Our Solar System

Students will travel through the solar system and learn how far apart the planets are and how they move through the solar system.

Grade Level: 2nd

Phenomena:
How long does it take the planets to orbit the sun?

Objectives:
- Students will create a model to demonstrate how far apart planets in our Solar System are from each other.
- Students will differentiate between the two ways in which planets move through the solar system (rotation and revolution).
- Students will demonstrate how those planets move using a model.

Materials:
- Planet walk posters
- Objects to represent planet sizes (optional)
- Chalk
- Yard stick
- Earth ball

Appendixes:
- Plant walk distances: Page 4,5
- Orrery diagram: Page 6
- Planet walk posters: Page 7-14

Time Considerations:
Preparations: 30 minutes
Lesson Time: minutes
Intro: 10 minutes
Activity 1: 20 minutes
Activity 2:10 minutes
Activity 3:10 minutes
Conclusion: 10 minutes

Related Lesson Plans:
Our Amazing Moon, Our Special Planet, Comparing Worlds, Solar

Nevada Outdoor School . org

Next Generation Science Standards

2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Science and Engineering Practices (SEP):
Constructing Explanations and Designing Solutions

Disciplinary Core Ideas:
The History of Planet Earth

Crosscutting Concepts:
Stability and Change

Excellence in Environmental Education Guidelines

Strand 1—Questioning, Analysis, and Interpretation Skills

F) Learners understand that relationships, patterns, and process can be represented by models.

Background

The solar system is the neighborhood in which our planet resides. It is called the solar system because it centers around the sun. There are now eight planets that orbit the sun and a number of smaller “dwarf” planets. Our earth is the third planet from the sun and is the only one we know of that supports life. The four inner planets are known as the ‘rocky planets’ because they have solid surfaces. These are, in order, Mercury, Venus, Earth and Mars. The asteroid belt separates the inner planets from the outer, gas planets. The outer planets are made of lighter materials, mainly gas. These are, in order, Jupiter, Saturn, Neptune and Uranus. The planets are not evenly spaced and the outer planets are very far from the sun.

The planets in the solar system are not stationary; they move in several different ways. The first way planets move is called rotation. This is where a planet spins on its axis; one complete rotation is a day. The second biggest movement planets make is called revolution. This is where planets orbit the sun, one revolution makes a year. The speeds of these movements vary with each

planet. Some move faster or slower relative to Earth.

You can model the movement of the planets by constructing an orrery. The instructions for making an orrery can be found in the preparation section.

Scientists who study the solar system and universe (astronomers) believe the solar system is about 4.6 billion years old. During this time the sun ignited from a nebula (planetary cloud) and the planets formed as the debris coalesced.

Preparation

This lesson requires a bit of set up time. The setup of the orrery takes the longest and requires the naturalist to arrive at the school at least 20 minutes before the lesson to make sure it is chalked out.

Orrery:

An orrery is a model of how the planets move within the solar system. To create the model, you will need to find an open place on the cement or blacktop where you can draw it out. Start with the sun as the center. The first planet is Mercury. On the model, Mercury is 58 cm (22.8 in) from the sun and there are 6 marks, equally spaced, demonstrating Mercury's orbit.

Next comes Venus, which is 108 cm (42.5 in) from the sun, with 16 marks around the sun. Earth is 150 cm (59.1 in) from the sun with 26 marks. And Mars is 228 cm (89.8 in) from the sun with 50 marks. Chalk is the best way to make the orrery, and if it doesn't rain, you will only need to refresh the tic marks. Each mark represents two weeks of the planets orbit. The Students will model how the planets move through the solar system. Refer to page 5 for orrery diagram.

Planet Walk:

It is helpful to review the details on each planet. It is also helpful to scout out where the best place to walk out the planets would be. This activity needs a lot of space and it is rare to get past Uranus. But the scope is still very real to the students and they can conceptualize the rest, especially when you say that Uranus is only half way through the solar system!!

Doing the Activity

Introduction:

Today we are going to talk about the solar system and how it moves. Take a few minutes to talk to your partner/neighbor about what you know about the solar system.

After the students discuss for a few minutes, have them tell the class a fact about the solar system. Make sure any misconceptions are pointed out and cleared up. See if the students can name all eight planets. Tell them that we will be visiting the planets today and learning cool facts about each one.

Activity 1: Planet Walk

Have the students stand up and stretch to prepare for the space flight. Have them put on their space suits and helmets and sit down and get ready to take off. Before the countdown starts, make sure you give expectations about how the kids students should act (stay in line, inside voices, etc). Also, mention that we are going to do a whisper countdown (so we don't disturb other classes). 3, 2, 1… BLAST OFF!!!

After the space ship has taken off, line the kids students up at the door and head outside. Take the class to the furthest part of the school yard to maximize the distance you can travel.

Begin with the sun; talk about how it is the center of the solar system and that we are going to travel from here. Walk the appropriate number of steps to get to the next planet. Have the students line up shoulder to shoulder and help to count out the pacing. As you arrive at each planet talk about the points on the posters.

It is rather difficult to get past Uranus in the planet walk. If this is the case, you can talk about how far we would have to go to get to Neptune and that Uranus is the center of our solar system

(when the dwarf planet Pluto is included).

Activity 2: Planets in Motion

After traveling through the solar system, bring the students together to talk about how the planets move in the solar system. Use the earth ball to demonstrate. Begin by asking questions: Are the planets lined up in a straight line? (no) Do they stay in one place or do they move? (move)

That's right, the planets all move through the solar system. We are going to talk about the two main ways they move today. Lets think about Earth; how does Earth move? (if the students bring up spin, orbit, or another name for the motions go with that way first) Earth spins on its axis, or rotates. Show the earth ball spinning. What does this motion create? (day and night) Earth also moves around, or orbits the sun. This is called a revolution. Show this with the earth ball. What does this create? (a year)

Now all of the planets move this way, but they all move at different speeds. We are now going to do an activity that will show us the difference in how the planets move.

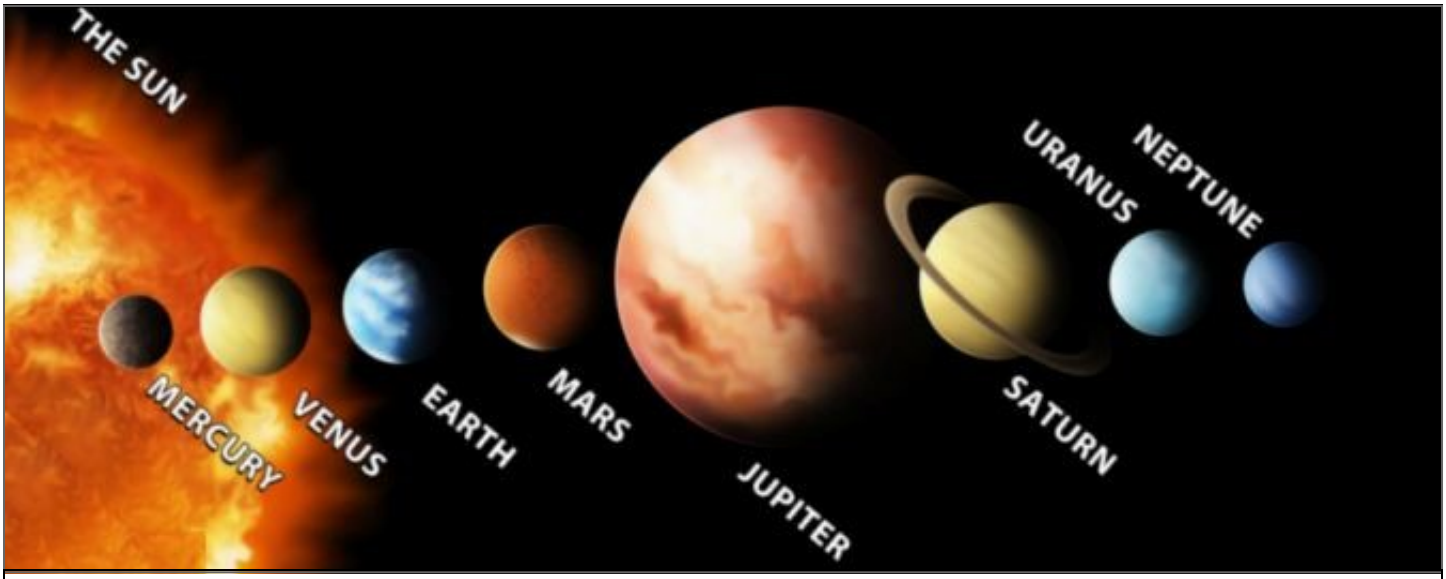
Activity 3: Orrery

Bring the students to the orrery. Explain that the marks on the ground represent the paths that the planets take around the sun. Each mark represents two weeks.

Choose students to represent each planet and the sun in the orrery. Explain that we will be moving all at the same time to revolve around the sun. Each time the instructor claps, the students will move one mark in the orrery. This needs to be made clear so the students don't get ahead of themselves. It is good to practice with one or two steps before doing the whole thing. Have the students start in a line along the orrery. Ask the students if the planets are lined up like this in space. (no) We will see what happens when they start moving. Tell Earth that they will need to yell out 'stop!' when he/she completes one full revolution. (It is helpful to make a special mark so the student knows when they have gone all the way around.)

When the planets stop, point out to the class where each planet is. Are they lined up? Why not?

If the students can remember how many times they revolved around the sun, use that to further show how planets move at different speeds take different amount of time to make a revolution around the sun. To help students remember how many revolutions they made they can each have a partner help them to keep track while



Our Solar System
http://nineplanets.org/

Students acting as planets revolving around the Sun during Orrery Activity
Photo By: NOS

Along the planet walk show an object that represents the relative size of the planets.

Planet Walk Distances

Mercury:
10 paces from the sun

Venus:
9 paces from Mercury
19 paces from the sun

Earth:
7 paces from Venus
26 paces from the sun

Mars:
14 paces from Earth
40 paces from the sun

Jupiter:
109 paces from Mars
149 paces from the sun

Saturn:
112 paces from Jupiter
261 paces form the sun

Uranus:
249 paces from Saturn
510 paces from the sun

Neptune:
281 paces from Uranus
791 paces from the sun

they are walking. They should see that the planets closer to the sun (Mercury) completed more revolutions move faster than those further away (Mars).

Conclusion

Bring the students back into the class and review the topics discussed. Some key points they should have learned:

- The inner planets are closer together than the outer planets.

- The planets are very far apart.

- The planets all move within the solar system.

- A revolution is when a planet makes a complete orbit around the sun. This is also a year.

- A rotation is when a planet completes a spin on its axis. This creates day and night.

Assessment

Assess the students' understanding of rotation and revolution by asking what kind of motion we are seeing during the orrery. You can also assess the listening skills of the students as they count out the paces for the planet walk.

During the conclusion, assess their understanding of the overarching concepts.

Extensions

Have students create their own pneumonic device to remember the order of the planets.

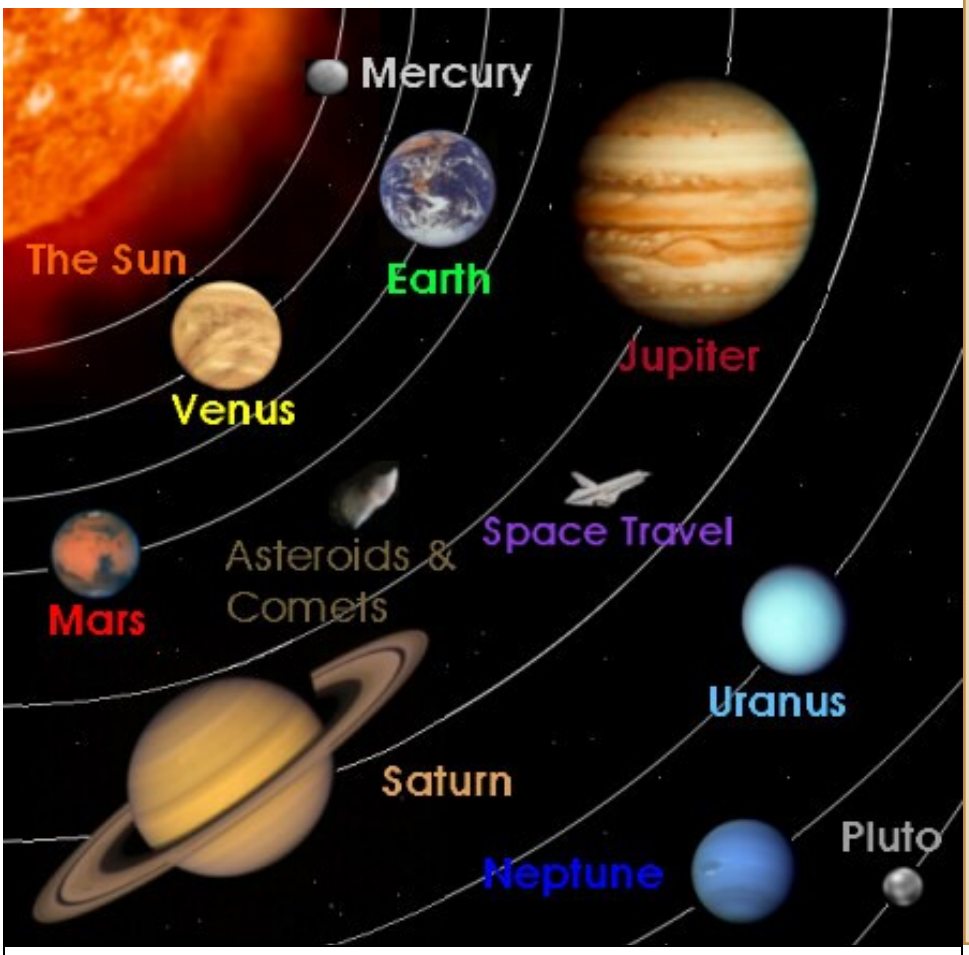
Vocabulary

Orbit: the path that a planet takes around the sun

Orrery: a model of the solar system that demonstrates how the planets move relative to each other

Revolution: when a planet completes an orbit around the sun; creates one year

Rotation: when a planet completes one spin along its axis; creates day and night



http://library.thinkquest.org/25097/graphics/g_main.htm

Sources

- Orrery activity adapted from the GEMS space science Curriculum Sequesnces; Unit 3. The Solar System
- http://nineplanets.org/
- http://library.thinkquest.org/25097/graphics/g_main.htm

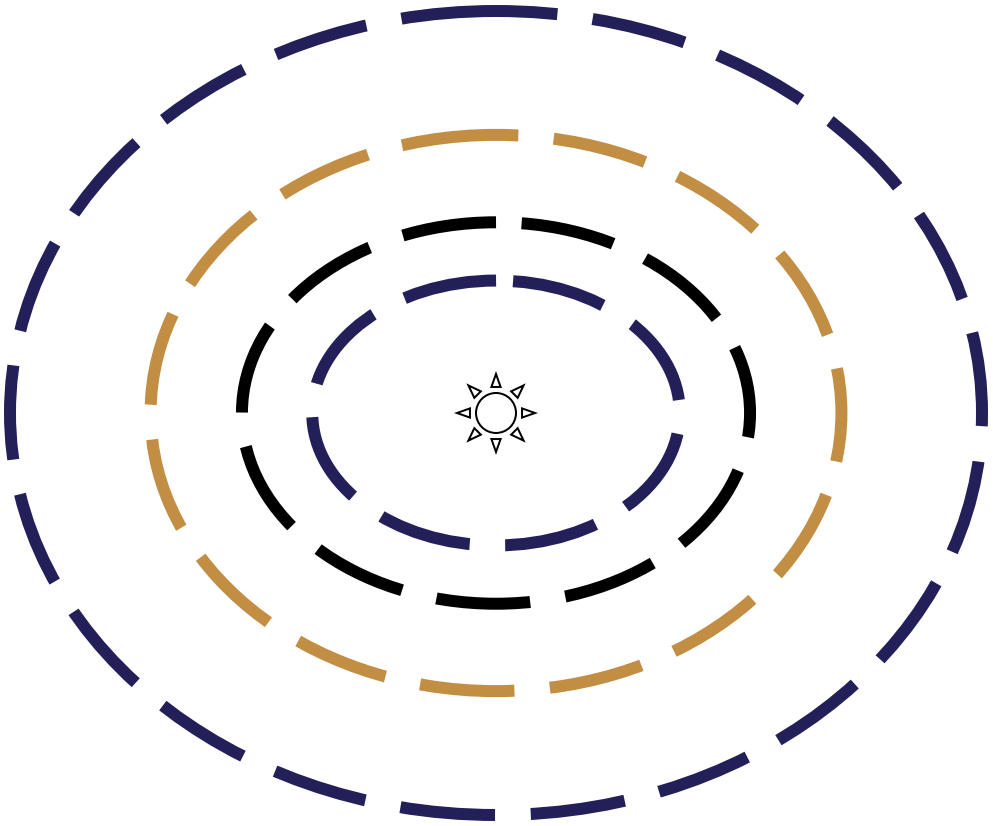
Orrey Set Up

Arrive to school at least 20 minutes prior to the start of the lesson. Using side walk chalk, draw the orrey on a cleared concrete or black top area. The following measurements represents the radial distance each planet is from the sun. Each dash mark (number of dashes are not correct in this diagram) represents two weeks worth of time.

This model demonstrates that each planet, indeed orbits the sun but, takes a different amount of time to complete one revolution.

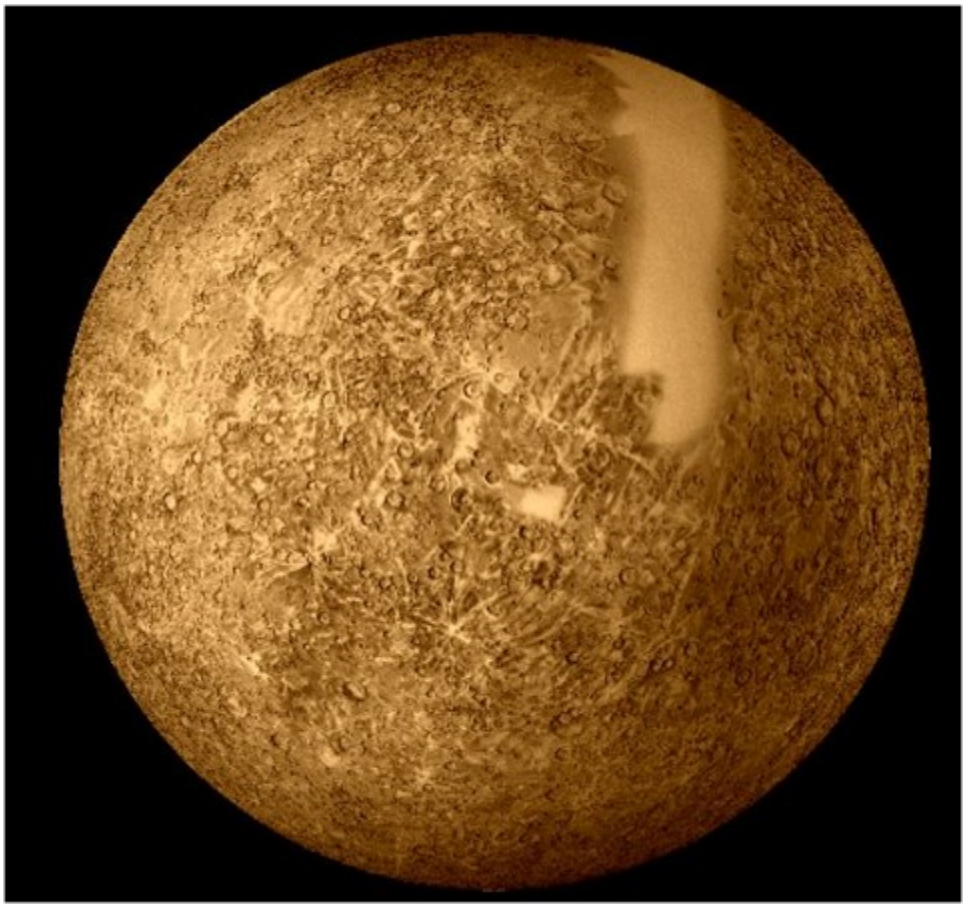
Students will demonstrate and see these different rates of revolution by walking each orbit. Four students should start at one side of the orrey and begin walking each dash mark at a normal walking pace. Very soon students will notice that Mercury revolves around the sun faster than the other planets.

Mercury: 58 cm (22.8 inches) from the Sun & 6 dash marks (12 weeks to orbit)
Venus: 108 cm (42.5 inches) from the Sun & 16 dash marks (32 weeks to orbit)
Earth: 150 cm (59.1 inches) from the Sun & 26 dash marks (52 weeks to orbit)
Mars: 228 cm (89.8 inches) from the Sun & 50 dash marks (100 weeks to orbit)



Mercury

http://planets.sciencedaily.com/l/1/Mercury



- 3,000 miles wide
- 36 million miles from the sun
- Temperature Range: -300°F to 800°F
- Mercury has the biggest temperature range of any other planet. It can change as much as 1,000°F between day and night.

Venus

http://en.wikipedia.org/wiki/File:Venus_globe.jpg

- 8,000 miles wide
- 64 million miles from the sun
- Average Temperature: 855°F
- Venus spins backwards - the sun rises in the west and sets in the east.

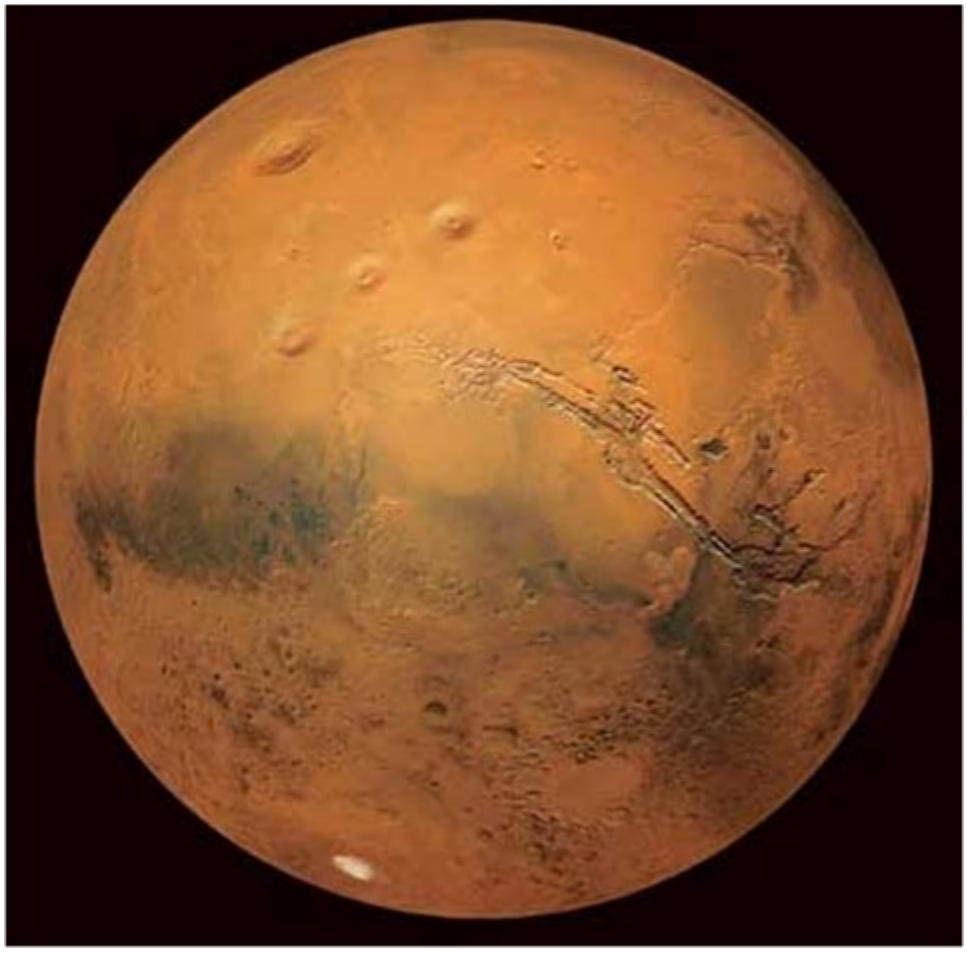
Earth

http://www.123rf.com/photo_12761145_earth-globe-cloud-map-on-a-black-background-side-of-the-north-and-south-america-the-earth-texture-of.html

- 8,000 miles wide
- 93 million miles from the sun
- Average Temperature: 59°F
- Earth is called the “Blue Planet” because more than 70% of Earth’s surface is covered with liquid water.
- Earth is where we live!

Mars

http://en.wikipedia.org/wiki/File:Celestia_mars.jpg



- 4,000 miles wide
- 143 million miles from the sun
- Temperature Range: -200°F to 32°F
- Mars is called the “Red Planet” because of its red soil. The soil is red because it contains rust.

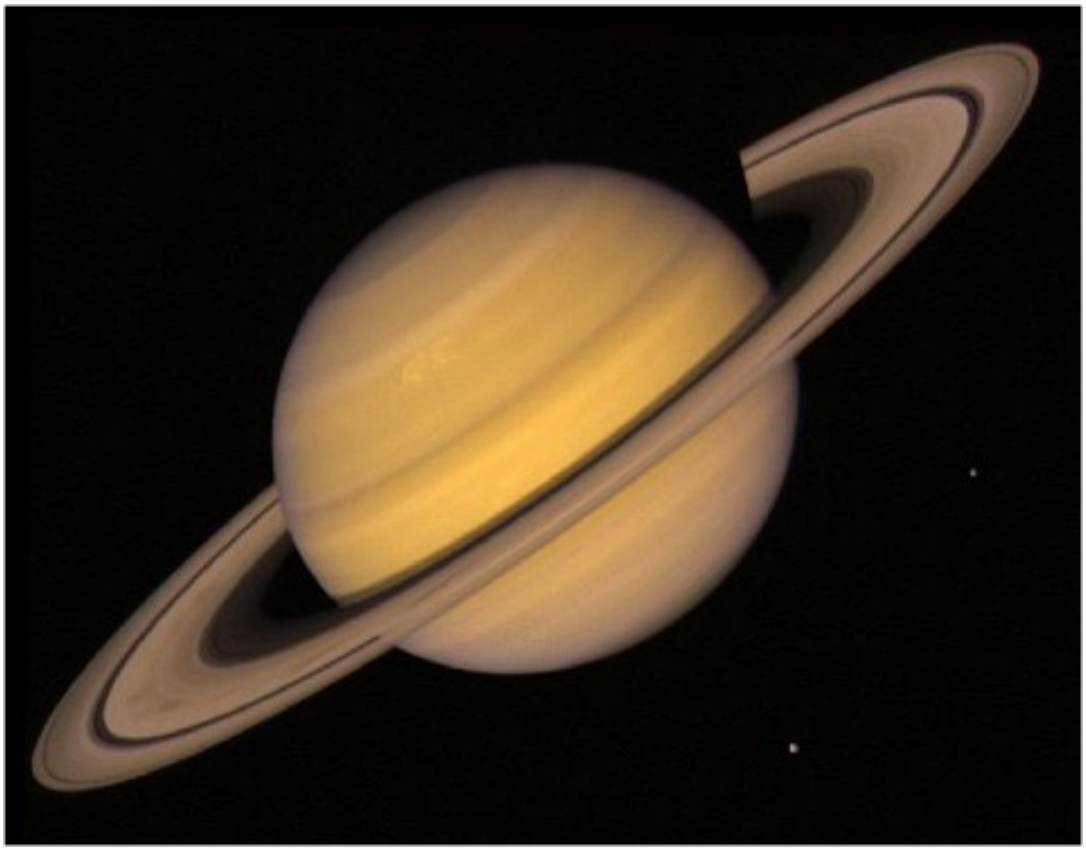
Jupiter

http://pikimal.com/planet/jupiter

- 90,000 miles wide
- 483 million miles from the sun
- Average Temperature: -101°F
- Jupiter has 3x more matter than all of the other planets combined.1,321 Earths could fit inside Jupiter.

Saturn

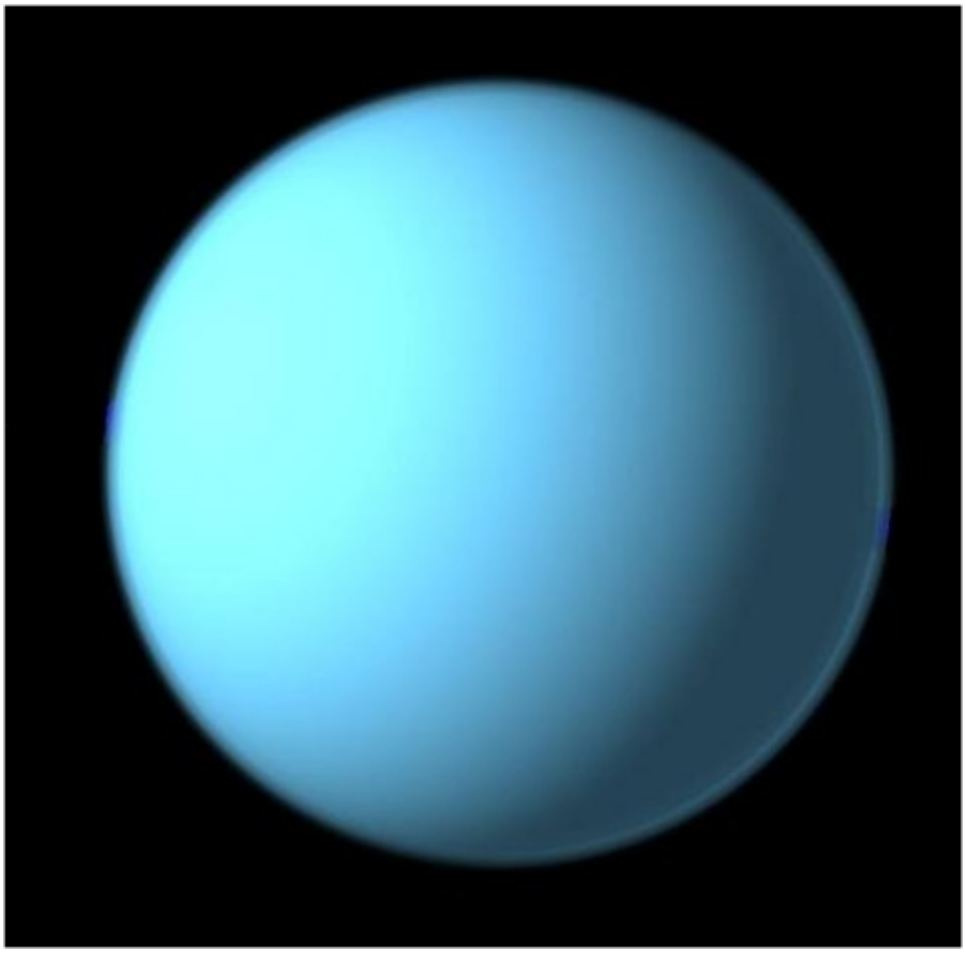
http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-saturn.html



- 70,000 miles wide
- 887 million miles from the sun
- Average Temperature: -274°F
- Saturn has beautiful rings of rock, ice, and dust.

Uranus

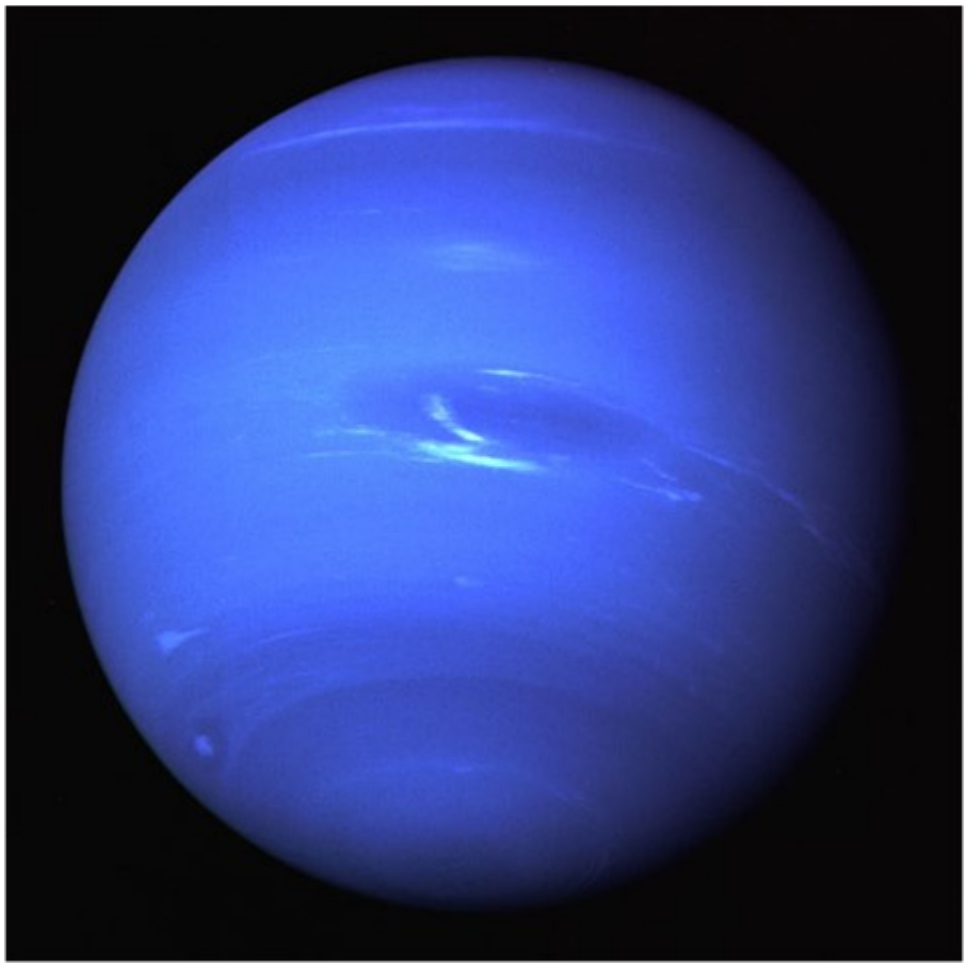
http://www.alpcentauri.info/uranus.html



- 30,000 miles wide
- 1,785 million miles from the sun
- Average Temperature: -328°F
- Uranus has 11 known rings and 27 known moons.

Neptune

http://nssdc.gsfc.nasa.gov/planetary/factsheet/neptunefact.html



- 30,000 miles wide
- 2,796 million miles from the sun
- Average Temperature: -346°F
- Neptune is the fourth largest planet. About 60 Earths could fit inside of it.