figure out which will work as an effective material for your structure. List pros and cons for each item.

Engineer and **brainstorm** how you can optimize to improve the items you choose that will work best in your structure. (Hypothesis)
Sketch your design below. Label (diagram) each part and explain what it will do based on the science testing you did earlier. (Engineering)

Make your final structure based on your final sketch. Test your structure.

What worked?

What needs fixed or changed?
Redesign your structure. Show each change and explain the improvement.

Retest your structure. How did the new design work? Do you need to make changes?
Daily Engineering Notebook

Name _________________________________________

Day ___________ of the Engineering Challenge.

What phase of the design cycle were you using today?

Explain what you did for the design challenge today?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Draw a picture of how you contributed.

________________________________________________________________________

Describe 3 things you learned about science or engineering from what you did today.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### Science Exploration Report

**Title of Experiment:**

**What did you observe?**

**Write a Hypothesis that can be tested. (If __________, then _________.)**

**Write down the steps of your Experiment.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>What stays the same every time you do the experiment?</th>
<th>What is the ONE thing that you changed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create a table below to record experimental findings (attach pages as needed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do your results support or disprove your hypothesis? What conclusions can you think of based on your results?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How will you communicate your results?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Structures built for a hot climate
Information adapted from www.greenhammerhomes.com

To test the structure, an ice cube will be placed inside the structure. The structure you built must be able to keep an ice cube from melting for one minute when exposed to heat from a hair dryer.

People in different parts of the world have different materials that they can use to build their homes and other structures. When building a home, they think about how to best use these materials to build a house that works well for where and how they live. In the southwestern part of the US, where people have a lot of clay and little wood, they build houses from adobe, a mixture of clay, straw and water.

Adobe houses have very thick walls that keep them cool in the hot dry desert weather. Adobe houses would not be good in places where it rains a lot because too much water makes adobe crumble.

A hot day in the life of a good roof should include releasing -- not storing and absorbing -- the sun's rays.
Think of it this way: If you're sitting on a chair covered in black fabric and you go to the kitchen for a cup of coffee, your chair will likely be warm when you get up -- and it will stay warm until you return. But if your chair is metal, clay, molded plastic or slate, for example, it might be slightly warm to the touch when you get up, but it will be entirely cooled by the time you return. Traditional shingles keep a piece of tissue dry roofing materials hold and transfer heat in a similar way. Roofing tiles made of felt-like materials overlaid with asphalt and tar will hold heat, and even transfer it downward into a structure, while other types of roofing will reflect light and heat upward and away from a building instead. Roofing materials and colors impact how buildings -- and even entire cities -- handle heating and cooling.
Structures built for a wet climate

Information adapted from www.popularmechanics.com

To test the structure, a tissue will be placed inside the structure. The structure you built must be able to keep a piece of tissue dry when 1 cup of water is poured on top of your structure.

The weather in certain tropical islands in the Pacific Ocean is hot, but wet. People there make their homes from materials that are easy to find, such as palm leaves, woven grasses and bamboo. Sometimes they build the houses on stilts to keep them off the wet ground and let the breezes move under the house, helping to keep it cool.

Beach houses and coastal homes are designed for shoreline living. Typically, a beach home has one or two stories with the main living areas raised one level above the ground and a parking area beneath it. In most cases, coastal houses and beach homes are built to accommodate the rising tides of oceanfront property preventing flooding. Being raised one level, coastal homes and beach houses allow water to flow underneath the home without any risk to the structure or the items inside. Most beach houses enjoy large windows strategically placed to maximize the coastal or shoreline view. Large decks and porches further enhance coastal homes and beach houses.
To test the structure, it must be able to withstand a high level of wind from a fan or hair dryer for 1 minute.

Can a home be built to withstand a tornado?

The answer is yes—if the home were constructed like a bomb-proof bunker, with thick walls, a reinforced concrete roof, and a super-strong internal support system to prevent structural collapse. Window and door openings would require fortification with impact-resistant shutters that could be swung shut and locked at a moment’s notice.

In short, a tornado turns a wood-frame house into a gigantic, wind-driven pry bar. Once the departing structural elements have left a hole in the structure, the wind enters and dismantles the home like a bomb. Given this awesome power, the question is not how to "tornado-proof" a house, but rather how to increase its resistance to damage. To resist high winds, whether they’re from tornadoes or hurricanes, homes must be built with what is called a series of reinforced connections that tie every element together from roof to foundation, like a chain.
To test the structure, sand will be poured on the roof 4 times in 2 minutes. The roof of the structure you build must be able to withstand a cup of sand being poured on the structure every 30 seconds for 2 minutes.

Houses built for the snow and cold have to take into account certain considerations. Houses are usually built out of wood and have a great deal of insulation in the walls and attics. The shape of the roof also has to be taken into consideration. A-frame houses have steep roof pitches. The sharply sloped roof resembles the letter "A". This shape was designed to help snow fall to the ground in colder climates, reducing the structural wear incurred by the house frame under the heavy weight of snow. Some people prefer metal roofs that allow the snow to slide off more easily. A-Frame home plans typically incorporate vaulted ceilings and tall windows.