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

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.

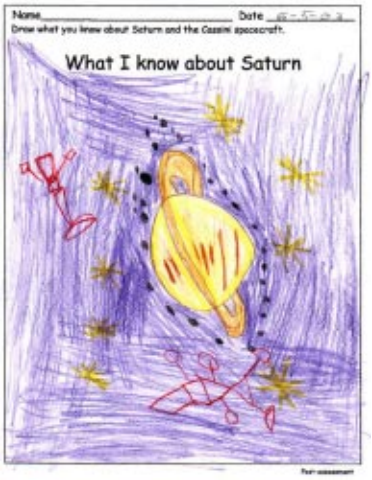
Our experience with young writers is that a few questions make it much easier for them to begin writing. The Science Notebook section contains:
- A question to prompt your students to think about what they have learned.
- A question to encourage students to think about how they learned.

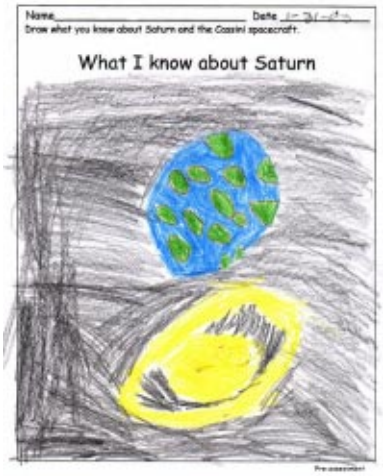
Encourage students to look back at their Science Notebooks throughout the course of this unit. The notebooks contain valuable information captured in the students' words. Like scientists, young students can use their Science Notebooks to keep a record of what they learned and how they learned it, and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

Assessment

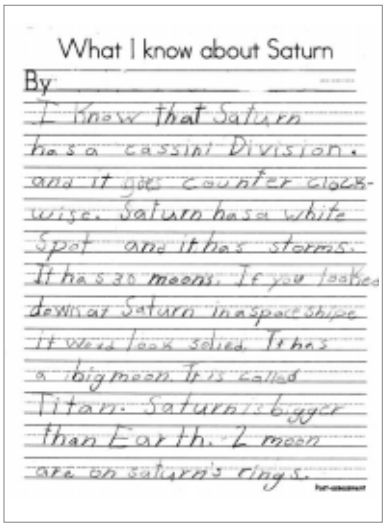
What does student growth look like in a unit such as this? What can you expect to see in your students' work as they learn more about Saturn? A look at some pre- and post-assessment work samples (below) will give you an idea of how students' ideas about Saturn and their abilities to express them can 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.

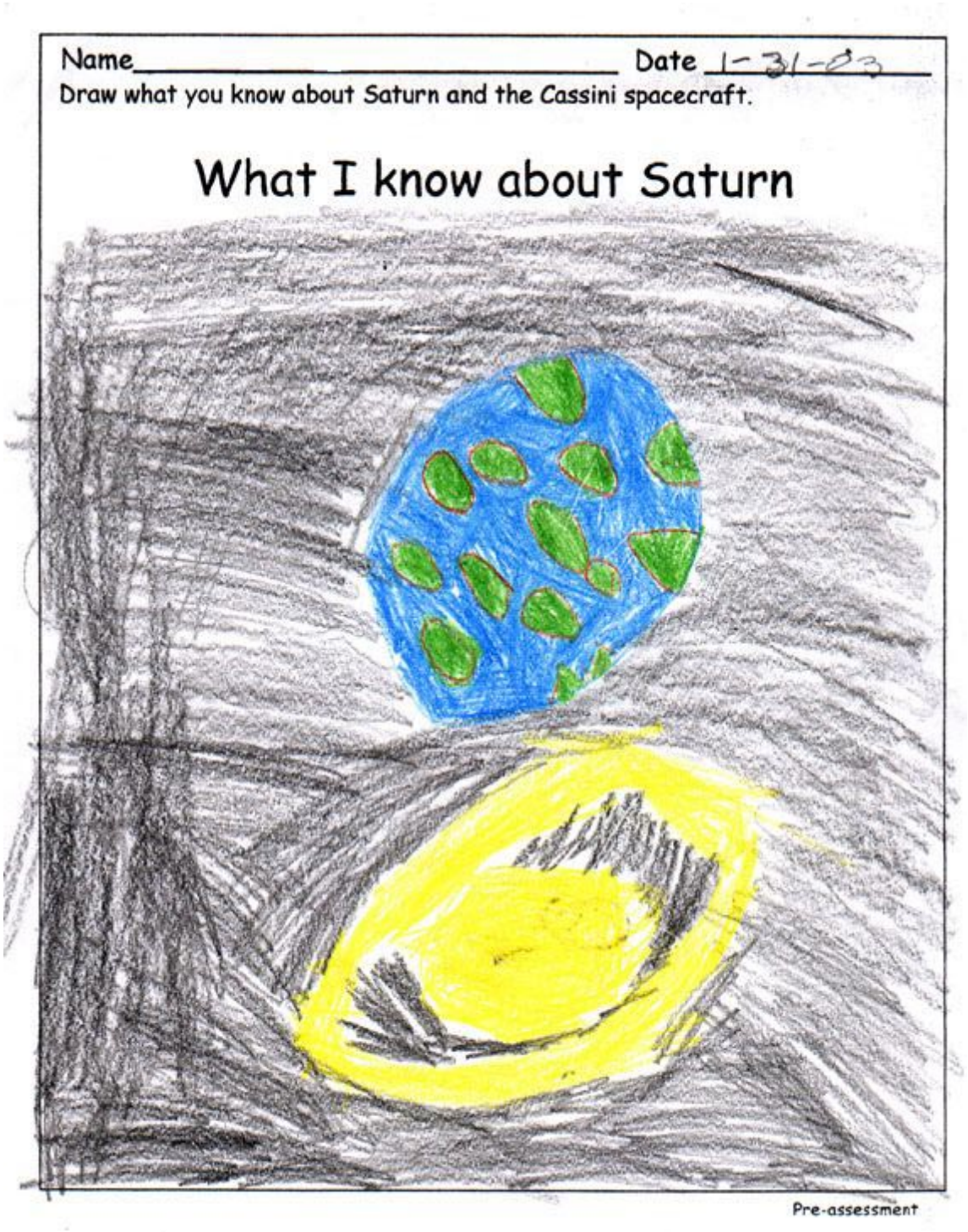
8. Practice a variety of writing strategies. The strategies may include brainstorming and using graphic organizers to help students move from structured to open-ended writing.

9. Use analogy to describe differences between objects like Saturn and Earth.

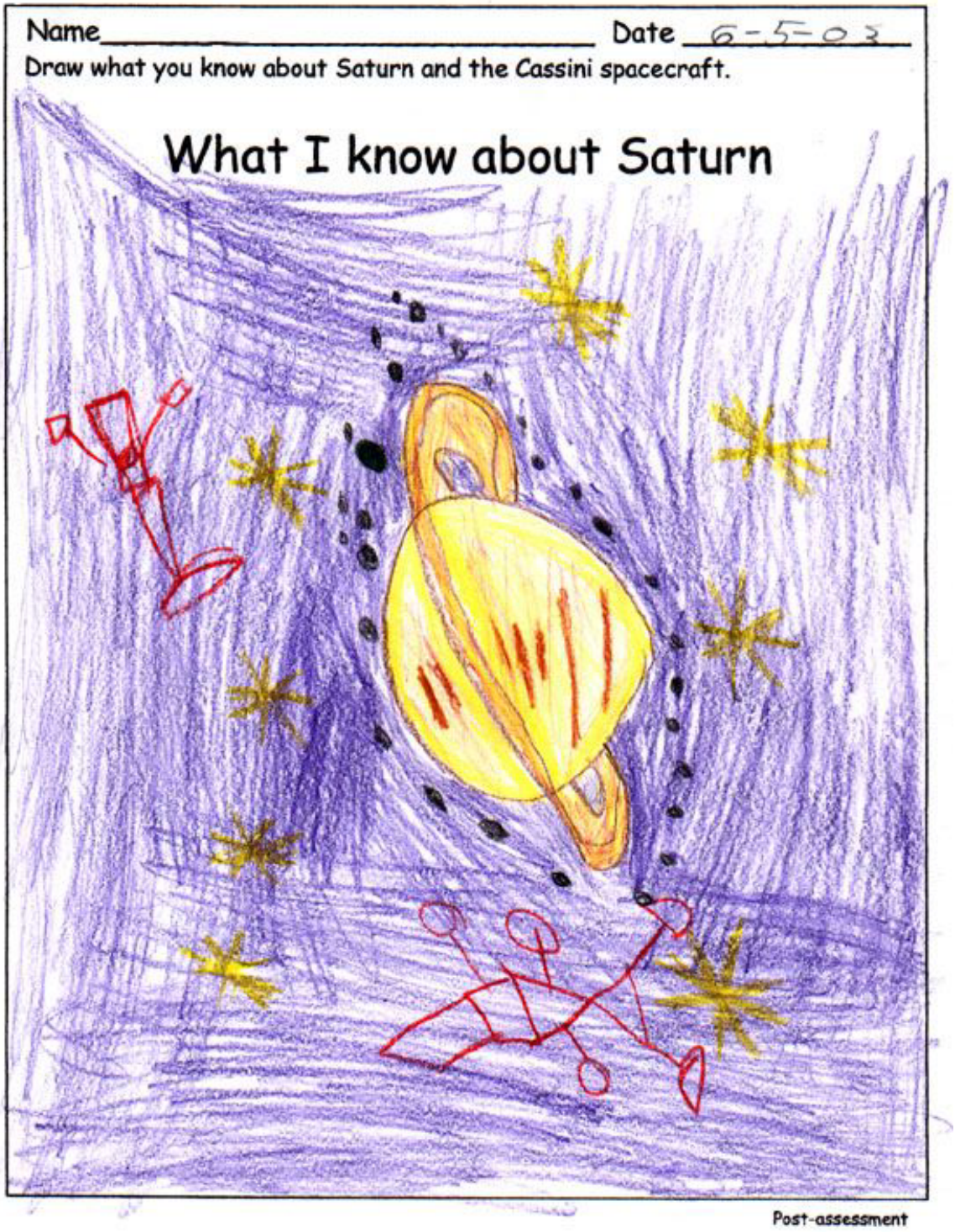
10. Write a basic paragraph that includes a main idea, some supporting details, and a conclusion.

11. Use a variety of poetic forms to write about Saturn.

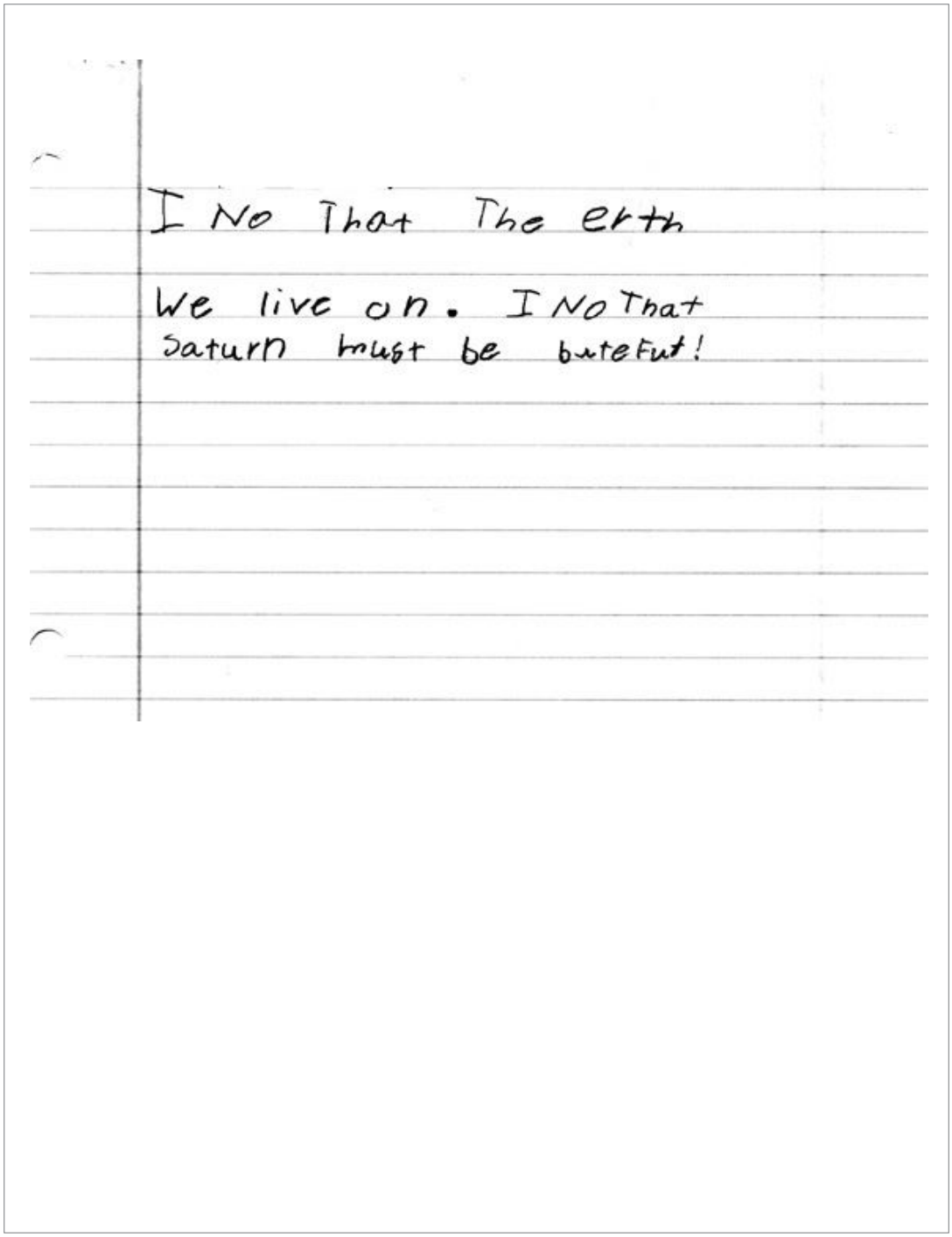
Pre-Assessment Drawing Example



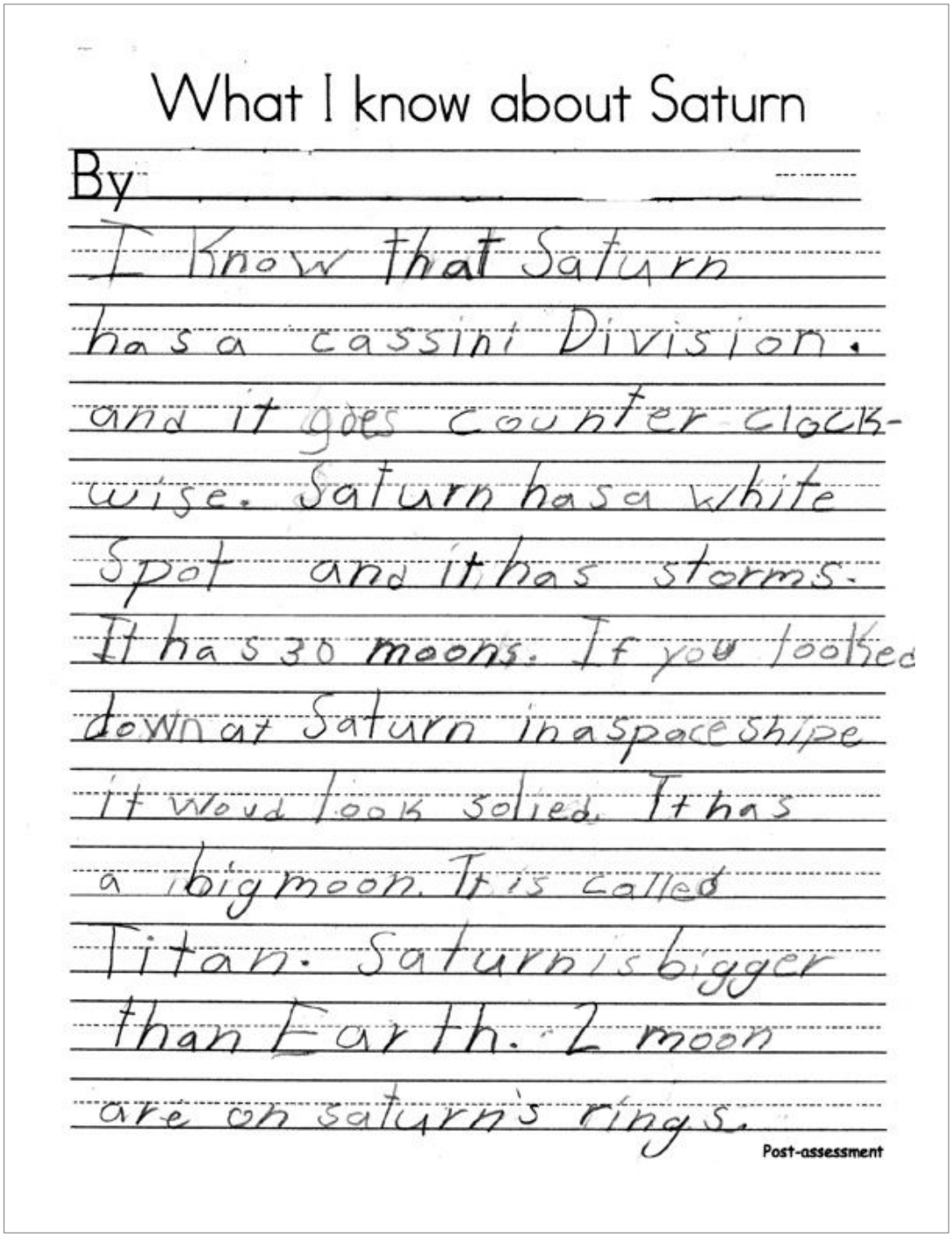
Post-Assessment Drawing Example



Pre-Assessment Writing Example



Post-Assessment Writing Example



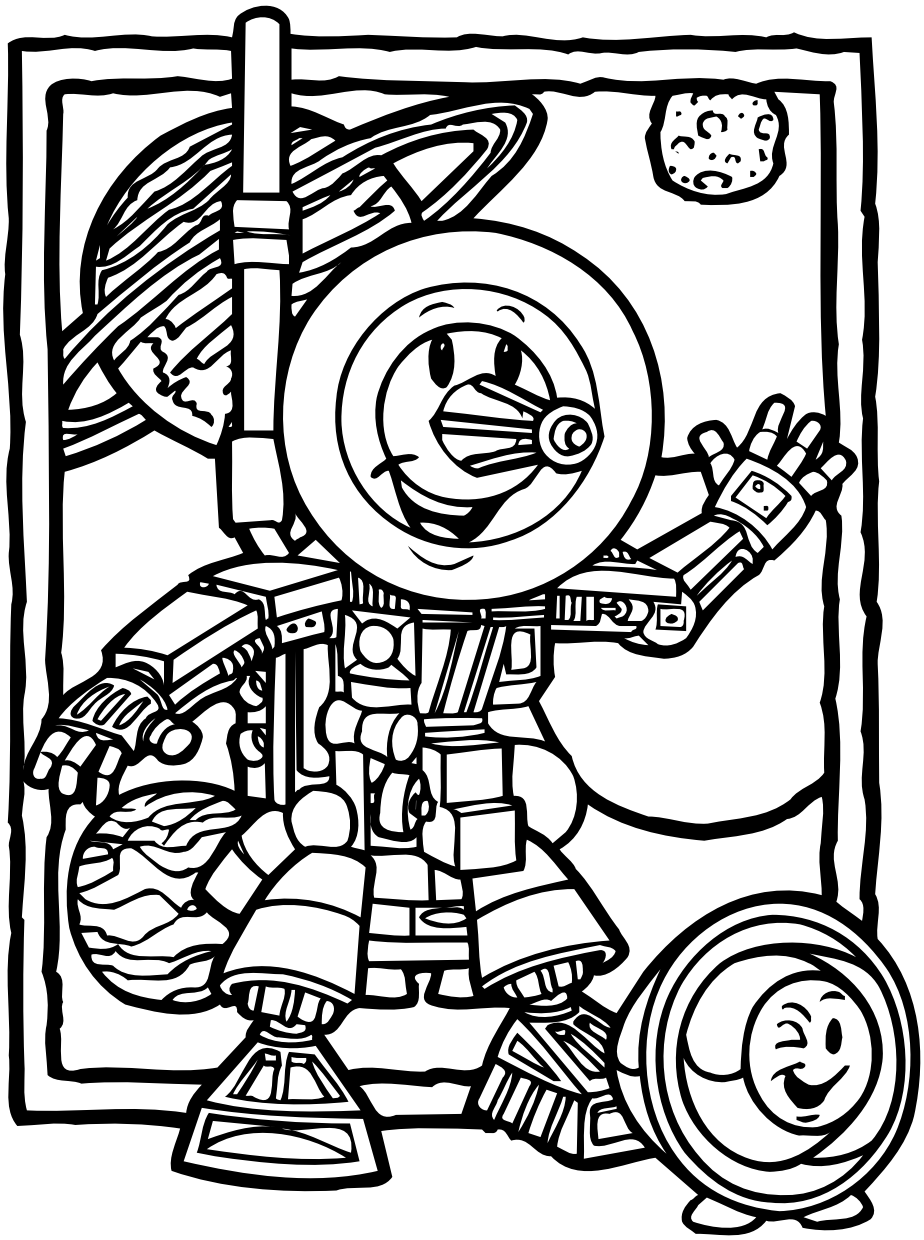
What I know about Saturn

By

I Know that Saturn has a cassini Division. and it goes counter clock-wise. Saturn has a white Spot and it has storms. It has 30 moons. If you looked down at Saturn in a space shipe it would look solied. It has a big moon. It is called Titan. Saturn is bigger than Earth. 2 moon are on saturn's rings.

Post-assessment

MY CASSINI-HUYGENS SCIENCE NOTEBOOK



Name _____

My Cassini-Huygens Science Notebook

Date