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!)

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!

teacher TIP

- Display postcards 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.

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?

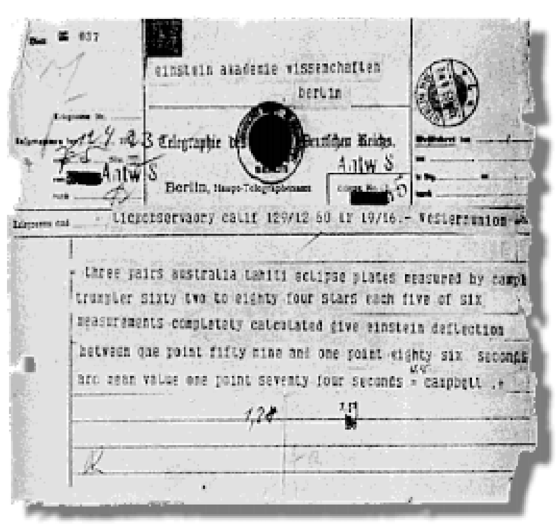
Extension Activities

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.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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., conven tions, 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 infor mation).

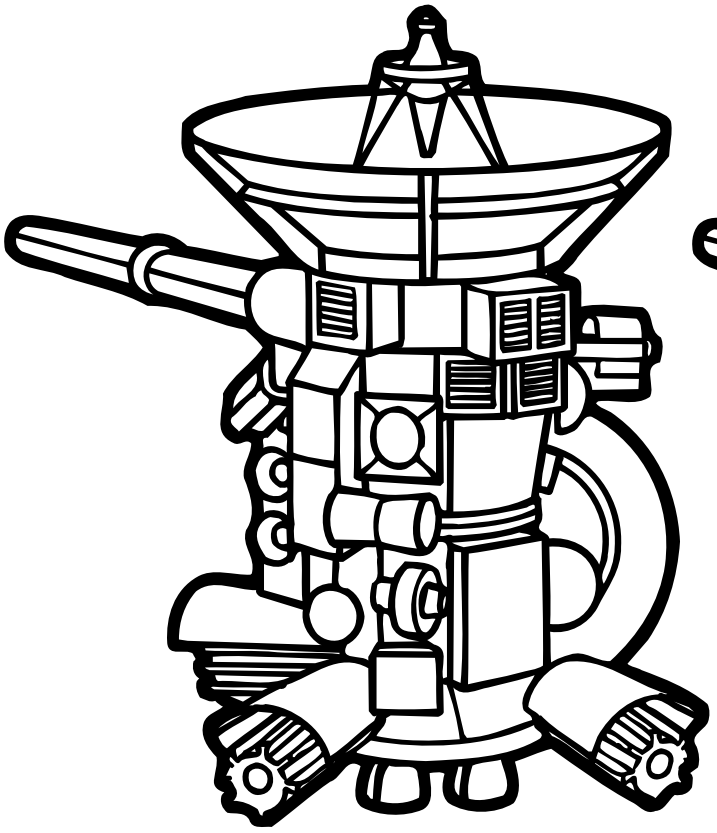
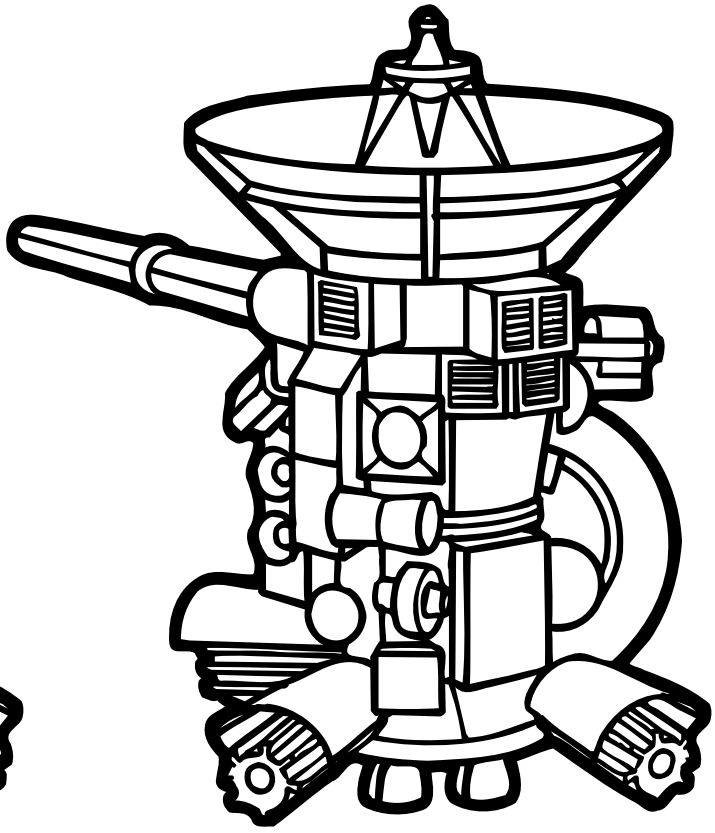
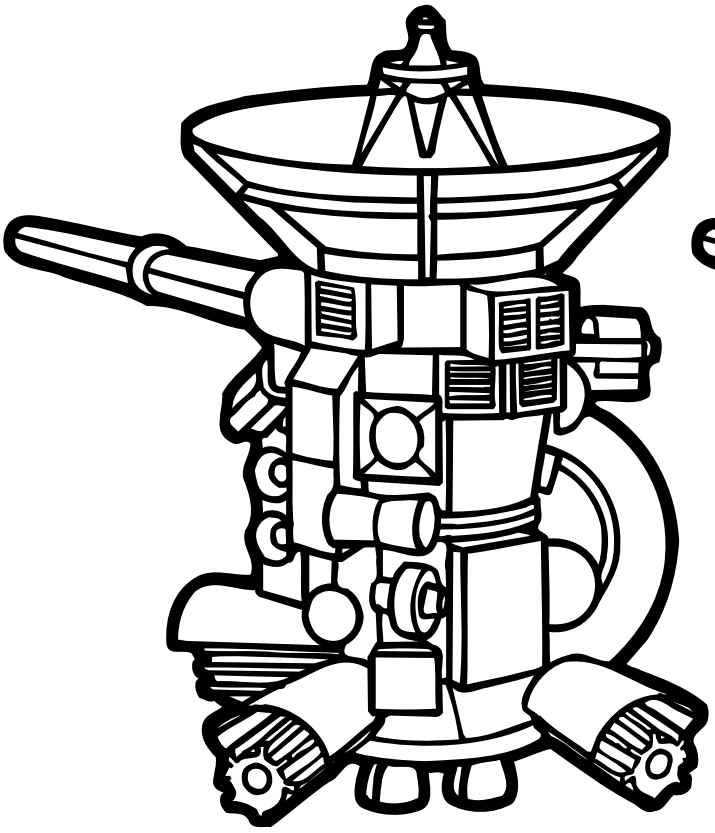
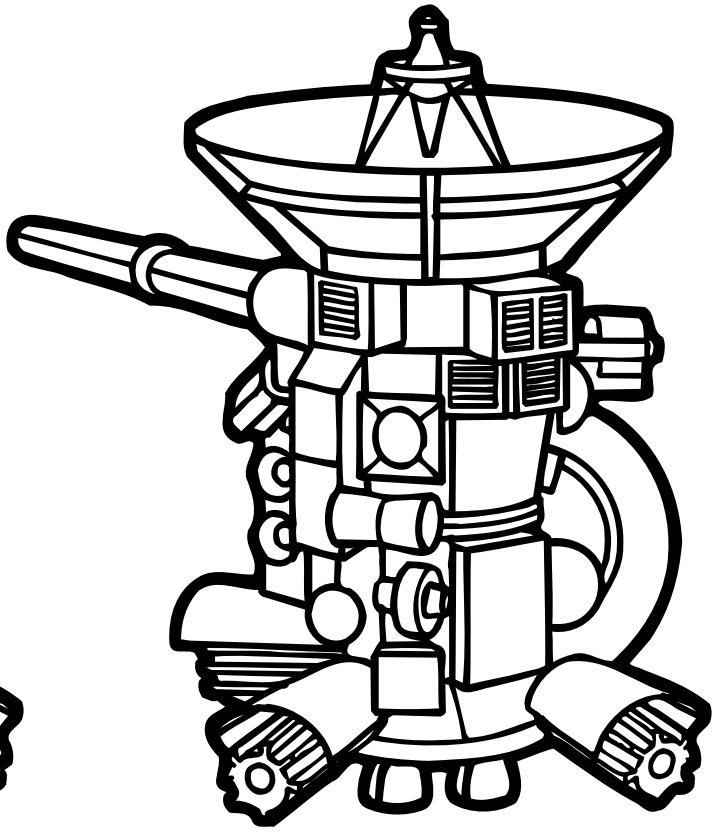
National Science Education Standards

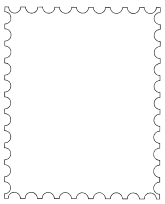
Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



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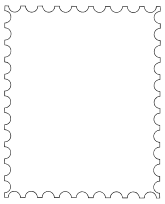

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