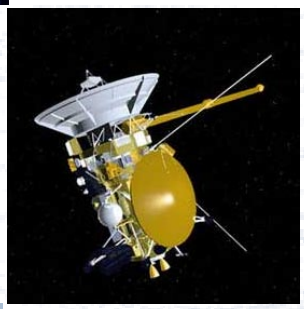
Educational Product	
Educators and Students	Grades 3–4

EG-2004-03-013-JPL
JPL 400-1138 3/04

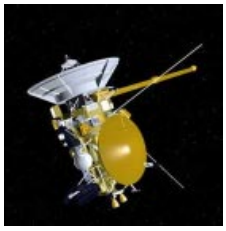
Mission to Saturn Educator Guide

Reading, Writing & Rings!

Grades 3–4



Lesson List



1 What Do I See When I Picture Saturn?

Your students begin the unit by creating a Saturn Discovery Log. Students will use their Saturn Discovery Logs to chronicle their journey of discovery about Saturn, the Cassini–Huygens spacecraft, and nonfiction writing. For their first log entry, students will draw what they picture when they hear the words "Saturn" and "Cassini," and add labels and captions to their drawings. Students will share this illustrated text with a partner. At the end of the unit, students repeat this exercise and observe their growth over the course of the unit.

- Language Arts Focus — Nonfiction Writing Practice: Illustrations with Text
- Science Focus — Pre-Assessing Students: Scientific Ideas and Understandings

2 The Mysteries of Saturn and Cassini

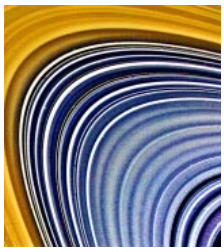
Your students will start learning about Saturn just as the first observers of Saturn did — by observing and wondering. Your students will look at pictures of Saturn, the Cassini spacecraft, and the Huygens probe and write what they notice, know, and wonder. This activity invites students to observe carefully and learn from each other, while providing you with an idea of students' prior experiences with this topic.

- Language Arts Focus — Nonfiction Writing Practice: Descriptive Writing
- Science Focus — Observing and Wondering: Essential Tools for Science

3 Wondering About Saturn: A Short History

Humans have been wondering about Saturn for centuries. Students hear a read-aloud of the history of Saturn discoveries. Next, they learn two reading comprehension strategies (visualizing and wondering) that they can use to become more powerful readers of nonfiction text. Finally, students share their work with partners and the class.

- Language Arts Focus
  —Nonfiction Writing Practice: Summary
  —Nonfiction Comprehension Skills: Visualizing and Wondering
- Science Focus — Reading to Support Inquiry-Based Thinking



4 How Far Away Is Saturn?

Saturn is far away from Earth! Distances in space are difficult for students (and adults) to understand. In this lesson, students use simple props to create a playground model for size and distance for the Sun, Earth, and Saturn — they actually take a "walk of wild size" to Saturn. Writing activities engage students in reflecting on experience and in comparing and contrasting.

- Language Arts Focus
  —Nonfiction Writing Practice: Descriptive Paragraph
  —Nonfiction Writing Practice: Compare/Contrast Paragraph
- Science Focus — Understanding Size and Distance by Creating Sun/Earth/Saturn Models

5 Discovering Saturn, the Real "Lord of the Rings"

At this point in our imaginary journey, we have arrived at Saturn. Students extend and enhance their current understandings about Saturn by reading a series of Saturn minibooks, and learn a note-taking technique that will help them better understand nonfiction text. They use their notes for descriptive writing and to compare and contrast with new information that we learn about Saturn from Cassini. Students will practice the illustration with text strategy learned in Lesson 1. For the final activity, students build 3-D models of Saturn and its rings. Learning all about Saturn prepares students for designing their own spacecraft.

- Language Arts Focus
  —Nonfiction Reading Practice: Saturn Minibooks
  —Nonfiction Writing Practice: Descriptive Paragraph
- Science Focus — Understanding the Saturnian System by Building 2-D and 3-D Models of Saturn

6 My Spacecraft to Saturn

Students get the chance to think like engineers as they are presented with problems that the NASA team faced when designing a spacecraft to travel to Saturn. Students work with partners to think of solutions to address those problems, and to use these ideas to sketch their spacecraft. (In the next lesson, students have the opportunity to compare their ideas to the ideas of the NASA team.)

- Language Arts Focus
  —Nonfiction Reading and Writing as Tools for Problem-Solving
  —Nonfiction Reading Practice: Summary
- Science Focus — Thinking Like an Engineer: Problem-Solving Spacecraft Design

7 My Spacecraft and Cassini

Students will be curious to hear how NASA solved the design problems that they faced in Lesson 6 — they hear the NASA solutions to the questions they wrote about in the previous lesson. Students write a nonfiction piece comparing their spacecraft to Cassini, and share these pieces with the class. This introduction to design prepares students for the task of trying to design a working model of a probe to land on Saturn's moon Titan.

- Language Arts Focus
  —Nonfiction Reading Practice: Summary
  —Nonfiction Writing Practice: Compare and Contrast
- Science Focus — An Eye for Comparison

8 All About Titan and the Huygens Probe

Students extend and enhance their understandings of Titan and the Huygens probe by listening to a narrative "told" by the Huygens probe. Visualization and drawing are used as motivators to enhance comprehension and to get students thinking about Titan and what we might find there. Students draw what they envision the surface of Titan will look like to the Huygens probe. Next, they read an article about Titan and the Huygens probe and write a summary. This lesson gives the students additional background for Lesson 9.

- Language Arts Focus — Nonfiction Writing Practice: Summary
- Science Focus — Building Mission Background Knowledge

9 Drop Zone! Design and Test a Probe

Students are invited to participate in a challenging activity. Using the information learned in Lessons 6, 7, and 8 — and their own creativity and problem-solving skills — students design and test a parachuting probe that will withstand a fall from a high point and land intact, be able to float in a liquid, descend slowly, and cost the least to launch into space. Extensions provide an option if the teacher has limited time, and also invite the students to simulate other experiments that will be carried out by the Huygens probe. While this lesson provides opportunities and invitations for students to integrate reading, writing, and experimenting, writing provides the unifying thread for student learning.

- Language Arts Focus — Writing to Plan, Problem-Solve, and Analyze
- Science Focus — Designing and Testing a Parachuting Probe

10 What Do I See Now When I Picture Saturn?

Students are coming to the end of their journey of discovery about Saturn, the Cassini spacecraft, and nonfiction writing. To reflect on what they have learned, students repeat the exercise that they did at the beginning of the unit in Lesson 1. Students draw everything they picture when they hear the words "Saturn" and "Cassini," add labels and captions to their drawings, and look back at their first exercise and compare the two. They end the lesson by sharing their work with a partner.

- Language Arts Focus — Nonfiction Writing Practice: Illustrations with Text; Compare and Contrast
- Science Focus — Post-Assessment of Scientific Ideas and Understanding

11 Pulling It All Together

Students now have a working knowledge of Saturn and Cassini, as well as their Saturn Discovery Logs full of notes and observations. Students will organize notes to prepare to write one of the following types of nonfiction for their final piece: descriptive, compare and contrast, or summary.

- Language Arts Focus — Nonfiction Writing Practice: Descriptive; Compare and Contrast; Summary
- Science Focus — Synthesis of Information and Reflection

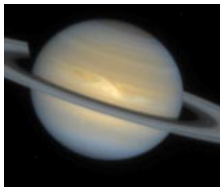
12 Celebrating Saturn and Cassini

Though this unit on Saturn is coming to a close, students will begin a lifelong journey of learning more about the mysteries of space and challenges of space travel. For the final lesson, students will use prewriting notes to write a nonfiction piece about Saturn or Cassini. These final projects provide a way for children with varying learning styles to consolidate and share their learning.

- Language Arts Focus — Final Nonfiction Writing Practice: Descriptive; Compare and Contrast; Summary
- Science Focus — Sharing New Knowledge with Peers

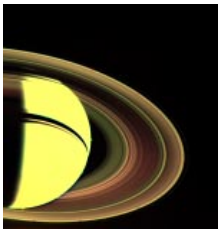
Foreword

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.

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.



A view of Saturn's rings by Voyager 2.

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-

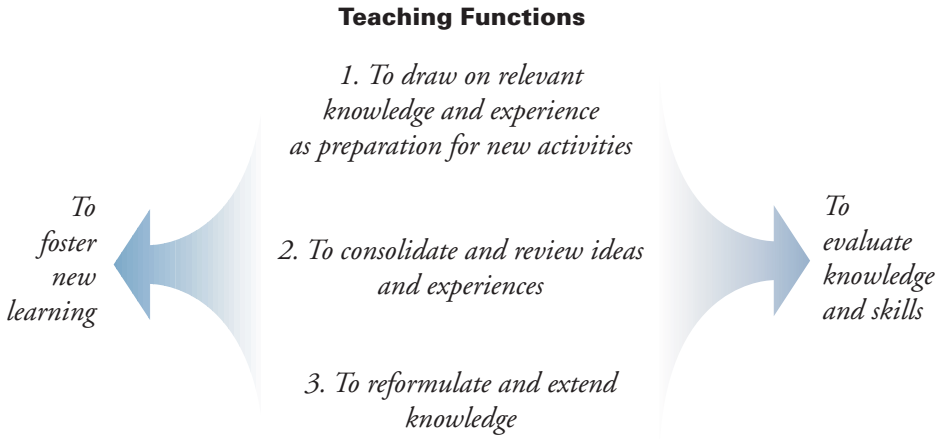
ence process skills are metacognitive in nature and have close correspondence with the skills of reading and writing. The skills of observing, classifying, comparing, predicting, describing, inferring, communicating, interpreting data, organizing information, and drawing conclusions are among the skills 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

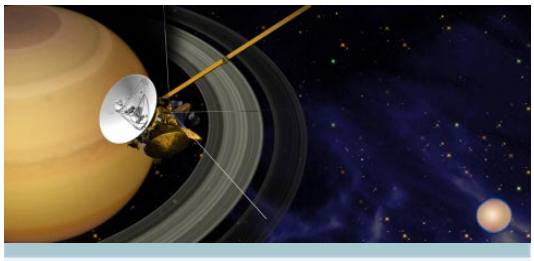
Reading and writing are central activities in each lesson. The lessons focus mainly on expository (explanatory) reading and writing. This kind of reading and writing tends to take a backseat to personal narration in the early grades. As a result, young students become very familiar with structure of 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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