



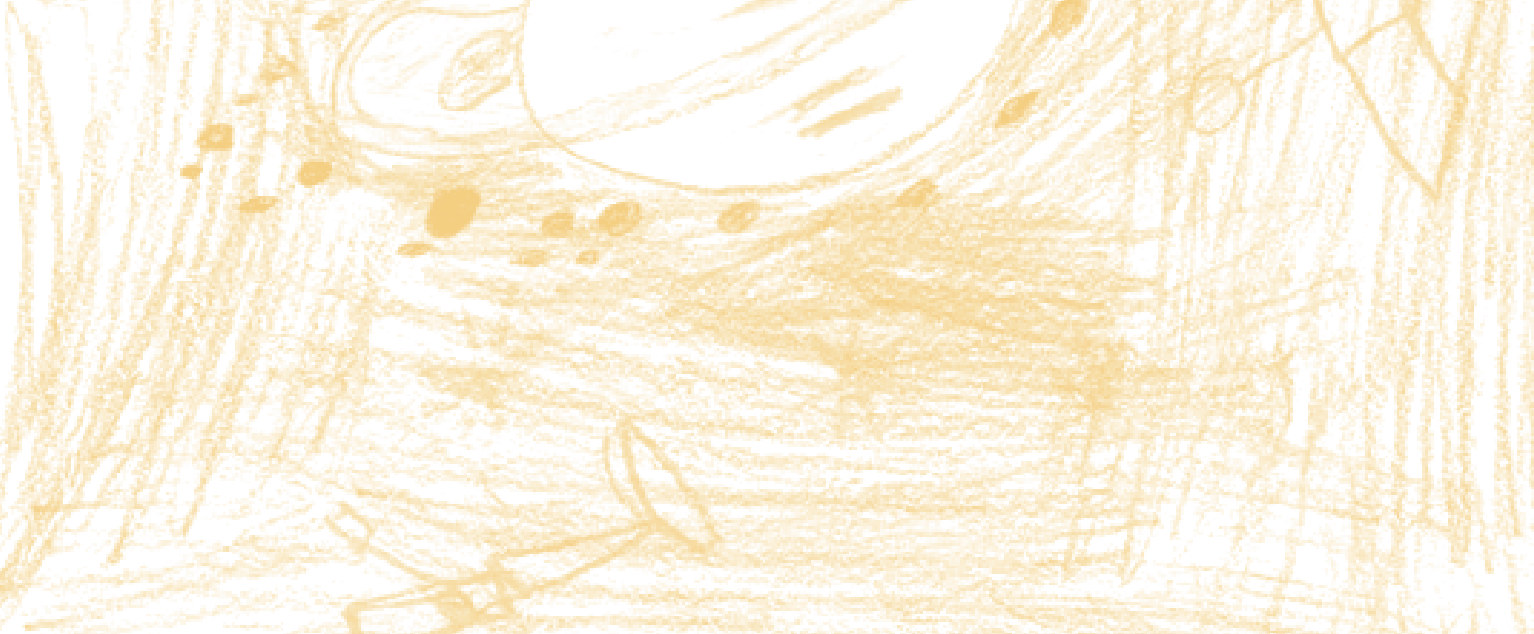
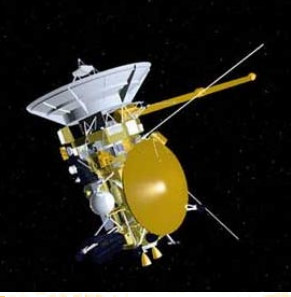
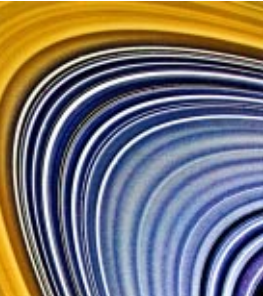
Educational Product	
Educators and Students	Grades 1-2

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JPL 400-1139 3/04

Mission to Saturn Educator Guide

Reading, Writing & Rings!

Grades 1-2



Lesson List

1 What Do You Know About Saturn?

This lesson starts students thinking about Saturn. They draw and write to express their knowledge of Saturn and the rings and moons.

- Language Arts Focus — Descriptive Writing
- Science Focus — Assessment through Writing and Illustration

2 Where Is Saturn in the Solar System? Where am I in the Solar System?

This lesson introduces students to Saturn and its place in the solar system. Students participate in a whole-class read-aloud and participate in a structured writing activity.

- Language Arts Focus — Nonfiction Texts: Listening and Structured Writing
- Science Focus — Learning About the Structure of the Solar System

3 Wow, Saturn Is Much Bigger than Earth!

Students explore the comparative sizes of Saturn and Earth; they make to-scale illustrations and caption their illustrations using scientific language.

- Language Arts Focus — Scientific Captions and Labels
- Science Focus — Creating an Earth–Saturn Model

4 Amazing — Saturn Is So Far, Far Away!

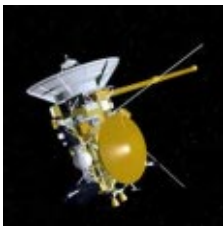
Students create an outdoor, to-scale model of the distances between the Sun, Earth, and Saturn to get a glimpse of the vastness of space.

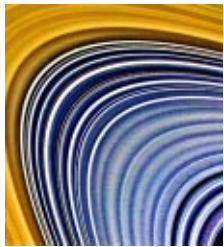
- Language Arts Focus — Writing an Informational Postcard
- Science Focus — Using a Playground Model to Explore Distance

5 My Spacecraft Model

Students engage in basic problem-solving as they design and construct a model of a spacecraft, document their work, and complete a Design Review Summary.

- Language Arts Focus — Written Reporting and Oral Peer Presentations
- Science Focus — Planning, Building, and Explaining a Spacecraft Model





6 **Earth to Saturn, Earth to Saturn!**

In this lesson, students use drawing and writing to explore the comparative features of Saturn and Earth.

- Language Arts Focus — Descriptive Analogies
- Science Focus — Understanding the Attributes of Earth and Saturn

7 **Rotating Rings of Ice**

Students create a three-dimensional model of Saturn and its rings and write about the model; students draft and write a paragraph explaining what they know about the ring system.

- Language Arts Focus — Drafting and Writing a Paragraph
- Science Focus — Modeling Saturn's Icy Ring System

8 **Titan and the Other Moons of Saturn**

Students learn that Saturn has many moons and that the Cassini–Huygens mission may discover more moons; they examine characteristics of Saturn's moons and sort the moons by attributes, then write about the moons and explain how they sorted them.

- Language Arts Focus — Descriptive Scientific Language
- Science Focus — Sorting by Scientific Attributes

9 **Focus on Saturn's Fascinating Features**

In this lesson, students create a multilayered book showing Saturn's layers, ring system, and moons; then develop their own texts to explain their Saturn diagrams.

- Language Arts Focus — Writing and Illustrating Expository Texts
- Science Focus — Creating Saturn Books: Rings, Moons, and Other Features

10 **Awesome Saturn**

Students generate a word list, then create one or more poems about Saturn.

- Language Arts Focus — Using Poetry to Describe Saturn
- Science Focus — Summative Reflections on Saturn



Foreword

Children begin rudimentary scientific thinking from the time they are born as they explore their natural environment and seek to make sense of it. When they acquire language, they begin asking questions about what they experience, observe, and think. Once they are in school, children's natural curiosity links closely with science learning, which offers an ideal opportunity to help young students expand their budding knowledge about the world. Science learning is also an ideal opportunity to involve students in rich reading and writing activities that not only help improve the quality of their learning but also help make them better readers and writers — a key goal in the elementary years.



A Saturn storm as seen by the Hubble Space Telescope.



A view of Saturn's rings by Voyager 2.

The sets of lessons you are about to encounter purposefully bring together reading, writing, and science in ways that underscore the belief that scientific thinking and the intelligent use of language go hand-in-hand. These lessons build good language use into the science curriculum, helping students use reading and writing to learn. In doing so, the lessons also help spur students' growth in vocabulary as they acquire new words through their engagement in authentic learning experiences.

While the lessons are grouped for grades 1/2 and 3/4, they can readily be used interchangeably as needed. Older students with little space science background might benefit from the grades 1/2 lessons. English learners might benefit from the early grades' reading and writing activities, too, finding them more accessible. The upper-grade lessons can also be used for enrichment for younger students who are ready for further study. We encourage teachers to look at the lessons as a whole and use them as best suits their teaching context.

Most important, the lessons open up the world of Saturn and emerging data about this planet to young children, and invite them to be part of space exploration. The scientific concepts, language, and content have been reviewed for accuracy by NASA's Jet Propulsion Laboratory staff.

Connecting Theory and Practice

Common to the reading and writing activities found in the lessons is an underlying belief that metacognitive skills practiced in socially interactive situations can contribute to young children's capacity to think scientifically.

The lessons aim to improve science learning by enhancing metacognitive skills. For example, in science notebooks and logs, students are asked to think about what they have learned and think about how they have learned, both key components of metacognition, which concerns the ability to reflect on our own cognitive processes (the process of knowing) and knowledge about when, how, and why to engage in various cognitive activities (Flavell, 1981). A number of key sci-



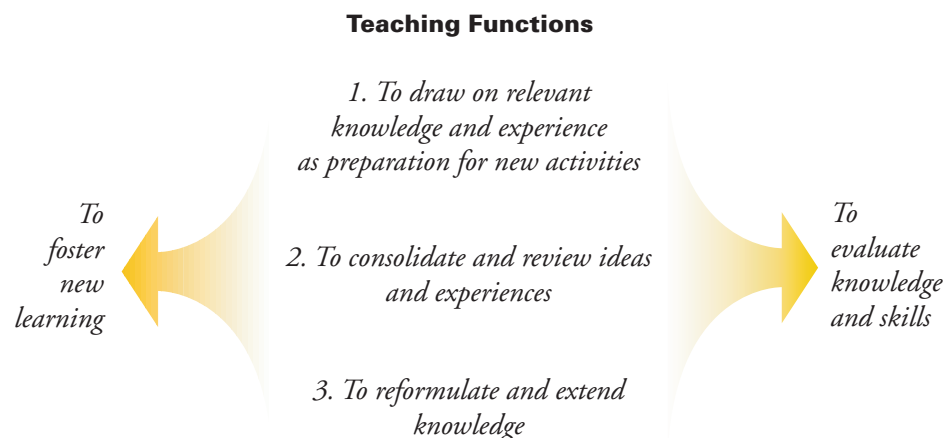
ence process skills are metacognitive in nature and have close correspondence with the skills of reading and writing. The skills of observing, classifying, comparing, predicting, describing, inferring, communicating, interpreting data, organizing information, and drawing conclusions are among the skills young children engage in as they explore a scientific concept, read a text, draw a picture, or compose a piece of writing. The lessons seamlessly integrate and reinforce these important skills.

The instructional activities enable students to be active learners and take responsibility for their own learning. Children first learn how to engage in various problem-solving tasks such as those listed above through social interaction with others (Vygotsky, 1978). The lessons highlight social interaction through exploratory talk (Barnes, 1976) with teachers, partners, and in small groups, and the use of expressive language (Britton, 1990) in talk and writing. This kind of language use among adults and peers helps students clarify ideas and work through new concepts. Little by little, students begin to internalize these new skills and processes.

Connecting Reading, Writing, and Science Learning

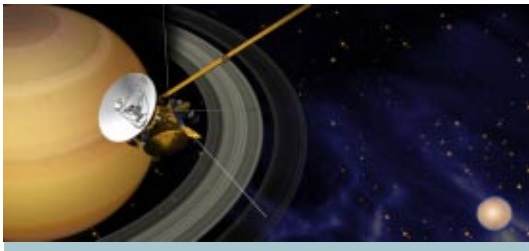
Reading and writing are central activities in each lesson. The lessons focus mainly on expository (explanatory) reading and writing. This kind of reading and writing tends to take a back seat to personal narration in the early grades. As a result, young students become very familiar with structure of a story but less familiar with the structure of expository and informational texts, even though learning how to read and write to explain, analyze, and report are essential skills for students as they move through the grades. Through engaging reading and writing activities, the lessons enable deeper learning by involving students in using writing to help organize and clarify their thinking.

Writing is essential to learning both the content and the processes of science. Langer and Applebee (1987) have identified three important teaching functions of writing that can scaffold students' learning of new content (see table at end of Foreword that relates functions to writing activities in the lessons):



Writing encourages active engagement in learning and helps students activate their schema for the concepts to be explored. Expressive writing in notebooks and logs in children’s own everyday language is their thinking written down, made permanent so that students can revisit their first impressions and revise their thinking as their understanding deepens. Writing helps students gain awareness of their developing knowledge and helps teachers to assess what students are learning and not learning, what they are interested in, and what difficulties they are experiencing. Further, research has shown that the more that scientific content is manipulated through analytic writing tasks, the better it is recalled (Langer, 1986, Wotring, and Tierney, 1981).

Reading also encourages active learning by students and has much in common with science process skills. Whether exploring a new area of science or reading a text connected to science, students are engaged in several of the same problem-solving processes. The reading skills of visualizing, questioning, determining important ideas, and understanding text structures resonate with the science process skills of making inferences, making predictions, and drawing conclusions.



The Cassini–Huygens Mission

During an exciting four-year mission of discovery, the Cassini spacecraft will study Saturn’s rings, magnetosphere, and atmosphere, and observe the planet-size moon Titan and a number of the icy satellites. The Huygens probe will collect data about the atmosphere, winds, and surface conditions of Titan. Cassini–Huygens is an international collaboration of the National Aeronautics and Space Administration (NASA), the European Space Agency, and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology, manages the Cassini–Huygens mission for NASA’s Office of Space Science.

Effective vocabulary development is essential as well, especially in science where children’s limited meanings for words can limit their understanding of concepts and the subject being studied (Herber, 1978). New vocabulary learning in science is developmental, where a definition is a start, but expanded meaning and knowledge require multiple experiences with the word. Through well-planned reading and writing activities and hands-on experiences with new content, children begin to learn, retain, and then use their newly acquired knowledge of scientific concepts and terms.

Strong reading and writing skills can unlock the doors to unlimited learning for our students. Students need practice, though, in reading and writing in a broad range of genres and content areas to reach this level of literacy. The design of the lessons in this program offer students chances to use their emerging literacy skills for real scientific learning, while giving them much needed experiences in reading nonfiction texts and using writing to describe, compare, and explain.



Teaching Functions and the Lessons

This table illustrates the Langer and Applebee teaching functions as they relate to grade levels and writing activities in the lessons.

TEACHING FUNCTION	GRADES / LESSONS
1. To draw on relevant knowledge and experience as preparation for new activities	Grades 1/2: Lesson 1 Grades 3/4: Lessons 1, 2, 3, 4, 5
2. To consolidate and review ideas and experiences	Grades 1/2: Lessons 2, 3, 4, 5, 7, 8 Grades 3/4: Lessons 4, 5, 9, 10, 11, 12
3. To reformulate and extend knowledge	Grades 1/2: Lesson 6, 8, 10 Grades 3/4: Lessons 6, 9, 12

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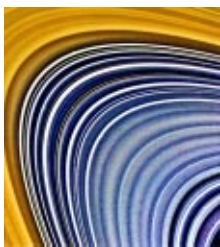
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Introduction

Welcome to a spectacular journey of learning — NASA’s Cassini–Huygens mission to Saturn and Titan!

The lessons in *Reading, Writing & Rings!* serve as a roadmap of student learning. You’ll see that each lesson contains age-appropriate learning goals for language arts *and* science. The lessons provide multiple opportunities for young students to develop important literacy skills — reading, writing and oral communication — and to expand and enrich their scientific understanding of Saturn and the amazing Cassini–Huygens voyage.



False-color view of Saturn's B and C rings.

These classroom lessons for grades 1 and 2 have been organized along the path of a journey. It is a fitting approach as the Cassini spacecraft has also been on an exciting journey of nearly seven years since its launch from Earth on October 15, 1997. Along the way, the Cassini–Huygens mission will be investigating Saturn’s atmosphere and interior, its magnificent rings, the surfaces of the icy satellites orbiting Saturn, and its largest moon, Titan.

We welcome you and your students along on this awesome ride!



Saturn's A ring; the tiny dot at upper left is a shepherding moon.

Students begin their journey of learning about Saturn by taking stock of what they know about the ringed planet. Some students may know a great deal about Saturn, others may know very little. Understanding the knowledge and language levels of your students will help you begin your lessons at a point where your students are ready to learn.

Early on in the journey we need to get our bearings and understand where Saturn fits into the solar system. We know it is the sixth planet from the Sun, but there is much more to learn. One of our goals is to help students see Saturn and themselves as parts of a larger system — the wondrous neighborhood we call our solar system.

Like all travelers, your students will want to know a bit about their destination. The next set of activities encourages students to explore two “big” concepts — Saturn’s enormous size and the vast distance that lies between us here on Earth and Saturn.

With some basic understanding of where we are headed, students want to know more about the spacecraft that is actually taking this exciting trip, and so we focus on exploring spacecraft design and construction. Students will grapple with age-appropriate, hands-on design problems in order to begin understanding



I n t r o d u c t i o n

some of the challenges scientists and engineers faced in building the two-story-tall robotic Cassini spacecraft.

The next stop along the way is to glance back at Earth and look for similarities and differences between our own planet and Saturn. The path of learning new things often begins with that which is familiar. With that in mind, we use Earth as a point of departure for understanding Saturn.

We all know that Saturn is special. While some other planets do have rings, Saturn's are unmistakable and glorious. Ask most young students what they know about Saturn and they will tell you that it has rings. We have included an activity that allows for more focused learning so that students will begin to understand why some scientists refer to the rings of Saturn as "flying snowballs."

Other stops along our journey are Titan, Saturn's largest moon, and the many other satellites that orbit the ringed planet. Students take a look at Saturn's varied moons and hone their critical thinking skills as they sort the moons according to each moon's scientific attributes.

Toward the end of our travels, we take some time to integrate all that we have learned about Saturn and share our excitement and learning with others. Students construct their own multilayered Saturn books, integrating image and text. The books make great reading for other students and family members. We also take some time to reflect on Saturn and, through poetry, express the awe which Saturn can inspire.

Have a great trip!



Getting Started

It is a good idea to maintain a folder or student portfolio for the duration of the grades 1–2 unit. Having your students keep a Science Notebook is also a component of this unit. The pre-assessment (described in Lesson 1) will be the first item in the student portfolios and/or Science Notebooks.

Using Science Notebooks

You will notice that each lesson contains a section titled “Science Notebooks.” We encourage students to keep Science Notebooks over the course of these lessons. The Science Notebooks need not be hard-covered, bound books. Several stapled sheets of lined paper with a construction paper cover will serve young students quite well. We have also included a student-friendly Cassini–Huygens [Science Notebook cover](#) as well as [Science Notebook paper](#) — both can be easily photocopied for your students.

Some teachers ask students to use the Science Notebooks during their classroom activities, while other teachers — especially those with younger students — use them at the end of an activity to structure student reflection on what they are learning. Notebook writing does not have to take place on the same day as the activity — there is value in allowing students some time to think about the activity and then write. We leave it up to teachers to decide when it makes the most sense for your students to write in their notebooks!

You will note that we have placed our writing prompts for the Science Notebooks right after the “Procedure” section for the lesson. We think of the notebook writing as the last step of the procedure. We have found that coupling the notebook writing with the science activities significantly enriches learning.

We are often asked whether to integrate all the worksheets and other writing activities from this unit into the Science Notebook or to collect them in separate student portfolios. Again, we leave this to the discretion of teachers. If you can easily keep all your students’ work in the Science Notebook, please do so. If it is easier to make a student portfolio for the lesson worksheets, that will work too.

Our experience with young writers is that a few questions make it much easier for them to begin writing. The Science Notebook section contains:

- A question to prompt your students to think about what they have learned.
- A question to encourage students to think about how they learned.

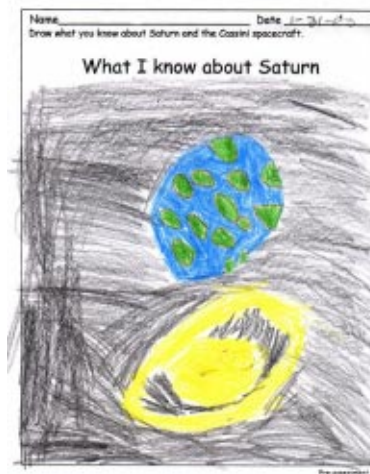
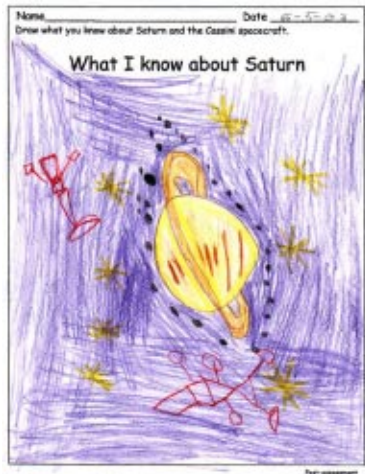
Encourage students to look back at their Science Notebooks throughout the course of this unit. The notebooks contain valuable information captured in the students’ words. Like scientists, young students can use their Science Notebooks to keep a record of what they learned and how they learned it, and new ideas to explore.



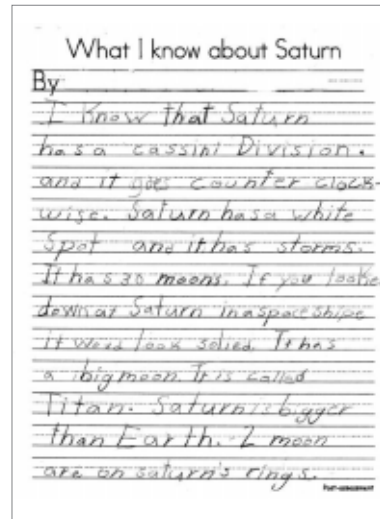
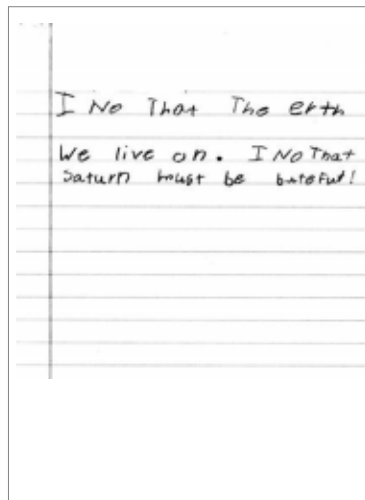
Assessment

What does student growth look like in a unit such as this? What can you expect to see in your students' work as they learn more about Saturn? A look at some pre- and post-assessment work samples (below) will give you an idea of how students' ideas about Saturn and their abilities to express them can change over the course of the unit. For full-size examples, see the end of this section. (The pre- and post-assessment drawing and writing worksheets can be found linked to Lesson 1.)

Pre- and Post-Assessment Drawing Examples



Pre- and Post-Assessment Writing Examples



Growth Indicators

Changes in Student Science Understanding

Here are things to look for in student writing, illustrations, and classroom discussions.

After students have completed the activities in Reading, Writing & Rings!, they should be including several of the science concepts listed below in their work. You will, of course, see some students incorporate these concepts very easily, others will need more time or exposure to these ideas before they have made them their own. We are providing them here to point you toward areas and topics where you will see changes in student understanding.

1. The Cassini–Huygens mission is exploring Saturn and its rings and moons.
2. Saturn is part of the solar system.
3. Planets vary in size. Saturn is much larger than Earth.
4. The distances in space are vast. Saturn is very far from Earth and even farther from the Sun.
5. Models help us understand many things in science. Models help us plan and make it easier for us to compare different objects.
6. Saturn and Earth are different in many ways. For example: size, composition, habitation, number of moons, and presence of rings. Your students will undoubtedly come up with their own interesting differences!
7. Saturn has many rings made of particles of varying sizes. The particles are primarily water ice.
8. The rings have many gaps in them — the largest is the Cassini Division. The rings revolve around Saturn.
9. Saturn has many moons. Titan is the largest. The moons of Saturn are diverse and have identifiable characteristics.
10. Saturn has many features — gas layers, rings, moons, a rocky core, and moons.



Changes in Student Literacy

Listed below are some areas where students will change their writing and communication practice. Look in their Science Notebooks as well as their worksheets for evidence of growing writing skills. In their discussions with you and their peers, listen for changes in their thinking and their abilities to express their ideas. This list is not meant to be complete, but simply gives an idea of where to expect growth in students' learning. Look for your students to do some of the following:


1. Create scientifically accurate illustrations and/or diagrams. For example, Saturn is shown as having rings around it, not rings near it. It also has numerous moons and other features that can be described, such as a core and gas layers.
2. Use labels to give scientific information about their illustrations and/or diagrams.
3. Use captions to explain their scientific illustration or diagram.
4. Use adjectives to accurately describe an event or object. For example, students may write "Saturn has many icy moons."
5. Use accurate vocabulary when describing Saturn. For example, the rings around Saturn are referred to as "rings," not "circles."
6. Explain their ideas and work in a way that is understandable to their peers and to you.
7. Ask questions of their peers and respond to the questions asked of them.
8. Practice a variety of writing strategies. The strategies may include brainstorming and using graphic organizers to help students move from structured to open-ended writing.
9. Use analogy to describe differences between objects like Saturn and Earth.
10. Write a basic paragraph that includes a main idea, some supporting details, and a conclusion.
11. Use a variety of poetic forms to write about Saturn.



Pre-Assessment Drawing Example

Name _____ Date 1-31-03
Draw what you know about Saturn and the Cassini spacecraft.

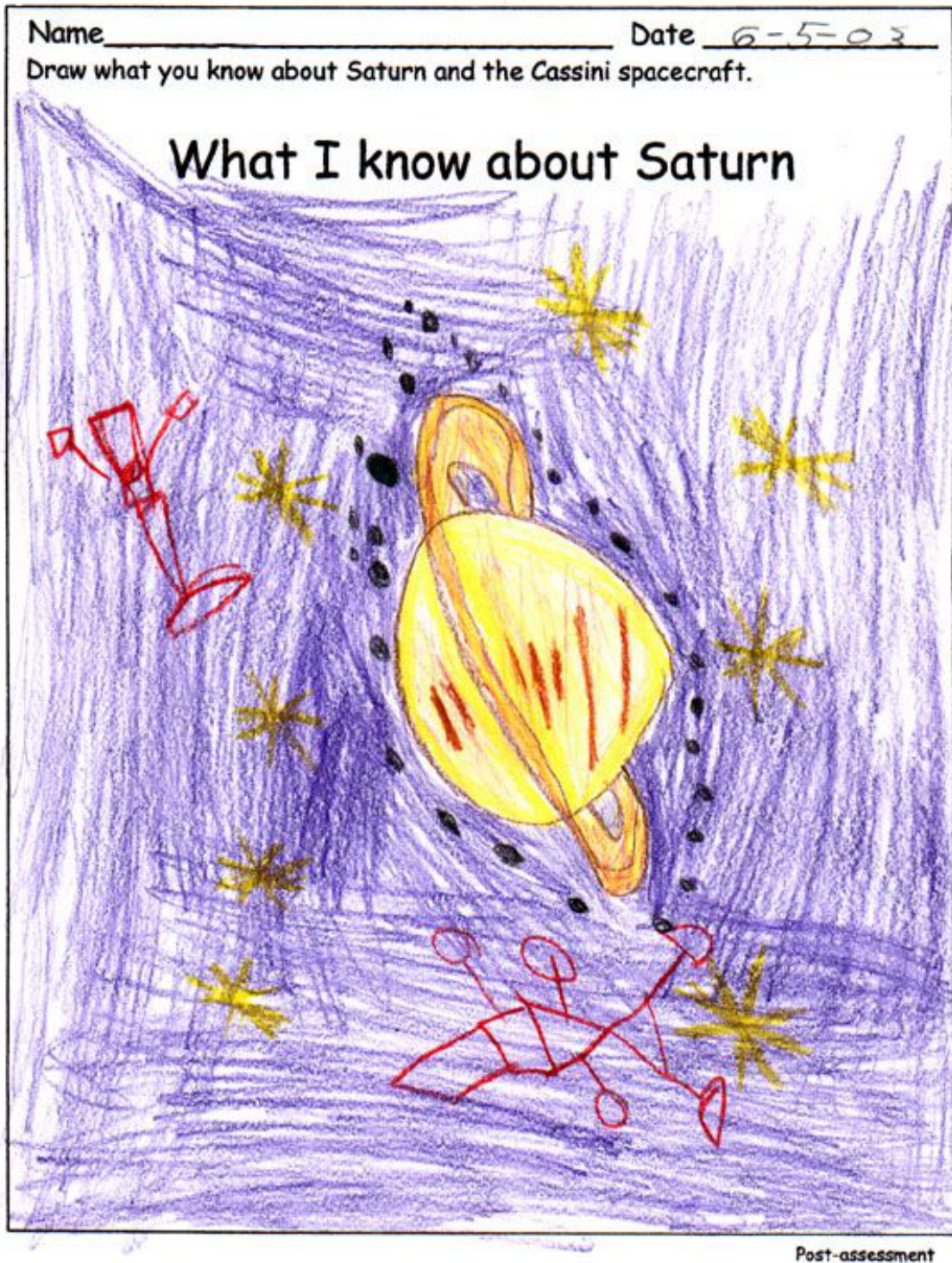
What I know about Saturn



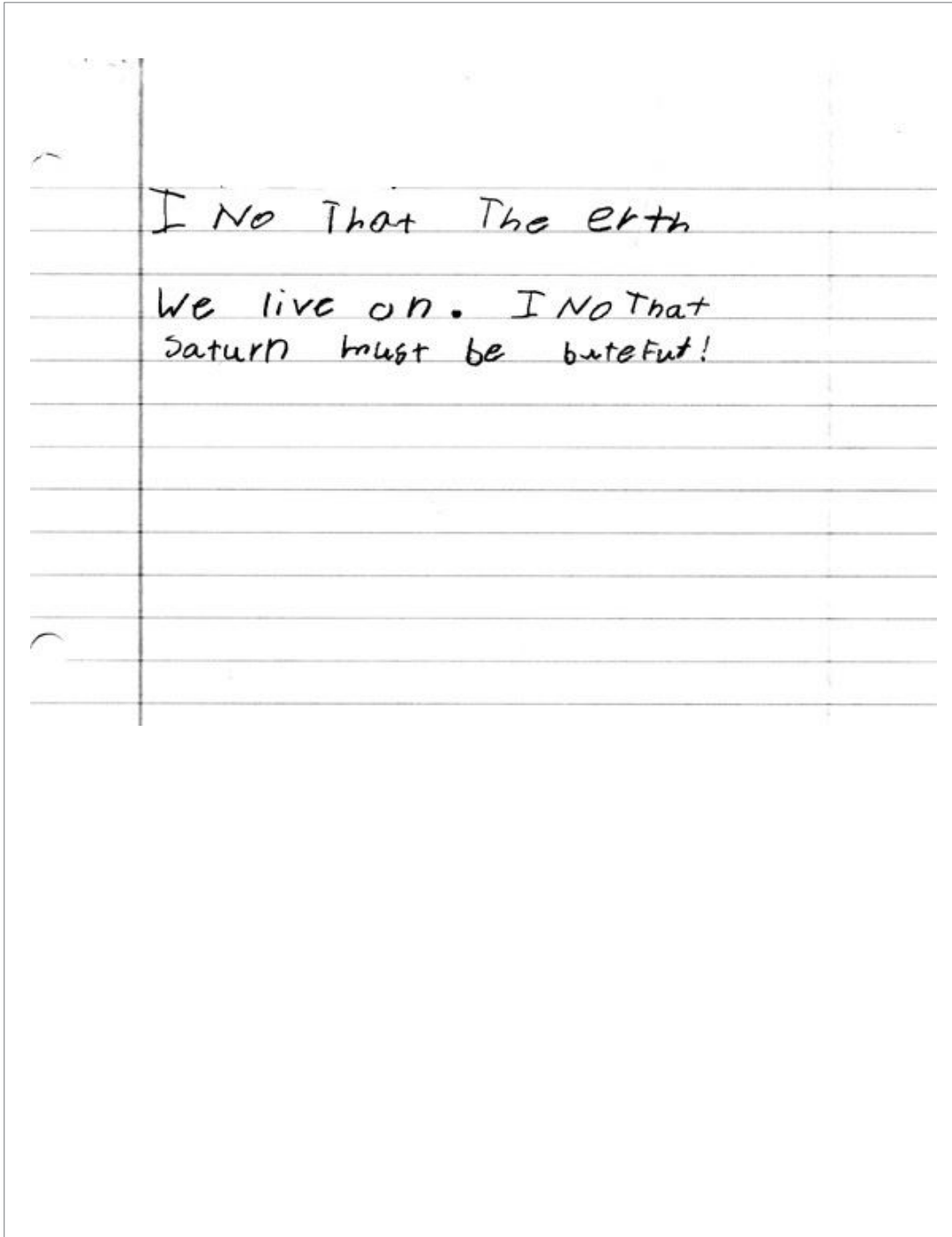
Pre-assessment



Post-Assessment Drawing Example



Pre-Assessment Writing Example



Post-Assessment Writing Example

What I know about Saturn

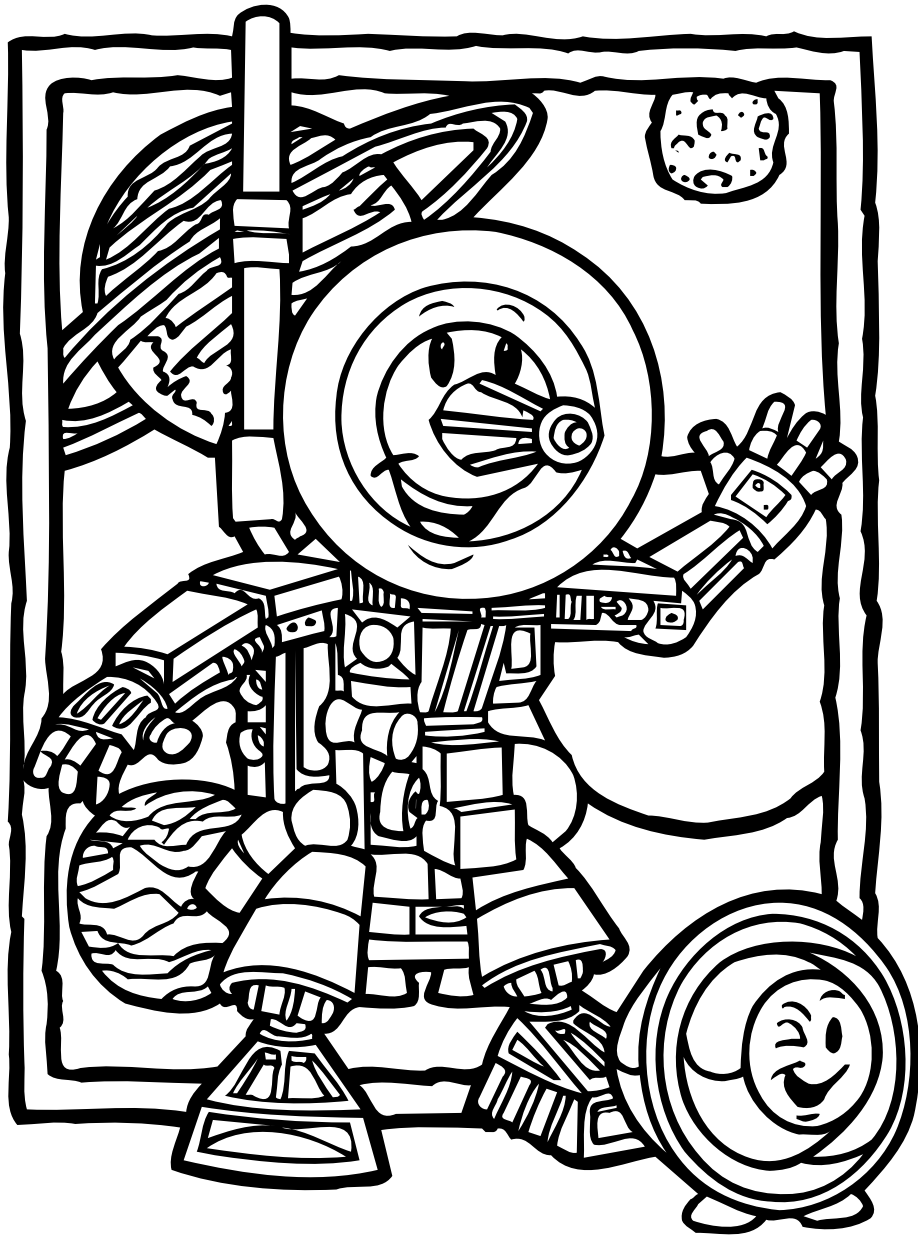
By _____

I know that Saturn has a Cassini Division, and it goes counter clockwise. Saturn has a white spot and it has storms. It has 30 moons. If you looked down at Saturn in a spaceship it would look solid. It has a big moon. It is called Titan. Saturn is bigger than Earth. 2 moons are on Saturn's rings.

Post-assessment



MY CASSINI-HUYGENS SCIENCE NOTEBOOK



Name _____

My Cassini-Huygens Science Notebook

Date

Blank lined notebook page with horizontal ruling lines and a dashed midline for handwriting practice.

What Do You Know About Saturn?

Saturn — the jewel of the solar system.



LESSON TIME

20 to 30 minutes

PREPARATION TIME

15 minutes

MATERIALS CHECKLIST

- Crayons
- Pencils
- Pre-assessment drawing and writing worksheets, or 1 sheet of black construction paper and writing paper, for each student
- Post-assessment drawing and writing worksheets for each student

STUDENT PREREQUISITES

Students should be able to draw and write independently or with some teacher support.

LESSON NO. 1

Language Arts Focus — Descriptive Writing

Science Focus — Assessment through Writing and Illustration

OVERVIEW

This lesson starts students thinking about Saturn. In this short activity, students draw and write to express their knowledge of Saturn.

BACKGROUND

Through pre-assessment you will get an idea of how your students think about Saturn and its place in the solar system. You will be looking at how your students draw Saturn’s shape, rings, and moons and what level of detail they include. The pre-assessment will help you answer questions about language skills and scientific concepts, for example:

- In what areas will I need to build vocabulary?
- Do my students have an understanding of the Saturnian system?
- Can my students articulate, in writing, what they know about Saturn and the Cassini–Huygens mission?

At the end of the *Reading, Writing & Rings!* unit, you will be able to measure student growth through a pre- and post-assessment comparison.

Objectives

The pre-assessment will:

1. Identify student thinking about Saturn and the Cassini–Huygens mission at the start and at the conclusion of the unit.
2. Reveal students’ scientific misconceptions at the outset.
3. Indicate evidence of student learning over the course of the lessons.

Teacher Preparation

Make one copy for each student of the pre-assessment drawing worksheet and the pre-assessment writing worksheet, or provide black construction paper and writing paper for each student. For post-assessment at the end of the unit, make one copy for each student of the post-assessment drawing and writing worksheets.

Procedure

1. Pass out a copy of the **pre-assessment drawing worksheet** “What I Know About Saturn” (or black construction paper) and crayons to each student.



2. Prompt students by asking them to draw what they know about the planet Saturn and the Cassini spacecraft. Do not give students any ideas or added directions for drawing to ensure that the activity will give an accurate assessment of student understanding.
3. When drawings are complete, hand out a copy of the [pre-assessment writing worksheet](#) “What I Know About Saturn” (or plain paper) and pencils.
4. Prompt students by asking them to write what they know about Saturn and the Cassini spacecraft. Do not give additional information. Their writing will provide an important indication of their understanding at the outset of this unit.
5. At the completion of the unit, repeat the exercise using the [post-assessment drawing worksheet](#) and the [post-assessment writing worksheet](#).

Using Science Notebooks

Decide whether to integrate all the worksheets and other writing activities from this unit into the Science Notebook or to collect them in separate student portfolios. For more information, see “Using Science Notebooks” in the Getting Started section of the Introduction.

Why This Works

As you begin *Reading, Writing & Rings!* you will want to know what students know or think they know about Saturn. Very often students have misconceptions about scientific topics. By identifying misconceptions early, they can be addressed and, over time, corrected.

It can be challenging to get a clear picture of student understanding. This assessment provides students two modalities for expression: writing and drawing. For very young students, drawing often serves as an impetus to writing, so in these activities we have asked students to start by drawing and then to write. By using both these skills, students who learn through image, and students who learn through text, will be able to express what they know and what they have learned.

Using the same assessment activity at the outset (pre-assessment) and at the conclusion (post-assessment) of this unit will allow you and your students to see just how much they have learned about Saturn and the Cassini–Huygens mission.

Assessment

The students’ work for this lesson will be the basis for assessing their progress at the end of the unit. For things to look for in students’ work, see “Growth Indicators” in the Getting Started section of the Introduction.



Name _____ Date _____

Draw what you know about Saturn and the Cassini spacecraft.

Pre-assessment

What I know about Saturn

What I know about Saturn

By _____

Date _____

Name _____ Date _____

Draw what you know about Saturn and the Cassini spacecraft.

Post-assessment

What I know about Saturn

What I know about Saturn

By _____

Date _____

Where Is Saturn in the Solar System? Where Am I in the Solar System?

A photomontage of Saturn and some of its moons.



LESSON TIME

40 minutes

PREPARATION TIME

Allow time to locate reading materials and make copies of the handouts.

MATERIALS CHECKLIST

- *Read-alouds (see Teacher Preparation)*
- *Chalkboard, whiteboard, or easel with paper; chalk, or markers*
- *“What I Wonder About Saturn” for each student*
- *“My Place on Earth! My Place in the Solar System!” worksheet for each student*
- *Science Notebooks*

STUDENT PREREQUISITES

Students should be able to write independently or with some teacher support.

LESSON NO. 2

*Language Arts Focus — Nonfiction Texts: Listening and Structured Writing
Science Focus — Learning About the Structure of the Solar System*

OVERVIEW

This lesson introduces students to Saturn and its place in the solar system. Students see Saturn as part of the larger system of the Sun and its orbiting planets. A whole-class read-aloud provides students practice in listening to nonfiction text and a KWL chart supports the discussion of the text. Also included in the lesson is a structured writing activity that leads students to understand and explain their own place in the solar system.

BACKGROUND

The notion of a system characterizes many aspects of our solar neighborhood. Students begin to understand the workings of our solar system by learning that the Sun is at its center and the nine known planets and asteroid belt are in constant orbit around it. Saturn is also part of a system. Much like our own Sun, Saturn is at the center of a system — the Saturnian system. Saturn too has objects in constant orbit around it. Revolving around Saturn are its many beautiful and complex rings and numerous icy moons. For more information on the solar system, visit — <http://www.solarsystem.nasa.gov>

Objectives

Students will:

1. Learn that Saturn, the other planets, and the Sun are part of the solar system.
2. Practice listening to and understanding nonfiction text.
3. Write about their place in the solar system.

Teacher Preparation

For each student, make a copy of “What I Wonder About Saturn” by NASA Scientists (see page 4) and the “My Place on Earth! My Place in the Solar System!” worksheet. For read-alouds, the following books are excellent choices: *Me and My Place in Space* by Joan Sweeney; *My Place in Space* by Robin Hirst and Sally Hirst; *What’s Out There: A Book About Space* by Lynn Wilson; *Our Solar System* by Seymour Simon; *The Planets in Our Solar System* by Franklyn Branley.



Procedure

1. Gather students together for a whole-class read-aloud activity.
2. Form pairs and ask students to brainstorm with their partners about what they know about the solar system and Saturn. Using chalkboard, whiteboard, or easel with paper, create a KWL chart to organize their comments. List student responses in the first column of the KWL chart, What We Know.
3. Ask students if they have any questions about the solar system or Saturn.
4. You may want to model how to ask questions. A list of question words (who, what, when, where, why, how) is a helpful language prompt in the classroom to encourage inquiry. Asking students, “What do you wonder about the solar system or Saturn?” is another way to prompt inquiry in young students. List 3 or 4 questions or wonderings in the second column of your KWL chart, What We Want to Know or What we Wonder.
5. Give a copy of “[What I Wonder About Saturn](#)” by NASA Scientists to each student. Explore the list of “wonderings,” taking a few minutes to read them with your students and see what scientists are wondering about Saturn and its largest moon, Titan.
6. Introduce the solar system and Saturn by reading one of the books listed in the materials section.
7. As you read, stop and ask students to raise their hands when they hear new vocabulary words, words that they find difficult, or words that they want to know more about. Write words on the board and explain them as you read.
8. After reading and discussion, review questions that students generated and ask if anyone can answer any of the questions. Be sure to allow students some “think time.” Place students’ answers in the last column of the KWL chart, What We Learned.
9. Ask the students if they have any new questions. Add these to the KWL chart and encourage students to look for answers in future reading and discussions.
10. After you have completed the reading, distribute the “[My Place on Earth! My Place in the Solar System!](#)” worksheet for students to complete.
11. Depending on the skill levels of students, the worksheets can be done as a guided writing activity using an overhead projector, or an independent writing activity.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: Where is Saturn in the solar system? Where are you in the solar system?
2. Process questions: How do you know where Saturn is? How did you find your place in the solar system?



Extension

For additional activities focusing on the locations of objects in the solar system and their sizes and distances, visit:

<http://stardust.jpl.nasa.gov/classroom/activities/3-stardst-ch03.pdf>

Why This Works

The reading genre that young children encounter most often in classrooms and at home is overwhelmingly narrative in nature. When primary teachers were asked what type of text they last used in their classroom read-alouds, 84% reported fiction, 14% reported nonfiction, and the remaining 2% reported other (such as spelling lists). Parents exhibit a similar preference for fiction over nonfiction in their reading choices for their children.

To develop robust literacy skills, students must be exposed to a variety of text types. While narrative reading is important, content reading is essential to success in the classroom as well as in the workplace. Many of the lessons in *Reading, Writing & Rings!* reference nonfiction reading resources to increase student's exposure to informational texts.

Not to be overlooked is how motivating content reading can be for beginning readers. Young students are curious about the world, and nonfiction reading is a very effective way to bring the real world into the classroom.

Assessment

Student writing in Science Notebooks and writing and illustration in their worksheets will give an indication of what they have learned during this lesson.

Standards

NCTE Standards for the English Language Arts

- Students read a wide variety of print and nonprint texts to build an understanding of texts, themselves, and the world.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (learning, the exchange of information).

National Science Education Standards

Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



"What I Wonder About Saturn"

by NASA Scientists



The journey to learn more about Saturn is just beginning! We asked two NASA Cassini-Huygens scientists what they wonder about Saturn. Here is what they said:

Jim Fraunick of Mission Planning wonders:

- I wonder how thick Saturn's rings are.
- I wonder what will happen to the spacecraft as it passes through the rings.
- I wonder what causes storms in Saturn's atmosphere.
- I wonder if we will get some good pictures showing the particles in the rings.
- I wonder what the mission probe will find out about the moon Titan.
- I wonder if there is an ocean on Titan.
- I wonder how fast the winds are on Titan.

Dr. Bonnie Buratti, Investigation Scientist for the Visible and Infrared Mapping Spectrometer (VIMS) instrument wonders:

- I wonder what the rings are made of.
- Saturn has a moon called Iapetus. One side is very bright, almost as bright as fresh snow, and the other side is as dark as soot. I wonder how it got that way.



My Place on Earth!

My Place in the Solar System!

Name _____ Date _____

I live on _____.(street)

My school is _____.

I live in _____.(city)

I live in the state of _____.

My country is _____.

I live on the continent of _____.

I live on the planet _____.

My star is called _____.

On my way to Saturn, I saw _____

When I got to Saturn, I knew it was Saturn because _____

Wow, Saturn Is Much Bigger than Earth!

A giant storm can be seen near Saturn's equator.



LESSON TIME

May be carried out over two days. Total time: 1 hour, 20 minutes.

PREPARATION TIME

20 minutes

MATERIALS CHECKLIST

- *White drawing paper*
- *Black construction paper (9 x 12 inches)*
- *Glue, scissors, watercolors, paint brushes, pencils or markers*
- *Half-inch round blue adhesive labels*
- *Copies of "Watercolor Saturn" and "Saturn Labels" worksheets*
- *Silver glitter glue (optional)*
- *Science Notebooks*

STUDENT PREREQUISITES

Students should have some basic knowledge of Earth and Saturn and be able to write independently or with some teacher support.

LESSON NO. 3

Language Arts Focus — Scientific Captions and Labels

Science Focus — Creating an Earth–Saturn Model

OVERVIEW

This lesson explores the comparative sizes of Saturn and Earth. Students learn about their relative sizes first-hand as they make to-scale illustrations. Students also label and caption their illustrations using scientific language.

BACKGROUND

Sizes of objects in the solar system can be far greater than those we encounter here on Earth. Young students — and adults for that matter — often cannot easily grasp the enormity of these objects. This activity is meant to begin students' exploration of size using a model and introduces the basic concept that Saturn is much larger than Earth.

COMPARING EARTH AND SATURN

Here are a few measurements to help you understand the comparative sizes of Earth and Saturn. Earth is the fifth largest planet in our solar system. Saturn is the second-largest planet — only giant Jupiter is larger. The diameter of Earth is about 13,000 kilometers (8,000 miles). Our planet's diameter is rather small when compared to Saturn's diameter of about 121,000 kilometers (75,000 miles). The ratio of Earth's diameter to Saturn's diameter is about 1 to 9. For young students, who are just beginning to develop a sense of numbers, it is enough to know that when using Earth's diameter as a measure, it will take about nine Earths to span Saturn's diameter. For more information on Earth and Saturn, visit:

<http://www.solarsystem.nasa.gov/>

Objectives

Students will:

1. Draw and paint an accurate illustration of Saturn.
2. Learn that planets vary in size.
3. Learn that Saturn is much larger than Earth.
4. Learn that the diameter of Saturn is about 9 times the diameter of Earth.
5. Practice vocabulary words related to Saturn.
6. Write scientific labels and captions.



Teacher Preparation

For each student, make one copy of the “Watercolor Saturn” worksheet and “Saturn Labels” worksheet. (If possible, use white drawing paper to make copies of the “Watercolor Saturn” worksheet; regular paper can be used for the “Saturn Labels” worksheet.) Make a teacher’s copy of the worksheets for modeling. Provide one piece of black construction paper, 9 x 12 inches, for each student and 9 half-inch round blue labels per student.

Procedure

You may wish to take two or more days for this activity.

Day One

Starting the Illustration — 20 minutes

1. To give your students a good idea of what Saturn looks like, visit: <http://saturn.jpl.nasa.gov/multimedia/images/saturn/index.cfm>
2. Distribute the “Watercolor Saturn” worksheets, paints, and brushes.
3. Model this activity for your students with your own worksheet.
4. Begin painting with diluted light yellow paint and cover the entire planet. Model brush strokes going one way across the circle outlining the planet.
5. Place a few streaks of diluted brown paint across the middle of the planet and a few thin streaks at the top and bottom. The brown streaks will bleed into the yellow to resemble the dense cloud cover of Saturn.
6. Using the brown paint, show students how to paint the rings of Saturn. Explain to students that the rings are not solid, but rather chunks of water ice — some big, some small — that are orbiting the planet.
7. Ask your students to use a series of small dots (pointillism) to indicate that the rings are actually made up of many, many chunks of ice.
8. If you are using optional silver glitter glue to simulate ice in the rings, put a drop on each child’s rings and let them use their index finger to spread it.
9. Let dry.

Day Two

Completing the Illustration — 30 minutes

1. Return the “Saturn Watercolor” worksheets to the students.
2. Ask students to cut out the painted Saturn and glue it to a piece of black construction paper. Model the cutting and gluing for your students.
3. Discuss the enormous size of Saturn in contrast to Earth.
4. Hold up a round blue label and ask students to predict which planet the round blue label is. If needed, explain that it is Earth.
5. Ask students to predict how many labels, or “Earths,” are needed to go across the diameter of Saturn.
6. Write their predictions on the board.



7. Place your Saturn illustration on the board. Ask two or three students to come up and place the round labels across the diameter of Saturn. Remind them to be careful to place labels edge to edge. Count up the blue circles!
8. Note how many different predictions there were and compare your students' findings to their predictions.
9. Distribute 9 round blue labels to students so that they can place them on their own illustrations.

Writing Scientific Labels and Captions — 30 minutes

1. In pairs, ask students to brainstorm which features they would like to include on their illustrations. Allow some time for discussions and then ask students to name the features. Write the features on the board. Your words might include: rings, ice, Saturn, Cassini Division, Cassini spacecraft, and moons.
2. If you are keeping a Saturn Word Wall in your classroom, add this vocabulary to it.
3. Distribute a “**Saturn Labels**” worksheet to each student. Ask students to write their vocabulary words on the label section of their worksheets.
4. Explain that many books contain labeled illustrations and that they also have captions that explain the illustration or picture. Explain that a caption is usually one or two sentences that give the reader more detail about the picture or illustration.
5. Show some examples from classroom books.
6. Ask students to write a caption for their Saturn illustration in the caption section of the worksheet.
7. Help students edit their captions if needed.
8. Have students cut out the labels and glue them to the appropriate locations on the illustration. Also cut out caption and glue it below the Saturn illustration.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: Where is Saturn in the solar system? Where are you in the solar system?
2. Process questions: How do you know where Saturn is? How did you find your place in the solar system?

Why This Works

After students have created their own to-scale illustrations of Earth and Saturn, they have first-hand experience of their different sizes. This lesson provides students an opportunity to learn through illustration, and then reinforces their learning as they label their work and write captions about it.



Assessment

Student writing in Science Notebooks and examples of student labeling and captioning show what they have learned during this lesson.

Standards

NCTE Standards for the English Language Arts

- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning for enjoyment, persuasion, and the exchange of information).
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

National Science Education Standards

Physical Science

- Position and motion of objects

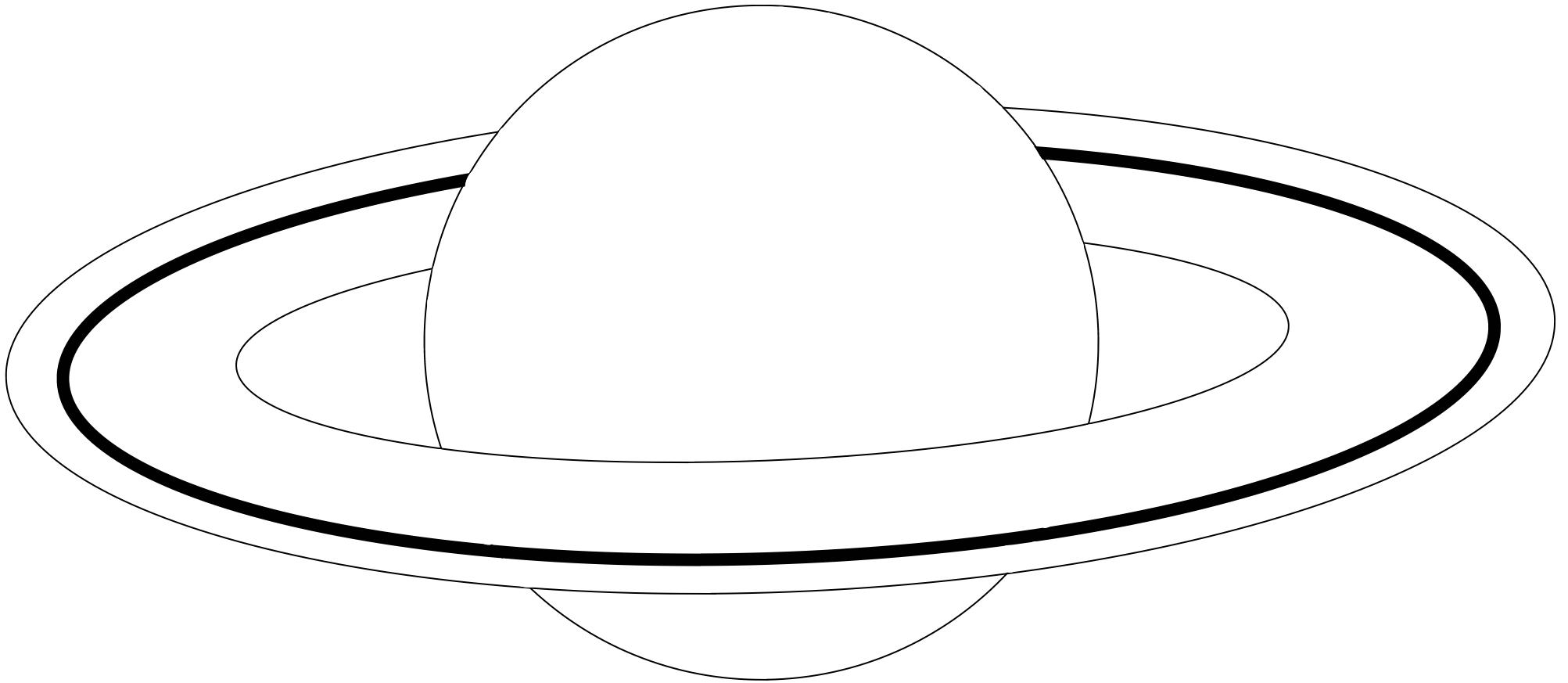
Earth and Space Sciences

- Objects in the sky



Watercolor Saturn

by _____



Saturn Labels

Saturn Caption Writing Paper

Handwriting practice lines consisting of solid top and bottom lines with a dashed midline, repeated ten times.

Amazing — Saturn Is So Far, Far Away!

A long-distance view of Saturn by Cassini.



LESSON TIME

Total time 60 minutes; there are two separate activities.

PREPARATION TIME

Allow time to collect materials and prepare signs.

MATERIALS CHECKLIST

- An example postcard
- Construction paper
- One peppercorn and one walnut (or ping-pong ball)
- Large piece of paper and easel, or overhead transparency
- Roll of string, at least 275 yards (optional)
- Scissors; glue; popsicle sticks or skewers
- One large ball to represent the Sun
- Copies of “Postcard from Saturn” worksheet and “Cassini spacecraft” handout
- Science Notebooks

STUDENT PREREQUISITES

Students should be able to write independently or with some teacher support.

LESSON NO. 4

Language Arts Focus — Writing an Informational Postcard

Science Focus — Using a Playground Model to Explore Distance

OVERVIEW

In this activity, students create an outdoor, to-scale model of the distances between the Sun, Earth, and Saturn. To get a glimpse of the vastness of space, you and your students will have to take a trip to the school yard. Through this school-yard walk, students begin to gain some understanding of how far away Saturn is from Earth and the Sun. Like enthusiastic travelers everywhere, students will write a “postcard home” to share their exciting trip!

BACKGROUND

In this unit on Saturn, it is helpful to give students a sense of the neighborhood they are studying. Young students — and adults for that matter — do not easily grasp the vast distances we encounter in the solar system. This activity is meant to begin the exploration of distance using an outdoor model and introduces the concept that Saturn is very, very, very far from Earth.

DISTANCES IN THE SOLAR SYSTEM

The distances in the solar system are vast! Here are a few figures to give an idea of the distances you and your students will be exploring. We will start with the Sun and move out from there.

- Earth is about 150 million kilometers (93 million miles) from the Sun.
- Saturn is about 1.3 billion kilometers (746 million miles) from Earth.

By greatly reducing the scale of Earth and Saturn to a peppercorn and walnut, respectively, we can reduce the 150 million kilometers or 93 million miles to a mere 26 yards, and the 1.3 billion kilometers or 746 million miles to 221 yards — still a pretty impressive distance for young students!

Please note that these sizes and distances are only approximately to scale and serve to introduce the exploration of the astronomical distances in a student-friendly way.

Objectives

Students will:

1. Learn that Saturn is very far from Earth.
2. Learn that Saturn is very, very far from the Sun.



3. Use a model to explore the distances between the Sun, Earth, and Saturn.
4. Practice the scientific skills of predicting and comparing.
5. Learn the formal conventions of a postcard.
6. Create a “Saturn postcard” using accurate language to describe distance.

Teacher Preparation

Label one sheet of construction paper SUN, another EARTH, and the third sheet SATURN. Glue a peppercorn to the “Earth” sign and a walnut or a ping-pong ball to the “Saturn” sign, and glue the signs to popsicle sticks or skewers. If you are using the optional roll of string to mark the distances, measure out 247 yards to indicate the Sun–Saturn distance and cut. Then measure out 26 yards from one end of the string and mark that location with a piece of tape to indicate the Sun–Earth distance. For the “Sun,” a red rubber ball or soccer ball work well. Make copies of the “Postcard from Saturn” worksheet and the “Cassini spacecraft” handout for each student. You may wish to make a transparency of the “Postcard from Saturn” worksheet to model the parts of a postcard.

Procedure

Part One

Exploring Distance on the Playground — 30 minutes

(Note: Much of this activity is done outside and is easier with the aid of another adult or an older student.)

1. Distribute a “Cassini spacecraft” handout and a popsicle stick or skewer to each student along with scissors and glue. Ask the students to cut out a spacecraft and glue it to the stick.
2. Explain that you will be using a model to explore how far Saturn is from Earth. Tell students you will be going outside and walking across the yard to learn more about Cassini’s voyage to Saturn.
3. Ask students to predict how many steps they will have to take to cover the distance between Earth and Saturn. Accept all predictions — even the wild ones! Post predictions on a large sheet of paper or overhead transparency.
4. Go outside with your students to begin your “walk to Saturn.”
5. Select a spot in the yard and mark it with the “SUN” sign and place the large “Sun” ball next to it. (Allow plenty of space to do this activity — you will need about 250 yards.)
6. Explain to students that you will take “big steps” to pace off the distances. Model how to pace off distance. Begin your “big steps” and ask students to count along with you as you walk from the Sun toward Earth and on to Saturn. If you are using the optional string, unravel it as you go along.
7. From the Sun, take 26 paces to reach Earth’s location. Place the “Earth” sign in the ground.
8. To reach Saturn you will have to walk another 221 paces. When you have reached Saturn, place the “Saturn” sign in the ground. (You’ll see that some of those “wild” predictions may not have been so wild after all!)



teacher
TIP

- Display post-cards you and your students have received in the classroom to serve as models for writing.
- Create a word bank with students to help them recall the playground discussion.
- Vocabulary words that are generated in student discussions can be added to the Word Wall.

9. At Saturn, ask students to look back at the Earth and Sun signs.
10. Discuss the model with your students.
11. Prompt the students with the following questions:
 - How did that trip feel?
(It took a long time. I got tired. It was hard to remember how many steps we took.)
 - How many steps did it take to walk to Saturn? (We had to take 221 giant steps.)
 - Are you far away from the Sun? (Yes, we are very far from the Sun. Earth is the third planet in the solar system and Saturn is even farther out. It is the sixth planet.)
 - What can you see from here? (We can look back toward the Sun, and we can see the signs for Earth and the Sun, but the Earth is very small.)
 - Do you think it is colder on Earth or Saturn? (It is much colder on Saturn.)
 - Why do you think it is colder on Saturn? (It is colder on Saturn because it is so very far from the Sun, which is the source of heat in the solar system.)
 - Why do you think Saturn might be dimmer than Earth? (Because Saturn is so far from the Sun — not much sunlight travels all the way to Saturn.)
12. Now return to the classroom and take a look at the predictions. Note the variety of predictions!

Part Two

Writing About Saturn — 30 minutes

1. Distribute “**Postcard from Saturn**” worksheets to the students.
2. Show an example postcard you (or one of your students) have received and explain the parts of the postcard. Using a worksheet, model writing a postcard — ask your students for the date, a salutation, and a message. After you have completed the postcard, sign it on one side and address it on the other. An overhead will make this easy for your students to follow.
3. Ask students to choose someone to write their postcards to — a friend, family member, or classmate.
4. Discuss with students how to describe the trip to Saturn. On the board, write vocabulary such as “distance,” “pace off,” “dim,” “sunlight,” “long time,” and “far away,” “cold,” and other student suggestions.
5. After students have completed writing their postcards, ask them to turn them over and draw a diagram of Saturn, Earth, and the Sun.
6. Collect the postcards and display them on a board or from strings so that both sides can be seen.



Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: How far away is Saturn from Earth? If you were feeling cold and wanted to warm up, which planet would you visit — Earth or Saturn? Why?
2. Process question: What did you do to find out how far Saturn is from Earth?

Extension Activities

When doing this model, be sure that your students also have a chance to create a radial model of the Sun, Earth, and Saturn. When students are only exposed to linear models they come to have the misconception that planets are “all lined up” in a straight line. This lesson also provides a great opportunity to begin a discussion with your students of why we use models in science and some of their limitations.

Why This Works

After students have paced off the solar system, they know from experience that Saturn is very far away from the Sun and Earth. This experience, shared with their classmates, provides students with a common event and new vocabulary for writing. The lesson also asks students to identify a reader for their writing — another characteristic of authentic writing.

Short messages can contain very important scientific information. Below is a telegram sent to Albert Einstein by W. W. Campbell, head of Lick Observatory in California, providing information on observations in Australia made during a solar eclipse. The eclipse expedition’s observations were evidence of the bending of light by a gravitational field as predicted by Einstein’s general theory of relativity. This telegram from 1922 confirmed observations made by Arthur Eddington, an English physicist, on a 1919 African solar eclipse expedition. These observations marked an important change in our views about the structure of space-time.



Assessment

Use students' writing to assess what they have learned during this lesson. Their writing should contain at least one accurate description of distance. The writing should take on the formal conventions of a postcard, including a salutation, the date, a message and a signature. Entries in students' Science Notebooks will give additional information on what students are taking away from this lesson.

Standards

NCTE Standards for the English Language Arts

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

National Science Education Standards

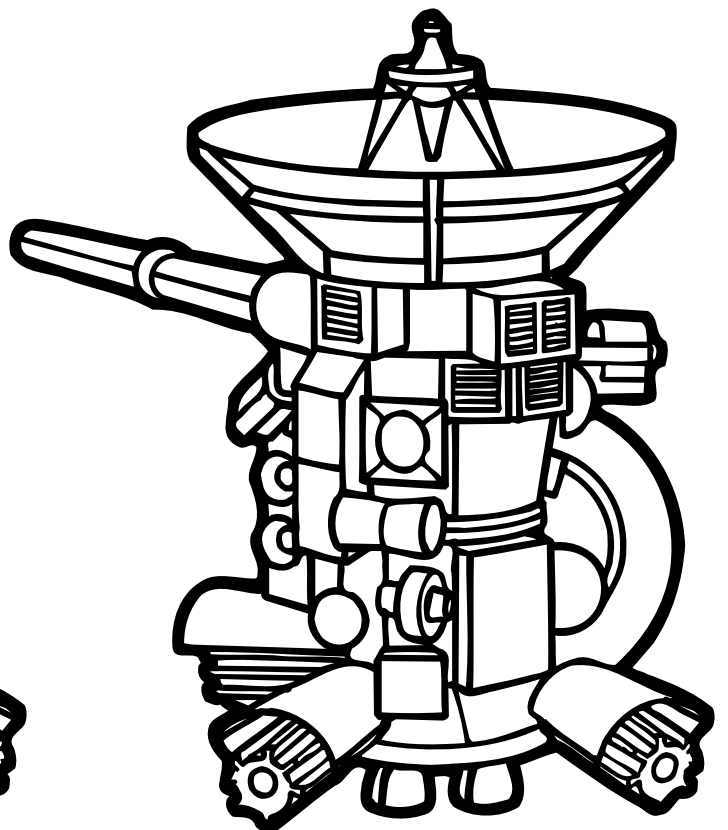
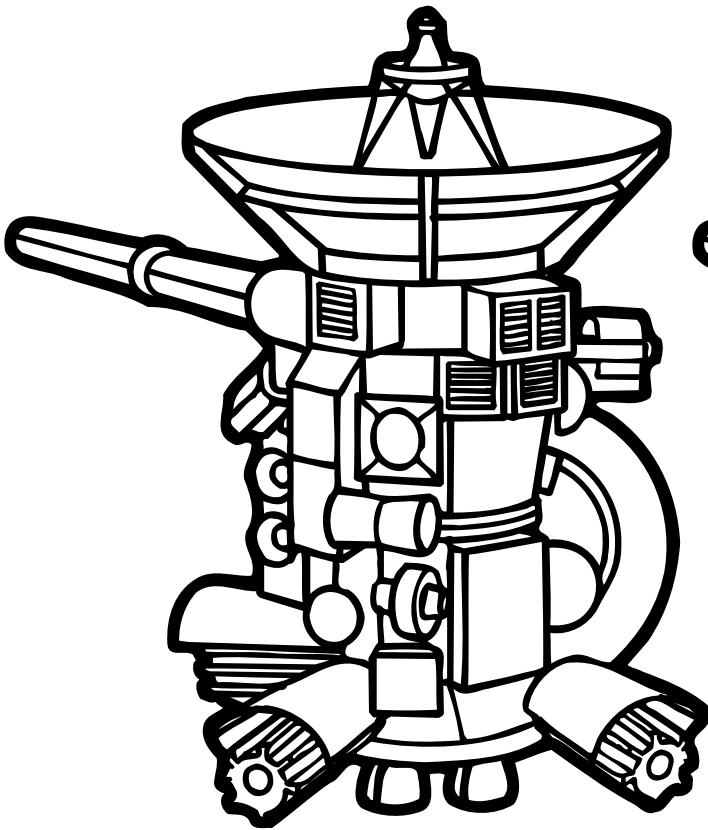
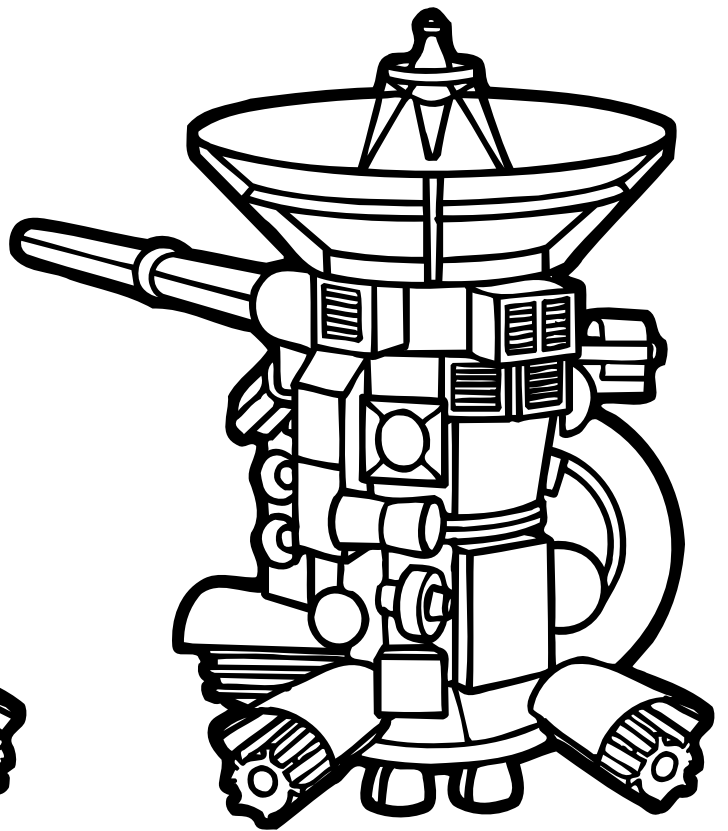
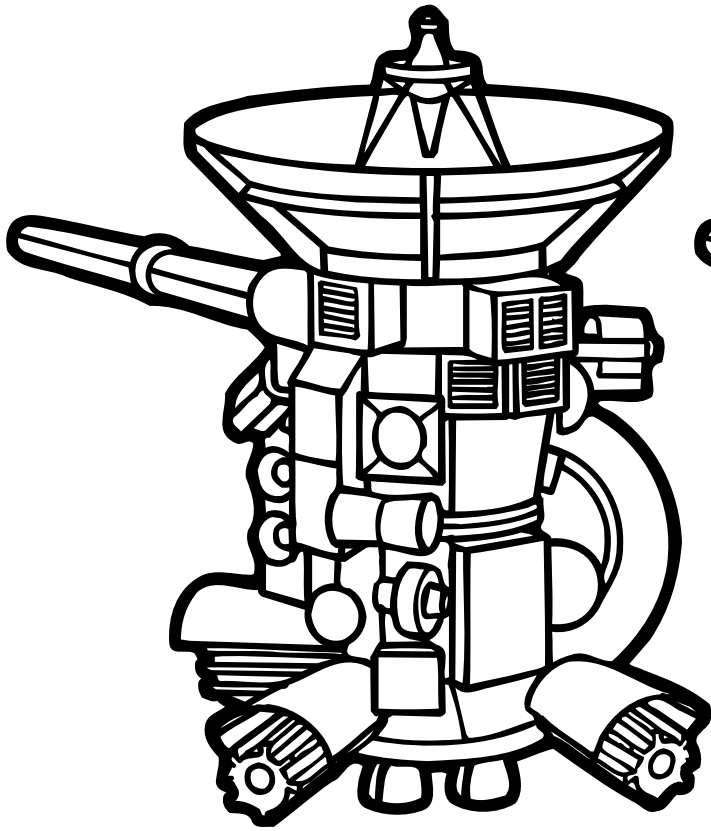
Physical Science

- Position and motion of objects

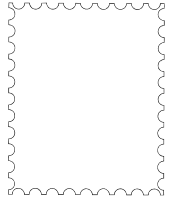
Earth and Space Sciences

- Objects in the sky





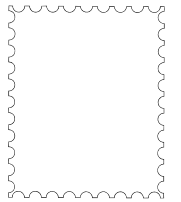
Handwriting practice lines consisting of 10 sets of three horizontal lines (top, dashed middle, bottom) for writing practice.



To

Handwriting practice lines consisting of 5 sets of three horizontal lines (top, dashed middle, bottom) for writing practice.

Handwriting practice lines consisting of 10 sets of three horizontal lines (top, dashed middle, bottom) for writing practice.

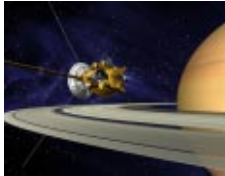


To

Handwriting practice lines consisting of 5 sets of three horizontal lines (top, dashed middle, bottom) for writing practice.

My Spacecraft Model

An illustration of Cassini at Saturn.



LESSON TIME
May be carried out over two days. There are four activities; total time 2 hours.

PREPARATION TIME
30 minutes

- MATERIALS CHECKLIST**
- Miniature marshmallows, 30 per student
 - Round toothpicks, 30 per student
 - Sandwich bags, 1 per student
 - Copies of “Cassini Spacecraft Design” and “Cassini Spacecraft Design Review Summary” worksheets
 - Science Notebooks

STUDENT PREREQUISITES
No prerequisites are required, but students need some background information to understand the Cassini spacecraft challenges — see Procedure, Day One, first part.

LESSON NO. 5

Language Arts Focus — Written Reporting and Oral Peer Presentations
Science Focus — Planning, Building, and Explaining a Spacecraft Model

OVERVIEW

Students will engage in basic problem-solving as they design and construct their own small model of a spacecraft. Through writing and illustration, students will document their work and will complete a Design Review Summary. Like scientists and engineers, students will make presentations to show and explain their models and design summaries to their peers.

BACKGROUND

Scientists and engineers developing and designing the Cassini spacecraft faced a number of complex and challenging issues. The spacecraft has many unique requirements.

Cassini has to:

- Hold all the fuel and equipment required for extended space travel
- Be durable for long-term space travel
- Be small enough to maintain the speed needed to travel a long distance quickly
- Have enough power to run all the equipment for at least 10 years

This hands-on activity introduces students to basics of the design process. The following website details the requirements of the Cassini spacecraft in terms that young students can follow:

<http://eis.jpl.nasa.gov/~skientz/cassini/spacecraft.html>

Other ideas for building models of the Cassini spacecraft can be found at:

<http://saturn.jpl.nasa.gov/kids/activities.cfm>

Objectives

Students will:

1. Design spacecraft models.
2. Learn that design is an iterative process.
3. Build spacecraft models based on their designs.
4. Document their designs using scientific labels.
5. Practice communication skills as they make a presentation to their peers.



Teacher Preparation

Prepare material for model building and collect materials for writing activities. You will need enough miniature marshmallows and enough round toothpicks so that each student gets 30 of each item. Make a copy for each student of the “Cassini Spacecraft Design” worksheet and “Spacecraft Design Review Summary” worksheet.

Procedure

Day One

Introduction to Saturn and the Cassini–Huygens mission — 20 minutes

1. Background knowledge about Saturn and the Cassini–Huygens mission is needed so that students understand the problems of size, distance, and durability that need to be overcome so the spacecraft can complete its voyage to Saturn.
2. The following are good sources for background information on Saturn and the mission for classroom read-alouds:
 - *Saturn: The Sixth Planet* by Michael D. Cole
 - *Saturn* by Elaine Landau
3. The website <http://eis.jpl.nasa.gov/~skientz/cassini/spacecraft.html> provides a good introduction to the spacecraft.

Planning and Starting the Model — 40 minutes

1. Explain to students that they will be designing and building a spacecraft model.
2. Tell students that they will each receive 30 marshmallows and 30 toothpicks for model building.
3. Explain that they will need to do some planning before starting to build the model.
4. Remind students that their spacecraft should be:
 - Lightweight and small
 - Able to carry enough fuel for the mission as well as equipment for collecting new information
5. Explain that students will make three “planning” designs, but will have to decide on one final design.
6. Explain that they will receive a spacecraft design worksheet that contains space for drawing and labeling their designs. Model how to draw a simple design.
7. Explain to students that the drawings will help them construct the model. Model putting together some of the basic parts of your spacecraft. Be sure to remind students not to use your design, but to create a design of their very own!
8. Distribute a “Cassini Spacecraft Design” worksheet to each student.

teacher

TIP

Some students may need a little help from you in order to get started with this activity; other students will do the designing with ease. Some students will not be developmentally ready to construct in three dimensions. Encourage those students to construct their models in two dimensions. Either format works!



9. When each student has illustrated what he/she wants to construct, distribute marshmallows and toothpicks for model building. You may want to “approve” each design before they begin.
10. To keep materials organized, ask students to put their worksheets together and place their models on top of the worksheet in an undisturbed area of the classroom. The models should remain out for another day to completely air dry.

Day Two

Completing and Documenting the Final Design — 15 minutes

1. Have students gather their worksheets and models together.
2. Distribute the “**Cassini Spacecraft Design Review Summary**” worksheet.
3. Explain to students that they will draw and label their finished spacecraft.
4. Have students complete their drawings and answer the questions on the bottom of the worksheet.

Peer Reporting — 45 minutes

1. Each student will make an oral presentation to show and explain his/her final drawings.
2. Begin the presentations by asking each student to explain how their model works and what they like best about their model.
3. Encourage students to ask questions of the presenters. To prompt student-generated questions, you may begin the discussion with some of the following questions:
 - a. What was the hardest part of designing your model?
 - b. What was the hardest part of building your model?
 - c. What are the parts of your model called? What do they do?
 - d. Why did you choose this version of your design to be your final model?
 - e. Would you change anything?
 - f. Does your model have a name?
4. When finished, students can display their models in the classroom and add their worksheets to their portfolios.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus question: What makes your spacecraft model a good model?
2. Process questions: What did you do to build your model? What did your classmates think of your model? Do you agree with them?



Why This Works

This hands-on activity provides students with an opportunity to experience some of the challenges that engineers and scientists encounter when working on space missions. Teachers who have done this activity reported that their students were so engrossed in their work that the classroom was silent for 20 to 30 minutes — that's concentration!

This activity not only allows students to create their own designs and give them a concrete presence in the classroom, but it gives them an important opportunity to share their work with their peers. Peer presentations, in which students show their models and explain how they arrived at their model designs, encourages higher-level thinking and increased learning. Teachers reported that young students enjoyed naming their designs and relished the opportunity to tell others how they worked.

Lastly, students learn that modification is an important step in the process of making a final product. In this lesson, students make multiple versions of their final plans — an iterative thought process that also serves students in language arts as they work through multiple drafts before finalizing their writing.

Assessment

The students' oral presentations, spacecraft designs, and writing will allow you to assess their work. Their oral explanations and drawings will show how well the students completed the tasks. Entries in students' Science Notebooks will also help you to evaluate their learning.

Standards

NCTE Standards for the English Language Arts

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).



National Science and Mathematics Education Standards

Earth and Space Sciences

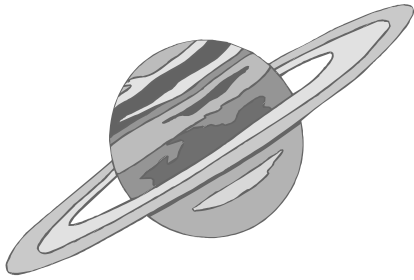
- Objects in the sky

ITEA National Technology Standards

Students will develop an understanding of design. This includes knowing about:

- The attributes of design
- The role of troubleshooting, invention, innovation, and experimentation in problem solving





Cassini Spacecraft Design Worksheet

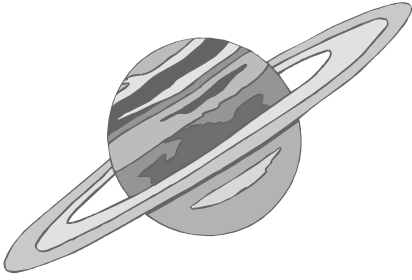
Name _____

1. First Idea

2. Second Idea

3. Third Idea

4. Final Plan



Cassini Spacecraft Design Review Summary

Name _____

Draw your finished spacecraft.

1. What is the name of your spacecraft? _____

2. What was the easiest part of building your spacecraft?

3. What was the hardest part of building your spacecraft?

4. What changes did you make?

Earth to Saturn, Earth to Saturn!

Saturn's rings cast a shadow on the planet.



LESSON TIME

May be carried out over two days; total time approximately 1 hour.

PREPARATION TIME

Allow time to collect materials and make copies.

MATERIALS CHECKLIST

- Board, easel, or transparency; markers
- Optional: a peppercorn and a ping-pong ball (or walnut)
- Pencils and crayons
- Copies of worksheets: "Earth and Saturn Drawing," "Brainstorming," "Cloze," "Independent Writing"
- Science Notebooks

STUDENT PREREQUISITES

Students need to have done some reading and discussion of Saturn, and they should be able to write independently or with minimal teacher support.

LESSON NO. 6

Language Arts Focus — Descriptive Analogies

Science Focus — Understanding the Attributes of Earth and Saturn

OVERVIEW

This lesson should be done toward the second half of the activities in this unit. In this activity, students use drawing and writing to explore the comparative features of Saturn and Earth. To scaffold student writing, the lesson includes a drawing activity, a brainstorming activity, a structured Cloze activity, and a chance for independent writing where students create their own analogies.

BACKGROUND

Our solar system is populated by a rich variety of wonderfully different objects. Just think how different our own blue planet and Saturn are from one another! Viewed from space, Earth has striking green and brown landforms surrounded by blue oceans and is covered by white clouds. Saturn, in contrast, appears muted, with storm-induced, yellowish striations and spectacular rings and moons. For more information on Earth and Saturn, visit:

<http://www.solarsystem.nasa.gov/index.cfm>

Objectives

Students will:

1. Learn that Saturn and Earth differ in many ways.
2. Practice a variety of writing strategies to create comparative analogies.
3. Use analogies to describe the characteristics of Saturn and Earth.

Teacher Preparation

Make copies, one per student, of the four worksheets, "Earth and Saturn Drawing," "Brainstorming," "Cloze," and "Independent Writing." You may wish to make transparencies of these worksheets for modeling. The optional peppercorn and ping-pong ball (or walnut) may be used as analogies for Earth and Saturn, respectively.



Procedure

Day One

Exploring Attributes of Earth and Saturn — 30 minutes

1. Begin with a whole-class discussion of what students know about Earth, Saturn, and our solar system.
2. Distribute an “Earth and Saturn Drawing” worksheet and crayons to each student.
3. Ask students to illustrate the Earth on the left half of the worksheet. Encourage them to draw green or brown land and blue water, and include other details they know about Earth.
4. Ask students to illustrate Saturn on the right half of the worksheet. Demonstrate how to draw Saturn’s rings to show them going behind the planet. This may be challenging for young children to draw. Encourage students to draw Saturn’s stormy atmosphere marked by beige and brown streaks.
5. After their illustrations are complete, distribute a “Brainstorming” worksheet to each student.
6. Point out to students that one side of the worksheet has a small circle and the other a large circle. Ask them: Which one is Earth? Which one is Saturn? Have them write “Earth” over the small circle and “Saturn” over the large circle.
7. Begin a class discussion by asking students to describe Earth and Saturn and their differences. Students can look at the “Earth and Saturn Drawing” worksheets that they have just completed for ideas about differences.
8. List students’ comments on the board, easel, or transparency. Your list might look something like this:

<u>Earth</u>	<u>Saturn</u>
small	huge
very tiny	enormous
no rings	many rings
ice cubes	icy rings
has people	no people
one moon	many moons

9. Ask students to list their own contrasting “Earth” and “Saturn” words in the two columns on their “Brainstorming” worksheets. Encourage students to use the list on the board as a reference.
10. Collect both worksheets for follow-up activity.



Day Two

Structured and Independent Writing — 20 to 30 minutes

1. Return worksheets to students and do a short review of vocabulary by asking students for pairs of words from their “Brainstorming” worksheets.
2. Using one of their contrasting word pairs, model how to complete the sentences on the “Cloze” worksheet. You might write something like:
“The Earth is very tiny and Saturn is enormous.”
3. Distribute the “Cloze” worksheet and have students write four analogies. The worksheet serves as writing support and practice before students write independently.
4. Distribute the “Independent Writing” worksheet and ask them to write four analogies on their own.
5. Students’ writing on the lined paper may serve as a first draft or a final copy.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: How is Earth different from Saturn? What makes Saturn special to you?
2. Process questions: What did you do to think about the differences between Earth and Saturn?

Why This Works

When introducing new information and concepts to young students, it’s effective to link new information to something known. In this case, we take something we encounter every day and already know a lot about — our Earth — and see how it compares to Saturn.

By creating descriptive analogies, students can hone their reasoning skills, develop critical thinking, understand relationships and learn new vocabulary. Practice with analogies can also help prepare students for test-taking as many types of analogies appear on standardized tests.

Assessment

Students’ worksheets will indicate the extent to which they can differentiate between Earth and Saturn and create analogies to describe them. Their Science Notebooks will also show their thinking about the two planets.



Standards

NCTE Standards for the English Language Arts

- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Physical Science

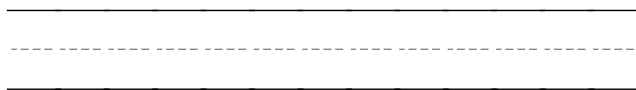
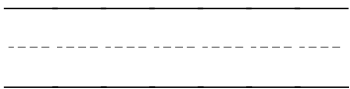
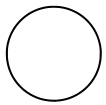
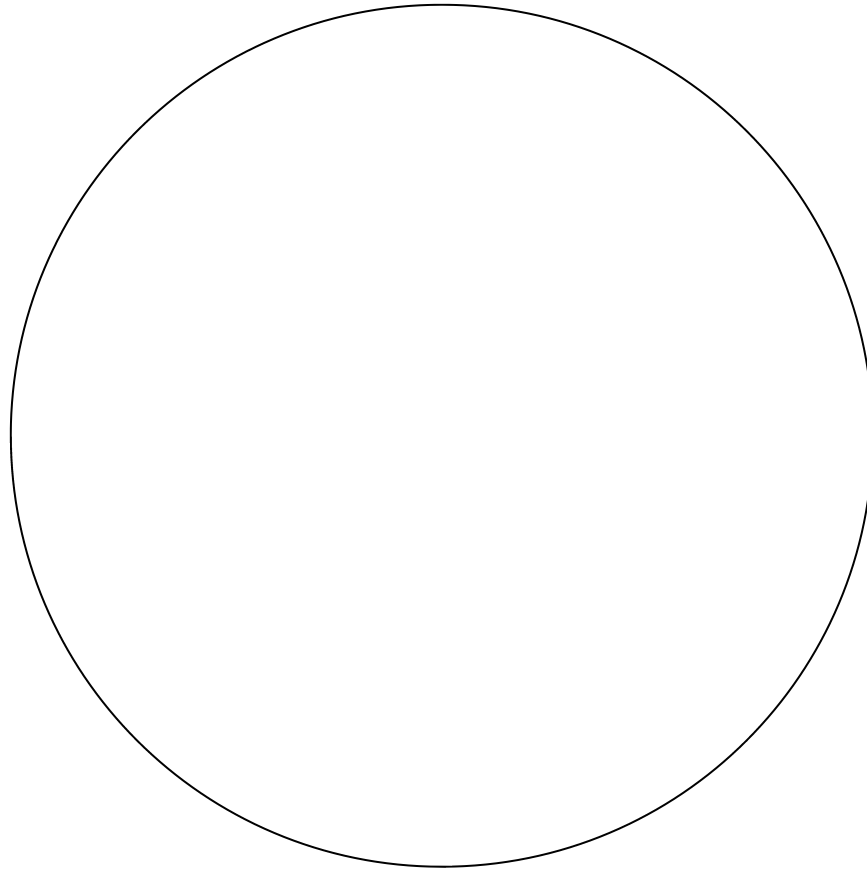
- Position and motion of objects

Earth and Space Sciences

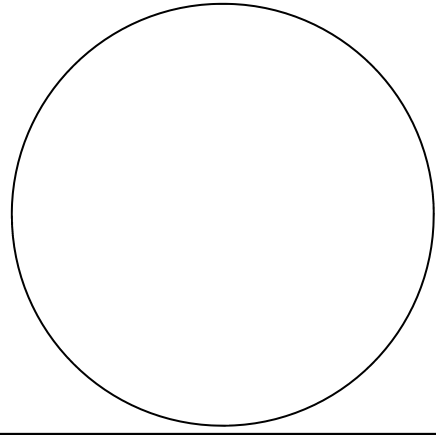
- Objects in the sky



Name _____



Name _____



Name

Date

1. If Earth is _____ then Saturn
is _____

2. The Earth is _____ and Saturn
is _____

3. The Earth has _____ but Saturn
has _____

4. The Earth is _____ to the Sun
and Saturn is _____ from the Sun.

Name

Date

1.

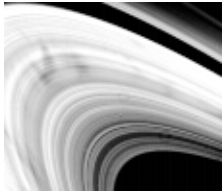
2.

3.

4.

Rotating Rings of Ice

Saturn's rings have intriguing features.



LESSON TIME

May be carried out over two or three days. Activities are 20 to 30 minutes in duration

PREPARATION TIME

30 minutes

MATERIALS CHECKLIST

- *Black construction paper (9 x 12)*
- *7-inch paper plates*
- *Glue and scissors*
- *Black markers*
- *Styrofoam balls*
- *Vermiculite*
- *Copies of "Saturn Paragraph Graphic Organizer" for students*
- *Writing paper; pencils*
- *Science Notebooks*

STUDENT PREREQUISITES

Students should have some familiarity with Saturn and its rings.

LESSON NO. 7

Language Arts Focus — Drafting and Writing a Paragraph

Science Focus — Modeling Saturn's Icy Ring System

OVERVIEW

In this lesson, students take a closer look at the rings of Saturn. Each student will create a three-dimensional model of Saturn and its rings. The model will show the particle nature and structure of the rings. Students also write about the model in this lesson. With the aid of a graphic organizer, students organize their thoughts, then draft and write a paragraph to explain what they know about the ring system.

BACKGROUND

People have been looking at Saturn for a very long time. It is visible to the naked eye as a bright object in the night sky. The ancient Romans named the planet after their god of agriculture. But it wasn't until 1610 that anyone actually saw Saturn's rings. That's when Galileo looked at the planet through one of the world's first telescopes. His telescope wasn't powerful enough to show the rings clearly, and Galileo mistakenly thought he was looking at a triple planet. In 1655, a Dutch astronomer named Christiaan Huygens looked at Saturn through a more powerful telescope and observed that the planet was surrounded by a giant flat ring. Saturn's rings have become one of the great, enduring mysteries of our solar system. Though we know considerably more about the rings since Huygens observed Saturn, there is still much to learn.

Objectives

Students will:

1. Create a three-dimensional model of Saturn and its rings.
2. Show that the rings are made of particles of varying sizes.
3. Indicate the Cassini Division between the A and B rings.
4. Learn that the rings revolve around Saturn in a counterclockwise fashion as seen from above Saturn's north pole.
5. Use a graphic organizer as a pre-writing tool.
6. Draft and write a short paragraph describing the rings of Saturn.



Teacher Preparation

Make copies, one per student, of the “Saturn Paragraph Graphic Organizer” worksheet. You may wish to make a transparency of the worksheet for modeling. Print out a copy of the “Graphic Organizer Summary” (see page 6) for yourself to use to structure the class discussion of how to extend students’ ideas on their graphic organizers into complete sentences for a paragraph. Gather materials, enough so that each student will receive one piece of 9 x 12 black construction paper, one 7-inch paper plate, writing paper, plus pencils, markers, glue, and scissors. Allow one 2-1/4-inch Styrofoam ball for each student; allow some time to cut the balls in half — each student will receive two halves. For one part of the lesson, you will be recording student responses on chalkboard, whiteboard, or chart paper. This lesson provides teacher information on the rings that can be adapted for classroom use as a handout or for teacher use as a transparency — “The Structure of Saturn’s Rings” (see page 7). For more information on Saturn and its rings, visit the Cassini–Huygens website at: <http://saturn.jpl.nasa.gov>

Procedure

Allow 40 minutes for model building and 30 minutes for writing. If you intend to have students write a final version, you may wish to extend the activity to a third day.

Day One

Starting the Model — 20 minutes

1. Distribute one 7-inch paper plate to each student. Explain to students that they will be building a three-dimensional model of Saturn and its rings.
2. Show students how to locate the raised inner portion of the paper plate and ask students to cut along its outer edge — they will end up with a circle about 4 inches across.
3. Ask students what is located between the A ring and the B ring of Saturn. If they do not know, explain that it is the Cassini Division and remind them to leave a gap in the rings.
4. Ask students to mark the Cassini Division by drawing a dark ring, using their black markers, about 1-1/2 inches from the center of the plate.
5. Distribute two halves of a Styrofoam ball to each student. Explain that the ball will represent Saturn in the model.
6. Have students glue one half of the ball to each side of the paper plate circle, placing the ball in the center of the circle.
7. Let the models dry before the completion phase.

Day Two

Completing the Model — 20 minutes

1. Return the models to the students. Engage students in a discussion and a series of questions to tap into their background knowledge of the Saturn and its rings. Some questions to frame your discussion might include:



- What orbits Saturn?
 - What do the rings look like from Earth?
 - How many rings are there?
 - How would you describe the rings?
 - What do you think they are they made of?
 - Is there something on Earth that reminds you of the rings?
 - Why do you think they are around Saturn?
2. After your discussion, explain to students that they will be adding Saturn's rings to complete their models.
 3. Model for students how to make several concentric rings of glue on the paper plate. Place your first ring about 1/2 inch from the edge of the ball. Remind students to keep the dark circle marking the Cassini Division free of glue!
 4. While the glue is still wet, have the students liberally sprinkle their paper plates with vermiculite. Remove the excess vermiculite and allow the model to dry.
 5. To demonstrate the orbiting rings, place the model on a table top and give it a quick counterclockwise turn. Ask students a few questions to encourage thinking about the model:
 - What do you see when the model is turned quickly?
 - What do the rings look like when the model is spinning?
 - Do the rings look solid or like individual pieces of ice?

With this model students can see for themselves that if particles orbit quickly enough, they do, in fact, look solid!

Writing about Saturn's Rings — 30 minutes

1. Explain to students that they will be writing about Saturn and its rings.
2. Have students form pairs and brainstorm about Saturn and its icy rings. After their brainstorming, ask students for some of their ideas and record them on chart paper or the board.
3. Show students a copy of the “**Saturn Paragraph Graphic Organizer**” worksheet and explain its three sections. Model how to use it to organize some of the ideas students have generated in their brainstorming. You might want to use an overhead projector to make it easier for students to follow along.
4. Examples of ideas you might note on your example:
 - Main idea: Saturn has rings.
 - Three supporting ideas:
 1. Rings — frozen water
 2. Some small, some big chunks of ice
 3. Gaps — Cassini Division
 - Conclusion: Saturn is a special planet.



teacher
TIP

Make sure you have a large container to catch the excess bits and pieces of vermiculite!

- Distribute a “Saturn Paragraph Graphic Organizer” to each student and have the students complete their copies with their own ideas.
- After students have completed their “Saturn Paragraph Graphic Organizer,” model how to extend the ideas on your example organizer into complete sentences for a paragraph. You may find the “[Graphic Organizer Summary](#)” (see page 6) useful as you structure the discussion.

Example of possible paragraph:

Saturn has rings of ice. Saturn is cold and its rings are chunks of frozen water. Some of the chunks are small and some are big. The rings have many gaps. The biggest one is the Cassini Division. Rings make Saturn a special planet.

- Using the ideas in their organizers, have students write a first draft of their paragraphs. (You may have to give them a third day to rewrite paragraphs in final form for publication.)
- Students’ writing can be added to their portfolios or displayed in the classroom with their models.

Using Science Notebooks

Writing prompts for this lesson:

- Focus question: What do you know about Saturn’s rings and what do you think they are made of?
- Process question: How did your model change when you gave it a spin?

Why This Works

Through this activity, students can bring Saturn — a very, very distant object — into their own classrooms. The experience of manipulating a tangible object, in this case a small model, can help students grasp new information. With the help of the Saturn model, students can observe the particle nature of the ring system. The model not only gives them “first-hand” experience of the orbiting rings, but it also provides an experience that can serve as the basis for their writing. The graphic organizer included in this lesson is a useful writing tool that supports students as they sort out their ideas in preparation for writing a paragraph. For beginning writers, graphic organizers have been found to be an essential tool for internalizing new information. They also allow students to sequentially organize their ideas and their subsequent writing.

Assessment

Students’ models and writing (in their paragraphs and Science Notebooks) will reflect what they have learned about the nature of Saturn’s rings. The model should show multiple rings and a gap indicating the Cassini Division. Student writing should include accurate capitalization and punctuation. The paragraph should include a main idea, two to three supporting sentences, and a brief conclusion.



Standards

NCTE Standards for the English Language Arts

- Students read a wide variety of print and nonprint texts to build an understanding of texts, of themselves, and the world.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning for enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



Graphic Organizer Summary

1	TOPIC SENTENCE - MAIN IDEA : What you plan to prove or explain (can be the focus question of the lesson turned into a statement)
2	DETAIL / FACT / CLAIM Data/information to back up your detail/fact/claim: What is your evidence?
3	DETAIL / FACT / CLAIM Data/information to back up your detail/fact/claim: What is your evidence?
4	DETAIL / FACT / CLAIM Data/information to back up your detail/fact/claim: What is your evidence?
5	CONCLUSION Restate your position, use synonyms, remind reader of your topic, convince your audience or challenge them to think about or apply what you have written. You might even share a new question.



The Structure of Saturn's Rings

Saturn's beautiful rings have been photographed through Earth-based telescopes, but because Saturn is so distant, details of both the planet and the rings have been difficult to see. Cassini–Huygens will be the fourth robotic spacecraft to visit and photograph Saturn close up. The first was Pioneer 11 in 1979. Pioneer 11's view of Saturn was about 50,000 times closer than any Earth-based telescope could see. When the two Voyager spacecraft flew by Saturn during the 1980s, they took many photographs and beamed them to Earth, and human beings were finally able to see some of the most subtle colors and structure in the rings. The Hubble Space Telescope, observing distant objects from Earth orbit, has also taken a number of photographs of the famous ringed planet.

Yet the rings still hold many mysteries. Some of the questions that scientists working on the Cassini–Huygens mission to Saturn hope to answer about the rings are:

- How do the ring particles interact with each other?
- Are there more moons hidden in the rings?
- How old are the rings?
- What is their source?
- What is the composition of the rings?

While Saturn is not the only planet in our solar system with rings, it is certainly the planet that is most famous for its rings. It is worth noting that Saturn's rings are compositionally unique in the solar system. While the rings of the outer planets Jupiter, Neptune, and Uranus are made primarily of dust grains or other dark material, Saturn's rings are mostly water ice. For more information on Saturn's ring system, visit:

<http://saturn.jpl.nasa.gov/science/rings.cfm>

<http://www.jpl.nasa.gov/saturn/back.html>

http://www.windows.ucar.edu/tour/link=/saturn/saturn_rings.html&edu=elem
(for young readers)

When you first look at Saturn, you might be tempted to think there are only two rings around the planet. But this is not so — in fact, there are many, many rings orbiting Saturn. Viewing Saturn from Earth, we can see that the ring system is divided into several radial zones and each of the zones is made up of many rings.

Scientists named the rings using a system of letters. Seven ring zones have been identified, beginning with the A ring and ending with the G ring. The order of rings from inner to outer is D, C, B, A, F, G, E. (The rings are not located in alphabetical order outward from the planet because they were named in order of their discovery.) An outer “zone” of rings, which is visible to Earth observers, is referred to as the A ring and the brighter inner zone is known as the B ring. The gap between the two zones (B and A) is named the Cassini Division. If viewing conditions are just right, observers on Earth can also see the C ring — an inner, semitransparent ring.



Beyond the A, B, and C rings, Saturn has several other distinct rings: the D, F, and G rings. These last three rings were all detected in images taken by the Pioneer and Voyager spacecraft as they flew past Saturn.

The distance between the rings is not constant. Some rings are relatively close together, like the rings making up the A and B rings. Others have quite a bit of space between them, like the rings that make up the C ring.

The rings of Saturn are very wide and they have differing diameters. The A ring — the outer zone of the main rings — has a diameter of about 273,000 kilometers (nearly 170,000 miles). The E ring has a diameter of about 965,000 kilometers (nearly 600,000 miles). To appreciate the size of Saturn’s rings, consider that the A ring would fit quite nicely into the space between Earth and our Moon.

The rings are wide, but not very thick — scientists estimate the A and B rings to be between 100 meters (300 feet) and 10 meters (30 feet) in thickness. Even though the rings are very thin, we can see them from Earth because of the Sun’s light reflecting off the particles of ice that make up the rings.

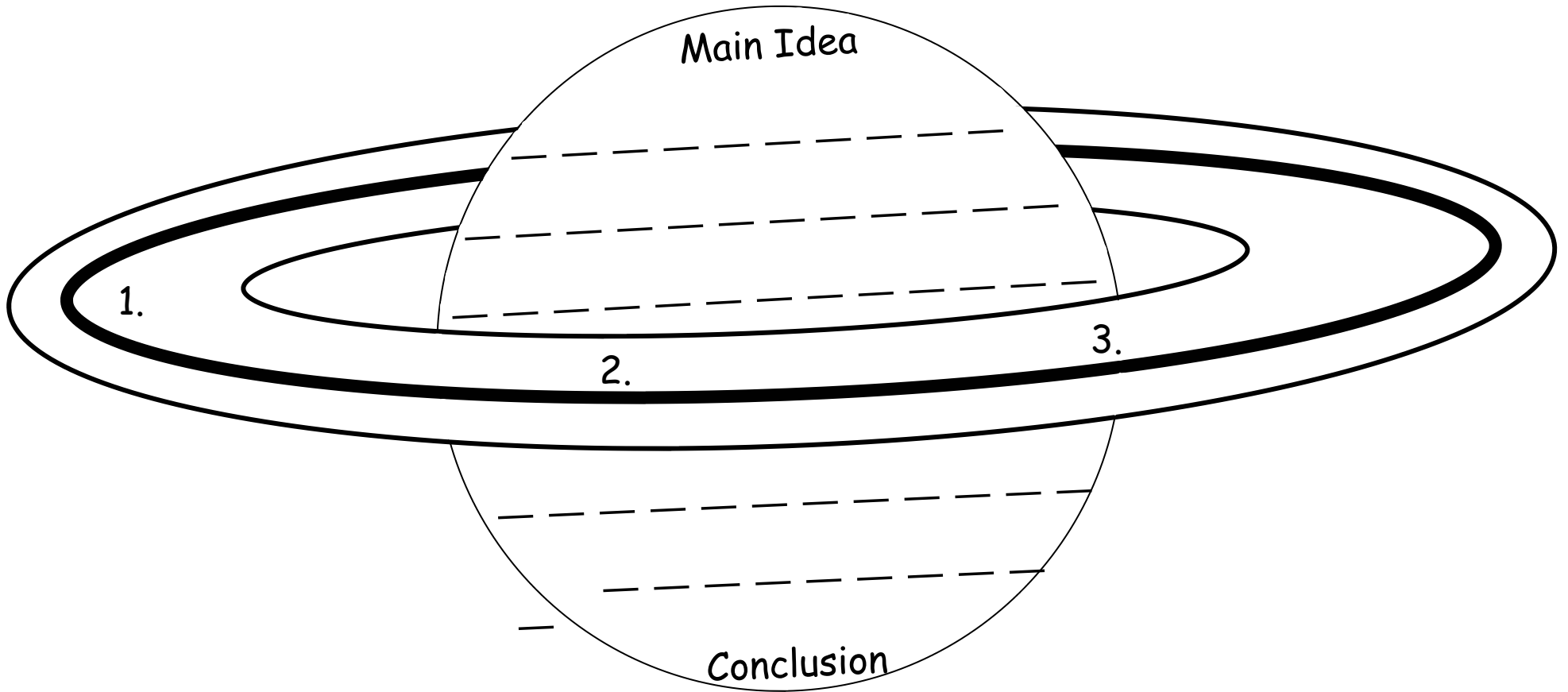
Seen up close by Cassini, the rings may be even more surprising. The particles that make up the rings vary in size from as small as a few micrometers to a few meters in size. The rings are mainly water ice. Some scientists have described the particles that make up the rings as icy snowballs. One of the questions scientists hope to answer is: What are the rings made of?

The structure of the rings is also interesting. From Voyager we learned that the thin F ring has a number of strands that appear to be intertwined and “braided” in some places and “kinked” in others. Some rings even contain small moons. Surely, the Cassini–Huygens mission will also discover new and unexpected information about the mysterious rings!



Saturn Paragraph Graphic Organizer

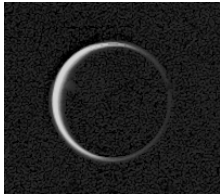
by _____



Write your main idea on the top side of Saturn on the dotted lines. Write three details about Saturn in the rings. Write your conclusion idea on the bottom side of Saturn on the dotted lines. Use this organizer to write your paragraph.

Titan and the Other Moons of Saturn

Titan's thick, opaque atmosphere obscures the surface.



LESSON TIME

May be carried out over two days; total time 90 minutes.

PREPARATION TIME

Allow time to make copies and collect materials.

MATERIALS CHECKLIST

For the teacher:

- “Saturn’s Moons” chart (transparency or copy)

For each student:

- A copy of the moon illustrations
- Scissors; glue; writing paper; pencil
- One piece of 12 x 18 inch construction paper
- Science Notebooks

STUDENT PREREQUISITES

Students should have some basic background information about Saturn’s moons.

LESSON NO. 8

*Language Arts Focus — Descriptive Scientific Language
Science Focus — Sorting by Scientific Characteristics*

OVERVIEW

In this lesson, students learn that Saturn has many moons and that the Cassini–Huygens mission may discover even more moons. Students will examine and sort through images of Saturn’s varied moons to see characteristics they share and those which set them apart. Students will write a paragraph about Saturn’s moons and explain how they sorted them.

BACKGROUND

Saturn has 18 named moons and we know of a total of 31 moons at last count. Titan was the first moon to be discovered — that’s not surprising, since it is the largest of Saturn’s moons. Most of Saturn’s smaller moons were discovered by the two Voyager spacecraft during the 1980–1981 flybys. It is exciting to think about other moons that the Cassini–Huygens mission may discover. The icy moons of Saturn are indeed an interesting and very diverse set of orbiting satellites. See the “Saturn’s Moons” chart for an overview of their various characteristics (the chart can be adapted for students).

For more information on Titan and Saturn’s other moons see:

<http://saturn.jpl.nasa.gov/science/titan.cfm>

<http://saturn.jpl.nasa.gov/science/icy-satellites.cfm>

Objectives

Students will:

1. Learn that the moons of Saturn are diverse.
2. Learn that the moons have identifiable characteristics.
3. Learn that Saturn’s moons, like our Moon, reflect light.
4. Sort and classify Saturn’s moons by their characteristics.
5. Write a paragraph describing the moons’ characteristics and explaining the basis for how the moons were sorted.



Teacher Preparation

Make a copy, for each student, of the moon illustrations (18 moons, two pages). Gather other materials needed for each student — construction paper can be any color. Make a photocopy, or a transparency, of the “Saturn’s Moons” chart (two pages) for discussion. Optional: you may wish to make copies of this chart for the students; there is a column for new information that Cassini–Huygens may discover about the moons.

teacher

TIP

The book “Saturn” by Elaine Landau is an excellent resource for understanding Saturn’s moons.

Procedure

Day One

Building Background Information — 45 minutes

1. Students will need some background information about the moons of Saturn.
2. Use the “Saturn’s Moons” chart to guide your discussion. Recommended for enriching background information is the book *Saturn* by Elaine Landau.
3. During your discussions, highlight the following:
 - Saturn is so far away from Earth that seeing and studying its moons is very difficult.
 - Scientists hope to learn many new things about the moons during the Cassini–Huygens mission.
 - The moons of Saturn have various sizes, shapes, colors, surfaces, and orbital patterns.
 - Titan is the largest of Saturn’s moons and has a very complex atmosphere.
 - The Huygens probe will be dropped into the atmosphere of Titan to get information about this large moon and will send exciting science results back to Earth.
3. Show the moon illustrations to your students as you introduce the moons’ diverse attributes — their varied shapes, sizes, surfaces, and colors. Write on the board any descriptive words that you and your students generate in your class discussions. If you have created a Saturn Word Wall, be sure to add these new words.
4. Distribute a set of moon illustrations to each student. Discuss each moon, asking students to describe what they see. Allow students time to color the moons as you discuss them. Use the “Saturn’s Moons” chart as your guide for discussion.
5. Have students write their names on their illustrations; collect for the follow-up sorting activity.

Day Two

Sorting Moons by Attribution and Writing — 45 minutes

1. Return their moon illustrations to the students.
2. Have students cut the illustrations apart into individual “moon cards.” They should have 18 separate cards, each one illustrating a moon.



3. Ask students to sort their moon cards according to the moons' different attributes. Give students the opportunity to sort the moons several times, using different criteria. For example, the moons might be sorted by shape (spherical and irregular), color (white, orange, etc.), or type (shepherding, co-orbital, etc.). Encourage students to come up with their own ideas for sorting.
4. When students are finished, ask them to pick their favorite "sort." Give each student a piece of 12 x 18 inch construction paper and have them glue the sorted moons onto their construction paper. They should glue the moons just as they were sorted.
5. After they have completed gluing down their moon cards, have students write a descriptive paragraph explaining how they sorted their moons. Be sure to have them include the categories they generated for sorting as well as a brief explanation about the reasons for sorting the moons as they did. Encourage the use of the descriptive language generated during earlier classroom discussions.
6. Take some time to have students share their ideas about their sorting. Students should be able to explain to their peers how they sorted their moons, and recount why they chose that particular way to sort them.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus question: What are some of the differences among Saturn's moons?
2. Process question: How many ways did you sort the moons of Saturn? What were those ways?

Extension Activity

This lesson focuses on the 18 named moons of Saturn. Students can create a blank grid, based on the grid for the "Saturn's Moons" chart, which can be filled out as more moons are discovered and named. The chart contains a "new information" column that can be filled in as we learn more about the many moons of Saturn. Happy moon hunting!

Why This Works

One way to enhance student learning of new information is to provide them with an opportunity to "manipulate" that new information. Here manipulation takes the form of careful examination and sorting of images of Saturn's varied moons. Sorting activities of this kind require that students pay close attention to a variety of characteristics. They also help students develop the higher-level thinking skill of differentiating between common and unique characteristics.

Sorting and classifying are important scientific skills. As students select discrete data from a larger set, and then describe that selection process in their paragraphs, they are thinking and writing much like scientists do.



Assessment

Student sorting and classification will indicate how much they have learned in this lesson. Students' writing about their method of sorting and their description of how they have classified the moons will allow you to evaluate student learning.

Standards

NCTE Standards for the English Language Arts

- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



Saturn's Moons

Name	color	craters	shape	Atmosphere	Orbit type	New Information
Titan	orange	unknown	round	yes	Synchronous rotation*	
Mimas	gray	yes	round	no	Synchronous rotation*	
Enceladus	pure white	no	round	no	Synchronous rotation*	
Tethys	white	yes	round	no	Synchronous rotation*	
Dione	light brown	Yes	round	no	Synchronous rotation*	
Rhea	light brown	yes	round	no	Synchronous rotation*	
Iapetus	White/dkred	yes	round	no	Synchronous rotation*	
Atlas	unknown	unknown	irregular	no	Shepherding**	
Pandora	gray	yes	irregular	no	Shepherding**	
Prometheus	unknown	yes	irregular	no	Shepherding**	
Janus	gray	yes	irregular	no	Co-orbital***	
Epimetheus	gray	yes	irregular	no	Co-orbital***	
Calypso	gray	unknown	irregular	no	Lagrangian****	
Helene	unknown	yes	irregular	no	Lagrangian****	
Telesto	unknown	unknown	irregular	no	Lagrangian****	
Hyperion	light brown	yes	irregular	no	Chaotic*****	
Phoebe	Unknown	yes	round	no	Synchronous rotation*	
Pan	unknown	unknown	irregular	no	Embedded*****	

*Synchronous rotation - The orbiting body (moon) takes as long to rotate on its axis as it does to make one orbit and always keeps the same hemisphere pointed at the body it is orbiting.

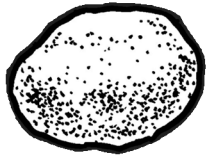
**Shepherding - Moons that orbit along side a ring. Their gravitational effects keep the edges of the rings sharp and distinct. If the shepherding moons were not present, the ring material would have a tendency to spread out.

***Co-orbital - Moons that share, or nearly share the same orbit.

****Lagrangian - Lagrangian moons orbit in the Lagrangian points of larger moons. These are locations within an object's orbit in which a less massive body can move in an identical stable orbit.

*****Chaotic - The moon, Hyperion, tumbles around at random in its orbit, never repeating its orbit exactly. Hyperion is a moon of Saturn that is tugged by the gravitational pull of both Saturn and another moon, Titan. Because of this gravitational pull, Hyperion changes both its rotational speed and its axis of rotation.

*****Embedded - Pan, a small moon, is embedded in the A ring and helps to clear the Encke division of particles.



Pan



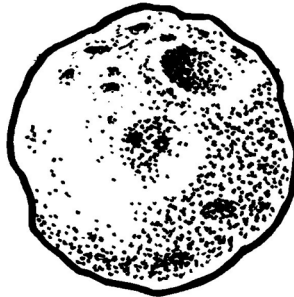
Atlas



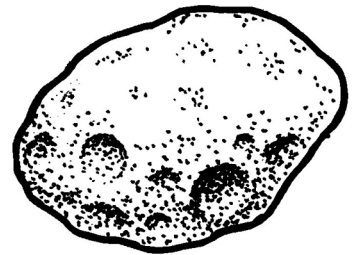
Prometheus



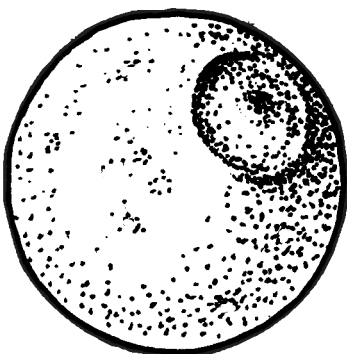
Pandora



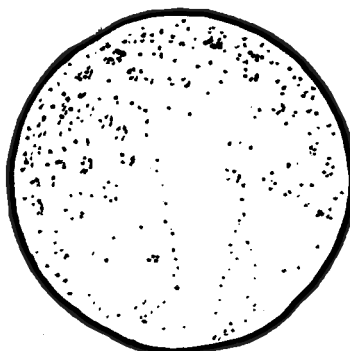
Epimetheus



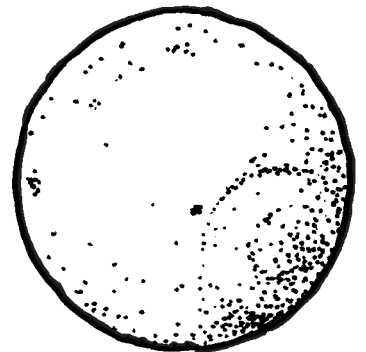
Janus



Mimas



Enceladus



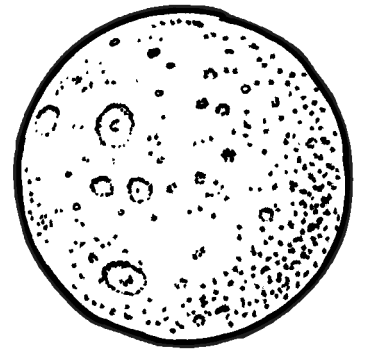
Tethys



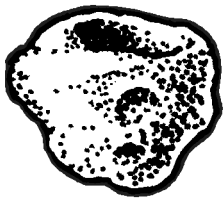
Telesto



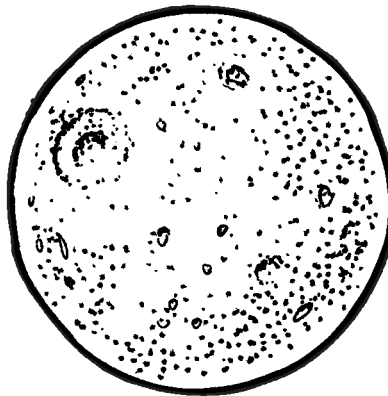
Calypso



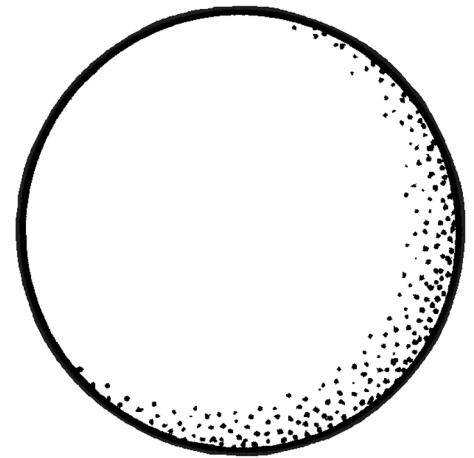
Dione



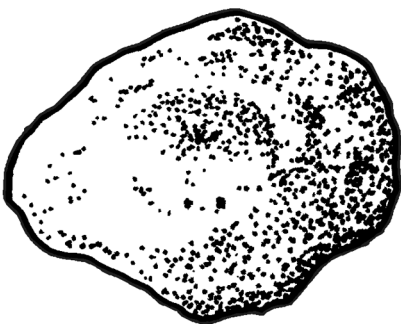
Helene



Rhea



Titan



Hyperion



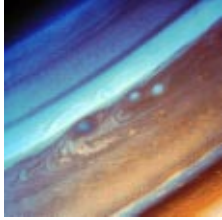
Iapetus



Phoebe

Focus on Saturn's Fascinating Features

Saturn's cloud layers hold many subtle details.



LESSON TIME

Two parts of 40 minutes each.

PREPARATION TIME

30 minutes

MATERIALS

For the teacher:

- *“The Ringed World of Saturn” script*
- *Stapler*

For each student:

- *Black construction paper; crayons*
- *Copy of “The Layers of Saturn” book pages*
- *Scissors; paper clips*
- *Silver glitter glue (optional)*
- *Science Notebooks*

STUDENT PREREQUISITES

Students should have some basic background information about Saturn's moons.

LESSON NO. 9

Language Arts Focus — Writing and Illustrating Expository Texts

Science Focus — Creating Saturn Books: Rings, Moons, and Other Features

OVERVIEW

Students will create a multilayered book with diagrams of Saturn showing its various layers, ring system, and many moons. To enhance background information on Saturn, students will practice listening to informational text. Students will also create their own texts to support and explain their Saturn diagrams. A teacher classroom script, “The Ringed World of Saturn,” containing background information with age-appropriate language, is provided for this lesson (see page 5).

BACKGROUND

Saturn is often referred to as the “jewel of the solar system.” Its striking rings and numerous icy moons set it apart from the other planets. It is important for students to understand that planets have distinct features that make them of particular interest to scientists and motivate our ongoing planetary exploration. Cassini–Huygens mission scientists will be exploring Saturn’s atmosphere to learn more about its temperature, cloud properties, structure, and rotation. The configuration of Saturn’s rings, their sizes, and the distribution of material within them are also being studied by scientists. The icy satellites that orbit Saturn are under investigation as scientists explore satellites embedded in the rings and their composition. This lesson introduces students to several of Saturn’s exciting features — features of particular interest to scientists that capture the imagination of all.

Objectives

Students will:

1. Write with accuracy to characterize Saturn and its features.
2. Create a multilayer book about Saturn.
3. Create diagrams of Saturn with rings and moons.



Teacher Preparation

Print out a copy of “The Ringed World of Saturn” script (two pages) to read to the students during discussion prior to the writing activity. Make copies of “The Layers of Saturn” book pages (five pages plus cover page), one set per student. Provide for each student one sheet of black construction paper, 8-1/2 x 11 inches.

Procedure

Part One

Creating the Book Pages — 40 minutes

(Depending on the ages of your students, this may take two days)

1. Distribute one set of “The Layers of Saturn” book pages plus one piece of black construction paper to each student. The black paper will serve as the back cover of the students’ books.
2. Model how to cut each of the pages for your students.
3. Have students use crayons to color the various pages of Saturn. Use pictures of Saturn from books, the Internet, posters, or newspapers to give the students a rich picture of what Saturn looks like. For excellent images, visit:
<http://saturn.jpl.nasa.gov/multimedial/images/index.cfm>
4. Explain to students that the colors they see in pictures of Saturn and its rings are often enhanced or color has been added to the images to bring out details. Suggested colors for the pages are as follows:

<u>Page</u>	<u>Features of Saturn</u>	<u>Colors</u>
1	Rings	Light brown
2	Surface	Yellow or tan with wide brown stripes
3	Rocky Core	Orange
4	Metallic Hydrogen Gas	Orange and brown
5	Hydrogen Gas	Yellow

5. Have students write their names on the covers on the “By” line.
6. Give each student a paper clip to keep their pages together. Remind them to use the numbers on the pages to keep them in order.
7. If you are using optional silver glitter glue, put a small amount of it on the rings and ask students to spread it around the rings to make them look icy.
8. Have students put their names on the back of the black construction paper.
9. Ask students to put the frozen moons of Saturn on the inside of the back cover. They can be labeled. Don’t forget that Titan is the largest!
10. To add stars to the background, students can dot a small amount of glitter glue to the top half of the black construction paper (very cool!).
11. Set the pages aside to dry.

teacher
TIP

Most of Saturn’s moons orbit along the plane of the rings, but Phoebe does not. It orbits outside the ring plane and also orbits in opposition to the rest of the moons!



teacher TIP

If your students are writing independently, ask each student to make his or her own sentences. If your students are just beginning to write, support their writing by working as a whole class.

Part Two

Writing the Book — 40 minutes

1. Return the pages of the books to students.
2. Ask them to listen very carefully to what you are about to read about Saturn (using “The Ringed World of Saturn” script).
3. Tell them that together you are going to make sentences about Saturn to write in their books.
4. After you have read about each of Saturn’s features, stop and do your writing — either as a shared or independent writing activity.
5. When the writing is complete, staple the pages along the left edge of the bottom half of the black construction paper.
6. Slip the planet into the rings and the book is complete.
7. Students can read their books to each other or make presentations to other classrooms.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: What is Saturn’s system like? Would you like to visit Saturn? Why?
2. Process question: What activities did you do to learn more about what Saturn is like?

Why This Works

The strongly visual nature of the book’s diagrams enhances student learning. As students create this multilayered book, they learn in a very hands-on way that Saturn is multidimensional. When you open the cover, you see Saturn and its ring system. As you continue reading the book, you also see a cut-away section of the planet showing the layers in various colors. The final page places Saturn in its context, surrounded by frozen moons in the darkness of space.

Student writing and reading of the book further reinforces the idea that Saturn is a complex planet at the center of larger system. The unique quality of this book will compel students to share it with family and friends, thus repeating and reinforcing the main ideas being learned.

Assessment

Students’ writing and drawings, and entries in their Science Notebooks, will indicate how well they have grasped the main features of Saturn.

Here are some sample sentences to show what successful student writing may look like:

- The rings: Saturn has rings. The rings are icy. The rings are big. The rings have gaps. One is the Cassini Division.



- The surface: Saturn is cloudy. Saturn is windy. The wind makes Saturn look striped. Saturn's winds are fast.
- The rocky core: The core is hot. It is molten rock. So is Earth's core.
- Hydrogen gas layer: The first layer of gas is hydrogen gas. Saturn has gases. You cannot stand on Saturn.
- Metallic hydrogen gas layer: Saturn is made of different gases. This layer is hot. The gases spin fast on Saturn.

Standards

NCTE Standards for the English Language Arts

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and the world.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning for enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



Teacher Background Information and Classroom Script



The Ringed World of Saturn

Saturn is the sixth planet from the Sun. Because it is so far from the Sun, it doesn't get much sunlight and it is very, very, very cold! It is much sunnier and warmer on Earth. Don't worry about getting a sunburn on Saturn!

Saturn moves much slower in its orbit around the Sun than Earth does. It takes Earth one whole year — 365 days — to go all the way around the Sun. But it takes Saturn almost 30 Earth years to go all the way around the Sun! That's a long, long time.

The first thing most people notice about Saturn is its very special rings. They are very, very big. Saturn is far, far away from us — so far, in fact, that Saturn looks a lot like a small speck of light in the sky. When the Cassini spacecraft is close to Saturn and its rings, we will find out many new things about Saturn and what is around it.

Let's begin our trip to Saturn.

Imagine you are the Cassini spacecraft and you have been on the very, very long trip to Saturn. The trip from Earth to Saturn takes about 7 years, traveling day and night! Space is a very, very big place! After being in space for all that time, you see a beautiful planet in the distance. As you get closer, you realize it is a huge gas planet with rings. What do you think it is? It's Saturn!

First Stop — The Rings

You might think there are only two rings around Saturn, but hundreds of rings combine to form the ring system of Saturn. Scientists use letters to name the rings, and they have named 7 ring zones so far. We can see some of the rings from Earth using telescopes. We can observe the outer zone, called the A ring, and the brighter, inner zone called the B ring. The big space between the A and B rings is called the Cassini Division.

The rings are very wide, but very thin! Some of the rings look like they are braided — they are pretty complicated. Some of the rings even look twisted. There are also some small moons in the rings.

The rings are made mostly of chunks of water ice and ice-covered rock. Some of the chunks are small and some are pretty big — some are the size of a grain of sand, some are as big as a house. The rings do not stay in one place, but orbit Saturn, just like Earth orbits the Sun. Things are really moving in space!

Saturn's Surface

Saturn is covered with thick clouds. The top layer of the clouds is very cold. We have seen big storms in Saturn's clouds. It is very windy on Saturn. The clouds



move and make Saturn look striped. The moving clouds give Saturn the swirling yellow and gold cloud bands that we see. Saturn also has big white spots. Scientists think the white spots may be big storms.

Now let's look past the clouds at Saturn's core and its gas layers.

Saturn's Core

The very center of Saturn is called the core. Scientists think that Saturn has a rocky, molten core. Molten means melted — the center is made of liquid rock. Earth's core is also made of molten rock. Why do you think it is liquid rock? The reason is, it is very, very hot and rock that is so hot melts into a liquid, like lava from volcanoes here on Earth.

Saturn's Inner Layer — Metallic Hydrogen Gas

Except for the core, Saturn is made of lots of gas. One of the inner layers of Saturn is made of a gas or liquid called hydrogen (when it is hot and deep inside the planet there is no difference between gas and liquid.) Don't forget we are still pretty close to the core of Saturn and it is very, very hot! Saturn isn't very dense because it is made mostly of hydrogen. If you ever got close to Saturn, you could put your hand right through it. Remember, Saturn is not solid like Earth, but a big ball of gas and liquid. You would sink into Saturn if you ever visited it. Scientists want to know more about the gases on Saturn.

Saturn's Outer Layer — Hydrogen Gas

We find hydrogen gas in lots of places in the solar system. Not all parts of Saturn move at the same speed. When Earth spins, it all moves together because it is solid. (Remember, the water in the ocean is sloshing around on solid ground!) When Saturn spins, some parts move faster and some parts move slower—because it is made of gas. Isn't that surprising?

Saturn's Neighbors

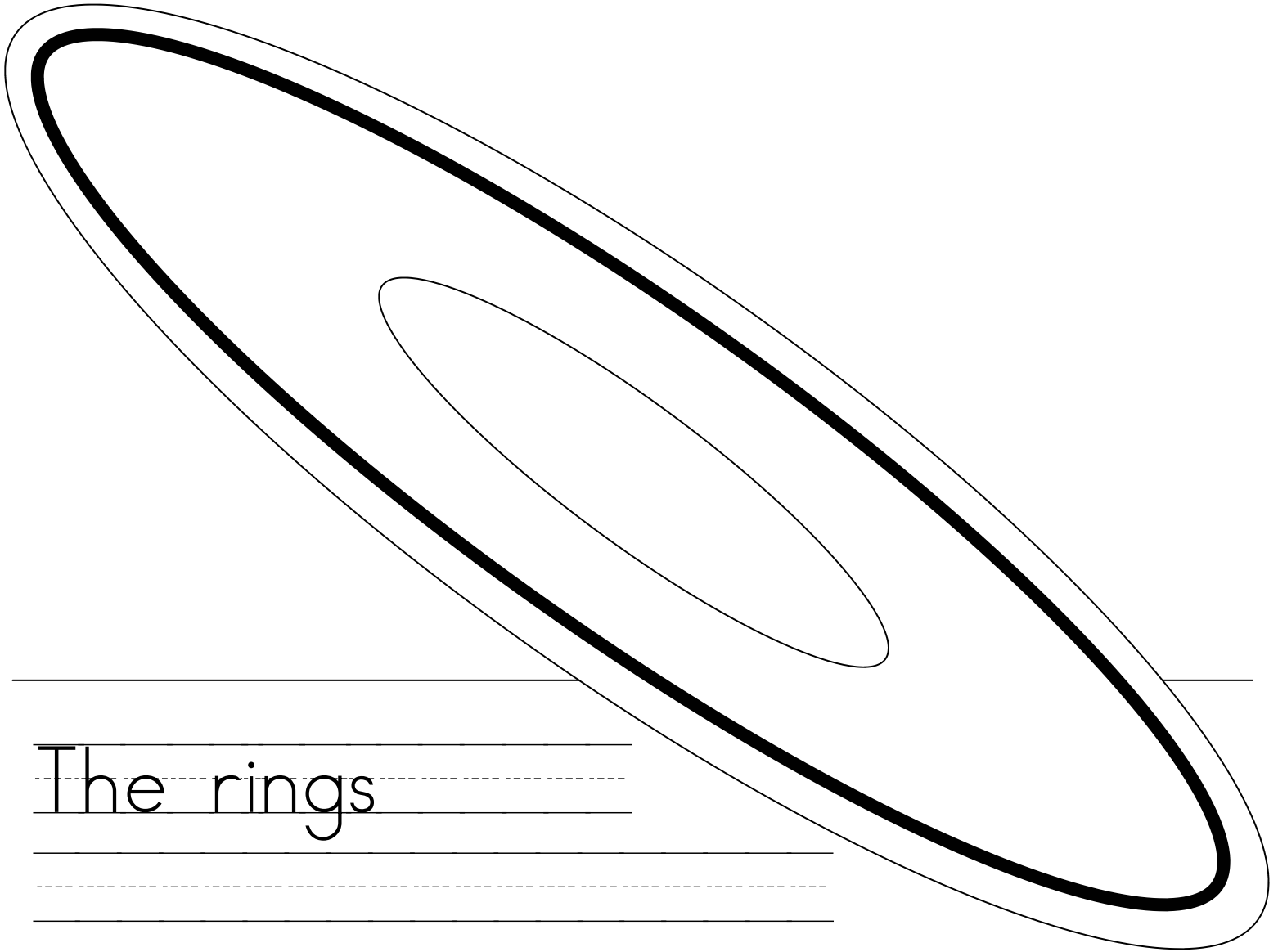
Saturn is not in space all by itself. Many icy, frozen moons orbit around Saturn. Some of the moons are in the rings, but most of them are a little farther from Saturn. Earth has only one moon, but Saturn has 18 moons with interesting names, and scientists have discovered many more. We think there may be more than 31 moons around Saturn. It's kind of crowded up there with all those moons. Saturn's biggest moon is named Titan.

Can you think of something else that is in the sky? (Hint — we see them twinkle at night.) Stars! The stars are really far away from Saturn, but we can still see their light as they shine in the sky.

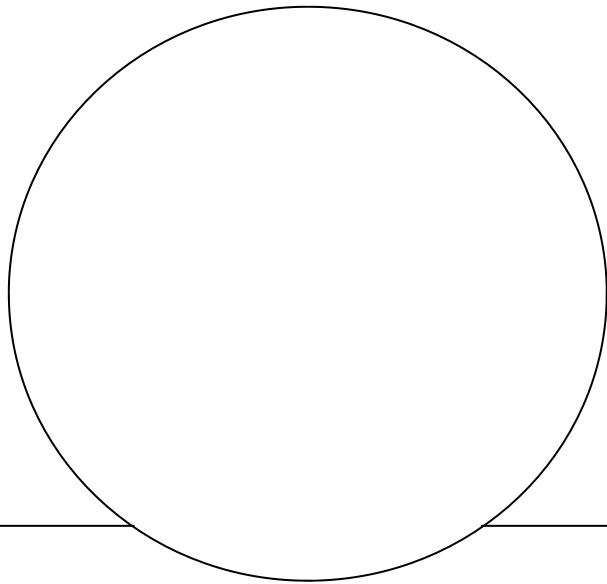


The
Layers
of
Saturn

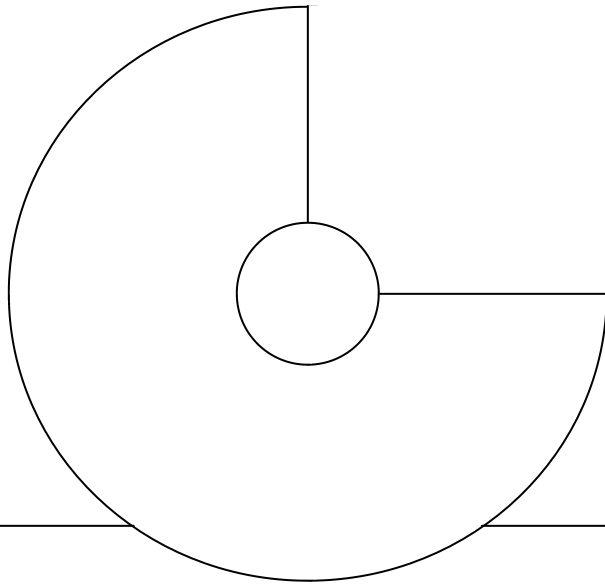
By _____



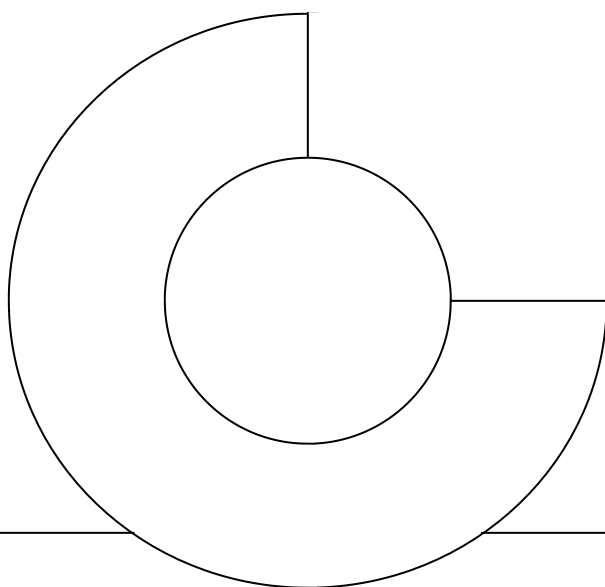
The rings



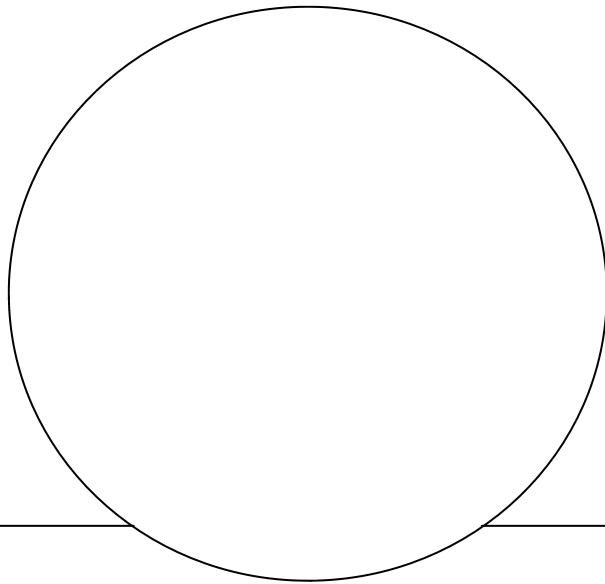
The surface



The rocky core



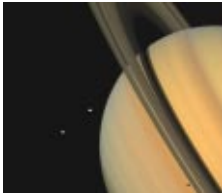
Metallic hydrogen gas



Hydrogen gas

Awesome Saturn

Saturn and some of its icy moons.



LESSON TIME

60 minutes

PREPARATION TIME

*Approximately
15 minutes*

MATERIALS CHECKLIST

For the teacher:

- *Chart paper*
- *Books to read aloud (see Teacher Preparation)*
- *“Poem Examples” and “Word Banks” (copy or transparency)*

For the students:

- *Copies of “Saturn Poem” worksheets*

STUDENT PREREQUISITES

Students should be familiar with several books about Saturn and completed the Reading, Writing & Rings! activities. Students will need well-developed vocabulary for writing about Saturn; they should be able to write independently or with limited teacher support.

LESSON NO. 10

Language Arts Focus — Using Poetry to Describe Saturn

Science Focus — Summative Reflections on Saturn

OVERVIEW

Students complete one or more poems about Saturn using descriptive words. As a pre-writing activity, students generate a word list from books they have heard and read and images they have seen and created. With the support of the word lists, they will create poems.

BACKGROUND

The images sent to Earth from the Cassini–Huygens spacecraft are magnificent. The scientific value of the images is obvious, but their ability to inspire cannot be overlooked. With this in mind, this lesson encourages young students to give voice to the awe that Saturn can inspire. The lesson, which comes at the end of Reading, Writing & Rings!, allows students to integrate all that they have learned about Saturn from previous lessons, discussions, and readings. Students can use a variety of poetic forms in this lesson, among them: acrostic poems, place poems, list poems and “I used to think...” poems. With each form, students express their own understanding of Saturn.

Objectives

Students will:

1. Prepare to write by brainstorming words to describe Saturn.
2. Write poems using several poetic forms.

Teacher Preparation

Recommended books to read aloud are *Saturn* by Elaine Landau, *Saturn* by Seymour Simon, or *Saturn* by Gregory Vogt. Prepare chart paper for creating word lists or word banks. Make a copy or transparency of “Poem Examples” (two pages, can also be copied for student reference). Make copies for the students of the “Saturn Poem” (Acrostic Poem and Place Poem) worksheets.

Procedure

1. Begin this lesson by reading one of the recommended books to your students. You can also focus your reading on specific sections of the text. Be sure to point out the rich language that is used when Saturn is described.
2. When you have completed the reading, elicit from students some of the facts they have learned about Saturn.



3. Review Saturn images with your students. The following website contains the most up-to-date images of the Cassini spacecraft:
<http://saturn.jpl.nasa.gov/multimedia/images/index.cfm>
4. After finishing the review of images, brainstorm with your students to come up with nouns and descriptive words for Saturn, its moons, the Cassini spacecraft, space, and other topics associated with Saturn.
5. Try to generate 15 to 20 words for each topic. List your words under each topic heading to help students organize their writing. The lists can be placed on the board or added to your Saturn Word Wall. Use your copies or transparencies of the “Poem Examples” and “Word Banks” to guide the discussion.
6. Select the type(s) of poem your students will write from the poem examples. Note: If you choose the acrostic poem, be sure students understand how to pick the descriptive words that should be used. The place poem is the easiest way to teach young students to begin writing poetry.
7. Distribute the “Saturn Poem” (acrostic poem) and “Saturn Poem” (place poem) worksheets to students and assist them in writing as needed. Provide extra writing paper if you’d like them to try forms other than acrostic or place poems. Encourage students to use the vocabulary in the word banks or on the Saturn Word Wall.
8. Have the students add their finished poems to their portfolios.

Poetry Forms

Here are some poetry forms and the “rule of thumb” for their creation. The “Poem Examples” sheets give samples of these types of poems.

teacher

TIP

Use a transparency of “Poem Examples” to show the class as you describe how to write each type of poem.

- An *acrostic poem* is a short verse that is constructed so that the first letter of each line forms a specific word. You begin with the word and add the verse.
- A *place poem* describes the essence or feel of a particular place. The first line contains the name of the place, followed by three lines of descriptive words. The second line contains two words, the third three, the fourth two. The last line contains the name of the place again.
- A *chant* is a poem without a fixed form. However, one or more of its lines are repeated over and over. It is fun to recite as a group.
- A *list poem* is the itemization of an event, place, or thing.
- A *thing poem* is created by describing a place or thing in as many ways as you can. This would be a great whole-class poem.
- An “*I used to think. . .but now I know*” poem is created by recalling what you used to think and compare it with what you currently think. This poem form is an effective way to capture changes in student thinking that have taken place over the course of this unit.



Why This Works

Poetry is a wonderful way to give students their own voice. Through poetry, they can express what is meaningful to them about their learning. There are no wrong answers when expressing how one feels about something in a poem. For beginning poets, these very simple, no-fail poetry forms are a way to inspire poetry writing as an ongoing, independent activity.

Conclusion to Reading, Writing & Rings!

Reading, Writing & Rings! contains numerous lessons and covers a variety of topics. You and your students have come a long way. This integrative lesson calls upon students to reflect on all that they have learned. This activity works largely because students can choose to focus on what they find most meaningful about the Cassini–Huygens journey. We hope you have had a great trip! Here is a poem written by one 2nd-grade student:

Saturn

Big, windy
Gas, fast, white spot
Moons, beautiful

Saturn!

Assessment

Students' poems will show how students have integrated new information and enriched their understanding of Saturn and the Cassini–Huygens mission.

Standards

NCST Standards for the English Language Arts

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning for enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Earth and Space Sciences

- Objects in the sky



Acrostic Poem

S pinning
A mazing
T itan
U nbelievable
R otating
N arrow rings

Place Poem

Saturn!
Ringed, Icy
Cold, spinning, orbiting,
Tan, dim.
Saturn!

Chant Poem

Saturn is cold!
Saturn is cold!
Far from the Sun,
Saturn is cold!

List Poem

When Cassini gets to Saturn it will find rings.
When Cassini gets to Saturn it will find moons.
When Cassini gets to Saturn it will find ice.
When Cassini gets to Saturn it will find helium.
When Cassini gets to Saturn it will find hydrogen.
When Cassini gets to Saturn we will celebrate!

Thing Poem

It is round.
It has rings.
It has moons.
It is made of gases.
It is cold.
It is Saturn!

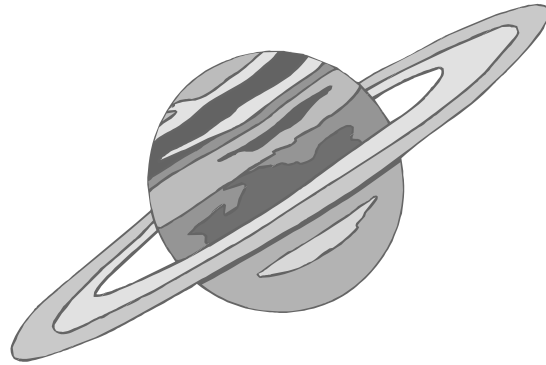
"I used to think" Poem

I used to think Saturn was small but now I know it is huge.
I used to think Saturn was close to Earth but now I know it is very far.
I used to think Saturn was standing still but now I know it is orbiting.
I used to think Saturn was hot but now I know it is cold.
I used to wonder about Saturn but now I know I want to learn even more!

Solar System	Saturn	Moons	Titan	Rings	Cassini
Sun	rings	craters	thick atmosphere	icy	spacecraft
Mercury	ringed	spherical	clouds	Cassini Division	journey
Venus	sixth planet	round	orange	A-rings	7 years
Earth	second largest	orbiting	big	B-rings	Cassini Division
Mars	icy rings	paths	smog	equator	Huygens
Jupiter	gas giant	icy	orbiting	ringlets	antenna
Saturn	cold	rock	cold	moons	instruments
Uranus	no life	irregular shape	Huygens Probe	shepherding	mission
Neptune	rotates	bumpy	parachute	particles	launched
Pluto	clouds	diameter		crashing	space probe
Orbit	cold gases	collided		thin	scientists
Planets	wind storms	impact		huge	astronomers
Rotation	core	smooth		wide	
Revolution	inner layer	surface		gaps	
Moons	outer layer	grooves		orbiting	
Asteroids	surface	reflect			
Comets	orbits	frozen water			
Milky Way	gravity	canyons			
	moons	cold			
	atmosphere	frost			
		shepherding			
		co-orbital			
		terrain			
		big			
		small			

Name _____

Saturn Poem



S _____

A _____

T _____

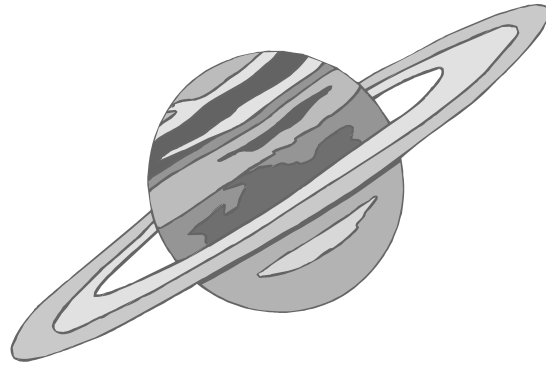
U _____

R _____

N _____

Name _____

Saturn Poem



Saturn

Saturn!