Names:

Assigned Solar Learning Station

System Object:

Projects Due:

Solar System Learning Station Guidelines

Learning Station Project Checklist
Be sure to prepare the following items for your station:

• **Title Sign or Banner**—Make a sign or banner that clearly displays your object's name.

• **Drawing of Object**—Create a color illustration of your object.

• **Accurate Scale Model**—Make a scale model of your object. Refer to your object fact sheet to find out how you should make your model.
The most important thing is that your model is sized correctly!
Although the final model doesn't have to look exactly like your object, if you would like to decorate your model to make it look more realistic, go ahead!

• **Travel Brochures**—Each team member should prepare a travel brochure sharing interesting and accurate information about the object!

Name:

Assigned Solar Learning Station:

System Object:

Projects Due:

Solar System Travel Brochure Guidelines

Travel Brochure Checklist
Be sure to include the following information in your travel brochure:

• Five pieces of accurate and interesting information about your object in the brochure text. Write this information in a fun and exciting way—you are trying to convince someone that it would be fun to vacation there!
• Information about conditions on your object. For example:
Does it have an atmosphere? If so, what is the atmosphere made of?
What are its temperature conditions? Is it hotter or colder than Earth?
What is the surface like? Is it rocky or gaseous?
How big is it? Is it larger or smaller than Earth?
• At least one drawing of your object.
• A description of what it looks, smells, and feels like there. Remember, these descriptions should be based on accurate information about your object!
• A list of the research sources you used. In addition to the object fact sheet, you should use at least two other sources to gather information about your object. List these sources on the back of your brochure.
• Make your brochure exciting, colorful, neat, interesting, and factual! Be creative, funny, artistic, poetic, daring. The sky's the limit!
• Remember to write out all of the information in your brochure using your own words.

Do not copy directly from your sources. Do not include anything you do not understand in your brochure.

Some Additional Ideas
• Explain what a person visiting should wear for their trip in order to be comfortable.
• Describe any special activities a person could do there.
• Come up with a cool nickname or slogan for your object.
• Make true-or-false-question cards that can be flipped over to reveal the correct answer underneath.
• Write a poem, rap, or song about your object. Have the words written out or the song recorded for visitors to appreciate when they visit your learning station!

Mercury

For your model: Make a ball 5 millimeters in diameter.
Diameter: 4880 kilometers
Average distance from the Sun: 58 million kilometers
Mass: about 1/20 of Earth's mass
Surface gravity: about 1/3 of Earth's gravity
Length of day (the time it takes to turn around once): 59 Earth days
Length of year (the time it takes to orbit the Sun): 88 Earth days
Atmosphere: almost none
Moons: none

The closer a planet is to the Sun, the faster it orbits. As the planet closest to the Sun, Mercury clips along at 48 kilometers per second. In Roman mythology, Mercury was the messenger of the gods, and the planet got its name because it orbits the Sun faster than any other planet. Mercury is hard to see from Earth because of the Sun's glare.

Temperature: Since Mercury is so close to the Sun, it gets almost 10 times as much heat, light, and radiation per square foot as Earth. During the day, surface temperatures can reach 450oC (800oF). Because it has so little atmosphere, it can't hold the heat at night, so it gets freezing cold—hundreds of degrees below zero. Of all the planets in the Solar System, Mercury has the biggest changes in temperature from day to night.

Atmosphere: Mercury captures small amounts of solar wind gases (mostly helium) that stream by from the Sun. These gases never remain very long in the atmosphere because the gravity of Mercury is weak, and the daytime temperature gets very high. The atmosphere is only one million-billionth the density of Earth's atmosphere. Sound cannot travel without air, so Mercury is a silent world. Mercury is one of the most inhospitable planets around the Sun because the surface is continually bombarded by unfiltered sunlight, which includes dangerous ultraviolet radiation and X-rays.

Geology: Mercury is one of the rocky, or terrestrial, planets in the Solar System. Because it has a weak magnetic field and high density, scientists think Mercury has a large iron core. Above the core is the mantle, a layer of compressed molten rock. On top of the mantle is a solid, rocky crust. Mercury's surface has many craters caused by asteroids and comets smashing into it, like the Earth's Moon. One of the most noticeable features on the surface, the 1300-kilometer-wide Caloris Basin, was probably formed by a giant meteor that hit Mercury early in the planet's history. The largest remaining crater is called Beethoven and is 625 kilometers across.

Exploration: The first spacecraft to explore Mercury was Mariner 10, which flew by Mercury three times in 1974 and 1975. As of June 2007, a new spacecraft called MESSENGER (Mercury Surface, Space Environment, Geochemistry and Ranging) is on its way to explore Mercury. It is scheduled to fly by the planet three times in 2008 and 2009 and finally end up in orbit around the planet in 2011.

Venus

For your model: Make a ball 1.2 centimeters in diameter.
Diameter: 12,100 kilometers
Average distance from the Sun: 108 million kilometers
Mass: about 8/10 of Earth's mass
Surface gravity: about 9/10 of Earth's gravity
Length of day (the time it takes to turn around once): 243 Earth days
Length of year (the time it takes to orbit the Sun): 225 Earth days
Atmosphere: mostly carbon dioxide, thick
Moons: none

The second planet from the Sun, Venus is named after the goddess of love and beauty in Roman mythology. Venus comes closer to the Earth in its orbit than any other planet. Other than the Sun and the Moon, it is the brightest object in the sky. Venus is often called the morning star or the evening star, because it looks like a bright white star and can be seen near the horizon in the morning or early evening. Thick clouds make it impossible to see the surface of Venus through telescopes. Before it was examined by space probes, many thought it might be Earth-like, with oceans, swamps, and maybe even life.

Temperature: Venus' thick atmosphere and complete cloud cover acts like a greenhouse and keeps heat from the Sun from escaping, making the surface temperature almost 900oF (465oC)! That's more than hot enough to melt lead.

Atmosphere: Venus' thick and heavy atmosphere is made of 96% carbon dioxide. This results in an atmospheric pressure that is more than 90 times Earth's, enough to crush a person in seconds. The surface of the planet is surrounded by clouds of sulfuric acid. It is always raining sulfuric acid, but the rain never reaches the surface. It vaporizes and forms clouds again, high in the atmosphere. Because of the cloud cover, the stars and our Sun can't be seen from the surface.

Geology: Venus is a rocky, or terrestrial, planet that is similar to the Earth in size, weight, and composition. Like Earth, Venus has a dense iron-nickel core (which is probably partly liquid), a mantle of molten rock on top of that, and an outer crust. The surface of Venus is covered with thousands of volcanoes and six large mountain ranges. Because of these similarities, it has been called Earth's sister planet.

Exploration: Venus was known by the ancients and studied by Galileo, who noticed that it has phases like the Moon. It has been explored by many spacecraft since the 1960s. These include the Venera and Vega missions sent by the Soviet Union between 1961 and 1984. Several of these missions included landers that could collect data on the surface of Venus. However, the landers transmitted data for only two hours at the most before breaking down in the harsh surface environment. The United States has sent several missions of its own, including Mariners 2, 5, and 10 between 1962 and 1974 and the Pioneer orbiter and probe in 1978. The United States' most recent mission to Venus was Magellan, which orbited the planet from 1990 to 1995 and mapped the surface with radar that could scan right through the clouds. The European Space Agency sent the Venus Express, which began orbiting Venus in 2006, to study the atmosphere and surface of the planet.

Earth (Terra)

For your model: Make a ball 1.3 centimeters in diameter.
Diameter: 12,756 kilometers
Average distance from the Sun: 150 million kilometers
Length of day (the time it takes to turn around once): 1 Earth day
Length of year (the time it takes to orbit the Sun): 365 Earth days
Atmosphere: mostly nitrogen (78.08%) with plenty of oxygen (20.95%), some water vapor (0%–3%), and a trace (0.03%) of carbon dioxide
Moons: one (Luna)

Earth, the third planet from the Sun, is the only body of the Solar System that we know for certain has life. Human beings are one among many millions of Earth's diverse lifeforms—on land and in both fresh and salt water. Most life on Earth depends on the Sun's energy. Plants use the Sun's energy to make food, and other lifeforms get their energy either from eating plants or by eating other animals that get their energy from eating plants. It has recently been discovered that some lifeforms get their energy from volcanic heat and chemicals deep in the oceans. The Earth's molten nickel-iron core and the planet's daily rotation create a large magnetic field. Along with the atmosphere, this magnetic field protects us from almost all the harmful radiation from the Sun.

Temperature: The Earth's atmosphere acts like a blanket around the Earth and helps keep heat from the Sun from escaping. This is called the *greenhouse effect*. Without this effect, the Earth would be much colder.

Atmosphere: Earth has enough gravity to hold onto an atmosphere, which is rich in life-giving oxygen. Earth's atmosphere was once mostly carbon dioxide, but long ago one of Earth's early lifeforms, blue-green algae, made oxygen from carbon dioxide through photosynthesis. The Earth's atmosphere protects us by burning up most meteors before they can hit the planet. High in the atmosphere, a form of oxygen called *ozone* screens out some of the dangerous radiation from the Sun. Weather on Earth is caused by the Sun heating up the air. The air moves from hot areas toward cold areas, making wind. The Sun's heat causes liquid water to evaporate into water vapor, which cools, turns into liquid or solid, and falls to Earth as rain, snow, or hail. This water cycle is one of the keys to life as we know it.

Geology: Earth is one of the rocky, or terrestrial, planets in the Solar System. The inside of the Earth has several layers including a solid metal inner core, a liquid metal outer core, and a molten rock mantle. As you get closer and closer to the center of the planet, the temperature increases to over 9000oF (5000oC). The Earth's crust is a relatively thin layer of rock at the surface, which floats on the liquid rock below. The crust is arranged in a series of large plates that slowly collide, slide past one another, and pull apart. The movement of these plates causes earthquakes and volcanoes and helps give the Earth's surface its shape. Wind and water erosion also change the shape of Earth's landforms.

Exploration: Earth has been explored more fully than any other planet, yet many mysteries remain. The deep ocean has undiscovered lifeforms. Beneath rocks and ice lie clues to our planet's past, which may help us discover its future. Satellites and space ships give us views of the Earth that show how oceans, deserts, forests, grasslands, and cities all interact with and affect each other, helping us visualize and seek global solutions to pressing environmental issues.

Luna (Earth's Moon)

For your model: Make a ball 3 millimeters in diameter.
Diameter: 3475 kilometers
Average distance from the Earth: about ⅜ million kilometers
Mass: about 1% of Earth's mass
Surface gravity: about ⅙ of Earth's gravity
Length of day (the time it takes to turn around once): about a month
Time it takes to orbit the Earth: about a month
Atmosphere: none

All the planets in the Solar System have moons, except Mercury and Venus, but Earth's Moon is one of the biggest. Our Moon is named Luna, but most people just call it "the Moon." It is a good object for beginning astronomers to study because the features on its surface can be seen with the naked eye. It does not shine with its own light, but instead reflects sunlight. Luna is thought to have formed about 4. billion years ago, possibly from leftover debris from a crash of a Mars-sized object into the young Earth. Other astronomers think it may have broken off from the Earth. Another possibility is that it was a rock captured by Earth's gravity, or that it formed from dust and rocks around the young Earth. The Moon's gravity is one-sixth as strong as Earth's gravity, which means that a person who weighs 150 pounds on Earth weighs only 25 pounds on the Moon. The sky is always black, because there is no atmosphere. Earth looks colorful and beautiful from the Moon.

Temperature: Because it has no atmosphere to hold in heat, the Moon's temperature changes a lot. It can range from –275oF (-170oC) at night to 280oF (138oC) during the day.

Atmosphere: The Moon has no atmosphere, because it doesn't have enough gravity to hold one. Since sound needs air to travel, there is no sound on the Moon!

Geology: The Moon has two main types of terrain that can be seen with the naked eye. The lighter areas are mountains and craters, and the darker areas are flat plains called "maria," caused by ancient lava flows. Since the Moon doesn't have an atmosphere to protect it against comets and asteroids, it is covered with craters from bombardments throughout its history. The intense early bombardments smashed, melted, buried, or mixed a lot of the original Moon rocks. There is no wind or rain to break down rocks on the Moon. The Moon has no volcanoes or tectonic plates like Earth, so the Moon is relatively geologically inactive. The Moon has a small iron and sulfur core surrounded by a layer of partially melted rock. The crust is a relatively thick layer of solid rock. There are rocks on the Moon that have not changed in over 4 billion years. The only activity on the moon are meteor impacts and occasional "Moon quakes."

Exploration: Apollo missions explored the Moon in the 1960s and 1970s. On July 20, 1969, Neil Armstrong became the first person to walk on the Moon. Eleven more astronauts have "Moonwalked" since then, and the Moon is still the only body in the Solar System, other than Earth, that people have visited. Information from the Lunar Prospector mission in 1998 showed evidence of ice buried in some of the deep craters near the Moon's poles where the Sun never shines.

Mars

For your model: Make a ball 7 millimeters in diameter.
Diameter: 6794 kilometers
Average distance from the Sun: 228 million kilometers
Mass: about 1/10 of Earth's mass
Surface gravity: about 1/3 of Earth's gravity
Length of day (the time it takes to turn around once): 25 Earth hours
Length of year (the time it takes to orbit the Sun): 687 Earth days
Atmosphere: thin carbon dioxide
Moons: two small moons (less than 25 kilometers across)

Mars is the fourth planet from the Sun. From Earth, it looks like a bright red star. Mars is covered with rocks with iron in them—so the red is just rust. Because of its fiery color, the planet was named after the Roman god of war. Many people have imagined Mars as a likely location for extraterrestrial lifeforms. Astronomers looking through telescopes 100 years ago even thought they saw canals built by Martians. None of the missions to Mars have turned up any evidence of life. Mars is dry now, but there is evidence that water once flowed. There appear to be dry river channels and rocks that formed in water. There is soil that is more than half salt, as if a salt-water pond dried up. There is very little water vapor in the atmosphere, but there are large amounts of ice below the surface as well as ice in the polar ice caps. Mars has two tiny moons, Phobos and Deimos. They may have been asteroids that came near and were captured by Mars' gravity. Phobos is slowly getting closer and closer to Mars each year, and it is predicted Phobos will collide with Mars within the next 50 million years.

Temperature: Mars has two icy poles like Earth. Most of the ice caps are made of frozen carbon dioxide (dry ice). They grow in the winter and shrink in the spring. Mars has a maximum temperature of 68oF 20oC) and a minimum of –200oF (-129oC). The temperature on Mars changes dramatically in a single day as the sun warms the surface.

Atmosphere: Mars has an atmosphere much thinner than Earth's, made up of 95% carbon dioxide. Winds of 45 to 90 meters per second can whip up a lot of very fine red dust. The dust is so fine, it stays in the air for months and makes the sky look pink. Although the Martian atmosphere only has 1/1000 as much water as the atmosphere on Earth, this is enough to form some clouds, frost, and fog.

Geology: Mars is one of the rocky, or terrestrial, planets in the Solar System. It has the largest known mountain in the solar system—a volcano called Olympus Mons, which is about three times as tall as Mount Everest. A series of canyons called Valles Marineris is ten times longer and four times deeper than the Grand Canyon. Mars has a core of iron. Its mantle is made of sand-like materials, with a crust of iron-rich rocks.

Exploration: There have been many different missions to Mars over the years. The first missions, Mariner 3, 6, and 7, simply flew past the planet between 1964 and 1969. Another series of missions sent spacecraft to orbit Mars to gather more data and map the surface. These orbiters include Mariner 9, the Mars Global Surveyor, the Mars Odyssey, the Mars Express, and the Mars Reconnaissance Orbiter. There have been several landers and robotic rovers that have explored the surface of Mars in great detail. These include Viking 1 and 2 in 1976, the Mars Pathfinder in 1996, and two Mars Exploration Rovers in 2004.

Asteroid Belt

For your model: Use chalk dust.
Actual Size: from specks of dust to pieces a few hundred miles across; the diameter of Ceres (the largest asteroid) is 950 kilometers
Distance from Sun of main asteroid belt: about 300 to 500 million kilometers
Atmosphere: none

Asteroids are chunks of irregularly shaped rock and metal, ranging in size from specks of dust to pieces hundreds of kilometers across. A few are rounded, but most have irregular shapes—elongated or lumpy. There are millions of asteroids in the Solar System, but most of them are in what is called the Asteroid Belt—between the orbits of Mars and Jupiter. They are made of the same material that formed the planets. Many astronomers think that they were not able to clump together to form a planet because the gravity of nearby Jupiter kept them apart. Although most asteroids are in the Asteroid Belt, there are other families of asteroids in other parts of the Solar System. There is a group of asteroids in the same orbit as Jupiter called the Trojans—some orbiting in front of Jupiter and some behind. Another group, the Apollo family, crosses the orbit of Earth. Sometimes asteroids crash into planets. One of the most well-known theories about why the dinosaurs and other prehistoric animals became extinct is that an asteroid crashed into Earth, making a giant explosion and sending up dust that blocked out sunlight for a long time.

Temperature: Those asteroids that orbit far from the Sun are very cold and covered with ice, but those that orbit closer are warmer and mainly made of rock. The average temperature is -100oF (-73oC).

Atmosphere: Asteroids are small and do not have enough gravity to hold onto atmospheres.

Geology: All asteroids are made up of different minerals and chemicals. Some are rocky, while others are rich in metal. Some have organic carbon materials, and many have water trapped in them.

Exploration: A planet between Mars and Jupiter was mathematically predicted in the 1700s. After 16 years of searching for this mystery planet, the largest asteroid, Ceres, was discovered by accident in 1801. Since then, about 100,000 asteroids have been cataloged. Many photographs of asteroids have been taken by space probes on their way to other planets. For instance, Dactyl—a moon of the asteroid Ida—was photographed by the Galileo Probe on its way to Jupiter. Other spacecraft have landed on asteroids for a closer look, such as Japan's Hayabusa spacecraft in 2005 and NASA's NEAR Shoemaker spacecraft in 2001. NASA's Dawn mission was launched in 2007 to explore Ceres and Vesta, two of the largest asteroids in the main Asteroid Belt. The Near Earth Asteroid Tracking (NEAT) program searches for undiscovered asteroids near the orbit of Earth. These asteroids could be a hazard if they ever collided with Earth. Many astronomers would like more programs to systematically search for all asteroids that might come near Earth. Several proposals have been made to the United States Congress and the United Nations addressing this issue.

Jupiter

For your model: Make a ball 14.3 centimeters in diameter.
Diameter: about 142,984 kilometers
Average distance from the Sun: 778 million kilometers
Mass: 318 times Earth's mass
Surface gravity: about 2. times Earth's gravity
Length of day (the time it takes to turn around once): 10 Earth hours
Length of year (the time it takes to orbit the Sun): 12 Earth years
Atmosphere: thick and cloudy, mostly hydrogen with small amounts of helium
Moons: four large ones and around 60 smaller ones

Jupiter, named after the king of the gods in ancient Roman mythology, is the fifth planet from the Sun and, by far, the largest. Over 1300 Earths could fit inside Jupiter, and it has more matter than all the other planets put together. Of the four gas giants, it is the closest to the Sun. Jupiter has an extremely intense magnetic field—14 times more powerful than Earth's. Jupiter's four largest moons can be seen through small telescopes and even binoculars. In 1994, a shattered comet—Shoemaker-Levy 9—struck Jupiter causing enormous explosions that left marks in the cloud patterns, which lasted for nearly a year.

Temperature: The compression of the material in Jupiter's core by the huge atmosphere above it causes the core to release heat. Jupiter actually gives off more heat than it gets from the Sun! The core of Jupiter is predicted to be 43,000oF (24,000oC), but the upper clouds are very cold at –230oF (-145oC).

Atmosphere: Jupiter's atmosphere is mostly made of hydrogen and helium (with tiny amounts of methane, water, and ammonia). These gases form colorful clouds thousands of kilometers deep. This huge planet spins so rapidly (a day is 10 hours) that it causes strong winds and giant storms. The Great Red Spot is a giant hurricane three times as wide as Earth, which has lasted for more than 340 years! Lightning bolts have been observed in Jupiter's cloud tops.

Geology: Jupiter's immense atmosphere creates crushing pressures and very unusual chemistry as you get closer to center of the planet. Rather than being able to "land," a probe would sink for a long time and get crushed long before it reaches the bottom of this deep atmosphere. Jupiter is considered a "Jovian" planet—one that is mostly atmosphere—as opposed to a "terrestrial" planet, which is mostly rock. Many scientists suspect that deep inside the planet is an ocean of hydrogen in liquid and metallic form. Some scientists predict that at the very center of the planet is a rocky core similar in composition to Earth's.

Exploration: In 1610, Galileo discovered four of Jupiter's moons: Io, Europa, Ganymede, and Callisto. His discovery made an important contribution toward making the case that Earth was not the center of the Universe, since these moons orbit Jupiter and not Earth. The Voyager 1 and 2 spacecrafts took photos of the outer cloud layers of Jupiter in 1979. Voyager also revealed that Jupiter has rings that can't be seen from Earth, made of dust about the size of smoke particles. In 1996, the Galileo mission reached Jupiter. It sent a probe into the clouds to measure the conditions there. After hours of successful study, this probe was crushed deep in the thick atmosphere. The main Galileo orbiter continued to photograph Jupiter and its moons until 2003 when it ran out of fuel and was intentionally crashed into Jupiter. In 2007, the New Horizons mission took detailed pictures of Jupiter and some of its moons as it flew by on its way to Pluto.

Io (one of Jupiter's moons)

For your model: Make a ball 4 millimeters in diameter.
Diameter: 3630 kilometers
Average distance from Jupiter: 422,000 kilometers
Mass: about 1/60 of Earth's mass
Surface gravity: about 1/6 of Earth's gravity
Time it takes to orbit Jupiter: 1.8 Earth days
Atmosphere: thin sulfurous gases

In ancient Roman mythology, Io was another of Jupiter's lovers who, as the legend goes, was turned into a white cow by Jupiter to protect her from Hera, the queen of the gods. She also became the cow goddess queen of Egypt. The moon Io is a little larger than Earth's Moon and is sometimes called the "pizza" moon because in some photos it resembles a pizza, with its many volcanoes looking like toppings!
Io is one of the most interesting moons in the Solar System. It is not only tugged at by the gravity of Jupiter, the largest planet in the Solar System, but also by the gravity of Europa and Ganymede, two other large moons of Jupiter that are nearby. This tug of war makes for tidal bulging on Io as high as 100 meters and makes Io the most volcanically active body in the Solar System. When these gravitational forces squeeze it back and forth like a rubber ball, Io's insides heat up. The hot insides are released in huge volcanic explosions that can reach over 500 kilometers above the surface. Although it is less than a third the size of Earth, Io gives off twice as much heat! Io is swept by Jupiter's magnetic field, which strips away about one ton of material per second. As this material passes through Jupiter's magnetic field, it also generates more electrical energy than all the power stations in the United States!

Temperature: Because it is far from the Sun, it can be -225oF (-143oC) at the surface. However, in "hot spots" where liquid sulfur and magma reach the surface in volcanic eruptions, the temperature can be 1000oF (537oC) or more. One of these hot spots may be a lava lake similar to those on Earth, although the estimated 60oF (16oC) temperature suggests that much of this lava has solidified.

Atmosphere: Io has an extremely thin atmosphere of mostly sulfur dioxide and small amounts of other gases that come from volcanic activity. They remain in the atmosphere only a while and then are pulled away toward Jupiter.

Geology: Io is made mostly of molten rocky material but has an iron-rich metallic core. The surface is made mostly of sulfurous chemicals, which is white when cold and orange and red when melted by volcanic activity.

Exploration: The Voyager fly-by photographed Io in 1979 and counted 200 volcanoes, nine of them erupting at the time! These were the first volcanic eruptions seen anywhere in the Solar System other than on Earth. Between 1995 and 2003, the Galileo mission has made more discoveries including observations of Io's many volcanoes and its influence on Jupiter's magnetic field. In 2006, the New Horizons Mission flew by Io on its way to Pluto and took spectacular pictures of fountaining volcanic eruptions on Io.

Europa (one of Jupiter's moons)

For your model: Make a ball 3 millimeters in diameter.
Diameter: 3138 kilometers
Average distance from Jupiter: 670,900 kilometers
Mass: 1% of Earth's mass
Surface gravity: about 1/7 of Earth's gravity
Time it takes to orbit Jupiter: 3.6 Earth days
Atmosphere: a trace of oxygen

Europa (yur-ROH-pah) was named after one of Jupiter's mortal lovers, who became Queen of Crete, in ancient Roman mythology. A little smaller than Earth's Moon, Europa has one of the smoothest surfaces in the Solar System—it looks as smooth as a cue ball, without mountains, valleys, or major craters. Some think it looks like a cracked eggshell, because the surface appears to be criss-crossed by dark lines that look like veins. Most scientists believe that the surface is made of ice, and that the lines are caused by the gradual spreading and colliding of giant plates of ice floating on the surface like icebergs. Recent evidence suggests that the dark lines are ice that is rich in salty minerals, somehow carried to the surface as cracks in the surrounding ice form. Europa is tugged at by the gravity of Jupiter, the largest planet in the Solar System. Because the shape of Europa's orbit is not circular, Jupiter's gravity pulls and squeezes the moon in different directions. This squeezing heats up Europa's insides and may have melted some of the ice. The ice flow patterns and ridges on Europa suggest there may be a large ocean of liquid water or slushy layer of partly melted ice beneath the hard ice surface. There is even the possibility that ice-spewing volcanoes and geysers exist.

Temperature: The surface of Europa is -292oF (-180oC), but is probably much warmer on its inside.

Atmosphere: Europa has a very thin atmosphere of oxygen. The oxygen is not released by plants, as on Earth. Instead, sunshine breaks down the water molecules in the ice, creating hydrogen and oxygen gas. The hydrogen gas is light and escapes into space, but Europa's gravity holds onto the heavier oxygen for a while before it escapes. The air pressure is about one-hundredth of one-billionth of the air pressure at the surface of the Earth.

Geology: Europa probably has a metal core surrounded by a layer of rock, but above this is a 100- to 200-kilometer-thick layer of ice and possibly liquid water. The surface ice is permanently frozen. However, beneath it may be a deep ocean of liquid water—possibly even more water than all the oceans of Earth! A key question for future exploration is whether a liquid ocean exists or whether it is partially or completely frozen.

Exploration: Voyagers 1 and 2 photographed Europa in 1979. Between 1995 and 2003, the spacecraft Galileo took more detailed pictures of the fractures on Europa's surface.

Callisto (one of Jupiter's moons)

For your model: Make a ball 5 millimeters in diameter.
Diameter: 4800 kilometers
Average distance from Jupiter: 1.9 million kilometers
Mass: about 1/55 of Earth's mass
Surface gravity: about 1/8 of Earth's gravity
Time it takes to orbit Jupiter: 16.7 Earth days
Atmosphere: very small amounts of pure carbon dioxide

Callisto was named after one of Jupiter's many lovers. When their romance was discovered, Callisto was turned into a bear. When she was almost killed by her own son during a great hunt, Jupiter turned Callisto into the constellation Ursa Major, commonly known as the Big Dipper. In photographs, Callisto is a very large, icy moon that is almost the same size as the planet Mercury. It is the most heavily cratered object in our solar system, yet has no mountains or volcanoes on its surface. Scientists once thought this moon was simply a giant ball of frozen rock and ice. However, in 1998, the spacecraft Galileo discovered that this moon has a magnetic field that fluctuates in time to its orbit around Jupiter. A frozen moon of rock and ice should not be able to generate a magnetic field. On the other hand, if a layer of the ice had melted into a giant saltwater ocean, then a magnetic field could exist. Several later observations by the Galileo spacecraft have provided even more evidence that a deep saltwater ocean exists far beneath the surface of Callisto. This recent discovery is extremely exciting to scientists because liquid water is rare in the Solar System and is thought to be one of the necessary ingredients for life.

Temperature: It is very cold on the surface of Callisto, with average temperatures around -270oF (-168oC). However, if a subsurface ocean really exists, then conditions must be much warmer there.

Atmosphere: The extremely thin carbon-dioxide atmosphere appears to be continually generated from dry ice on the surface, which turns directly into a gas before being swept into space.

Geology: The surface of Callisto is entirely covered in craters. In fact, the craters are so tightly packed together that any new crater would erase or overlap an existing one. Some are gigantic, like Vallhalla. Vallhalla has a bright center region that is 600 kilometers in diameter with concentric rings around the main crater that are as wide as 3000 kilometers—more than big enough to fit all of India inside. This surface is estimated to be nearly 4.5 billion years old, as old as our Solar System. The icy surface is 80 to 160 kilometers thick. However, below the ice, scientists predict they would find a saltwater ocean at least 10 kilometers deep. That's more than twice as deep as the Pacific Ocean! Below the ocean, at the core of the moon, is a tightly packed mixture of rock and ice.

Exploration: The Pioneer and Voyager spacecrafts took several pictures of Callisto between 1973 and 1979. It was not until the Galileo mission from 1995 to 2003, that scientists understood the significance of this moon and the mysteries that lie under the ice. Because of the stability of the surface and its distance from Jupiter's harsh radiation, Callisto was identified by NASA as a potential base site for humans to explore Jupiter, its moons, and the outer Solar System. For now, scientists are focused on future unmanned missions to Jupiter as well as exploring the system of lakes deep below the surface of Antarctica here on Earth. These lakes may be excellent models for the oceans below the ice on Europa and Callisto.

Saturn

For your model: Make a ball 12.1 centimeters in diameter.
Diameter: 120,536 kilometers
Average distance from the Sun: 890 million miles
Mass: 95 times Earth's mass
Surface gravity: slightly less than Earth's gravity
Length of day (the time it takes to turn around once): 10. Earth hours
Length of year (the time it takes to orbit the Sun): 29. Earth years
Atmosphere: thick and cloudy, mostly hydrogen with small amounts of helium
Moons: 7 large ones and over 50 smaller ones

Saturn was named after the son of Uranus (the sky) and Gaia (the Earth), in ancient Greek mythology. The sixth planet from the Sun, Saturn is a gas giant and the second largest planet in the Solar System. Jupiter, Neptune, and Uranus all have rings, but Saturn has by far the most spectacular rings! The rings are made of countless pieces of icy rock, some as small as dust and some as big as houses. Scientists estimate that there are ten thousand rings! The system of rings is incredibly wide, stretching 250,000 kilometers in diameter, but also incredibly thin, less than one kilometer thick. Some think that the rings are leftover debris which failed to gather to form a moon. Others think they are the remains of a moon that was torn apart by Saturn's gravity or that crashed into another moon. Saturn has at least 57 moons. It is difficult to tell exactly how many there are since, technically, a big piece of ice in the rings could be considered a tiny moon.

Temperature: Saturn gives off more heat than it receives from the Sun. That means it is probably still warm from the time it was formed and has not finished cooling off. Nevertheless, the average cloud temperature is a bracing -285oF (-175oC).

Atmosphere: The atmosphere is mostly hydrogen and helium, with trace amounts of methane and water. Saturn has many storms circling in its clouds—including hurricanes far larger and stronger than those on Earth—which can last for months or years.

Geology: Although Saturn has 95 times more mass than Earth, its average density is less than water. That means that if there was an ocean of water big enough, Saturn could float in it. Because it has such low density and spins so fast (one day is about 10. hours), Saturn has a "tummy" bulge at its equator. Saturn has a core around the size of Earth, which is composed of rock and minerals and is surrounded by a layer of liquid metallic hydrogen. It has an outer layer made up of hydrogen and helium, which is gas toward the surface and liquid toward the center.

Exploration: In 1610, Galileo was confused by Saturn's rings, partly because his telescope did not show them clearly. He thought they might be a triple planet. In 1655, Christian Huygens, a Dutch astronomer, more clearly observed and described the rings as a solid disk of some strange material. But it was not until 1856 that James Clerk Maxwell explained that the gravitational field would tear any solid ring to pieces and concluded that they must be composed of numerous small particles in orbit around the planet. Voyager 1 and Voyager 2 photographed Saturn in the early 1980s. In 2004, Cassini arrived at Saturn and went into orbit around the planet. It carried the Huygens probe, which dropped into Titan's atmosphere in 2005. Since then, Cassini has sent back incredible amounts of data about Saturn, its rings, and its moons.

Titan (one of Saturn's moons)

For your model: Make a ball 5 millimeters in diameter.
Diameter: 5150 kilometers
Average distance from Saturn: 760,000 miles
Mass: about 1/40 of Earth's mass
Surface gravity: about 1/7 of Earth's gravity
Time it takes to orbit Saturn: 16 Earth days
Atmosphere: cloudy atmosphere made mostly of nitrogen with pressure 1. times the air pressure at the surface of Earth

In ancient Greek mythology, the Titans were one of the sets of offspring of Uranus (the Sky) and Gaia (the Earth). Titan (TY-tun) is Saturn's largest moon and the second largest in the Solar System after Ganymede, which is one of Jupiter's moons. Titan is bigger than the planet Mercury! Like Earth, Titan has rocks, lakes, riverbeds, rain, snow, deserts with dunes, and low mountain ranges. Titan is the only object we know of, besides Earth, with open bodies of liquid. The liquid in the seas, lakes, and rivers is not water, but ethane and methane—which on Earth are flammable and odorless ingredients of natural gas. With so much methane around, if you introduced oxygen and a single spark, the entire moon could explode! The rocks are made of ice, not silicates as on Earth.

Temperature: The average temperature is around -290oF (-179oC). The temperature is far colder than winter in Antarctica.

Atmosphere: Titan is the only moon in the Solar System with a heavy atmosphere. Its atmosphere is 90% nitrogen, mixed in with methane and ethane (which would be poisonous to animals on Earth). The atmosphere is so thick that standing on the surface would feel more like standing on the bottom of a swimming pool. The Sun breaks down the methane, which makes hydrocarbons like the smog over cities on Earth. The thick smog hides the surface and, therefore, made it difficult to study until the Cassini and Huygens spacecraft arrived in 2004.

Geology: The surface of Titan is mostly made of ice with liquid ethane-methane seas, some of which are as big as Earth's Lake Superior. The ethane-methane rain appears to have carved numerous riverbeds into the hills. A mountain range was observed that appears to have been formed by the movement of tectonic plates—large pieces of the crust that pulled apart, allowing material from deep inside Titan to surface. Evidence of volcanoes that spew ice and ammonia instead of lava has also been found. Below the layers of ice on the surface is thought to be a rocky core. The core may still be hot, allowing for a possible layer of melted ice and ammonia around the core.

Exploration: Voyager 1 flew by Titan in 1980 but could not see into the thick clouds. In 2004, the Cassini spacecraft took the first pictures of Titan that could see through the thick cloud layer at the moon's surface. The Cassini spacecraft carried a lander called the Huygens probe. In January 2005, the Huygens probe successfully parachuted down to the surface of Titan, taking extraordinary pictures during its descent and the few minutes it survived on the surface. The pictures show channels and riverbeds clearly carved by flowing liquid. Huygens also detected trace amounts of a form of the element argon in the atmosphere, evidence that the interior of Titan has not completely frozen over.

Uranus

For your model: Make a ball 5.1 centimeters in diameter.
Diameter: 5118 kilometers
Average distance from the Sun: 2,871 million kilometers
Mass: about 14. times the Earth's mass
Surface gravity: about 9⁄10 of Earth's gravity
Length of day (the time it takes to turn around once): 18 Earth hours
Length of year (the time it takes to orbit the Sun): 84 Earth years
Atmosphere: thick and cloudy (similar to Neptune)
Moons: 27 known

Uranus (the Sky) was the first ruler of the universe in ancient Greek mythology and, with Gaia (the Earth), had many offspring, among them the Titans. The planet Uranus is a cold gas giant with 17 moons and at least 11 thin black rings around it. The rings are made up of ice boulders and fine dust. Uranus is twice as far from the Sun as Saturn, but although all the planets from Mercury to Saturn had been discovered long before, Uranus was not discovered until 1781. Uranus is not easily visible to the naked eye. One of the strangest things about Uranus is that its axis is tilted far more than any other planet. Other planets spin around a vertical axis, but Uranus spins much more horizontally, as if it were on its side. Astronomers think it may have been tilted as a result of a collision or several collisions with another large body or large chunks of material early in its history. The moons of Uranus are all battered looking, with many craters, cliffs, and rough terrain. Unlike most other moons in our Solar System, which were named from gods and heroes in Greek and Roman mythology, the moons of Uranus are named after characters in Shakespeare's plays and in the works of Alexander Pope. The largest five moons are Miranda, Ariel, Umbriel, Titania, and Oberon. Miranda, the closest of the larger moons to Uranus, has a surface covered with deep canyons and long ridges. Some astronomers have speculated that Miranda may also have been affected by the collision that tilted the axis of Uranus—the moon appears to have been shattered into pieces, which were then clumped back together.

Temperature: Uranus' outer layers never get warmer than about –300oF (-185oC), but at its core it may be 11,000oF (6,100oC) or hotter.

Atmosphere: Uranus's atmosphere is 83% hydrogen, 15% helium, and 2% methane (or natural gas). Methane in the upper atmosphere reflects blue and green light, giving Uranus its blue-green color. Uranus has winds that blow at speeds up to 580 kilometers per hour.

Geology: Uranus has a rocky core a little larger than the planet Earth. Thousands of miles above the core is a thick region (mantle) of water, ammonia, and methane in ice and liquid form. The outer layer is composed of hydrogen and helium gases.

Exploration: Uranus was discovered in 1781 by William Herschel. In 1986, Voyager 2 photographed Uranus but could not see beneath the haze of the upper atmosphere. Voyager 2 also made the first detailed photographs of the rings and surfaces of the moons of Uranus.

Neptune

For your model: Make a ball 5 centimeters in diameter.
Diameter: 49,532 kilometers
Average distance from the Sun: 4504 million kilometers
Mass: 17 times the Earth's mass
Surface gravity: slightly more than Earth's gravity
Length of day (the time it takes to turn around once): 16 Earth hours
Length of year (the time it takes to orbit the Sun): 165 Earth years
Atmosphere: thick and cloudy (similar to Uranus)
Moons: 13 known

Named after the Roman mythological god of the sea, Neptune is the farthest known planet from the Sun. It is so big that almost 60 Earths could fit inside it. Like the other gas giants, Neptune also has a ring system with three rings. The curious thing about Neptune's rings is that they are clumpy and incomplete, unlike the other rings in the Solar System, which are generally smooth and evenly distributed. In fact, the rings may be so unstable that one of them may fade away completely by the end of the century. Why the rings are so changeable is a big mystery to scientists. Neptune has at least 13 moons. Its largest moon, Triton, has wrinkled features, which resemble the skin of a cantaloupe. Scientists have not yet been able to explain why this is. It may also have icy volcanoes. The unusual features of Triton lead astronomers to suspect that it was captured by Neptune's orbit from the Kuiper Belt.

Temperature: The average cloud temperature is -350oF (-212oC). However, the inside of the planet gives off more heat than it absorbs from the Sun. Thus, the core must be much hotter than the surface.

Atmosphere: The winds of Neptune blow at speeds of up to 2,000 kilometers per hour—stronger than on any other planet! The atmosphere is made up of hydrogen, helium, and methane. The methane reflects green and blue light and gives Neptune its bluish color, similar to Uranus. From 1989 to 1994, Neptune had a huge dark area that rotated around the planet and was called the Great Dark Spot. It was so big, both Europe and Asia could fit inside it! At first, it was thought to be a giant storm, but many scientists now think it is a hole through the clouds to the lower atmosphere below. Sometime before 1994 it disappeared, and a different spot appeared. There are white clouds of methane crystals high above the bluish atmosphere. Voyager photographed one of these clouds "scooting" around Neptune about every 16 hours. This cloud has been called "the scooter."

Geology: Neptune has a small rocky core, which is surrounded by an ocean of liquid water, ammonia, and methane (what we call natural gas). Above this is the thick atmosphere.

Exploration: Neptune's existence and position were mathematically predicted in the 19th century by astronomers in England and France, based on irregularities in the orbit of Uranus. It was first observed and identified in 1846 by Johann Galle and a German astronomy student, less than one degree from its predicted position. The two larger moons of Neptune were discovered by astronomers with telescopes. Voyager 2 discovered six new moons of Neptune when it flew by in 1989! Since then, the Hubble Space telescope has made many important discoveries.

Pluto

For your model: Make a ball 2 millimeters in diameter.
Diameter: 2,274 kilometers
Average distance from the Sun: 5,914 million kilometers
Mass: about 1/400 of Earth's mass
Surface gravity: about 1/12 of Earth's gravity
Length of day (the time it takes to turn around once): 6 Earth days
Length of year (the time it takes to orbit the Sun): 248 Earth years
Atmosphere: thin, if any
Moons: three known

Pluto, named for the Greek and Roman mythological god of the underworld, was discovered in 1930. For over 75 years, Pluto was considered the ninth planet in our Solar System; in 2003, astronomers discovered another Solar System object beyond Pluto, named Eris. This sparked debate among astronomers about which objects in the Solar System should be called planets and whether Pluto should be one of them. Since 2006, Pluto has been classified as a "dwarf planet." All other planets in the Solar System have orbits that are fairly circular, but Pluto's is not. Its ovalshaped orbit sometimes brings it closer to the Sun than Neptune. Pluto was closest to the Sun in 1989 and remained closer than Neptune until March 14, 1999. Pluto is extremely difficult to observe from Earth because it is so distant and so small. Pluto is almost 40 times farther from the Sun than Earth. It is so far that it is very dark. From Pluto, the Sun would only look like a very bright star. Pluto's largest moon, Charon, is named after the mythological boatman who operated the ferry across the river Styx to Pluto's underworld realm. Charon is about half the size of Pluto and is large enough to be considered a double dwarf planet along with Pluto. This means that the center of gravity between Pluto and Charon is actually in between the two objects, not inside Pluto itself. Pluto's other two moons, Hydra and Nix, are much smaller and were only discovered in 2005.

Temperature: The surface is extremely cold at around –380oF (-229oC).

Atmosphere: Pluto may have a thin methane atmosphere when it is closest to the Sun. As it moves away from the Sun, the methane freezes and falls to the surface. The frozen methane turns a reddish color in sunlight. Ices of water and ammonia are also present.

Geology: Pluto probably has a rocky core surrounded by a layer of water ice. Its surface is frozen methane (natural gas). Charon seems to be covered with water ice, not methane ice. In many ways, Pluto seems very similar, geologically, to Neptune's largest moon, Triton.

Exploration: In 1905, Percival Lowell and William Pickering calculated the position of another planet based on irregularities in the orbits of Uranus and Neptune. Astronomers began searching, but it was 25 years before a young astronomer, Clyde Tombaugh, photographed Pluto about 5 degrees from the predicted position. Pluto is the only major object in our Solar System (besides the recently discovered Eris) that has never been explored by spacecraft. In 2006, NASA launched the New Horizons mission which, will arrive at Pluto and Ceres in 2015 before continuing on to explore the Kuiper Belt.

The Kuiper Belt

For your model: Use chalk dust.
Diameter: various sizes ranging from dust to 2,500 kilometers across
Distance from the Sun: between 4.5 billion and 10 billion kilometers
Time it takes to orbit the Sun: from 248 years to 400 years
Atmosphere: None or very thin. Varies with the seasons

Several hundred objects beyond the orbit of Neptune have been discovered, and there are probably many thousands of others. Some of them are part of a belt of objects called the Kuiper Belt. It was named for Gerard Kuiper, one of the astronomers who proposed that a belt such as this was the source of some comets. Objects in the Kuiper Belt are called Kuiper Belt objects or KBOs. KBOs are different from planets in several ways.

- Planets have nearly circular orbits, but KBOs have orbits that are more oval.
- The orbits of planets are all nearly in the same plane, but the orbits of KBOs are usually significantly tilted.
- Planets have either rocky surfaces or a thick layer of cloudy gas at the surface. The surface of a KBO is composed of ice and other materials, which would melt or evaporate if they were closer to the Sun.

Pluto is the best-known KBO, but it is not the largest. Eris, discovered in 2003, appears to be larger. Both Pluto and Eris have moons as do many other KBOs. The movements of KBOs are influenced by the gravity of Neptune. This causes some of them to orbit the Sun two times every time Neptune orbits the Sun three times. Pluto has this kind of orbit. There is also a set of KBOs that orbits the Sun once every time Neptune orbits the Sun twice. Many KBOs have orbits that are not tied to Neptune in this way. Still, they all take hundreds of years to orbit the Sun.

Exploration: KBOs and other objects in space are discovered by examining photographs of the same part of the sky taken at different times. If any object appears to move, its motion is analyzed to see how it orbits and to determine the kind of Solar System object it is. This is how Pluto was discovered in 1930. After Pluto was discovered, no new KBOs were discovered (except for Pluto's largest moon) until 1992. Now there are hundreds of known KBOs. In 1989, the Voyager 2 mission photographed Triton, a moon of Neptune, which may be a captured KBO. Voyager discovered a thin atmosphere, erupting ice fountains, and a strange irregular surface. These features may have been caused by the influence of Neptune's gravity. Other KBOs are probably very different. The New Horizons mission was launched by NASA in 2006. It will arrive at Pluto in 2015. It will explore Pluto and its moon Charon in a fly-by encounter, taking pictures and looking for evidence of an atmosphere. The spacecraft will continue past Pluto. Astronomers are currently searching for other KBOs that it might be able to encounter in an extended mission.

The Oort Cloud (cold distant comets)

For your model: Use chalk dust.
Diameter: various sizes, ranging from dust to the size of a small moon, 1800 kilometers across
Distance from the Sun: between 7.5 billion and 7.5 trillion kilometers
Time it takes to orbit the Sun: from a few years to many millions of years
Atmosphere: none (for most objects)

Astronomers have evidence that some comets we observe in the Solar System come from a distant cloud of objects, which surround the Sun. This group of objects, called the Oort Cloud, has never been directly observed. It is thought to be made up of the leftovers from the dust cloud that formed the Solar System, and it contains billions of chunks of ice and dust as well as larger objects, perhaps as big as our Moon. Once in a while, interactions with the gravitational pull from neighboring stars are thought to bump an Oort Cloud object out of its normal orbit and send it toward the Sun. A few have settled into orbits that bring them back near the Sun on a regular oval path. These become the comets we observe. When a comet is far from the Sun, it is a large chunk of dirty ice. As it gets closer to the Sun, its surface ice turns to vapor (it sublimates), forming a head of gas called a *coma*. The coma may be a million kilometers wide, but the original ball of ice and dust—the nucleus of the comet—is much smaller. The Sun's radiation sweeps the coma and dust into two tails—one tail of gas and one tail of dust. Usually, the dust tail is yellow, and the gas tail is bluish. The tail always points away from the Sun, so, as the comet moves away from the Sun, it travels tail first. As it travels near the Sun, the comet loses material. It is estimated that Halley's Comet will completely decay after about 2,300 more trips around the Sun. Only three objects have been discovered that might possibly be objects in the closest edge of the Oort Cloud. Sedna is the largest and best known. Sedna takes its name from the Inuit goddess of the sea who is thought to live at the bottom of the Arctic Ocean. Sedna is the farthest known object that orbits the sun. It is three times farther from the Sun than Pluto. Scientists estimate that Sedna is about 1800 kilometers across, although direct observations are not possible from so far away. Most of the objects in the Oort Cloud are supposedly much smaller than Sedna—no more than 100 kilometers wide—and form the icy center of a comet.

Exploration: The three known potential Oort Cloud objects (Sedna, 2000 OO67, and 2000 CR105) were discovered using Earth-based telescopes between 2000 and 2003. Everything else we know about the Oort Cloud has been learned by studying comets that originally came from the Oort Cloud. In 1986, Halley's Comet was studied by a number of space probes. The Giotto probe photographed the comet from about 600 kilometers away, providing the first view of the nucleus of a comet. In 2004, NASA's Mission Stardust collected material from the tail of a comet named Wild 2. These samples were brought back to Earth in 2006 and have been studied extensively. Some surprises included finding interesting organic molecules as well as particles that must have formed under very different conditions. This suggested that comets themselves are formed from a mixture of dust from several different places in our Solar System or beyond.

Tour of the Solar System—Travel Notes

Facts You Need to Know:
Earth's Size: Diameter is 12,800 km (7950 mi)
Earth's Temperature: Range is -88°C to 58°C (-127°F to 136°F)

MERCURY

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Mercury:

:

EARTH'S MOON

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Earth's Moon:

VENUS

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Venus

MARS

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Mars:

Tour of the Solar System—Travel Notes (contd)

Facts You Need to Know:
Earth's Size: Diameter is 12,800 km (7950 mi)
Earth's Temperature: Range is -88°C to 58°C (-127°F to 136°F)

ASTEROID BELT

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About the Asteroid Belt:

JUPITER

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Jupiter:

IO

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Io:

EUROPA

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Europa:

Tour of the Solar System—Travel Notes (continued)

Facts You Need to Know:
Earth's Size: Diameter is 12,800 km (7950 mi)
Earth's Temperature: Range is -88°C to 58°C (-127°F to 136°F)

CALLISTO

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Callisto:

SATURN

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Saturn:

TITAN

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Titan:

URANUS

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Uranus:

Tour of the Solar System—Travel Notes (continued)

Facts You Need to Know:
Earth's Size: Diameter is 12,800 km (7950 mi)
Earth's Temperature: Range is -88°C to 58°C (-127°F to 136°F)

NEPTUNE

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Neptune:

PLUTO

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About Pluto:

KUIPER BELT

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About the Kuiper Belt:

OORT CLOUD

Temperature
❑ hotter than Earth ❑ colder than Earth

Size
❑ bigger than Earth ❑ smaller than Earth

What it is Made Of
❑ mostly gas ❑ mostly rock

Atmosphere
❑ has an atmosphere ❑ has no atmosphere

Interesting Fact About the Oort Cloud:

Tour of the Solar System—Thought Questions

1. On which object would it be best to have a record-breaking high-jump contest? Why?

2. Which is the strangest or weirdest-looking object?

3. On which object would an ice-cream cone melt the fastest? Why?

4. Which object would you most like to visit? Why?

5. Which object would you least like to visit? Why?

6. Share one really interesting or fun fact that you learned today about an object.