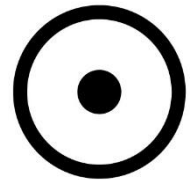
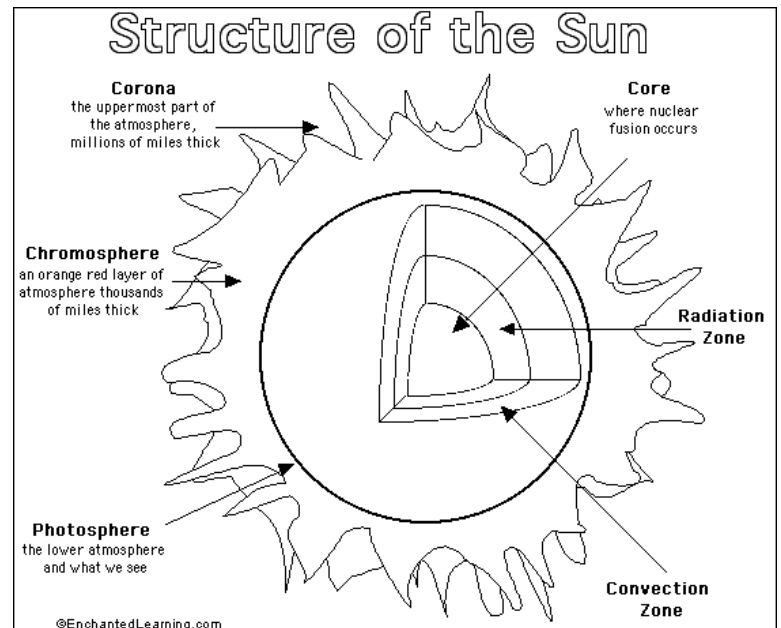


## Solar System Research – Teacher Notes

### The Sun

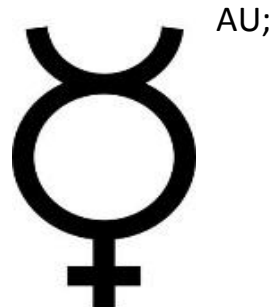
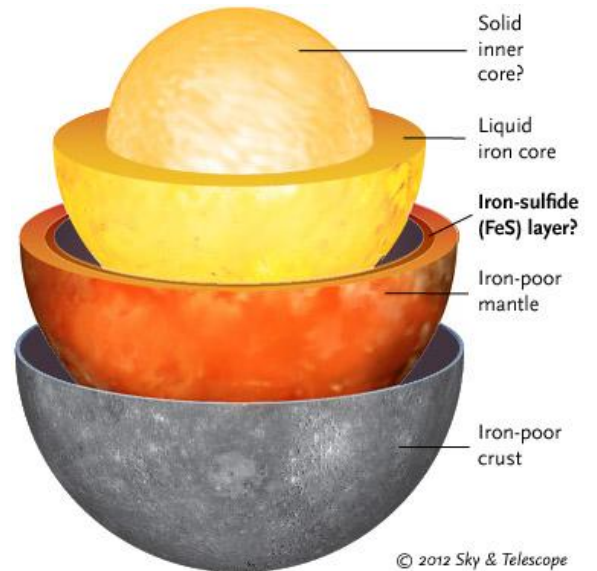
- G-type main sequence star (G2V), also known as a yellow dwarf
- Mass =  $1.99 \times 10^{30}$  kg or 333,000 Earths.
- Volume =  $1.41 \times 10^{18}$  km<sup>3</sup> or 1,300,000 Earths.
- Density (average) = 1.41 g/cm<sup>3</sup> or 0.255 Earths.
- Diameter (equatorial) = 1,392,684 km or 218 Earths.
- Circumference (equatorial) =  $4.38 \times 10^6$  km or 218 Earths.
- Gravity (surface) =  $274 \text{ m/s}^2$  or 28 Earths.
- Temperature (surface) = 5505 °C or 9941 °F or 5778 K.
- Distance (from galaxy center) =  $2.7 \times 10^{17}$  km or 27,200 light-years.
- Brightness (apparent magnitude) = -26.74, (absolute magnitude) = 4.83, (luminosity) =  $3.85 \times 10^{26}$  watts.
- Axial tilt (obliquity) = 7.25°
- Orbital period (revolution around galaxy center) =  $2.38 \times 10^8$  Earth years.
- Rotational period = 25.05 Earth days
- Satellites = all planets, asteroids, comets in Solar System.
- Interesting Facts: Latin name: Sol. Viewed as a deity by many cultures. Its energy supports all life on Earth. Brighter than 85% of other known stars. Enormous effect of Sun on Earth known since prehistoric times. Still many mysteries of how the Sun works. Made of mostly hydrogen (H) and helium (He), continuous thermonuclear reaction in the core. Approximately 4.5 billion years old. Color is actually white, but appears yellow on Earth. Generates the solar wind, a stream of charged particles that extends beyond the edge of the Solar System.



# Solar System Research – Teacher Notes

## Mercury

- Terrestrial (rocky) planet, inner planet
- Mass =  $3.30 \times 10^{23}$  kg or 0.06 Earths
- Volume =  $6.08 \times 10^{10}$  km<sup>3</sup> or 0.06 Earths
- Density (avg) = 5.43 g/cm<sup>3</sup>
- Diameter (equatorial) = 4,879.4 km
- Circumference (equatorial) = 15,329 km
- Gravity (surface) = 3.7 m/s<sup>2</sup> or 0.38 g
- Temperature (surface) = equatorial: 100 – 700 K; polar: 80 – 380 K (huge extremes!)
- Composition: rocky; 70% metallic, 30% silicate (rock)
- Distance (from Sun) = (1<sup>st</sup> planet) aphelion: 69,816,900 km or 0.47 AU; perihelion: 46,001,200 km or 0.31 AU; avg: 57,909,000 km or 0.39 AU
- Axial tilt = 2.11°
- Rotational period (day) = 58.65 Earth days
- Orbital period (year) = 88 Earth days
- Natural satellites (moons): none
- Discovered: known by the ancients
- Interesting Facts: Smallest planet (smaller than some moons), closest to Sun. Small, but very dense, 2<sup>nd</sup> most dense planet. Very large metallic core (42%). Travels around Sun very fast, so named after Mercury, Roman god of messengers. Almost no atmosphere to retain heat, has greatest temperature variation. Smallest axial tilt, greatest orbital eccentricity. Gravitationally locked, rotates in unique way: someone on Mercury would experience one Mercurian day for every two Mercurian years. Surface is heavily cratered.



**Inside Planet MERCURY**

The planet nearest the sun has a diameter of 3,032 miles (4,879 kilometers), about two-fifths of Earth's diameter. Mercury has a spin-orbit resonance, rotating three times for every two revolutions around the Sun. A day on Mercury lasts about 59 Earth days.

**THIN ATMOSPHERE**  
Extremely small amount of helium, hydrogen, oxygen and sodium.

**SURFACE CONDITIONS**  
AIR PRESSURE: None  
TEMPERATURE: 840°F (450°C)  
WINDS: None

**METAL CORE** The planet's liquid iron core makes up about three-fourths of its radius.

Note: Planet surface has been color enhanced

**GRAVITY**  
0.38 OF EARTH

**EARTH** 10 ft. dunk  
**MERCURY** 26 ft. dunk

The surface of Mercury photographed by the MESSENGER probe in 2008.

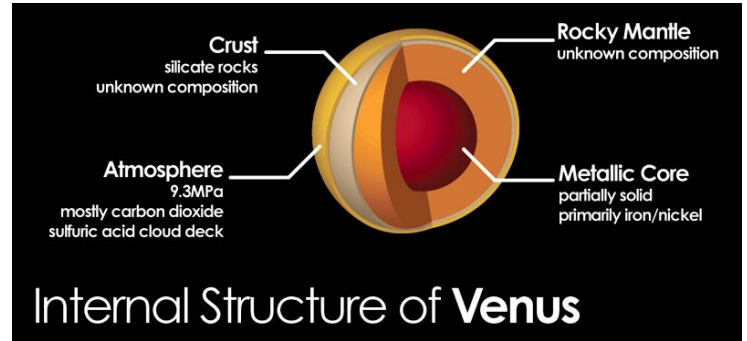
Mercury, 3,032 miles (4,879 km) in diameter, is slightly larger than the moon.

SOURCE: NASA  
ROSS TORO, SPACE.com

# Solar System Research – Teacher Notes

## Venus

- Terrestrial (rocky) planet, inner planet
- Mass =  $4.87 \times 10^{24}$  kg or 0.82 Earths
- Volume =  $9.28 \times 10^{11}$  km<sup>3</sup> or 0.87 Earths
- Density (avg) = 5.24 g/cm<sup>3</sup>
- Diameter (equatorial) = 12,103.6 km
- Circumference (equatorial) = 38,025 km
- Gravity (surface) = 8.87 m/s<sup>2</sup> or 0.91 g
- Temperature (surface) = 462 °C or 737 K (avg)
- Composition: rocky; metallic core, silicate mantle & crust (rock)
- Distance (from Sun) = (2<sup>nd</sup> planet) 108,208,000 km (avg) or 0.72 AU (avg)
- Axial tilt = 177.3° (true), 2.7° (effective, planet is "upside down")
- Rotational period (day) = 243 Earth days, retrograde rotation (rotates clockwise)
- Orbital period (year) = 224.7 Earth days
- Natural satellites (moons): none
- Discovered: known by the ancients
- Interesting Facts: Named after Roman goddess of love and beauty. After the Moon, it is the brightest natural object in Earth's sky. Sometimes called Earth's "sister planet" or "evil twin" as it is similar in size and composition, but hostile to life with extreme conditions. Densest atmosphere of terrestrial planets (92% CO<sub>2</sub>) with extreme atmospheric pressure, and hottest planet in solar system. Venus has been important in human culture for millennia because it is visible in the night sky. Venus is an "upside down" planet with retrograde rotation (clockwise).



**Inside Planet VENUS**

Venus is often visible to the naked eye in the morning and evening sky. It has often been called Earth's "twin" because of its similar size, but space probes have discovered that the environment there is actually quite inhospitable.

**THICK ATMOSPHERE**  
96.5% carbon dioxide, 3.5% nitrogen plus trace gases

**GRAVITY 0.9 OF EARTH**

**SURFACE CONDITIONS**  
AIR PRESSURE: 90x Earth  
TEMPERATURE: 870°F (465°C)  
WINDS: up to 220 mph (100 m/s)

**METAL CORE** It is not known if Venus' core is solid. Unlike Earth, Venus' weak magnetic field is not produced by a dynamo in the core.

The surface of Venus photographed by a Russian probe in 1982

Venus, 7,520 mi (12,100 km) in diameter, is slightly smaller than Earth

SOURCE: NASA  
KARL TATE, SPACE.com

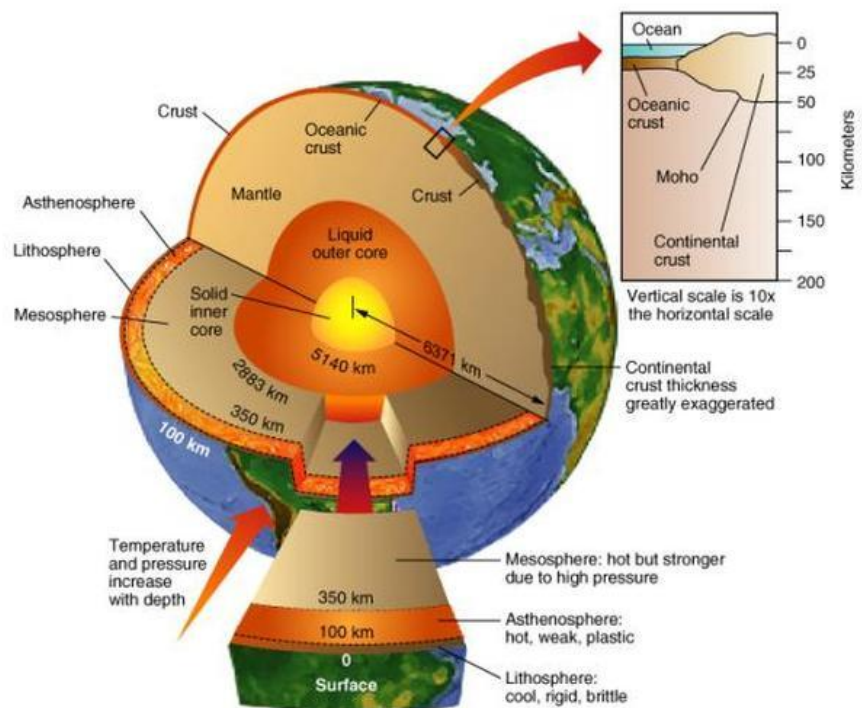
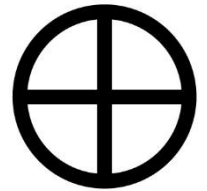
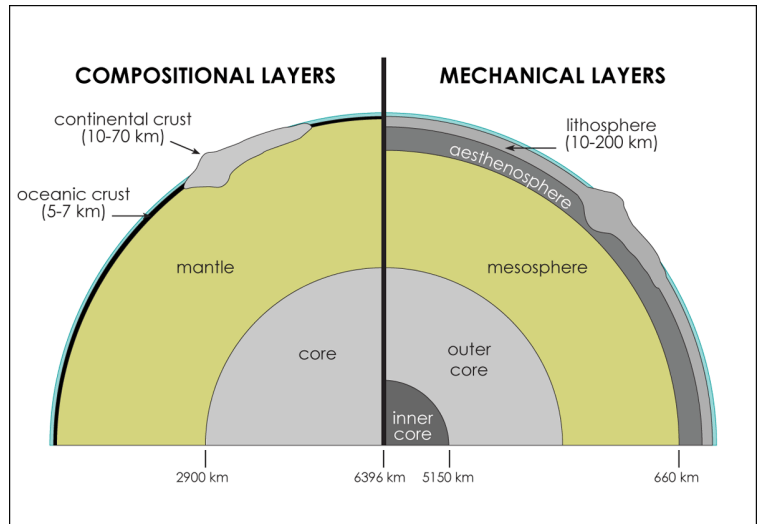
The infographic features several visual elements:
 

- A large cutaway of Venus showing its internal layers (atmosphere, mantle, and core).
- A comparison of a person dunking a ball on Earth (10ft) versus Venus (11ft) to illustrate gravity.
- A photograph of the Venusian surface from a 1982 Russian probe, showing a dark, rocky landscape.
- Small circular images of Venus and Earth for size comparison.

# Solar System Research – Teacher Notes

## Earth

- Terrestrial (rocky) planet, inner planet
- Mass =  $5.97 \times 10^{24}$  kg or 1 Earth
- Volume =  $1.08 \times 10^{12}$  km<sup>3</sup> or 1 Earth
- Density (avg) = 5.51 g/cm<sup>3</sup>
- Diameter (equatorial) = 12,756.2 km
- Circumference (equatorial) = 40,075.02 km
- Gravity (surface) = 9.8 m/s<sup>2</sup> or 1 g
- Temperature (surface) = 288 K or 15 °C (avg)
- Composition: rocky; metallic core, silicate mantle & crust (rock)
- Distance (from Sun) = (3<sup>rd</sup> planet) 149,600,000 km or 1 AU (avg)
- Axial tilt = 23.5°
- Rotational period (day) = 1 day (24 hours)
- Orbital period (year) = 365.26 days (1 year)
- Natural satellites (moons): 1. Moon
- Discovered: duh
- Interesting Facts: Latin name: Terra, also sometimes known as Gaia. Only known planet with life. Densest planet in solar system. Earth's thick atmosphere and strong magnetic field protect surface from radiation and meteors. Lithosphere broken into plates that move (plate tectonics). 70% of surface covered by water. Active core with solid inner core and liquid outer core that generates the strong magnetic field and drives plate tectonics.

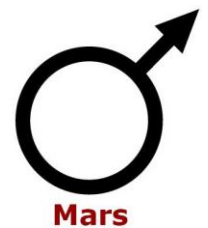
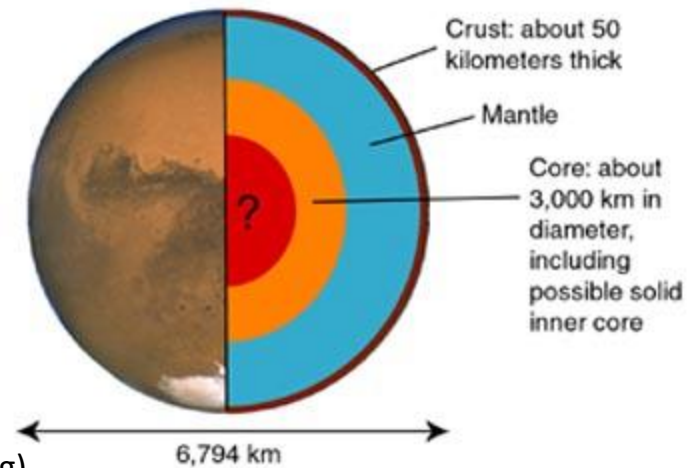




# Solar System Research – Teacher Notes

## Mars

- Terrestrial (rocky) planet, inner planet
- Mass =  $6.42 \times 10^{23}$  kg or 0.11 Earths
- Volume =  $1.63 \times 10^{11}$  km<sup>3</sup> or 0.15 Earths
- Density (avg) = 3.93 g/cm<sup>3</sup>
- Diameter (equatorial) = 6,792.4 km
- Circumference (equatorial) = 21,344 km
- Gravity (surface) = 3.71 m/s<sup>2</sup> or 0.38 g
- Temperature (surface) = -63 °C or 210 K (avg)
- Composition: rocky; metallic core, silicate mantle & crust (rock)
- Distance (from Sun) = (4<sup>th</sup> planet) 230,000,000 km or 1.5 AU (avg)
- Axial tilt = 25.19°
- Rotational period (day) = 1.03 Earth days (24 hrs 37 min)
- Orbital period (year) = 687 Earth days
- Natural satellites (moons): 2. Phobos, Deimos (both captured asteroids)
- Discovered: known by the ancients
- Interesting Facts: Named after the Roman god of war, also named “The Red Planet”.



Thin atmosphere and similar seasonal cycles to Earth. NASA and other groups have planned colonization missions to Mars, as it is the most like Earth of the planets. Most explored planet, has seven functioning spacecraft orbiting or on the surface currently. Can be seen in Earth's night sky without a telescope, has a reddish color. Red color comes from lots of iron rust in Mar's rocks and soil. Mars used to have rivers and oceans, but is now mostly dry.

### Inside Planet MARS

Often visible as a reddish light in Earth's sky, Mars captured the imaginations of those who dream of space travel. The planet's thin atmosphere is hostile to human life, but Mars has many interesting geological features similar to those on Earth, such as volcanoes and canyons.

**THIN ATMOSPHERE**  
95.32% carbon dioxide, 2.7% nitrogen, 1.6% argon, 0.13% oxygen, 0.08% carbon monoxide

**LIQUID IRON-SULPHUR CORE**

**MANTLE**

**CRUST**

**POSSIBLE SOLID INNER CORE**

**GRAVITY**  
0.38 OF EARTH

EARTH	MARS
10 ft dunk	26.3 ft dunk

**SURFACE CONDITIONS**  
AIR PRESSURE: 0.7% of Earth  
AVERAGE TEMPERATURE: -67 °F (-55 °C)

Martian sunset photographed by the Spirit rover at Gusev crater in 2005

Mars, 4,222 mi (6,794 km) in diameter, is slightly over half the size of Earth

SOURCE: ARGONNE NATIONAL LABORATORY, NASA, HSTSCI

KARL TATE, SPACE.com

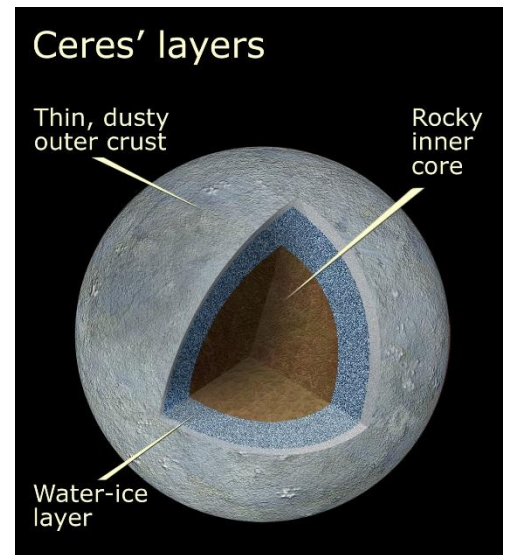
# Solar System Research – Teacher Notes

## Ceres & the Asteroid Belt

- Asteroid Belt: a region with many meteoroids, asteroids, and the dwarf planet Ceres
- Ceres: dwarf planet and asteroid

(all data below for Ceres)

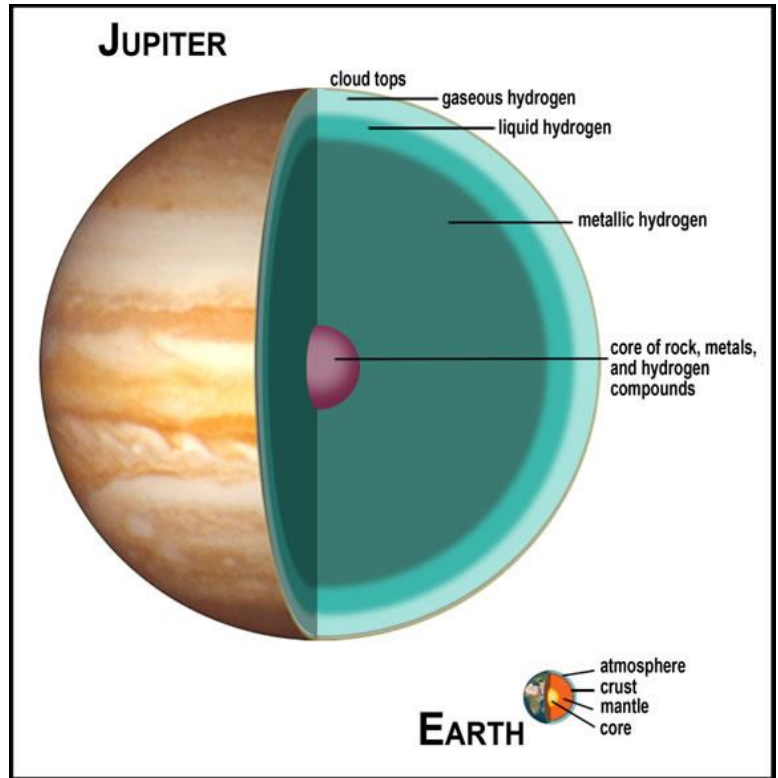
- Mass =  $9.43 \times 10^{20}$  kg or 0.00015 Earths
- Volume = 452,331,448 km<sup>3</sup>
- Density (avg) = 2.08 g/cm<sup>3</sup>
- Diameter (equatorial) = 950 km
- Circumference (equatorial) = 2,992.1 km (avg)
- Gravity (surface) = 0.28 m/s<sup>2</sup> or 0.03 g
- Temperature (surface) = 168 K (avg)
- Composition: rock, ice, dust
- Distance (from Sun) = Belt: between Mars & Jupiter; Ceres: 413,900,000 km or 2.77 AU (avg)
- Axial tilt = 3°
- Rotational period (day) = 0.38 Earth days (9.08 hours)
- Orbital period (year) = 1,680.99 Earth days (4.6 Earth years)
- Natural satellites (moons): None
- Discovered: Ceres first main belt object discovered, 1801.
- Interesting Facts: Asteroid Belt also known as Main Belt. Ceres is only known dwarf planet in asteroid belt. Ceres is considered both an asteroid and a dwarf planet. Asteroids range from a few meters to hundreds of km. Meteoroids are smaller than asteroids, basically small floating rocks in space. Asteroids in the belt are far enough apart a spacecraft could travel through the belt and never encounter one (it's not like scifi movies). Asteroids are found throughout the solar system, not just in the main belt.



# Solar System Research – Teacher Notes

## Jupiter

- Gas giant planet (jovian planet), outer planet
- Mass =  $1.9 \times 10^{27}$  kg or 317.83 Earths
- Volume =  $1.43 \times 10^{15}$  km<sup>3</sup> or 1,321.34 Earths
- Density (avg) = 1.33 g/cm<sup>3</sup>
- Diameter (equatorial) = 139,822 km
- Circumference (equatorial) = 439,263.8 km
- Gravity (surface) = 24.79 m/s<sup>2</sup> or 2.53 g
- Temperature (surface) = -108.15 °C or 165 K



- Composition: hydrogen (75%) and helium gas (25%), liquid matter, possible rocky core
- Distance (from Sun) = (5<sup>th</sup> planet) 778,340,821 km or 5.2 AU (avg)
- Axial tilt = 3.13°
- Rotational period (day) = 9.93 hours
- Orbital period (year) = 4,332.82 Earth days (11.86 Earth years)
- Natural satellites (moons): 67, famous “Galilean Moons” (first discovered by Galileo in 1610) are Io, Europa, Ganymede, Callisto
- Rings: yes, faint, 3 main segments of dust
- Discovered: known by the ancients
- Interesting Facts: Largest planet in solar system. Third brightest object in Earth’s sky (after Moon and Venus). Outer atmosphere separated into bands by latitude. Great Red Spot is a giant hurricane-like storm larger than the planet Earth!! Jupiter has a very strong magnetosphere, 14 times stronger than Earths.

# 4

**Inside Gas Giant JUPITER**

The largest planet in our solar system, Jupiter could hold more than 1,200 Earths. It has dozens of moons and an enormous magnetic field. The planet, mostly a giant ball of gas and liquid, also has a dark ring system composed of fine dust grains.

**TURBULENT ATMOSPHERE**  
89.8% hydrogen, 10.2% helium, plus trace gases.

**GRAVITY**  
2.4 OF EARTH

**SURFACE CONDITIONS**  
AIR PRESSURE: 1,000x Earth  
TEMPERATURE: Varies by depth  
WINDS: Over 400 mph in the upper atmosphere.

**METAL CORE** Jupiter's core is probably made up of layers of metals and rocks, along with methane ice, ammonia ice and water ice.

This image of Jupiter's clouds was taken in 1979 by the Voyager 2 spacecraft.

Jupiter is over 11x larger than the Earth.

SOURCE: NASA

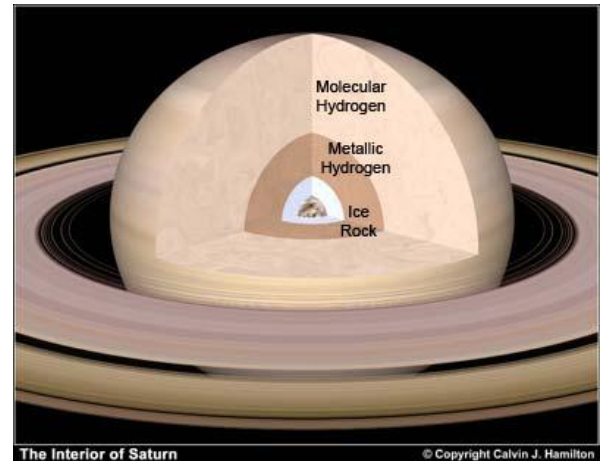
ROSS TORO, SPACE.com



# Solar System Research – Teacher Notes

## Saturn

- Gas giant planet (jovian planet), outer planet
- Mass =  $5.68 \times 10^{24}$  kg or 95.16 Earths
- Volume =  $8.27 \times 10^{14}$  km<sup>3</sup> or 763.59 Earths
- Density (avg) = 0.69 g/cm<sup>3</sup> or 0.13 Earths
- Diameter (equatorial) = 116,464 km
- Circumference (equatorial) = 365,882.4 km
- Gravity (surface) = 10.4 m/s<sup>2</sup> or 1.07 g
- Temperature (surface) = -178 °C or 95K
- Composition: hydrogen (96%) and helium gas (3%), liquid matter, possible rocky/metallic core
- Distance (from Sun) = (6<sup>th</sup> planet) 1,433,000,000 km or 9.02 AU
- Axial tilt = 26.73°
- Rotational period (day) = 0.44 Earth days (10.66 hrs)
- Orbital period (year) = 10,759.22 Earth days (29.46 yrs)
- Natural satellites (moons): 62, Titan, Enceladus, Mimas, Tethys, Dione, Rhea
- Rings: yes, prominent, 9 main rings
- Discovered: known by the ancients
- Interesting Facts: Saturn is less dense than water, and could float (if you could find an ocean big enough)! Has a hexagonal cloud pattern at the north pole. Chunks of rock and ice that make up Saturn's rings are sometimes called moonlets. Titan has a thick atmosphere and might support life. Mimas is called the "Death Star Moon" as an impact crater makes it look like the space station from Star Wars.



h

**Inside Gas Giant SATURN**

Saturn is the most distant planet which can be seen with the unaided eye. When Galileo became the first person to look at Saturn through a telescope in 1610, he saw strange ear-like shapes at the sides of the planet. His telescope was not sharp enough to reveal that the shapes were actually rings.

**THICK ATMOSPHERE**  
96.5% carbon dioxide, 3.5% nitrogen plus trace gases.

**GRAVITY 1.1 OF EARTH**

**MAGNIFICENT RING SYSTEM**  
composed almost entirely of water-ice chunks that are under 30 ft (10 m) in diameter.

**TINY CORE OF ROCK AND METAL**  
The solid core of Saturn may be the size of Earth. It is surrounded by thick layers of metallic hydrogen.

**EARTH** 10ft dunk

**SATURN** 9.4 ft dunk

Saturn's moons Titan and tiny Epimetheus orbit beyond the ring system in this Cassini photo.

Saturn is oblate, meaning that it is wider at the equator than at the poles. Saturn's equatorial diameter of 74,898 mi (120,536 km) is about 9.4 times that of Earth.

SOURCE: NASA, ESA, Space Telescope Science Institute

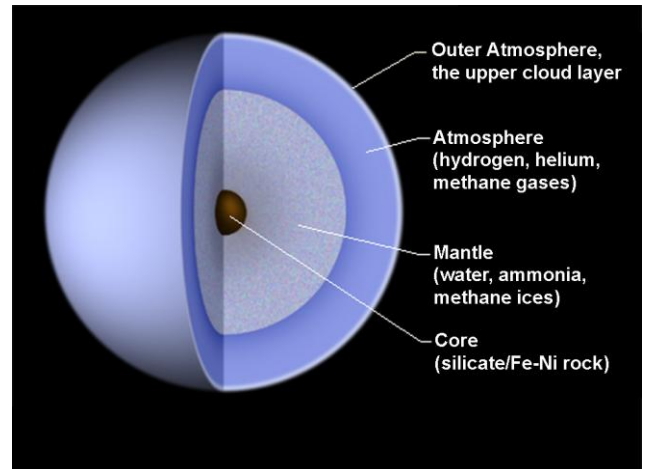
KARL TATE, SPACE.com



# Solar System Research – Teacher Notes

## Uranus

- Gas giant planet (jovian planet), ice giant, outer planet
- Mass =  $8.68 \times 10^{25}$  kg or 14.54 Earths
- Volume =  $6.83 \times 10^{13}$  km<sup>3</sup> or 63.09 Earths
- Density (avg) = 1.27 g/cm<sup>3</sup> or 0.23 Earths
- Diameter (equatorial) = 50,724 km
- Circumference (equatorial) = 159,354.1 km
- Gravity (surface) = 8.87 m/s<sup>2</sup> or 0.89 g
- Temperature (surface) = -216 °C or 57 K
- Composition: hydrogen, helium, water, ammonia, methane
- Distance (from Sun) = (7<sup>th</sup> planet)
- Axial tilt = 97.77° (sideways planet)
- Rotational period (day) = 0.72 Earth days (17 hrs 14 min)
- Orbital period (year) = 30,687.15 Earth days (84.02 Earth years)
- Natural satellites (moons): 27, Miranda, Ariel, Umbriel, Titania, Oberon
- Rings: yes, 13 distinct rings made of dark particles
- Discovered: 1781 officially, but observed as far back as 128 BC
- Interesting Facts: Named after the Roman/Greek sky god who was father of Saturn and grandfather of Jupiter. Known as the "Sideways Planet" as its axis is over 90° from the ecliptic and is where most planets have their equator. Along with Neptune, is known as an "ice giant" because of "icy" liquid layers inside, although in astronomy "ices" are substances with melting points above 100 K and can be solid, liquid, or gaseous (and even hot).



**Inside Gas Giant URANUS**

The seventh planet in our solar system is a giant ball of gas and liquid. It is tilted so far on its side that its axis lies nearly level with its path around the sun. Like the other gas and ice giants, Uranus has thick cloud cover. Its blue-green color is the result of methane in its atmosphere.

**SMOGGY ATMOSPHERE**  
83% hydrogen,  
15% helium,  
2% methane plus trace gases.

**GRAVITY**  
0.9 OF  
EARTH

**SURFACE CONDITIONS**  
AIR PRESSURE: 1.3x Earth  
TEMPERATURE: 4,200°F (2,300°C)  
WINDS: About 450 mph.

**ROCKY CORE** The center of Uranus may be a rocky core about the size of Earth. More than 80% of the planet's mass is a fluid mix of water, methane and ammonia ices.

Image of Uranus' rings was taken in 2007 by the Hubble Space Telescope.

Uranus, with a diameter of 31,763 miles (51,118 km), is over 4x that of Earth.

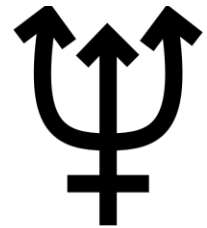
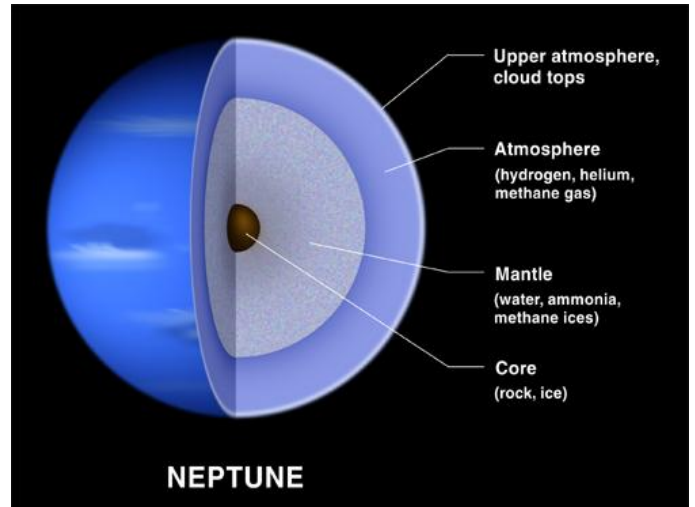
SOURCE: NASA

ROSS TORO, SPACE.com

# Solar System Research – Teacher Notes

## Neptune

- Gas giant planet (jovian planet), ice giant, outer planet
- Mass =  $1.02 \times 10^{26}$  kg or 17.15 Earths
- Volume =  $6.25 \times 10^{13}$  km<sup>3</sup> or 87.72 Earths
- Density (avg) =  $1.64 \text{ g/cm}^3$  or 0.3 Earths
- Diameter (equatorial) = 49,244 km
- Circumference (equatorial) = 154,704.56 km
- Gravity (surface) =  $11.15 \text{ m/s}^2$  or 1.14 g
- Temperature (surface) =  $-214 \text{ }^\circ\text{C}$  or 59 K
- Composition: hydrogen (75%) and helium gas (25%), liquid matter, possible rocky core
- Distance (from Sun) = (8<sup>th</sup> planet)  $4.5 \times 10^9$  km or 30 AU
- Axial tilt =  $28.32^\circ$
- Rotational period (day) = 0.67 Earth days (16 hrs 6 min)
- Orbital period (year) = 60,190.03 Earth days (164.79 Earth years)
- Natural satellites (moons): 14, Triton
- Rings: 6 rings of ice particles
- Discovered: 1846
- Interesting Facts: Triton used to be a dwarf planet that Neptune "captured" and has retrograde revolution and will eventually crash into Neptune or get torn apart! Sometimes Pluto's orbit takes it closer to the Sun than Neptune. Along with Uranus, is known as an "ice giant" because of "icy" liquid layers inside, although in astronomy "ices" are substances with melting points above 100 K and can be solid, liquid, or gaseous (and even hot).



### Inside Gas Giant NEPTUNE

Neptune's existence was inferred mathematically before it was first observed in 1846. The planet takes more than 165 Earth years to complete one orbit of the sun. When the Voyager 2 probe visited Neptune in 1989 it found a "Great Dark Spot" in the atmosphere, but more recent photos show the spot has since vanished.

**THICK ATMOSPHERE**  
80% hydrogen, 19% helium plus ices of ammonia and water

**GRAVITY 1.14 OF EARTH**

**NEPTUNE HAS THE FASTEST WINDS IN THE SOLAR SYSTEM, UP TO 1,300 mph (2,100 km/h)**

**CORE OF ROCK AND ICE**

**MANTLE OF WATER, AMMONIA, METHANE ICES**

**EARTH NEPTUNE**  
10 ft dunk 8.5 ft dunk

Neptune's moon Triton is the only major moon in the solar system that orbits "backward"

Neptune, 30,760 mi (49,500 km) in diameter, is nearly 4 times the size of Earth

SOURCE: ARGONNE NATIONAL LABORATORY, NASA, HSTSCI  
KARL TATE, SPACE.com

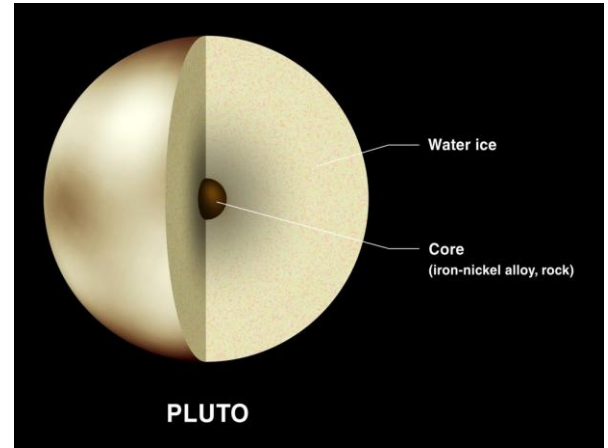
# Solar System Research – Teacher Notes

## Pluto & the Kuiper Belt

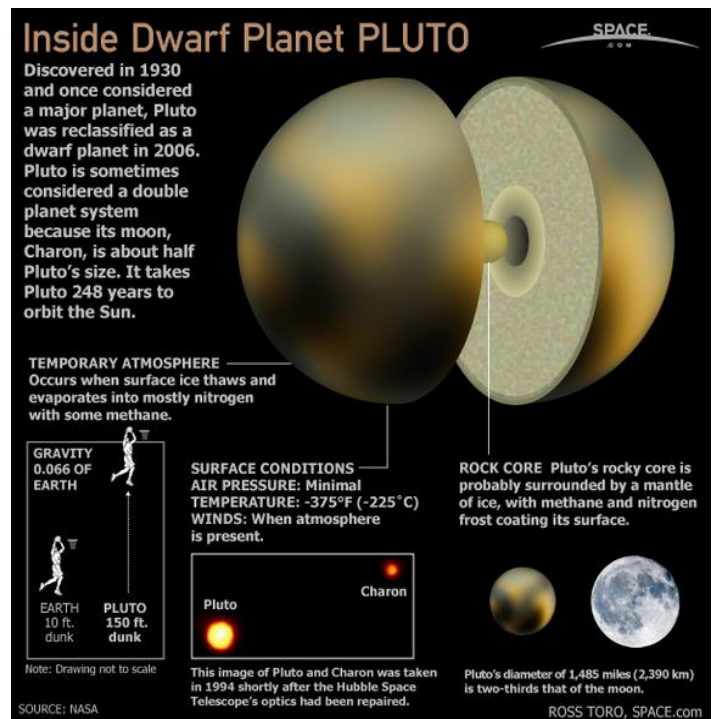
- Kuiper Belt: region filled with asteroids, meteoroids, comets and dwarf planets like Pluto
- Pluto: dwarf planet, KBO, TNO

(facts below are about Pluto)

- Mass =  $1.31 \times 10^{22}$  kg or 0.002 Earths
- Volume =  $6.39 \times 10^9$  km<sup>3</sup> or 0.006 Earths
- Density (avg) = 2.03 g/cm<sup>3</sup>
- Diameter (equatorial) = 2,378 km
- Circumference (equatorial) = 7,232 km
- Gravity (surface) = 0.66 m/s<sup>2</sup> or 0.07 g
- Temperature (surface) = -229 °C or 44 K
- Composition: rock and ice
- Distance (from Sun) = Belt: beyond Neptune, 30 - 55 AU; Pluto: (highly eccentric orbit) aphelion:  $7.31 \times 10^9$  km (48.87 AU), perihelion:  $4.44 \times 10^9$  km (29.66 AU)
- Axial tilt = 119.59 ("sideways" like Uranus)
- Rotational period (day) = (retrograde) 6.39 Earth days
- Orbital period (year) = 90,465 Earth days (247.68 Earth years)
- Natural satellites (moons): 5, Charon, Nix, Hydra, Kerberos, Styx
- Discovered: 1930
- Interesting Facts: Icy asteroids, comets, and dwarf planets in the Kuiper belt are called KBO's (Kuiper Belt Objects). Like the main belt, the Kuiper belt objects (KBO's) are far enough apart a spacecraft could pass through the belt without encountering one. Other dwarf planets in the Kuiper belt include Eris, Makemake, and Haumea. Pluto is largest object in belt, and used to be considered the 9th planet. Some consider Pluto and Charon a double planet rather than planet and moon.



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# Solar System Research – Teacher Notes

## Scattered Disk & Oort Cloud

- Scattered Disk: distant region filled with icy comets and asteroids, widely scattered
- Oort Cloud: spherical region far beyond the planetary region of the solar system, consists of small, icy comets and asteroids
- Comets: objects made of ice and rock that develop a "tail" when approaching the Sun in their long, highly elliptical orbits
- Composition: rock and ice
- Distance (from Sun) = Scattered Disk: about 30-35 AU; Oort Cloud: around 50,000 AU
- Orbital period (year) = can be up to millions of years
- Interesting Facts: Scattered Disk overlaps with the Kuiper Belt. Objects in the Scattered Disk are called SDO's (Scattered Disk Objects). Oort Cloud has not been directly observed, is theoretical at this point. Origin of many comets that travel through the main solar system. Objects in the Kuiper Belt, Scattered Disk, and Oort Cloud are known as TNO's (Trans-Neptunian Objects, "beyond" Neptune).

