

SPACE SCIENCE

ADVENTURE IS WAITING

A Cross-Curricular Science and Language Arts Program

GREAT SWEEPSTAKES!

GREAT PRIZES!
Family Trip to
Kennedy Space Center
Visitor Complex
in Florida!

See take-home page.

- **Lessons & Reproducibles**
- **Classroom Wall Poster**
- **National Standards Matrix**
- **Take-Home Pages**

Coming to theaters this November

ZATHURA

Visit
www.Zathura.com
and click "The Movie"
to arrange a class trip
to experience the
adventure of this
new film when
it opens this
November.



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The children's book *Zathura*, by Chris Van Allsburg, is published by

 Houghton Mifflin

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Developed in
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NASA



Welcome to **Space Science: Adventure Is Waiting**, a dynamic education program to build student skills in both science and language arts. Look inside for easy-to-use, national standards-based lessons and reproducibles, as well as a great sweepstakes with amazing prizes (see the Take-Home pages)!

Developed in cooperation with both NASA and Scholastic, **Space Science: Adventure Is Waiting** has been generously sponsored by Columbia Pictures. The program also provides inspiring images of the upcoming feature film *Zathura*. This adventure film is based on renowned author/illustrator Chris Van Allsburg's acclaimed children's book, published by Houghton Mifflin.

We hope you and your students enjoy this valuable program!

Columbia Pictures • NASA • Scholastic Inc. • Houghton Mifflin

Student Sweepstakes!

Prizes include:

- Family Trip for four to Kennedy Space Center Visitor Complex in Florida
- Plasma TV and DVD Player
- Classroom sets of space/science books

See Take-Home pages for details.

Share This Program with a Colleague!

Printable version available online at

www.scholastic.com/spacescience



The movie
Zathura
is coming to
theaters this
November.

Connect Your Classroom Through NASA's Digital Learning Network™

On November 16, 2005, author/illustrator Chris Van Allsburg and a NASA scientist will be participating in three Digital Learning Network events with NASA Explorer School sites as hosted by NASA Langley Research Center. For more information, visit <http://nasadln.nmsu.edu/dln>



LESSON OVERVIEW

This Program Meets National Standards (see matrix on back cover)



Comet Facts, Myths, and Legends

Goal/Purpose

Students will explore some facts, myths, and legends linked to comets.

Desired Learning Outcomes

1. Identify one fact, legend, and/or myth associated with comets.
2. Identify a property of comets and explain how that property makes comets visible.
3. Describe the path of a comet and explain how this affects its reappearance.

Prerequisites

Before attempting to complete this lesson, students should:

- * Understand that the Solar System consists of planets, moons, asteroids, comets, and the Sun.
- * Understand the differences among a fact, a legend, and a myth.

Preparation

1. Provide time to download computer software to support the lesson.
2. Allow time to preview the activity and to read the science background pages. (<http://amazing-space.stsci.edu/resources/explorations/cometmyth/teacher/lessonplan.html>)
3. Background: Distribute Reproducible 1, "General Comet Misconceptions," and Reproducible 2, "Vocabulary."
4. Students may work in groups of two or three, or individually. If computer access is limited, use an overhead projector with an LCD to project the computer image onto a screen, or hook up a computer to a television monitor. Some software programs provide off-line access to the Internet, allowing you to save Web pages to your local hard drive. Consider bookmarking the activity (such as one of the pages you wish to use) and downloading it onto your hard disk. This will eliminate the inconvenience of unexpectedly losing your connection to the Internet.

Classrooms Without Computers

Here are some suggestions:

1. If you have access to a computer with Internet capabilities at home or in the school library, you may print selected parts of the activity as paper copies or transparencies.
2. If your school has one or more computers located outside your classroom, students may experience the activity individually or in small groups as a learning station.
3. Some students might have computers at home with access to the Internet. If that's the case, you might consider assigning "Comet Facts, Myths, and Legends" as homework or extra credit.
4. Through the Educator Resource Center Network, NASA provides the expertise and necessary facilities to help educators access and utilize science, mathematics, technology, and geography instructional products (www.nasa.gov/education/ercn).

Execution Time

The amount of time needed to complete this activity will vary, depending on the length of available teaching time, the ratio of computers to students in the class, and what you have your students do. Estimated 20 minutes for students to read "Comet Facts, Myths, and Legends" (<http://amazing-space.stsci.edu/resources/explorations/cometmyth>) and 40 minutes to complete activities.

Materials

This activity requires a computer with a color monitor and Internet connection. The Web browser must be capable of running Netscape's Navigator 3.0 (or better) or Internet Explorer 4.0 (or better).

Procedure/Directions

This is a self-directed computer activity. Suggested enhancements:

1. Project images of comets from the Space Telescope Science Institute's Web site, www.stsci.edu, onto a screen or television monitor. In a class discussion, ask students to describe what they already know about comets and planets, and what they can learn from the images.
2. Organize an informal debate or discussion on the topic "Comet Collisions with Earth: Fact or Myth?"

Evaluation/Assessment

Share the learning outcomes with your students ahead of time. Then, following the reading, distribute Reproducible 3, "Identifying Comets," and Reproducible 4, "Truth or Fiction?"

Answer Key

Reproducible 3:

1. Some possible answers include: Comets travel far beyond the orbit of the Moon. Comets move in elliptical orbits around the Sun. Comets return to the inner Solar System at predictable times. Edmund Halley correctly predicted the return of the comet named for him. Comets leave a trail of debris behind them. For a long time afterward, whenever the Earth passes through the left-behind trails, the debris strikes our atmosphere and causes meteor showers. 2. Some possible answers include: Some people in ancient times thought that a comet was a curse. To save himself from the "curse of the comet," Emperor Nero of Rome had all possible successors to his throne executed. The famous Bayeux Tapestry, which commemorates the Norman Conquest of England in 1066, depicts an image of Halley's Comet bright in the sky before the Battle of Hastings. Some people thought this meant that King Harold would lose his throne to William, the Duke of Normandy. He did. 3. Some possible answers include: Most astronomers in the 1500's and early 1600's thought that a comet appeared once and was never seen again. They believed that a comet approached the Sun in a straight line, spun around it, and then disappeared into space in a straight path. Another myth claims that the gas from a comet tail is poisonous and can affect people on Earth if its path crosses the planet. 4. Students will probably identify the tail as the primary feature that makes comets visible. Comets have bright tails when near the Sun—this makes them visible. Comets are composed of ice and dust, which changes to gas when their elliptical orbits bring them close to the Sun. The gas creates a coma and flowing tail(s). 5. Comets move in orbits around the Sun. Since the path is a complete oval, comets return to the inner Solar System at predictable times. 6. Comets from the Kuiper Belt tend to have short periods—like Halley's Comet, which reappears every 76 years, or comet Swift-Tuttle, which reappears every 120 years. Comets from the Oort Cloud tend to have long periods, like Comet Hale-Bopp with its 2,400-year period, or Hyakutake, which will not appear again for another 14,000 years.

Teaching with the Poster

There are all kinds of objects that orbit the Earth, the Sun, and other planets. Could a house launch into orbit, as the poster depicts? Could it travel through space? Show students the poster, and encourage them to come up with questions the image raises. (*How much force is required to lift a house that far into space? How fast would the house need to be traveling, and in what direction? What would prevent the house from burning up in our atmosphere?*)

While you discuss these questions, keep track of science topics raised in the discussion. Keep a list on the board. Areas of interest might include: *acceleration, satellite, meteor, asteroid, orbit, gravity, jet propulsion, and velocity.*

Students can then visit www.nasa.gov to conduct research and explore their questions.

ADDITIONAL TEACHER RESOURCES

Visit www.nasa.gov and use the search function on the main page to access additional teacher resources that provide the latest information on the science of space. Resources found on www.nasa.gov can be used to provide students with a subject background before proceeding with the lesson, to amplify students' knowledge of specific topics, or to supplement the lesson as you progress through it.

Visit www.Zathura.net for a language arts lesson plan based on *Zathura*, plus links to other lesson plans on books by Chris Van Allsburg.



Name _____ Date _____

General Comet Misconceptions

Misconception: Comets are not part of the Solar System.

1 Reality: Comets are part of the Solar System. They are believed to originate from one of two locations within the Solar System: the Kuiper Belt or the Oort Cloud.

Misconception: Comets are similar to asteroids.

2 Reality: Comets and asteroids have a very different make-up. Asteroids are composed of rocky and metallic material, while comets are composed of water, ice, dust, and carbon- and silicon-based compounds.



Misconception: All comets look the same and don't change their appearance.

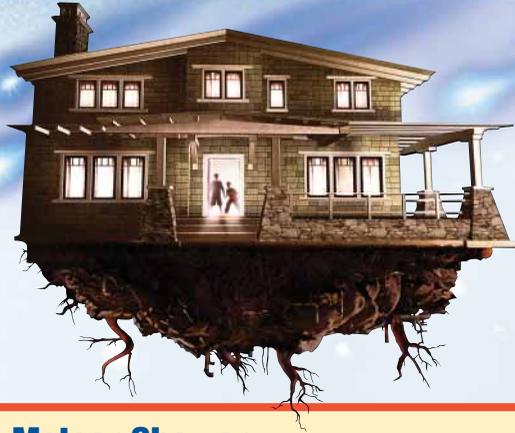
3 Reality: Comets have a coma and one, two, or three tails when near the Sun, and no coma or tail when far away from the Sun. (A *coma* is a cloud of gaseous material surrounding the nucleus.)

Misconception: Pluto is the most distant and last object in the Solar System.

4 Reality: Beyond Pluto's orbit is a group of icy objects known as the Kuiper Belt, from which short-period comets emerge. Farther still is a sphere of icy bodies, called the Oort Cloud, from which long-period comets emerge. Short-period comets visit the inner Solar System frequently, while the long-period comets visit infrequently.

Misconception: There is empty space between the planets.

5 Reality: There is gas and dust, also known as the interplanetary medium, between the planets. Comets are responsible for depositing some of the gas and dust found in the inner Solar System.



Name _____ Date _____

Vocabulary

Asteroid

A small Solar System object composed mostly of rock. Many of these objects orbit the Sun between Mars and Jupiter. Their size can range anywhere from a few meters to several hundred kilometers in diameter.

Coma

The cloud that forms around a comet's nucleus. This cloud is made by solar wind striking the surface of the nucleus, causing a mixture of gas and dust to form around it.

Comet

A small Solar System object consisting of ice and other compounds. A comet will form a coma and sometimes a visible tail whenever it orbits close to the Sun.

Dust Tail

This type of comet tail forms when the solar wind separates dust from the coma, pushing it away from the Sun in a slightly curved path.

Gas-Ion Tail

This type of comet tail forms when the solar wind separates gases from the coma, pushing them away from the Sun in a straight path.

Inner Solar System

The path of the Solar System between the Sun and the orbit of Jupiter.

Meteor

The flash of light that we see in the night sky caused by the friction of a meteoroid passing through the atmosphere.

Meteor Shower

Many and sustained flashes of light that are seen in the night sky as a result of the Earth passing through the former path of a comet. The debris released by the comet causes the meteor shower.

Meteorite

Any part of a meteoroid that survives its fall through the atmosphere and lands on the Earth.

Meteoroid

An interplanetary chunk of matter that is smaller than a kilometer in diameter and most frequently measured in millimeters.

Naked-Eye Visibility

Being able to see a celestial object, such as a comet, without the aid of telescopes, binoculars, or other astronomical devices.

Comet Nucleus

The solid, rocky part of a comet.

Orbit

The path followed by one celestial object around another celestial object, such as Earth's path around the Sun or the Moon's path around Earth.

Period

The time needed for one complete trip or cycle. For example, the period for the Earth to travel around the Sun is 365 days.

Solar Wind

A stream of charged particles ejected from the surface of a star.





Name _____ Date _____

Identifying Comets

- 1** Identify a fact associated with comets.

- 2** Identify a legend associated with comets.

- 3** Identify a myth associated with comets.

- 4** Comets are small Solar System objects, yet ancient cultures knew about them. Identify one property of comets that explains why humanity has known of comets for so long.

- 5** Describe the path of a comet and explain how this affects its reappearance.

- 6** Short-period comets tend to originate from the Kuiper Belt—a region beyond the orbit of Neptune similar in shape to the asteroid belt. Long-period comets tend to originate from the Oort Cloud—a spherical region well beyond the orbits of Neptune and Pluto. Based on the reading, explain where each of the following comets is likely to have originated: Hale-Bopp, Swift-Tuttle, Hyakutake, and Halley's. Explain your choices.



Name _____ Date _____

Truth or Fiction?

Based on your reading of "Comet Facts, Myths, and Legends," would you say the following statements are true or false?

True False

- 1 It's possible that a big comet striking the Earth killed off the dinosaurs.
- 2 Only a professional astronomer with a powerful telescope can discover a new comet.
- 3 About 100 years ago, some people bought comet-protecting umbrellas and anti-comet pills to protect themselves.
- 4 The closer a comet is to the Sun, the brighter it will appear.
- 5 The ancients thought comets were the power rays of supernatural beings.
- 6 A meteor shower occurs when a lot of comets at once pass over the Earth.

<input type="checkbox"/>	<input type="checkbox"/>

Answers: 1. True. One theory is that a 10-kilometer comet struck the Earth 70 million years ago and disrupted the environment enough to make it impossible for dinosaurs to live. 2. False. An amateur with binoculars discovered a new comet in 1996, for example. 3. True. People in Chicago panicked in 1910 when a comet passed through the Earth's path. 4. True. Comets are brightest when they are near the Sun. 5. True. People then did not know what comets were. They thought they contained fire. 6. False. A comet leaves behind a trail of debris. If its path crosses Earth's path, then every year for a long time there will be meteor showers as the long-gone comet's debris strikes our atmosphere.

ASSESSMENT RUBRIC

	Excellent	Good	Satisfactory	Needs Improvement
Lesson Background (Reproducibles 1 and 2)	<ul style="list-style-type: none"> Student demonstrates a complete understanding of background material through appropriate class discussion and participation Student demonstrates a complete understanding of the appropriate vocabulary to use for lesson 	<ul style="list-style-type: none"> Student demonstrates an understanding of background material through appropriate class discussion and participation Student demonstrates an understanding of the appropriate vocabulary to use for lesson 	<ul style="list-style-type: none"> Student demonstrates a limited understanding of background material through appropriate class discussion and participation Student demonstrates a limited understanding of the appropriate vocabulary to use for lesson 	<ul style="list-style-type: none"> Student demonstrates a lack of understanding of background material through appropriate class discussion and participation Student demonstrates a lack of understanding of the appropriate vocabulary to use for lesson
Lesson Activities (Reproducibles 3 and 4)	<ul style="list-style-type: none"> Student remains completely on task and finishes activities in timely manner Student completes activity with total accuracy and with full supporting, detailed information 	<ul style="list-style-type: none"> Student remains on task, but finishes activities with teacher's encouragement Student completes activity with some accuracy and some supporting, detailed information 	<ul style="list-style-type: none"> Student struggles to stay on task, and finishes with difficulty Student completes assignment with little accuracy and little supporting, detailed information 	<ul style="list-style-type: none"> Student lacks focus on task and does not complete activity Student either does not complete assignment and/or lacks accuracy and/or supporting, detailed information

NATIONAL STANDARDS AND BENCHMARKS

NATIONAL STANDARDS	BENCHMARKS	LESSONS			
SCIENCE					
Strand A: Science as Inquiry					
Has ability to do scientific inquiry	Knows that scientific inquiry and research lead to answers and solutions to issues scientists try to solve	x	x	x	x
	Thinks critically and logically to make the relationships between evidence and explanations, i.e., to explain differences between myths and facts		x	x	x
Has understandings about scientific inquiry	Knows how questions are to be asked and answered that allow the student to find solutions to scientific investigations	x	x	x	x
Strand B: Physical Science					
Understands the properties of objects and materials	Knows that objects in space are made up of material that can be measured by size, weight, color, temperature, and ability to interact with other substances	x		x	x
	Knows that objects can exist in different states—i.e., solids, liquids, and gas	x			x
Understands the position of and motions of objects	Knows how objects move through space relative to another object, i.e., behind, in front of, through, over, under, etc.	x	x	x	x
Understands the motion of objects in relation to the forces applied on that object	Grade 5				
	Knows ways in which object's motion is affected by natural and physical forces being applied to it, i.e., gravity, centrifugal force, and inertial forces	x	x	x	x
Strand D: Earth and Space Science					
Understands the objects in the sky	Knows the properties, locations, and movements of objects in the sky due to apparent observations	x	x	x	x
	Knows that objects in the sky have patterns of movements.	x	x	x	x
Understands the Earth's place in the Solar System	Grade 5				
	Knows the Earth's place in the Solar System in relation to the objects in the Solar System and universe, i.e., the Sun, Moon, planets, asteroids, comets, black holes, etc.	x	x	x	x
	Knows that events in the past have been influenced by occasional catastrophes, i.e., impacts by asteroids or comets		x	x	x
Strand E: Science and Technology					
Understands that science and technology work together	Knows that scientists use teamwork and technology to make better observations about the universe	x	x	x	x
	Knows that science is one way of answering questions and explaining the natural world	x	x	x	x
Has basic understandings about science and technology	Grade 5				
	Knows that scientific inquiry and technological design have similarities and differences, and one tends to drive the other further in advancements in pursuit of finding solutions to scientific research		x	x	x
Strand G: History and Nature of Science					
Understands that science is a human endeavor	Knows that science and technology have been practiced for a long time, and that there is much more about the Solar System and universe that needs to be researched, and in that, science will never be finished	x	x	x	x
LANGUAGE ARTS					
1. Uses general skills and strategies to acquire new information	Knows how to use appropriate reading skills to interpret and comprehend scientific material	x	x	x	x
4. Use of spoken, written language to communicate effectively with a variety of audiences and for different purposes	Knows how to listen and respond to information and questions discussed during lesson	x	x	x	x
	Knows how to communicate through speaking and in written form to effectively present conclusions and theories	x	x	x	x
5. Uses a wide range of strategies during the writing process appropriately to communicate with different audiences for a variety of purposes	Knows how to communicate and use the written form to present science-based answers to scientific inquiries			x	x
8. Uses technological and information resources for research purposes	Knows how and where to find appropriate research material for scientific inquiry, i.e., texts, Internet, etc.	x	x	x	x

Sources:

NCTE—The National Council of Teachers of English
www.ncte.org/about/over/standards/110846.htm

IRA—International Reading Association

www.reading.org/resources/issues/reports/learning_standards.html

NSTA—National Science Teachers Association

National Science Education Standards

www.nap.edu/books/0309053269/html/103.html