The Solar System Essay, Research Paper

Assignment 1: The Solar System

The solar system consists of the Sun; the nine planets, 67 satellites of the planets and a large number of small bodies (comets and asteroids).

The inner solar system contains the Sun, Mercury, Venus, Earth and Mars:

The planets of the outer solar system are Jupiter, Saturn, Uranus, Neptune and Pluto: The orbits of the planets are ellipses with the Sun at one focus, though all except Mercury and Pluto are very nearly circular. The orbits of the planets are all more or less in the same plane (called the ecliptic and defined by the plane of the Earth’s orbit). The ecliptic is inclined only 7 degrees from the plane of the Sun’s equator. Pluto’s orbit deviates the most from the plane of the ecliptic with an inclination of 17 degrees. Below you see a diagram that show some relative information about most of the objects in our Solar System:

Diameter (km) Moons Surface temp. Surface gravity Axial inclination Axial rotation

The Sun 1 390 000 – 5800c – - 25 – 36 days

Mercury 4 878 None 350c / -170c 0.38 0 58 days

Venus 12 104 None 480c 0.9 178 243 days

The Earth 12 756 1 20c 1 23.4 23h 56m

Mars 6 787 None -23c 0.38 24 24h 37m

Jupiter N/A 16 -150c 2.64 3.1 9h 50m

Saturn 199 300 18 -180c 1.2 26.7 10h 39m

Uranus 51 800 15 -210c 1.2 98 17h 10m

Neptune 49 500 8 -220c 1.2 29.5 18h 24m

Pluto 2 320 1 N/A 0.04 50 178 years

The Moon 3 474 – 107c / -153c 0.17 1.5 27 days

The Sun

The sun is the most important part of our solar system. It is the biggest object and does have about 98% of the whole mass of the solar system. About 1,3 billion earths would fit inside the sun.

The sun travels around the galaxy together with planets and other objects bound to it by gravitational forces. The largest of the bodies we call planets, most of which are in turn are orbited by smaller moons or satellites. These objects, together with many lesser masses, are known as the Solar system.

The Sun is just a star, one of a hundred billion inhabiting our galaxy alone. Being a star the Sun is an example of the fundamental building blocks of our universe. It formed, 4.5 billion years ago, as the nucleus of a cloud of gas which was collapsing under its own gravitational attraction.

At formation, hydrogen was the most abundant gas, as elsewhere in the universe, and accounted for three quarters of the Sun’s original material. This will changes as the hydrogen is burned, and within the very central regions virtually all the hydrogen has been converted to helium. The outer regions have not yet taken part in hydrogen burning. Astronomers have measured the chemical composition of the Sun, and can thus estimate that of the initial solar nebula from which the sun and planets formed. In addition to 78 percent by weight of hydrogen, they find 20 percent to be helium, while only 2 percent remains for other elements such as oxygen, carbon, nitrogen, and iron.

Later, as its hydrogen becomes depleted, it will evolve into a giant red star, swelling to engulf the earth and the inner planets. The remnant Sun will fade gradually to oblivion, passing through the white dwarf stage on its way.

Mercury

Mercury is named after the messenger of the Roman gods. It is the smallest of the inner planets and the second smallest in the whole Solar System. It has a very weak magnetic field and – being the closest planet to the Sun – has only a very thin atmosphere of helium captured from the solar wind.

The surface of Mercury is very much like the Moon’s – with craters, mountains and valleys. Since there is no form of atmosphere, life on Mercury is impossible. Nor will there be any manned flights in the forseeable future. However, there will be new unmanned probes sent out, if only to complete the map of the surface.

Although Mercury has only a third the diameter of Earth, its density is about the same. This suggests that 65 to 70 percent of Mercury’s weight is made up of a heavy material, probably iron. This is concentrated in Mercury’s large core. The outer layer is made of sillicate rock similar to the Earth’s mantle.

Venus

Venus is named after the Roman goddess of love. It is the second planet from the Sun and the brightest object in the sky other than the Sun and the Moon. It was once believed that life could exist in Venus but that has been proved wrong by various probes. In fact, Venus has the most hostile environment in the entire Solar System. The surface temperature is fiercely hot and the atmospheric pressure is crushing. One of the more apparent things that separate Venus from all the other planets in our solar system is that it rotates from east to west (all the other planets rotate from west to east). Because of this, Venus is said to be almost upside down.

Conditions may have been better in the past. In the early stages of the Solar System, the Sun was not as bright as it is now and so Venus and the Earth would have formed similarly. When the Sun became brighter, the Earth was far enough away to escape serious damage but Venus was not. The surface temperature rose and the oceans dried up.

Earth

The Earth, the third planet (rock) from the Sun, is the largest of the inner planets and also has the highest density. It is the only planet in the Solar System to be covered largely with water, the only planet with an atmosphere made up chiefly of nitrogen and oxygen and the only body that has a temperature suitable for life of the type that we know. It is also the only inner planet with a large moon – Mercury and Venus have none and the Martian moons are small. If the conditions on the Earth changed even slightly, the life as we know it could die out.

The Earth’s rotation period is not constant. It is slowly lengthening due to tidal friction between the oceans and the sea floor. This is caused by the influence of the

Moon.

Our Moon

The Moon has fascinated mankind throughout the ages. By simply viewing with the naked eye, one can discern two major types of terrain: relatively bright highlands and darker plains. Current knowledge of the Moon is greater than for any other solar system object except Earth. This lends to a greater understanding of geologic processes and further appreciation of the complexity of terrestrial planets.

The relatively bright, heavily cratered highlands are called terrae. The craters and basins in the highlands are formed by meteorite.

Mars

Mars is the fourth planet from the Sun and the seventh largest. Mars is sometimes referred to as the Red Planet. The name of the month March derives from Mars.

Mars has been known since prehistoric times. Except for Earth, Mars has the most highly varied and interesting terrain of any of the terrestrial planets. One being Olympus Mons, the largest mountain in the Solar System rising 24 km (78,000 ft.) above the surrounding plain.

Like Mercury and the Moon, Mars appears to lack active plate tectonics at present; there is no evidence of recent horizontal motion of the surface such as the folded mountains so common on Earth.

Jupiter

Jupiter is named after the king of the Roman gods. It is the largest planet in the Solar System, the fifth planet from the Sun and the first of the outer planets

Jupiter has had a dominant effect on a large part of the Solar System. It is likely that Jupiter’s huge gravity has prevented a planet from forming in the area now occupied by the Asteroid Belt. Jupiter has a magnetic field 20,000 times stronger than that of the Earth’s, having a devastating effect on its moons.

Saturn

Saturn is the sixth planet from the Sun and the second largest: In Roman mythology, Saturn is the god of agriculture and has been known since prehistoric times. Galileo was the first to observe it with a telescope in 1610; he noted its odd appearance but was confused by it. Early observations of Saturn were complicated by the fact that the Earth passes through the plane of Saturn’s rings every few years as Saturn moves in its orbit

Like Jupiter, Saturn is about 75% hydrogen and 25% helium with traces of water, methane, ammonia and “rock”, similar to the composition of the primordial Solar Nebula from which the solar system was formed.

Uranus

Uranus is the forth largest planet in the Solar System and the seventh from the Sun. Named after the father of Saturn, Uranus is a blue-green colour due to the methane in its atmosphere. Its magnetic axis is at 60 degrees to its axis of rotation. The unusual axial tilt may have been caused by a collision by a large body early in Uranus’ life. Scientists must await a new space mission.

Uranus is composed primarily of rock and various ices, with only about 15% hydrogen and a little helium (in contrast to Jupiter and Saturn which are mostly hydrogen).

Neptune

Neptune – named after the Roman god of the sea – was discovered using mathematic calculations based on the orbit of Uranus. It is the third largest planet in the Solar System and is usually the second last planet in distance. Because of Pluto’s eccentic orbit, Neptune is the last planet for 20 years every 247 years. Neptune was the last planet until recently, when Pluto past it with its orbit and became the last planet again.

Pluto

Pluto was discovered on February 18, 1930, making it the last planet found in our Solar System. Pluto is usually farther from the Sun then any of the nine planets.

Ground-based observations indicate that Pluto’s surface is covered with methane ice and that there is a thin atmosphere that might freeze and fall to the surface as the planet moves away from the Sun.

Pluto has one moon – Charon – its surface composition seems to be different from Pluto’s. The moon appears to be covered with water-ice rather than methane ice. Its orbit is gravitationally locked with Pluto, so both bodies always keep the same hemisphere facing each other.

Asteroids

Asteroids are rocky and metallic objects that orbit the Sun but are too small to be considered planets. They are known as minor planets. Asteroids range in size from Ceres, which has a diameter of about 1000 km, down to the size of pebbles. Sixteen asteroids have a diameter of 240 km or greater. They have been found inside Earth’s orbit to beyond Saturn’s orbit. Most, however, are contained within a main belt that exists between the orbits of Mars and Jupiter.

Asteroids are material left over from the formation of the solar system. One theory suggests that they are the remains of a planet that was destroyed in a massive collision long ago.

Meteors and Meteorites

The term meteor comes from the Greek ?meteoron?, meaning phenomenon in the sky. A meteoroid is matter revolving around the sun or any object in interplanetary space that is too small to be called an asteroid or a comet. A meteorite is a meteoroid that reaches the surface of the Earth without being completely vaporized.

Meteorites have proven difficult to classify, but the three broadest groupings are stony, stony iron, and iron. The most common meteorites are chondrites, which are stony meteorites. Radiometric dating of chondrites has placed them at the age of 4.55 billion years, which is the approximate age of the solar system.

Comets

Comets are small, fragile, irregularly shaped bodies composed of a mixture of non-volatile grains and frozen gases. They have highly elliptical orbits that bring them very close to the Sun and swing them deeply into space, often beyond the orbit of Pluto.

Comet structures are diverse and very dynamic, but they all develop a surrounding cloud of diffuse material, called a coma, that usually grows in size and brightness as the comet approaches the Sun.

As comets approach the Sun they develop enormous tails of luminous material that extend for millions of kilometers from the head, away from the Sun.

History

Traditionally histories of Astronomy usually begin with the Greeks. The Greek philosopher Aristotle held that the earth is fixed at the center of the universe while Ptolemy based a mathematical model of the moving planets in our Solar System. Nicolaus Copernicus, in 1543, published his hypothesis that the sun is the center of the universe but since the teaching of Aristotle had been adopted by the church his view was seen as unbelievable.

1609 A.D. Five years after the appearance of the great supernova of 1604, Galileo builds his first telescope. He sees the moons of Jupiter, Saturn’s rings, the phases of Venus, and the stars in the Milky Way. He publishes the news the following year in “The Starry Messinger”.

1665 A.D. At the age of 23, young Isaac Newton realizes that gravitational force accounts for falling bodies on earth as well as the motion of the moon and the planets in orbit. This is a revolutionary step in the history of thought, as it extends the influence of earthly behavior to the realm of the heavens. One set of laws, discovered and tested on our planet, will be seen to govern the entire universe.

1905 A.D. The first of his many seminal contributions to twentieth century science, relativity recognizes the speed of light as the absolute speed limit in the universe and, as such, unites the previously separate concepts of space and time into a unified spacetime. Eleven years later, his General Theory of Relativity replaces Newton’s model of gravity with one in which the gravitational force is interpreted as the response of bodies to distortions in spacetime which matter itself creates.