Activity 1
What Do I See When I Picture Saturn?

Overview

During this activity, your youth:

- Create science journals called *Saturn Discovery Logs*, to chronicle their journey of discovery about Saturn and the Cassini–Huygens mission.
- Draw and share what they picture when they hear "Saturn," and add labels and captions to their drawings.
- Closely observe pictures of Saturn, the Cassini spacecraft, and the Huygens Probe and write about what they notice. In teams, they also discuss and record what they wonder about. Practicing skills of careful observation, team discussion, and development of questions prepares students to develop "habits of mind" of scientists or engineers. Their writing forms the basis for "claims" and "evidence" as projects and presentations are formulated.
- Make and Take — their own decorated *Saturn Discovery Log*.

Time/number of sessions	Activity Type	Space Needed
Two 40-minute sessions (longer when there are extended questions)	Art and journaling	Room with tables and chairs

Activity Goals

Youth will:

- Practice organizing and presenting their thinking in illustrations with text format.
- Learn to observe carefully and record observations and questions.
- Begin to understand the need to support claims with evidence from reliable sources.

Where's the Science and Engineering?

- Saturn is the sixth planet from the Sun and is often called the "jewel of the solar system" because of its beautiful rings. It is the second largest planet in our solar system. Saturn is named for the Roman god of agriculture.
- The spacecraft Cassini–Huygens (pronunciation: cuh SEEN ee / HOY gens) was launched from Earth in 1997 and arrived at Saturn in July 2004. Cassini is exploring the mysteries of Saturn and its rings, while the Huygens Probe landed on Saturn's largest moon, Titan, in January 2005. The Cassini spacecraft continues to orbit Saturn and send back data until 2017. Explore more information about Saturn or the Cassini mission at NASA's Saturn website: saturn.jpl.nasa.gov.
- Science is a way of thinking and doing things, called inquiry. Identifying questions forms the basis for inquiry throughout this program unit.

National Science Education Standards

Science as Inquiry

- An appreciation of how we know what we know in science.

Understanding the Nature of Science

- The dispositions to use the skills, abilities, and attitudes associated with science.

The Standards state that "Inquiry into authentic questions generated from student experiences is the central strategy for teaching science." In this activity guide, students will read actively to find answers to their questions. Unanswered questions spark a lifelong curiosity to learn more about space, and follow discoveries as they are made.

Equity/Leveling the Playing Field

- This program unit has as much idea sharing and writing as hands-on activities. Students will be asked to publicly share what they know, so it is important to create an environment where everyone's idea is important and valued.
- Remember that writing may slow the process for some students. Be sure to allow enough time for everyone to contribute to the team.

Getting Ready

For Session 1

- Write the following *Saturn Discovery Log* prompt on the chalkboard or chart paper: "Draw everything that you picture when you hear the word Saturn. Add labels to your drawing."
- Find a newspaper or magazine article that has an illustration with text to use as an example to show the children.

For Session 2

- Print and cut out the Leader Reference *Saturn/Cassini–Huygens images*:
  Image 1 — Saturn (image by the Cassini spacecraft)
  Image 2 — The Saturn system (Collage of natural-color Cassini images of Saturn and moons. The moons shown are, starting at upper left and proceeding clockwise, Dione, Titan, Enceladus (directly in front of Titan), Rhea (partially in front of Titan), and Helene.)
  Image 3 — Cassini spacecraft approaching Saturn (artist's concept)
  Image 4 — Cassini launch
  Image 5 — Drawing of Cassini's path to Saturn, showing "swing–bys" that use the gravity and motion of planets to alter spacecraft path and speed
  Image 6 — Time sequence of the Huygens Probe as it descends to Titan's surface (artist's concept)
  Image 7 — Drawing of Saturn ring particles
- Create seven charts by attaching the images to the tops of sheets of chart paper. Drawing with a large marker, divide each sheet of chart paper into three columns under the image and label as follows — "What I Notice," "What I Know," and "What I Wonder."
- Place charts and images in seven locations around the room. Decide what signal you will use to have the students rotate to new images, and how you will make sure the rotation goes smoothly.

Leader Tips

- A fun way to introduce this activity is to show the students the live Cassini Status countdown clock that tells when the Cassini spacecraft will next pass by Saturn or Titan or another moon. See "Taking Science to the Next Step" for this activity.
- The format for the *Saturn Discovery Log* is a suggestion. Any folder or science notebook can hold students' writing and worksheets in an organized way.
- The images in this lesson provide breathtaking pictures of Saturn and its moons from the Cassini–Huygens mission. This lesson promotes two types of scientific skills — observing and wondering.
- Select one image to observe for a few moments yourself, and jot down your own thoughts on a separate piece of paper — both for what you notice and for what you wonder about. Model the learning process by participating in this activity with your own questions and writing to emulate the science process of inquiry. Your questions spark their curiosity!
- If students "know" something, ask how they know it, to support the idea of the importance of evidence to support claims. A "Word Wall" — a systematically organized collection of words displayed in the classroom — featuring "Claims" and "Evidence" might be helpful.
  - Encourage students to take risks in questioning.
  - Help students develop observational skills by encouraging them to notice the fine details.
- Keep the images and charts the students complete for them to later add more of "What I Know" in Activity 3 — "Discovering Saturn: The Real Lord of the Rings."

Materials

From Your Supply Closet

Session	For Leader	For Students
1	• Sample article(s) from the science section of a major newspaper or magazine with both illustration and text (with excellent illustrations and text to explain new discoveries) • Chart paper/whiteboard/ chalkboard and markers/chalk • Seven pieces of chart paper	• For *Saturn Discovery Log*: 12 x 18 inch construction paper (1 sheet for each student) and 8-1/2 x11 inch white paper (6 sheets for each student) • Crayons/markers • Construction paper • Colored pencils • Pencils

From a Photocopier/Printer

Session	For Leader
1	• Printouts of this activity's 7 Leader Reference *Saturn/Cassini-Huygens images*
2	• For optional Leader Reading: Copy of the mini-book "Introducing Saturn: Questions, Answers, and Cool Things to Think About" (from Activity 3 — "Discovering Saturn: The Real Lord of the Rings")

What Do I See When I Picture Saturn?

Activity 1

Student Activity

Session 1 • Creating Saturn Discovery Logs

1. Read the following paragraph: "Imagine space, magnificent space. Now imagine our solar system with a blazing Sun in the center. Spinning around it are beautiful planets. One of these planets is Earth. Another is Saturn, and a spacecraft is flying through space to find out more about this mysterious planet."

2. Explain that for the next few sessions (days, weeks, etc.), they will be learning about Saturn and its moons and the Cassini–Huygens mission. The Cassini spacecraft has been zooming past Saturn regularly since 2004, and the Huygens Probe landed on Saturn's largest moon, Titan, in 2005. The Cassini mission is scheduled to continue through 2017!

3. (Optional) Leader Reading: Read aloud all of page 2 and the first paragraph of page 3 from the mini-book "Introducing Saturn," showing the illustrations.

4. Tell students that they will be keeping all of their work during this entire program in their own *Saturn Discovery Log*, just as scientists keep journals or blogs to record their thoughts. Tell the children that today they will make the cover for their *Saturn Discovery Log* and write their first log entry.

5. Pass out construction paper, sheets of white paper, and crayons, colored pencils, and/or markers. Ask the group to fold the construction paper in half to make a folder that will hold 8-1/2 x 11 inch paper. Ask students to write "Saturn Discovery Log" and his or her name on the front cover of the construction paper folder. As students work, check that everyone has written his or her name and today's date on the cover.

6. Get students thinking and drawing about the planet Saturn, with the following conversation guide:
   - Now it's time to make your first log entry. Many scientists log their thoughts and questions every day. It's part of recording their journey to discovery. Sometimes they draw pictures and illustrations and label key things about them.
   - You can look at these sample news articles to see how items can be documented and labeled to make them clear to others. (Show the students the sample(s) you've collected.)
   - For so many centuries, people have looked up into the sky but have not really known what Saturn looked like. Scientists wondered a lot of things about the planet. Then they were able to look through telescopes and see the planets more clearly. Now that NASA has sent a robotic spacecraft all the way to Saturn, we have views that early scientists never thought possible.
   - What do you picture of when you hear the word "Saturn"? Take 15 minutes and draw a picture that reflects the word "Saturn" to you! Be sure to label the parts you think need explanation.
7. Circulate around the room, ask students questions about what they are drawing, and encourage them to add more detail to their labels and captions.
8. When they have finished their drawings, give students a few minutes to decorate the front cover of their *Saturn Discovery Log*. Then have the students put their drawings inside the log. Collect the logs.

Session 2 • What I Notice and Wonder

1. (Optional) Leader Reading: Read aloud page 4 from the mini-book "Introducing Saturn," showing the illustrations.
2. Ask the children to count off by 7's to create 7 teams, and assign one team to each image. For the leader's knowledge and use, the images are described here:
   - Image 1 — Saturn (image by the Cassini spacecraft)
   - Image 2 — The Saturn system (Collage of natural-color Cassini images of Saturn and moons. The moons shown are, starting at upper left and proceeding clockwise, Dione, Titan, Enceladus (directly in front of Titan), Rhea (partially in front of Titan), and Helene.)
   - Image 3 — Cassini spacecraft approaching Saturn (artist's concept)
   - Image 4 — Cassini launch
   - Image 5 — Drawing of Cassini's path to Saturn, showing "swing-bys" that use the gravity and motion of planets to alter spacecraft path and speed
   - Image 6 — Time sequence of the Huygens Probe as it descends to Titan's surface (artist's concept)
   - Image 7 — Drawing of Saturn ring particles
3. Lead the students in their observations of the first image, using the following conversation guide:
   - Now we'll begin learning about the planet Saturn and the Cassini–Huygens mission by looking at some images and making careful observations about them. Note there are 7 different images around the room. Your team will start by studying one of the images, discussing it, and writing down only those things you notice from looking at the image. Only include observations and claims that you can support with evidence you see in the image. (Some examples include: I notice the planet has rings. I notice a dark space in the rings. I notice there appear to be bands of different colors on the planet.)
   - Write your team's observations in the "What I Notice" column of the chart paper next to the image.

- Scientists work as teams in all stages of a space mission, so as you discuss the image, make sure that everyone on your team contributes observations and questions.
- Next, think about what questions you have about what's pictured in the image. Write those down in the "What I Wonder" column. (Following from the previous examples, you could wonder why there are different colors on the planet, and what the weather is like on Saturn. I wonder what would cause the dark space in the rings. I wonder who or what took this picture of Saturn. I wonder if it is a real picture.)
- Leave the "What I Know" column blank for now.
- I'll give you a signal when it's time for your team to move to the next image and add to what the previous team wrote.

4. Give the teams time to rotate and contribute to the charts of at least 3 different images.
5. As the students view the images, you might add these two actual contributions from Cassini scientists before Cassini arrived at Saturn:
   Jim Frautnick 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?
6. Bring the students back to the larger group, and lead them in suggesting two or three items to add to one of the "What I Know" columns, using the following conversation guide:
   - Let's discuss a few things we know about what's in these images, and how we know it. For us to be able to claim we "know" something, we need to have accurate evidence from a reliable source. Scientific claims can't be based on heresay or opinions. We need to think about how the claim has been tested and proven.
   - We might claim, for example, that the surface of Saturn's moon Titan is cold. We might think this because Saturn and Titan are so far away from the Sun. But we must have direct evidence for this before we can say it is true. If we are researching what others have already learned, we can look for reliable sources for that information, such as a teacher, textbook, science museum, or website that has been reviewed by scientists. If we are looking to discover it ourselves, we would need to design and conduct an experiment to measure the temperature (and perhaps send our own probe there to find out).
   - With that in mind, what are some things we can reliably say we know about Saturn and Cassini? How do we know they are accurate? (Examples: I know that Saturn has many moons. Cassini has taken images of them and scientists have published them on a NASA website. I know that Titan has an atmosphere, because engineers used a parachute to land the Huygens probe (a parachute needs an atmosphere to open). When students suggest a claim, ask them to name the reliable source and/or evidence that supports it. This can be an opportunity to reinforce internet literacy.)
   - We'll continue to learn about Saturn and record what we know throughout this program.

Questions for the Youth (Informal Assessment)

Pass the students their *Saturn Discovery Logs*. Give them time to write their own "What I Notice" and "What I Wonder" entries to their logs on one of their blank sheets of paper. Encourage them to write other questions they may have. Examples of questions or prompts are:

- What do you notice about Saturn that is different from Earth?
- What might be the explanation for Saturn's rings?
- Why are we interested in Saturn?

Sharing the Findings (Informal Assessment)

- Ask students to share their drawings with the group. Encourage the other students to voice what they like about each other's drawings.
- Encourage students to circulate to see what everyone wrote on the charts.
- Have the students write in their logs for 3 minutes about what they noticed during this activity and what surprised them.

Leader Reflection/Assessment

After each session ask yourself the following questions:

1. Were all of the students engaged?
2. Did some students take a leadership role? Did they know more about Saturn?
3. Did the students discuss the pictures? Were they surprised by any of the images?
4. Were some students more comfortable writing? Could you have done something different to support reluctant writers?
5. Did the students observe the images carefully? Is there detail in their observations or questions?
6. Did students find that observing leads to questioning?

Glossary

- **Engineer** — A person who designs, builds, or directs the use of engines or machines.
- **Spacecraft** — A vehicle designed for travel in space beyond Earth's atmosphere, to other planets or moons, or in orbit around Earth. Spacecraft can carry people or be robotic.

Information for Families

When Saturn appears in the night sky, it is bright enough to often be seen even in cities. Encourage families to pick up a public magazine on astronomy, call a local science museum, or contact an area amateur astronomy club to find out when and where to see Saturn for themselves! If families have Web access, they can also use an Internet search engine to look for "locate Saturn in the night sky."

Parents who would like to take a look at Saturn through a telescope with their kids can go to the Saturn Observation Campaign website to find out where local astronomers are participating. Events are open to the public — saturn.jpl.nasa.gov/education/saturnobservation

See "What's Up" in the night sky in these monthly podcasts:
solarsystem.nasa.gov/news/whatsup-archive.cfm

Is your weather bad when you want to observe Saturn? Try taking a picture with a remote telescope!
mo-www.harvard.edu/OWN/

NASA Resources

Careers at NASA

NASA has opportunities for fascinating careers. Go to https://careerlaunch.jpl.nasa.gov to see the current job postings at NASA's Jet Propulsion Laboratory. Share one of the listings with your students (you will have to summarize the listing for most teams) and ask them to describe how to qualify for these positions. How does someone become the Senior Orbit Determination Engineer? The Origins of Stars and Planets Group Research Scientist? Ask students what other kinds of jobs they think might be at NASA. Chart their responses and post them in the room.

Role Model Resource

Dr. Bonnie Buratti is a research scientist, and her main interest is studying the icy moons of Saturn and other planets. She thinks they are fascinating because some of them are volcanically active. Some of them are heavily cratered. Some of them are covered in snow

and ice. She analyzes data from the Cassini spacecraft. She says "The most important thing about being a scientist is that you are always on the forefront of knowledge, discovering new things. As a student it is important to do well in math and science, but it is also important to do well in English, because a lot of what you do is write and communicate with other scientists. It's important to learn "how to play with others," because as scientists we are always working as part of a team."
Watch a video of Bonnie at: solarsystem.nasa.gov/multimedia/video-view.cfm?Vid_ID=1042

Resources

Find more information, pictures, and video about the exploration of Saturn at the Cassini mission website — saturn.jpl.nasa.gov.

Get the latest NASA summaries and news from the Cassini spacecraft at:
www.nasa.gov/mission_pages/cassini/main
This cartoon and video shows how the surface of Saturn's moon Titan was viewed by the Huygens probe during its descent to the surface:
www.esa.int/SPECIALS/Cassini-Huygens/SEMKVQOFGLE_0.html

This site provides child-friendly background about the Cassini–Huygens mission:
saturn.jpl.nasa.gov/kids

Taking Science to the Next Step

The Cassini spacecraft passes by Saturn and Titan regularly. The Cassini Status countdown clock at saturn.jpl.nasa.gov forecasts when the spacecraft will pass by next and send back pictures of these other worlds.

Consider asking the leader in another room to do the same exercise (perhaps just the drawing portion of the activity if it is a room of younger children). The children can meet to share and talk about what they drew and why.

You may want to have the gallery of images from the Cassini mission bookmarked on the computer for the students to explore — or print them and post them around the room — saturn.jpl.nasa.gov/photos

Literacy

- Postcards and letters are a fun alternative for publishing students' descriptive writing about Saturn. Student pieces can be compiled into a group book, used for individual mini-books, or as text for "Postcards from Saturn" to be shared with kids in another classroom, pen pals, or family/friends.

Materials:

- pencil, scissors, cardstock (or index cards), colored paper, glue sticks, colored pencils, markers, crayons, and stickers. For samples, provide a real postcard, stamp, and envelope.

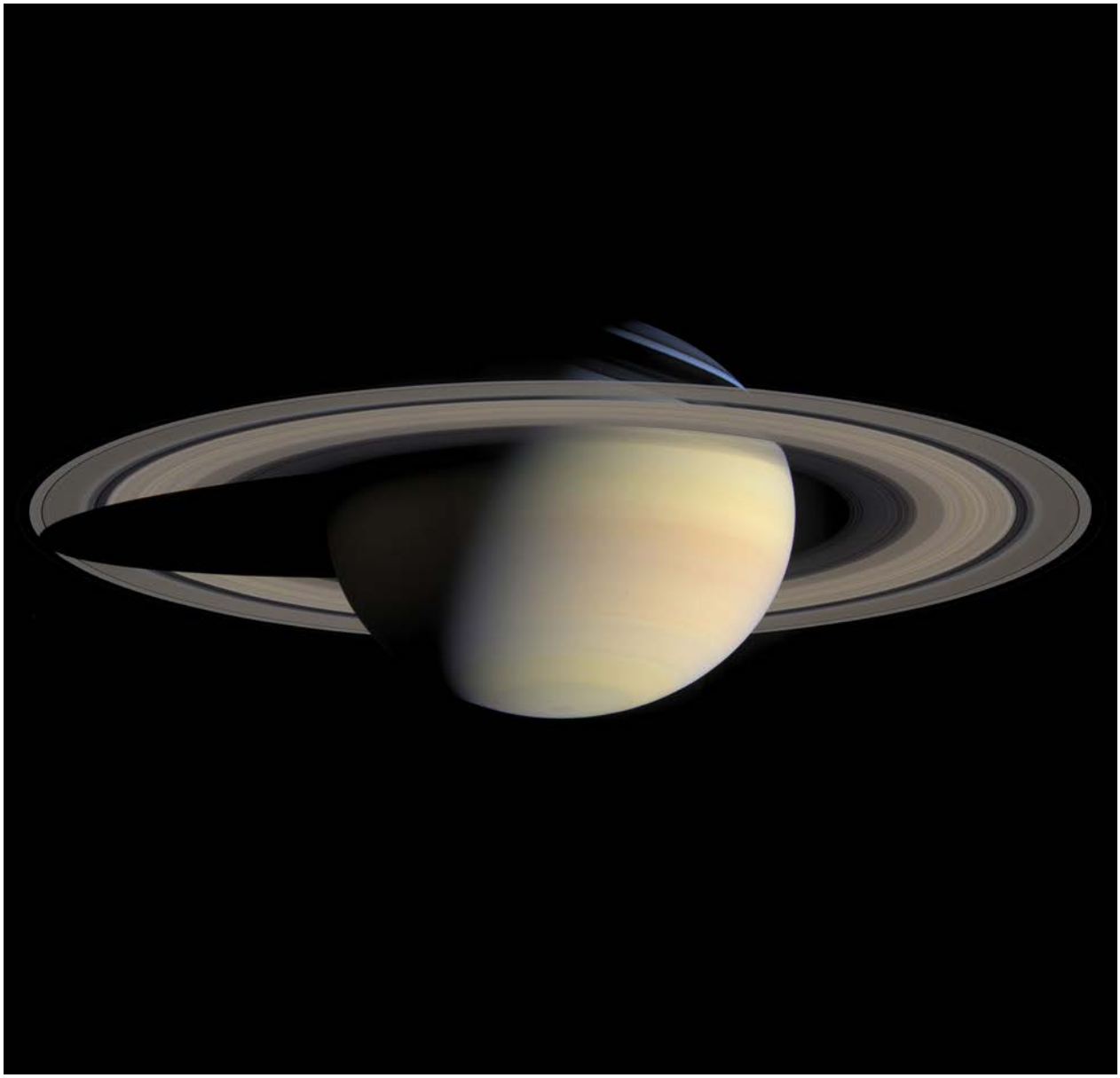
How to Make Envelopes

1. Carefully open an envelope along all the seams.
2. Use your flattened envelope as a template for tracing and cutting envelopes from colored paper. Decorate, using available materials, and then carefully reassemble the new envelope. Be careful that the glue stays on the flaps, and does not get into the interior of the envelope.
3. Envelopes can also be made from photocopied pictures of Saturn, recycled wrapping paper, or other decorative papers.
4. Students can design stamps for their envelopes.
5. Put Saturn mail inside envelope, and deliver. Or, you can make a whole-group book of Saturn mail, with a description or story woven throughout the book and a letter related to that part of the story tucked in to every other page.

How to Make Postcards

1. Cut cardstock, or use 4" by 6" or 5" by 8" plain index cards.
2. Use a real postcard as a model for deciding where to put text and images.
3. Students can design postage stamps for their postcards.
4. Postcards can be written before Cassini arrives at Saturn, and after (with new descriptive information).

Image 1



Activity 1 Materials

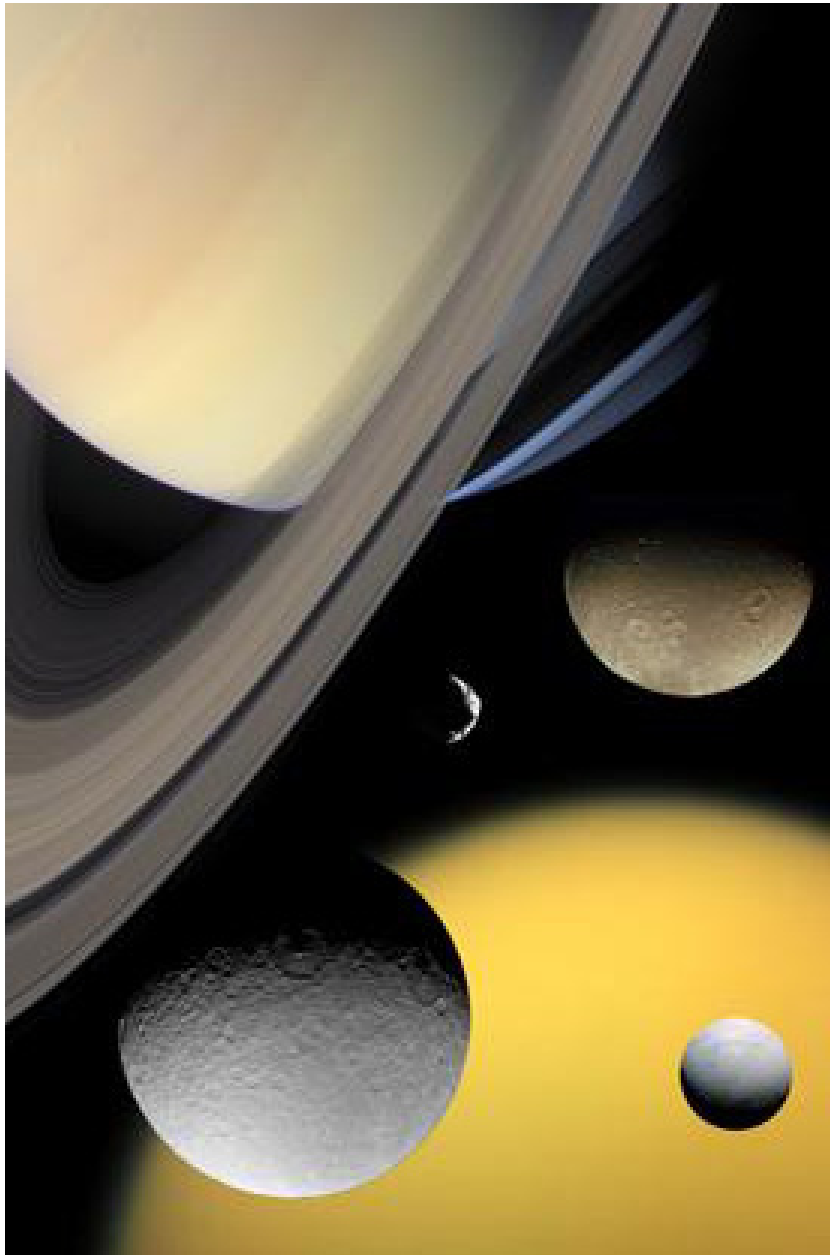


Image 2

Image 3

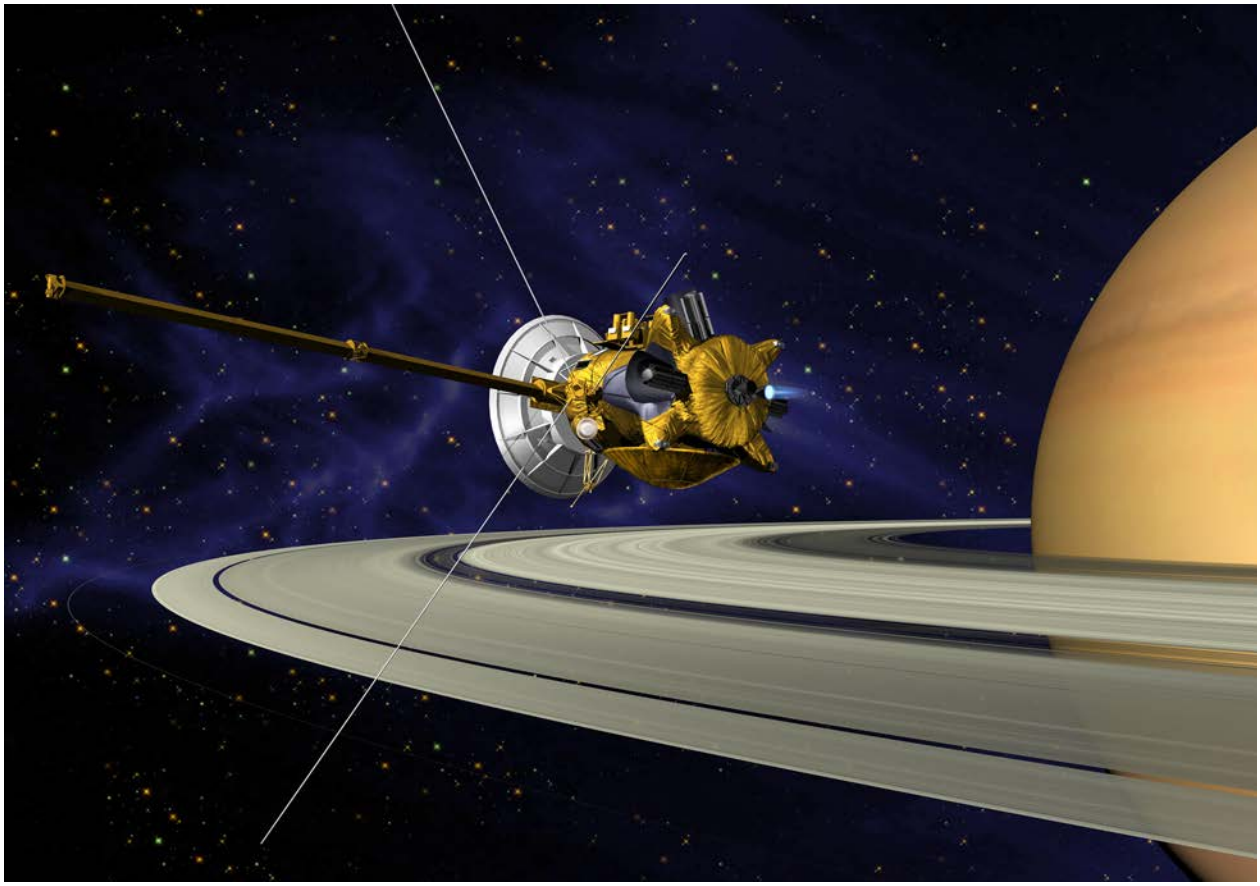


Image 4

Activity 1 Materials

Image 5

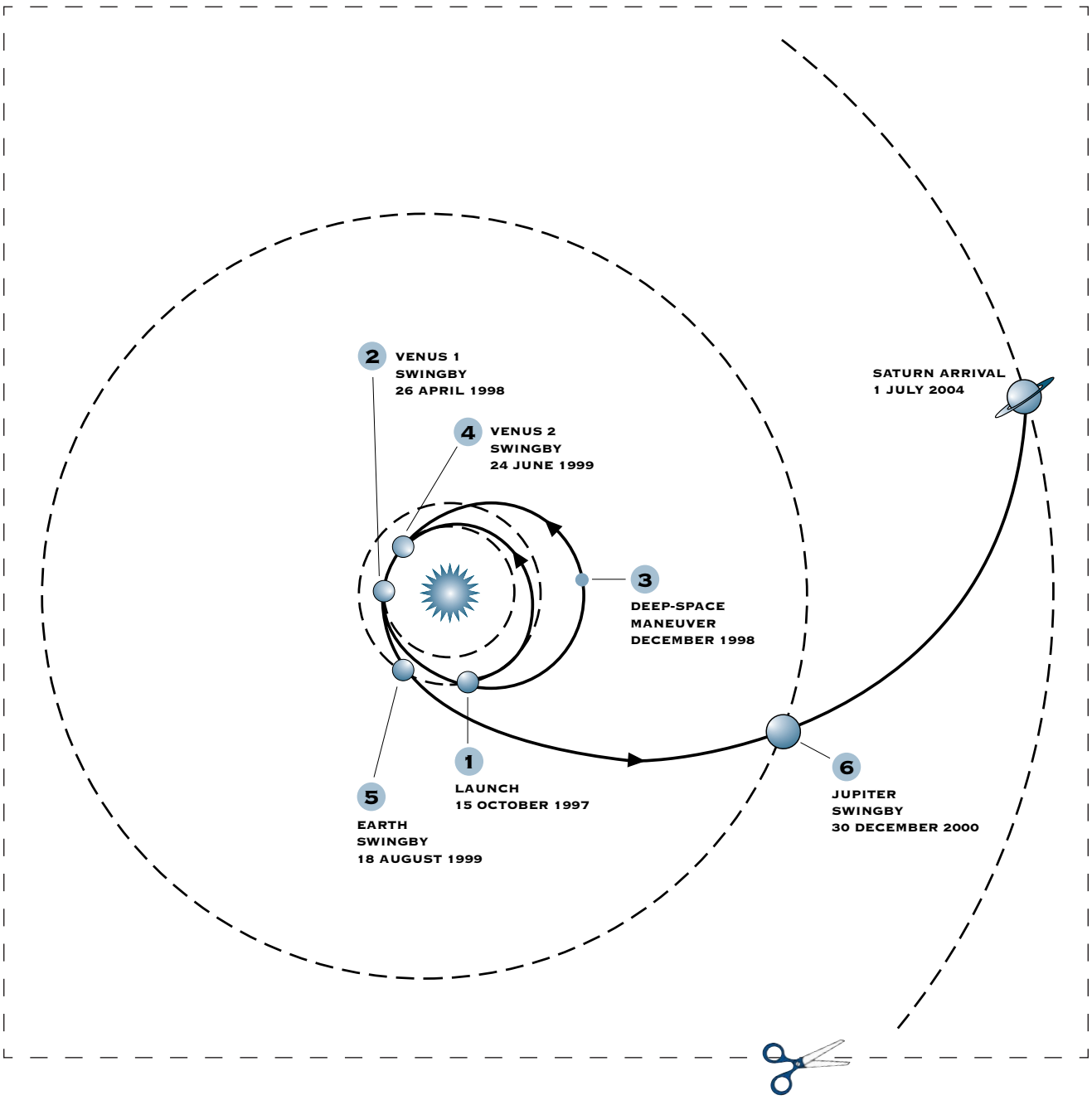


Image 6

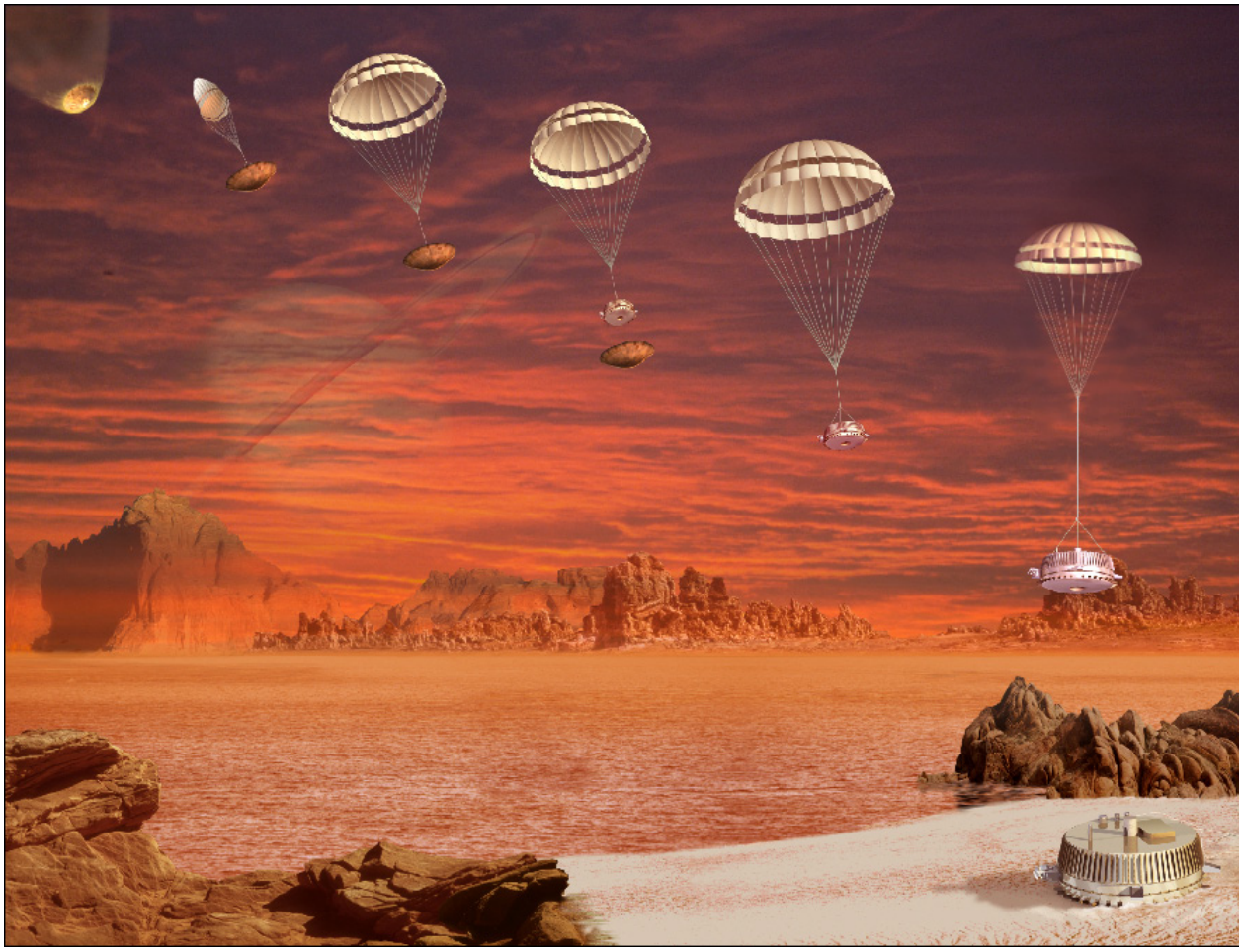


Image 7