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What is astronomy?

Space Concepts:

- Ancient people used the moon and stars as a guide to know when to sow and harvest crops, how to navigate in the seas, and how to record the passing of time.
- A building used to observe stars and other heavenly bodies is an observatory.
- "Astronomy" comes from the Greek word *astron,* meaning "star," and *nemein,* meaning to "name."
- A constellation is a group of stars visible from Earth that form a picture or a pattern.

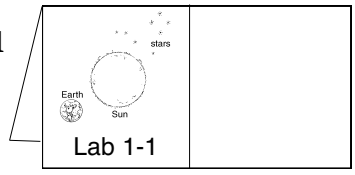
Vocabulary: space star *astronomy *constellation

Read: *Lots of Science Library Book #1.*

Activities:

Investigative Loop – Find North without a Compass Lab 1-1

Teacher's Note: This activity needs to be scheduled at noon, or 1 p.m. Daylight Saving Time.
Focus Skill: applying information
Activity Materials: newspaper yardstick or long dowel modeling clay rocks compass
Paper Handouts: 8.5" x 11" sheet of paper a copy of Lab Graphic 1–1
Graphic Organizer: Make a Large Question and Answer Book. Glue Lab Graphic 1–1 on the left tab. This is the students' Lab Book. It will be used in this and future lessons.



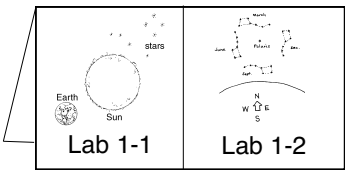
Concept: At certain times of the day, shadows indicate the direction north.
Research: Read *Lots of Science Library Book #1* and review the Concept.
Procedure: Find an open area outdoors, away from shade. Lay newspapers on the ground and weight the edges down with rocks. Form the modeling clay into a base and place it in the middle of the newspaper. Stick the yardstick in the clay base.
Observations: Look at the shadow of the yardstick on the newspaper.
Record the Data: Trace the yardstick's shadow with a marker. If you live in the Northern Hemisphere, the direction the line points is north. If you live in the Southern Hemisphere, the line points south.
Conclusions: Check the direction with the compass. What does this tell you about shadows at this time of day?
Communicate the Conclusions: Under the left tab in the Lab Book:

- ✎ Draw a picture of the activity. Draw a compass showing the direction the shadow is pointing.
- ✎✎ Complete ✎. Describe the activity.
- ✎✎✎ Complete ✎✎. Explain why the shadow points in the direction it does.

Spark Questions: Discuss questions sparked from the lab.
New Loop: Choose a question to investigate further.
✎✎✎ **Design Your Own Experiment:** Select a topic based upon the experiences in these *Investigative Loops*. See page viii for more details.

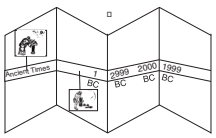
Investigative Loop – The Big Dipper Lab 1–2

Focus Skill: comparing
Paper Handouts: a copy of Lab Graphic 1–2 Lab Book
Graphic Organizer: Glue Lab Graphic 1–2 on the right tab of the Lab Book.
Concept: The Big Dipper is observed in the night sky.
Research: Read *Lots of Science Library Book #2* and review the Concept.
Procedure: On a clear night, look in the northern sky and find the Big Dipper.
Observations: Observe the position of the Big Dipper.
Record the Data: Compare it with the diagram in the Lab Book. Circle the one that best represents the Observations.
Conclusions: Draw conclusions about the Big Dipper's location in the sky.
Communicate the Conclusions: Under the tab:
✎ Draw the night sky showing the Big Dipper.
✎✎ Complete ✎. Describe the Big Dipper in the night sky.
✎✎✎ Complete ✎✎. Explain how the position of the Big Dipper will change throughout the year.



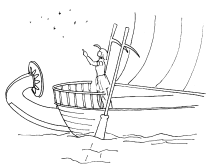
Spark Questions: Discuss questions sparked by this lab.
New Loop: Choose a question to investigate further.
✎✎✎ **Design Your Own Experiment:** Select a topic based upon the experiences in the *Investigative Loop*. See page viii for more details.

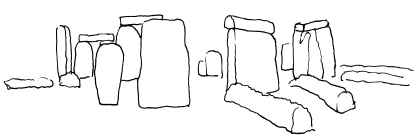
Space Timeline



Paper Handouts: 6 sheets of 12" x 18" construction paper
a copy of Graphics 1A–R
Graphic Organizer: Make an Accordion Book out of the 6 sheets of paper. This is the Space Timeline Book. Glue Graphic 1A across the middle of the first page of the Space Timeline Book. Glue Graphic 1B to the second page of the book. Continue with Graphics 1C–L. Glue Graphics 1M–R to the correct pages of the Space Timeline Book.
✎ Copy/dictate the name of the person or event under the graphic.
✎✎ Copy the name of the person or event under the graphic.
✎✎✎ Describe another detail about the person or event under the graphic.








Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.

1. Use a stopwatch or clock with a second hand. Without looking at a clock, guess how long a minute is. What helped you determine the time?

2. Using an almanac, find information on stars, moons, and tides for this month. When would this information be helpful?

3. Read *A Wrinkle in Time* by Madeleine L'Engle. ✎✎✎

4. Read *Carry On, Mr. Bowditch* by Jean Lee Latham. ✎✎✎

5. Using an Internet Search Engine, research the current moon phase.

6. Using an Internet Search Engine, research skywatching.

Notes

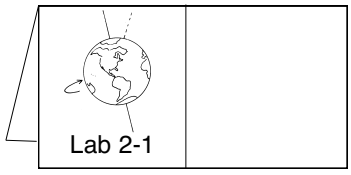
Who were the first astronomers?

Space Concepts:

- Scientists who study stars and planets are called astronomers.
- In 150 A.D., a Greek astronomer named Ptolemy believed Earth stood still and the Sun, stars, and planets circled around it.
- In 350 B.C., the Greek philosopher Aristotle argued that Earth was round, not flat.
- In 1543, Nicolaus Copernicus (1473–1543), a Polish monk and astronomer, claimed that Earth and all known planets circled around a still Sun.
- Galileo Galilei (1564–1642) proved Copernicus' theory by observing the planets with the first telescope.
- Johannes Kepler (1571–1630), a German mathematician, proposed three laws of planetary motion.
- Isaac Newton (1642–1727), an English scientist, invented the reflecting telescope, which used mirrors instead of lenses.

Vocabulary: sun planet telescope *astronomer

Read: *Lots of Science Library Book #2.*



Activities:

Investigative Loop – Round Earth Lab 2–1

Focus Skill: compare and contrast
Activity Materials: colored paper toothpick flat eraser large ball
Paper Handouts: 8.5" x 11" sheet of paper Lab Book a copy of Lab Graphic 2–1
Graphic Organizer: Make a Large Question and Answer Book. Glue it side–by–side to the Lab Book. See page 2 for instructions. Glue Lab Graphic 2–1 on the left tab.
Concept: The curvature of the earth can be observed at the horizon.
Research: Read *Lots of Science Library Book #2* and review the Concept.
Procedure: Cut a small triangle from the colored paper to make a flag. Tape the flag onto the toothpick and stick the toothpick into the flat eraser to make a ship. Place the ship on the table and gradually move it to the edge of the table, then over the edge. Now, hold the large ball at the same level as the table top and do the same with the ship on the ball.
Observations: Watch the ship sail over each edge. Compare and contrast the ship's disappearance on each surface.
Record the Data: On the top section under the tab, draw the ship going over the edge of the table and draw it going over the ball.

Conclusions: Describe how the ship looked when it went over the table. Describe how the ship looked when it went over the ball. How were the two alike? How did they differ? **Possible answer: The ship disappears immediately over the table and gradually over the ball.**

Communicate the Conclusions: On the bottom section, under the tab:

- ✎ Color the drawings while orally comparing and contrasting the ship's disappearances.
- ✎✎ Explain why the ship looks different when it goes over the ball than over the table.
- ✎✎✎ Complete ✎✎. Explain how this lab demonstrates Earth.

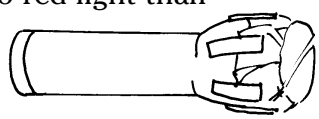
Spark Questions: Discuss questions sparked by this lab.

New Loop: Choose a question to investigate further.

- ✎✎✎ **Design Your Own Experiment:** Select a topic based upon the experiences in the *Investigative Loop*. See page viii for more details.

Night–Friendly Flashlight

When you go stargazing, you will need a flashlight. To help your eyes adjust to the dark, make a night–friendly flashlight. Your eyes adjust more easily and quickly to red light than white light.



Focus Skill: following oral directions

Activity Materials: flashlight red cellophane tape

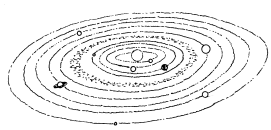
Activity: Read the following directions aloud. Read one step and ask your students to complete it. Repeat with each step.

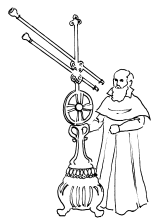
1. Put the flashlight head down on the red cellophane.
2. On the cellophane, draw a circle about 1 inch bigger than the flashlight head.
3. Cut out the red cellophane.
4. Hold the cellophane on the flashlight head, with the extra inch overlapping it.
5. Tape the cellophane to the side of the flashlight head.

Timeline

Paper Handouts: Space Timeline Book a copy of Graphics 2A–E

Graphic Organizer: Glue Graphics 2A–E to the correct pages in the Space Timeline Book.





Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.

1. Using a telescope or a good pair of binoculars, do some stargazing.

2. An observatory does not have to be fancy. Find a spot outside that gives a good view of the night sky. If you are in the Northern Hemisphere, a view of the South and West sky is best. If you are in the Southern Hemisphere, a view of the north sky is best. Set up a comfortable chair. Make a 'sky watching kit' that includes a notebook, pen, and night–friendly flashlight. Observe the sky and record your observations. Note changes over time.

3. Visit a planetarium.

4. Choose one of the astronomers mentioned in the *Lots of Science Library Book #2.* Research his life. Make a 4 Door Book and write one of these words on each tab: *Who, What, When,* and *Where.* Under the tabs, answer the questions about the astronomer.

5. Read and discuss *There's No Place Like Space* (Cat in the Hat's Learning Library) by Tish Rabe. ✎

6. Read and discuss *Starry Messenger: Galileo Galilei* by Peter Sis. ✎✎ ✎✎✎

7. Read and discuss *Ordinary Genius: The Story of Albert Einstein* by Stephanie Sammartino McPherson. ✎✎✎

8. Read and discuss *Albert Einstein: Young Thinker* (Childhood of Famous Americans series) by Marie Hammontree. ✎✎ ✎✎✎

9. Read and discuss *Albert Einstein and the Theory of Relativity* by Robert Cwiklik. ✎✎✎

10. Discover how Albert Einstein's theory of general relativity attempts to describe the Universe.

11. Read and discuss *Bowled Over: The Case of the Gravity Goof–Up* (Kinetic City Super Crew series) by Chuck Harwood. ✎✎✎

12. Read and discuss *Isaac Newton* by John Hudson Tiner. ✎✎✎

13. Using an Internet Search Engine, research astronomy.

14. Using an Internet Search Engine, visit the American Association of Amateur Astronomers.

Notes

What are stars?

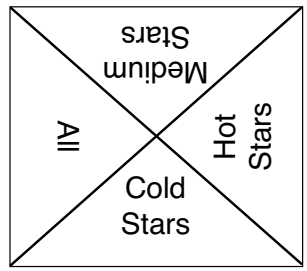
Space Concepts:

- Stars experience life stages: birth, childhood, adolescence, maturity, middle age, old age, and death.
- Stars are born in giant clouds of dust and gases, mostly hydrogen and helium. Gravity pulls the giant clouds together to form a spinning cloud. The spinning causes the hydrogen atoms to collide and heat up. As heat increases, the core of the new star is formed and starts to burn, or shine.
- A star's color can be used to determine its surface temperature.
- The Sun is our closest star.

Vocabulary: gas hydrogen spin collide *temperature *supernova

Read: *Lots of Science Library Book #3.*

Activities:



Hot Stars – Graphic Organizer

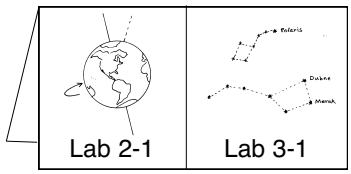
Focus Skill: memorizing information
Paper Handouts: 8.5" x 11" sheet of paper black construction paper
a copy of Graphic 3A
Activity Materials: white pen or white–out pen colored markers
Graphic Organizer: Make a Patch Word Quilt Square. See page 5 for instructions. Place a small amount of glue around the outer edges of the white square and glue it onto the black construction paper. Trim the black paper. Fold the four triangular tabs back and forth to form windows. Using white–out, dot the black construction paper with white dots to represent stars. Write/copy the following on the outside and inside of the triangular tabs using the appropriate colored markers:

Tab 1: use orange and red markers:
outside tab: "Cold stars" inside tab: "Orange and red"
Tab 2: use blue marker:
outside tab: "Hot stars" inside tab: "Blue and white"
Tab 3: use yellow markers.
outside tab: "Medium stars" inside tab: "White and yellow"
Tab 4: use orange, red, blue, and yellow markers.
outside tab: "All" inside tab: "producing heat and light."

Glue Graphic 3A on the back of the Patch Word Quilt Square. Memorize the poem.

Cold stars
Orange and red,
Hot stars
Blue and white,
Medium stars
White and yellow,
All producing
Heat and light.
Dinah Zike

Investigative Loop – The North Star, or Polaris Lab 3–1



Focus Skill: diagramming
Paper Handouts: a copy of Lab Graphic 3–1 Lab Book
Graphic Organizer: Glue Lab Graphic 3–1 on the right tab.
Concept: Locate the North Star, or Polaris, in the night sky.
Research: Review Graphic 3–1 to find the North Star's location.
Procedure: Use Lab Graphics 3–1 and 2–1 to locate the North Star, or Polaris. The Big Dipper is a group of seven stars that illustrate a pan with a curved handle. Mentally draw a line along the two stars forming the side of the pan away from the handle.
Observations: Imagine this line with an arrow point moving away from the pan and into space. Follow the arrow until it runs into a very bright star. That is the North Star, or Polaris.
Record the Data: Diagram The Big Dipper and the North Star on the top section under the tab.
Conclusions: The North Star is used for navigational purposes. How could you find the North Star, if you needed to.
Communicate the Conclusions: On the bottom section under the tab:

- ✎ Draw the Big Dipper and the North Star.
- ✎✎ Complete ✎. Describe how to locate the North Star.
- ✎✎✎ Complete ✎✎. Research the North Star and explain why it is so widely used for navigation.

Spark Questions: Discuss questions sparked by this lab.
New Loop: Choose one question to investigate further or make an *Investigative Loop* using this concept:
By facing the North Star, you can locate east, west, and south. Turn to face the North Star. North will be in front of you, south will be behind you, east to your right, and west to your left.

- ✎✎✎ **Design Your Own Experiment:** Select a topic based upon the experiences in the *Investigative Loop*. See page viii for more details.

Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.

1. Use Lab Graphic 3-1 as a guide to mark the stars with straight pins on dark felt or fabric. Sew buttons on as stars.
2. Research the names of the stars that make up the Big Dipper. Label them on your sewing project or on a sketch of the Big Dipper.
3. Read *Sally Ride: Shooting for the Stars* by Jane Hurwitz and Sue Hurwitz. ✎✎ ✎✎✎
4. Using an Internet Search Engine, visit the Calumet Astronomical Society.