



Solar System

PHYSICS • OUR SOLAR SYSTEM • SOLAR SYSTEM

Section 1: The Solar System

• What is the Solar System?

The Solar System consists of the Sun and the objects which orbit it. This includes eight planets and at least five dwarf planets (as well as the moons that orbit them). In addition to this there are smaller rocky or icy objects like asteroids, comets and centaurs. The Sun accounts for almost all of the mass of the Solar System (99.86%).

The planets go around the Sun in elliptical orbits. The planets all lie in the same orbital plane (the ecliptic), although there are some objects, such as comets, which orbit the Sun at an angle to this plane.

• Suggested Film

- What Is An Orbit?



A view of the Moon with planet Earth visible in the background

Extension Questions

Q1. Are there other systems like our Solar System?

Yes. Planets around other stars are known as exoplanets. The light from a star will be far brighter than that from planets orbiting it and this makes exoplanets very difficult to detect. However, improved detection methods led to the first discovery of an exoplanet in 1992. Since then around 500 planets have been found which orbit stars other than our own.

Q2. What were early models of the Solar System like?

Until the 17th century it was widely believed that the Earth was stationary at the centre of the Solar System and the rest of the planets, as well as the Sun and the Moon, orbited the Earth in circular paths. In 1543, Nicolaus Copernicus' heliocentric model placed the Sun at the centre of the Solar System. In the 17th century this was refined by Johannes Kepler, and a model of the Solar System centred on the Sun was supported by Galileo, although he was forced to renounce his views by the authorities.

Q3. How are objects in the Solar System named?

The word 'planet' comes from a Greek word meaning 'wanderer'. Early astronomers noticed that some 'stars' did not remain fixed in the sky but moved in relation to the other stars.

Most of the planets were given their names far back in history. Mercury, Venus, Mars, Jupiter and Saturn were all named after Roman gods. Uranus was not discovered until 1781 and the name 'Uranus' was not fully accepted until 1850. The discoverer of Uranus, William Herschel, originally called it Georgium Sidus (George's Star) after King George III. This was not popular outside Britain and the name Uranus was proposed instead. Neptune was discovered in 1846 and named after the Greek god of the sea.

When Pluto was discovered in 1930 it was named after the Greek god of the underworld. It was considered a planet until 2006 when it was reclassified as a dwarf planet.

The Earth is occasionally known by its Latin name, Terra. Moons are usually named after characters in mythology, although the moons of Uranus are an exception. These are named after characters from the works of William Shakespeare and Alexander Pope. Names are allocated to objects in the Solar System by the International Astronomical Union (IAU), which is composed of professional astronomers.

Extension Questions

Q4. Could our Sun have a companion?

Some scientists believe that mass extinctions on Earth follow a regular cycle, occurring every 26 million years. They suggest this may be caused by a small, dim star, Nemesis, which orbits our Sun and disturbs the Oort Cloud, a region of frozen objects around a light year from the Sun, sending comets into the Solar System, which then cause impact events on Earth. However, no evidence of Nemesis has ever been found and some have questioned whether extinction events really occur regularly. There are currently several ongoing projects mapping the sky, including NASA's infrared survey mission, WISE, which may be able to detect Nemesis if it exists.

Q5. How do we know what other planets are like?

Looking at other planets with telescopes only gives a limited amount of information. We have sent spacecraft to visit other planets (as well as moons, asteroids and comets). These take pictures and conduct measurements and have allowed us to learn a great deal about the Solar System.

In the 1970s, the Pioneer and Voyager spacecraft visited the outer planets, and are now on their way out of the Solar System. Voyager 1, at over 15 billion kilometres from the Sun, is now the most distant man-made object from Earth.

There are currently several ongoing projects mapping the sky, including NASA's infrared survey mission, WISE, which may be able to detect Nemesis if it exists.

Q6. Have humans ever visited anywhere in the Solar System apart from Earth?

Between 1969 and 1972, six Apollo missions took astronauts to the Moon. However, there have been no missions since and this remains the only place astronauts have visited.

NASA has long considered sending a manned mission to Mars and various ideas have been considered. A mission to Mars would likely involve a round trip of several years and this is challenging with current technology, although improvements in propulsion systems could reduce this considerably. In 2004, the US president George W Bush announced that a manned mission to Mars was again planned, as well as a return to the Moon. If a manned mission to Mars does take place it would likely be around 2030.

• How was the Solar System formed?

The Solar System formed around 4.6 billion years ago. An enormous molecular cloud collapsed under its own gravity. One part of this cloud became the Solar System. The cloud would have contained hydrogen, helium and a small amount of heavier elements, which had been ejected by previous stars at the end of their lives.

As the cloud collapsed, any small rotation in the cloud would be conserved. As the cloud became smaller it would spin faster. The temperature of the cloud would also have increased. It would eventually become a flattened, rotating disc. The centre would have become increasingly hot and dense until the hydrogen atoms began to fuse to create helium and release energy. This is how the Sun formed, and today this process of nuclear fusion is still going on inside the Sun.

After the Sun formed, dust and gas remained. The dust grains began to clump together and the planets eventually formed in a process known as accretion. Close to the Sun the temperature was so high that only substances with high melting points were able to condense, and so the inner planets are composed of materials like rock. Further out, the outer planets are gas giants.

Extension Question

Q7. Why do all the planets orbit the Sun in the same direction?

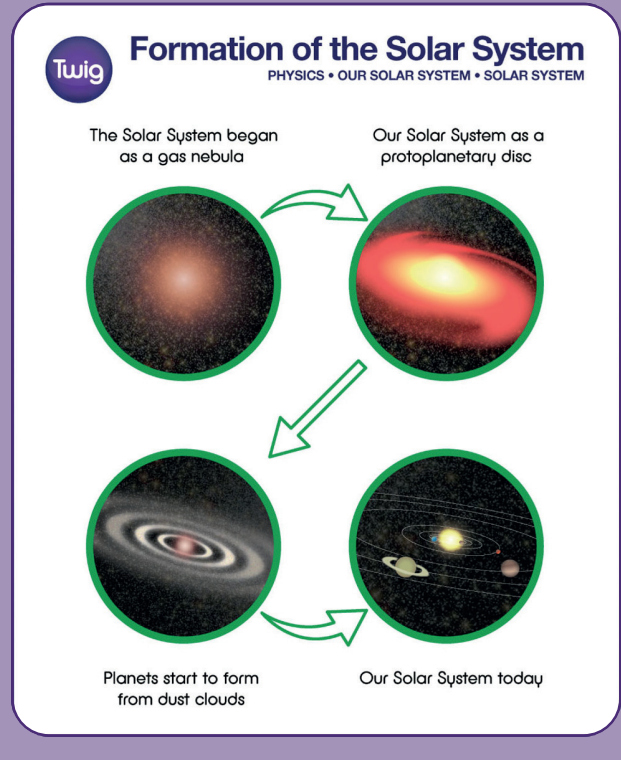
Most objects in the Solar System, including all the planets, orbit the Sun in the same direction. In addition, moons also orbit the planets in the same direction. This is known as direct, or prograde, motion and is a remnant of the rotation of the disc from which the Solar System was originally formed. There are a few exceptions.

Venus rotates in the 'wrong' direction, although its rotation is very slow. This is known as retrograde motion and may be due to Venus having undergone a collision, or a series of collisions at some point in its history, or it may be due to tidal effects from the Sun's gravity and the interaction of the atmosphere of Venus with the planet itself.

Uranus also exhibits retrograde motion. Its axis is at such an angle, around 98°, that is below the horizontal and the rotation is in the 'wrong' direction, with the planet almost rolling as it orbits the Sun. This is thought to be due to a collision with an Earth sized object.

Some small moons, which are likely to be asteroids that have been captured, have retrograde motion. Most large moons have direct motion, although an exception is Triton, a moon of Neptune. It is thought that Triton did not form along with Neptune, but is instead a captured object from the Kuiper Belt, a region of frozen icy objects which lies beyond Neptune and includes Pluto.

DIAGRAM 01:



• **Suggested Film**

- **The Birth of Our Solar System**

Section 2: The Inner Solar System

• **What is the Inner Solar System?**



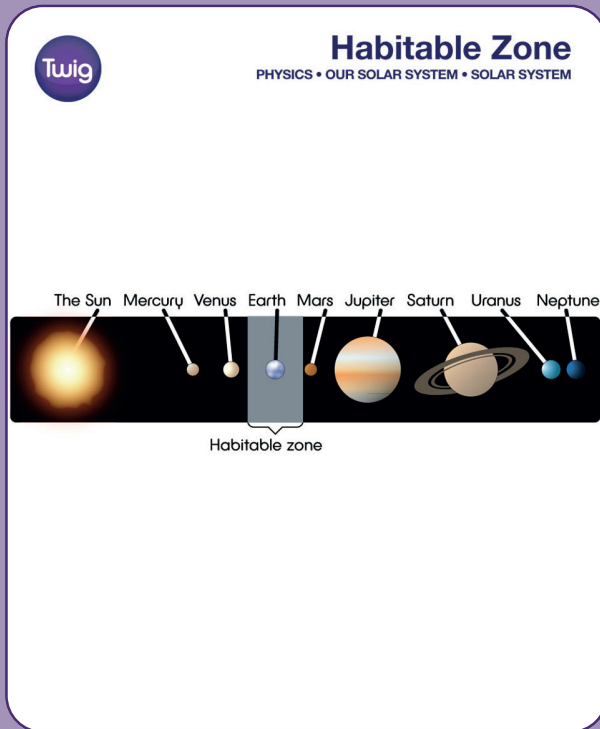
Earth is the third planet from the Sun

The Inner Solar System contains the four inner planets: Mercury, Venus, Earth and Mars, as well as the asteroid belt. The four inner planets are dense and rocky with no ring systems and few moons. The Earth is the largest of these four planets and the only planet with a moon of any significant size. Mars has two moons: Deimos and Phobos, but these are very small and are thought to be captured asteroids.

All, except Mercury, have atmospheres. Mercury is very hot due to its proximity to the Sun. This combined with its small size, means Mercury cannot hold onto an atmosphere.

Beyond the inner planets there is a region containing hundreds of thousands of small, rocky objects. This is the asteroid belt. These objects are left over from the formation of the Solar System. It is thought that the influence of Jupiter prevented these objects coming together to form a planet.

DIAGRAM 02:



Extension Question

Q8. What is special about the Earth?

The Earth inhabits a Goldilocks Zone. It is believed that outside this zone life may be impossible as conditions are either too hot or too cold. On Earth the conditions allow water to exist in all three forms: solid, liquid and gas. Earth is the only planet that has oceans of water. It is unclear whether there has ever been an ocean on Mars, although there appears to be frozen water on the surface.

It is also believed that liquid water exists on Titan, one of the moons of Saturn, and Europa, one of the moons of Jupiter.

• Suggested Films

- Earth
- Earth's Twin
- The Goldilocks Zone

• What is Mercury like?

Mercury is the smallest planet in the Solar System. It is larger than the Moon but has a similar appearance. It is heavily cratered and has no atmosphere.

It orbits close to the Sun. The average radius of its orbit is about one third that of the Earth's. Because of its proximity to the Sun the surface of Mercury can be as hot as 450°C , but when in shadow the surface temperature drops to -180°C . When a planet has an atmosphere, this traps heat and will transfer it to the side of the planet which is in darkness. As Mercury has no atmosphere this doesn't happen, so the side facing away from the Sun is very, very cold.

Sending spacecraft to visit Mercury is difficult. Its speed and position means that it takes a lot of fuel to travel there. Also, because it has no atmosphere it is difficult to slow down a spacecraft when it reaches Mercury so it can orbit the planet. Orbiting Mercury is also difficult, as it is close to the Sun and the influence of the Sun's gravitational pull complicates things.

• Suggested Film

- Mercury

Extension Question

Q9. What are vulcanoid asteroids?

For centuries it has been predicted that there may be a population of asteroids orbiting the Sun closer than the orbit of Mercury. Due to the brightness of the Sun it is very difficult to search for these 'vulcanoids', but if they could be detected they would tell us about the evolution of the early Solar System. It is possible that the MESSENGER spacecraft may be able to detect vulcanoids when it arrives at Mercury, but it will be keeping its instruments pointed away from the Sun to avoid damage and so opportunities to search for vulcanoids may be limited.

• What is Venus like?

Venus is the closest planet to Earth and in many ways is similar. Its mass, radius and volume are all similar, which means that the gravitational pull at the surface is also similar to that on Earth. Because it is covered in clouds which hide the surface there was some hope that the conditions on Venus might be similar to those on Earth. However, Soviet Venera spacecraft, which were sent to Venus in 1961, found the surface temperature was around 460°C, even hotter than Mercury.

It is thought that Venus has undergone a runaway greenhouse effect. Heat is trapped by its carbon dioxide atmosphere and the clouds of sulphuric acid, which blanket the planet.

The surface conditions on Venus are extremely hostile. As well as the high temperature, the pressure at the surface is 90 times the pressure at the Earth's surface. The clouds on Venus also contain large amounts of sulphuric acid and this presents a further challenge for missions which aim to put a lander on the surface.

Several probes, mostly sent by the Soviet Union, have managed to land on the surface and survive long enough to conduct measurements. In 1981, two of the Soviet Union's Venera spacecraft managed to return pictures from the surface of Venus. The longest a lander has ever lasted on the surface of Venus is just over two hours.

The European Space Agency's (ESA) Venus Express spacecraft is currently orbiting Venus. NASA, the ESA and the Russian Federal Space Agency are all currently considering missions which would put landers on the planet.

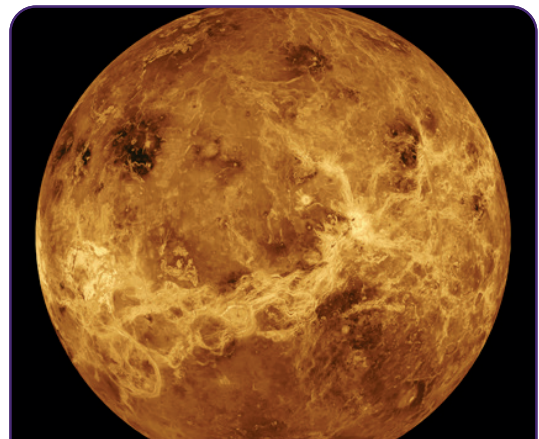
• Suggested Films

- Venus
- Venus 1: Atmosphere
- Venus 2: Surface

Extension Question

Q10. Why is Venus known as the morning star?

Due to light reflecting off the clouds in its atmosphere, Venus appears brighter than any of the stars in the sky and can even be seen in the daytime. It can be seen clearly either before sunrise or before sunset, depending on its position in relation to Earth, and is often mistaken for an unidentified flying object.



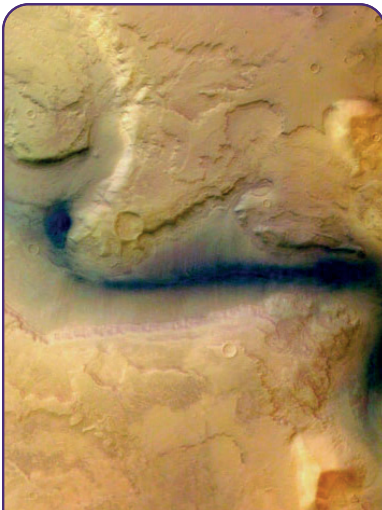
Venus is named after the Roman goddess of love

• What is Mars like?

Mars is much further from the Sun than the Earth, and much smaller and colder. The surface temperature can drop as low as -87°C. The maximum temperature on Mars is the subject of ongoing research, but it is unlikely to be far above 0°C. Its atmosphere is much thinner than Earth's and mostly composed of carbon dioxide. It is often known as the Red Planet due to the iron-rich minerals in its soil.

Around 40 spacecraft have been sent to Mars. Less than half have succeeded in reaching Mars and accomplishing their mission. This is often referred to as the 'Mars Curse'. Throughout the 1960s and 1970s the Soviet Union struggled to reach Mars, as their spacecraft repeatedly failed. NASA has also had more success but has also had its share of failure. In 1999 NASA's Mars Climate Orbiter spacecraft, which cost over \$330 million, was destroyed when it attempted to enter orbit around Mars at the wrong altitude. It was later found that the software on the spacecraft had provided instructions in imperial measurements when the spacecraft expected instructions in metric, causing the thrusters to provide more force than required.

Mars has two tiny moons, Phobos and Deimos. The Russian Federal Space Agency plans to send a probe to Phobos to obtain soil samples and return them to Earth.



An image of the surface of Mars from the European Space Agency

- **Suggested Film**
- Mars

Extension Question

Q11. Is there life on Mars?

There has always been speculation about life on Mars. There is ice on Mars. NASA's Viking missions conducted experiments to look for evidence of organisms in the Martian soil. NASA concluded that these experiments did not provide evidence of life in the Martian soil (although one of the scientists who designed the experiments disagreed). If it were shown that liquid water exists, or has existed, on Mars this would increase the chances of life being found. It is believed that liquid water cannot exist on the surface of Mars now. However, the issue of whether there has ever been liquid water on the surface of Mars, and, if so, how recently this occurred, is still unresolved.

Meteorites have been found on Earth which are known to have originated on Mars. In 1996 it was announced by NASA scientists that possible evidence for life on Mars had been found in one of the 34 known Martian meteorites. It was claimed that features found in the rock were examples of fossilised bacteria. However, these were smaller than any known bacteria and the results have been disputed. After further analysis in 2009 the scientists again restated their conclusion that the meteorite contained evidence of life.

- **What are asteroids?**

Asteroids are small and orbit the Sun in the region between Mars and Jupiter. This is known as the asteroid belt and contains millions of objects. The largest are a few hundred kilometres in diameter but most have a diameter of less than 100km. The asteroid belt also contains one object, Ceres, which has a diameter of around 900km and is large enough to be considered a dwarf planet.

Although there are a lot of asteroids, and they do collide with each other, they are very widely separated. When Pioneer 10 passed through the asteroid belt in 1972 there was some concern that the spacecraft might be struck by an asteroid but Pioneer 10 passed safely through on its way to Jupiter. Nine spacecraft have now passed through the asteroid belt without incident. It is estimated that the chances of a spacecraft hitting an asteroid is one in one billion.

There is another class of objects which are similar to asteroids. These are known as centaurs and orbit the Sun between Jupiter and Neptune. These have characteristics of both asteroids and comets.

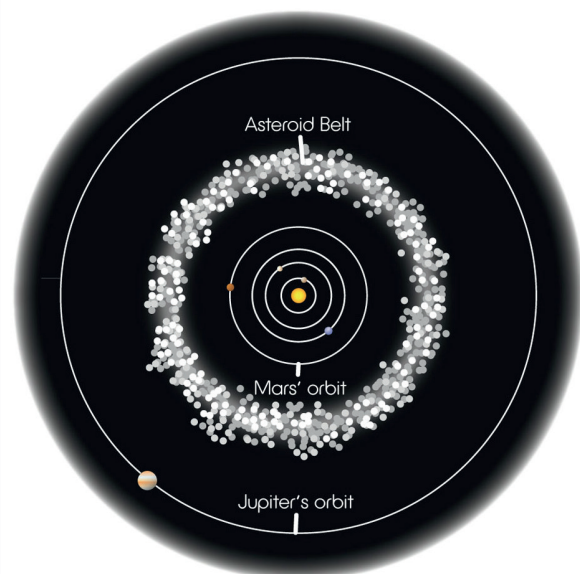
- **Suggested Film**
- What Are Asteroids?

DIAGRAM 03:



The Asteroid Belt

PHYSICS • OUR SOLAR SYSTEM • SOLAR SYSTEM



Extension Question

Q12. What was the Tunguska event?

In Siberia, June 1908, there was an enormous explosion, around 1000 times larger than the atomic bomb dropped on Hiroshima, which was caused by an object exploding a few kilometres above the Earth's surface. It is not clear what kind of object caused the explosion, but it may have been an asteroid or a comet. An asteroid 60m across would account for the size of the explosion.

If an object larger than 100m in diameter were to strike the Earth the consequences would be catastrophic. If an asteroid 10km across were to strike the Earth this likely be an extinction level event and would end most life on Earth. A comet would be travelling much faster and would likely do more damage.

Many asteroids move into the inner Solar System from the asteroid belt due to the influence of Jupiter. These then become near Earth objects. Efforts are currently underway to identify any of these near Earth objects which could present a threat to Earth. Over 7000 have so far been identified and research is also ongoing into methods of deflecting any objects which are found to be on a collision course with Earth. It is intended that by 2020, 90% of all objects over 140m in diameter will have been identified.

Section 3: The Outer Planets

• What are the outer planets?

The outer planets lie beyond the asteroid belt. Just as the Sun makes up over 99% of the Solar System, these planets account for over 99% of the remaining mass. The four planets: Jupiter, Saturn, Uranus and Neptune are all gas giants. Even the smallest of them is 14 times more massive than Earth.

Although Saturn is famous for its rings, all four of the gas giants have ring systems. These rings are composed of small particles of dust or lumps of ice and rock of various sizes.

Extension Questions

Q13. What was Planet X?

At the beginning of the 20th century some astronomers thought that discrepancies in Uranus' orbit could be better explained if there was a planet beyond Neptune. This proposed planet was called Planet X. In 1930, Pluto was discovered but this was too small to fit the required mass.

In 1993, after Voyager 2 conducted its fly-by of Neptune, the mass of Neptune was revised downwards by 0.5%. This accounted for any discrepancy in the orbit of Uranus, and Planet X was no longer required.

Q14. What lies beyond Neptune?

Beyond Neptune there is a region of frozen, icy objects in stable orbits called the Kuiper Belt. Beyond that there is a region known as the Scattered Disc. The orbits of objects in the Scattered Disc are thought to be less stable and many comets are thought to orbit in this region. Far beyond this there is thought to be a region known as a spherical cloud of billions of frozen objects called the Oort Cloud.

• Suggested Film

- FactPack: Moons

Extension Questions

Q15. Is Pluto a planet?

No. Until recently Pluto was considered a planet, however, in 2005, Eris was discovered. Eris is part of the Scattered Disc and is larger than Pluto. As a result of this discovery it was felt that more objects would be discovered, leading to perhaps 50 objects, which would have to be classed as planets, As a result the definition of a planet was changed in 2006, and the new definition states that an object must have cleared its neighbourhood around its orbit. Therefore, this means that Pluto, along with several other objects in the Solar System, is now considered a dwarf planet. In fact, there are other dwarf planets in the Kuiper Belt. In 2005 it was announced that two other dwarf planets had been discovered in the Kuiper Belt: Haumea and Makemake are both around one third of the mass of Pluto.

Q16. What are dwarf planets?

A dwarf planet orbits the Sun and is large enough for its gravity to make it spherical but has not cleared its orbit of other objects. Five objects in the Solar System are currently considered dwarf planets. These are Pluto, Haumea, Makemake, Eris and Ceres.

Pluto, Haumea and Makemake are all Kuiper Belt objects. Eris lies further away, in the Scattered Disc. Ceres lies in the asteroid belt between the inner and outer planets. Its mass is only 4% of the mass of the Earth's moon but it accounts for around a third of all the mass in the asteroid belt.

There are several other candidates for dwarf planet status and it is estimated that there may be as many as 200 dwarf planets when the entire Kuiper Belt is fully catalogued.

• What is Jupiter like?

Jupiter is enormous. It is a gas giant with a volume over 1000 times that of Earth. It is assumed that at one time Jupiter would have had a rocky core but it is not clear if this still exists. Jupiter is mostly composed of hydrogen and helium but it is thought that most of this is in a form of highly compressed, metallic hydrogen.

Spacecraft are often sent past Jupiter on the way to their destination. Swinging around Jupiter changes their speed. This is called a gravity assist manoeuvre. Several spacecraft have visited Jupiter on their way to somewhere else and one, Galileo, has been sent to orbit Jupiter and released a probe into Jupiter's atmosphere.

• Suggested Film

- Jupiter



Jupiter and its four largest moons. The planet has the most moons of any planet in our Solar System

Extension Questions

Q17. What is the Great Red Spot?

The Great Red Spot is a feature on Jupiter, which has existed for hundreds of years. It is of enormous size and has a diameter approximately twice that of the planet Earth. It is large enough to be visible from Earth based telescopes. It is known to be a giant storm.

Q18. What are Jupiter's moons like?

Jupiter has many moons and a very faint ring system. Only four of the moons are of a significant size. These are known as the Galilean moons and their diameters range from 3000 to 5000km. This compares with the Earth's diameter of 12,800km and the Moon's diameter of around 3500km. The rest of Jupiter's moons are very small. The fifth largest moon has a diameter of only 170km. Forty seven of Jupiter's moons have a diameter of less than 10km.

The four Galilean moons are Io, Callisto, Ganymede and Europa.

Io is one of only four known bodies in the Solar System which have been confirmed as volcanically active. The others are Earth, Enceladus (a moon of Saturn) and Triton (a moon of Neptune). As Io orbits Jupiter the planet's gravitational pull causes Io to be stretched and squashed. These tidal effects cause Io to heat and are the cause of its volcanism.

Europa is covered in ice and it is thought that under this ice there is a layer of liquid water 100km thick. It is believed that this water is kept warm by the same tidal effects that cause Io's volcanism. There has been a great deal of interest in Europa because of the possibility that life may exist in the ocean underneath the ice.

Ganymede is composed of rock but has an icy surface and, like Europa, is thought to have a deep ocean under its icy surface.

Callisto has a similar structure, composed of rock and ice, and it is thought possible that it also has a very thin subsurface water layer.

NASA and the ESA are currently discussing a possible mission to investigate Jupiter and the Galilean moons, which would launch in 2020. If the mission were approved it would include several landers and would investigate the atmosphere of Jupiter, as well as Io's volcanism and the subsurface water on Europa and Ganymede. NASA is currently investigating technology which could be used to drill through the ice on Europa (which is estimated to be tens of kilometres thick).

• What is Saturn like?

Like Jupiter, Saturn is a gas giant. It has a distinctive ring system. Saturn has been visited by both Voyager spacecraft and one Pioneer spacecraft. NASA also sent a dedicated mission to investigate Saturn and its moons. The Cassini spacecraft launched in 1997 and arrived at Saturn almost seven years later. The spacecraft conducted fly-bys of several of Saturn's moons and then launched a probe, which landed on Titan.

• Suggested Film

- Saturn
- How Did Saturn Get Its Rings?

Extension Questions

Q19. What are the moons of Saturn like?

Saturn has over 80 moons, but by far the largest is Titan with a diameter of 5100km, which is one and a half times the diameter of the Moon. Four moons, Tethys, Iapetus, Rhea and Dione have diameters of around 1000 to 1500km. Two, Mimas and Enceladus, have diameters of around 500km.

Titan is the only moon known to have a dense atmosphere (in fact its atmosphere is denser than Earth's) and the only body, apart from Earth, where it is known that large stable bodies of liquid exist. The atmosphere is mostly nitrogen. Titan has wind, rain, sand dunes, rivers, lakes and seas, and it is thought that the conditions on Titan may be similar to the conditions on the early Earth, although Titan is much colder. Titan's surface temperature is very low (around -180°C) and the liquid on the surface is thought to be methane, although water may exist beneath the surface of Titan and water ice is likely to exist on the surface. The surface of Titan is hidden by clouds but the Cassini spacecraft has been able to map it using radar.

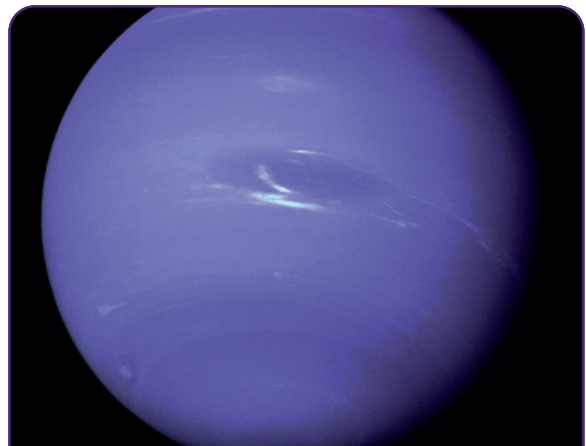
NASA and the ESA are considering a proposal to launch the Titan Saturn System Mission (TSSM) sometime after 2020. The mission would put a spacecraft into orbit around Titan and will also include two landers: a hot air balloon which would investigate the atmosphere and surface, and a lake-lander which would be designed to float on the seas of Titan.

Mimas is the smallest known body in the Solar System which has managed to become spherical due to its own gravity. It has been nicknamed the 'Death Star' because of a large impact crater, which means it resembles the space station from the Star Wars films.

• What are Uranus and Neptune like?

Neptune and Uranus both have a similar composition. They have diameters roughly a third that of Jupiter and Saturn. Like those two planets, both Uranus and Neptune are mostly composed of hydrogen and helium but also contain water, ammonia and methane ice. They are sometimes referred to as 'ice giants'. Both planets have complex ring systems composed of very small particles. One difference between the two planets is that Neptune has visible storm systems. Dark and light spots were observed on Neptune by the Voyager 2 spacecraft, which conducted a fly-by of the planet.

Uranus and Neptune have only been visited by one spacecraft, Voyager 2, in 1989. No missions to either planet are currently being considered. NASA had looked at the possibility of sending a spacecraft to Neptune to orbit the planet but this plan was abandoned in 2008.



Neptune has the fastest winds in the Solar System

• Suggested Films

- Uranus
- Neptune

Extension Questions

Q20. What are the moons of the ice giants like?

Uranus has 27 known moons but only five of are of a significant size: Miranda, Ariel, Umbriel, Titania, and Oberon. They are all composed of ice and rock, and are all much smaller than Earth's moon. Of Neptune's 13 moons, Triton is by far the largest. It is thought to be a captured object from the Kuiper Belt, a region of frozen objects beyond Neptune. This would explain why Triton orbits Neptune in a retrograde direction (the opposite direction to Neptune's orbit).

• Quizzes

Birth of Our Solar System
Basic

• What does the Solar System include?

- A – the planets orbiting the Sun
- B – the planets orbiting the Sun and the asteroid belt
- C – everything that falls within the gravitational influence of the Sun

• What caused the rocks in the early Solar System to come together to form the planets?

- A – gravity
- B – random collisions
- C – electrical attraction

• Where did the rocky planets form?

- A – near the Sun
- B – far from the Sun
- C – all over the Solar System

• What is found at the centre of the rocky planets?

- A – rock
- B – metal
- C – ice

• Which of these planets is not a gas giant?

- A – Neptune
- B – Saturn
- C – Venus

Advanced

• What is the process which generates heat inside the Sun?

- A – nuclear fission
- B – nuclear fusion
- C – convection

• How old is the Solar System?

- A – 10 million years
- B – 1.4 billion years
- C – 4.6 billion years

• How much of the Solar System is composed of hydrogen?

- A – 53%
- B – 74%
- C – 99%

• How much of the Solar System is composed of helium?

- A – 1%
- B – 15%
- C – 24%

• How long did the Sun take to form?

- A – 1 million years
- B – 10 million years
- C – 100 million years

What Are Asteroids?

Basic

- Which one of these is a moon of Mars?

A – Deimos
 B – Triton
 C – Iapetus

- Where is the asteroid belt found?

A – between the Sun and Mercury
 B – between Mars and Jupiter
 C – at the edge of the Solar System, beyond Neptune

- What size are asteroids?

A – hundreds of kilometres across
 B – a few metres across
 C – they vary from the size of pebbles to hundreds of kilometres across

- What are asteroids made of?

A – metal
 B – rock and ice
 C – rock, metal and carbon

- Where do asteroids come from?

A – they are formed far outside the Solar System
 B – they are leftovers from when the Solar System was formed
 C – they are formed when moons break up

Advanced

- What is a tiny asteroid that burns up in our atmosphere known as?

A – a meteoroid
 B – a meteor
 C – a comet

- What is an asteroid which survives entry into Earth's atmosphere known as?

A – a meteorite
 B – a meteor
 C – a comet

- How long do asteroids usually take to orbit the Sun?

A – around 1 year
 B – between 3 and 6 years
 C – over 10 years

A – 1878
 B – 1908
 C – 1923

- What area did this destroy?

A – 1000km²
 B – 2000km²
 C – 10,000km²



What Are Asteroids?

Basic

• What are comets made of?

- A – metal
- B – rock and ice
- C – rock, metal and carbon

Advanced

• How many years ago was the asteroid impact which caused the extinction of the dinosaurs?

- A – 65 million years
- B – 100 million years
- C – 225 million years

• Answers

Birth of Our Solar System

Basic

• What does the Solar System include?

- A – the planets orbiting the Sun
- B – the planets orbiting the Sun and the asteroid belt
-

• What caused the rocks in the early Solar System to come together to form the planets?

-
- B – random collisions
- C – electrical attraction

• Where did the rocky planets form?

-
- B – far from the Sun
- C – all over the Solar System

• What is found at the centre of the rocky planets?

- A – rock
-
- C – ice

• Which of these planets is not a gas giant?

- A – Neptune
- B – Saturn
-

Advanced

• What is the process which generates heat inside the Sun?

- A – nuclear fission
-
- C – convection

• How old is the Solar System?

- A – 10 million years
- B – 1.4 billion years
-

• How much of the Solar System is composed of hydrogen?

- A – 53%
-
- C – 99%

• How much of the Solar System is composed of helium?

- A – 1%
- B – 15%
-

• How long did the Sun take to form?

- A – 1 million years
-
- C – 100 million years

What Are Asteroids?

Basic

- Which one of these is a moon of Mars?

A – Deimos

B – Triton

C – Iapetus

- Where is the asteroid belt found?

A – between the Sun and Mercury

B – between Mars and Jupiter

C – at the edge of the Solar System, beyond Neptune

- What size are asteroids?

A – hundreds of kilometres across

B – a few metres across

C – they vary from the size of pebbles to hundreds of kilometres across

- What are asteroids made of?

A – metal

B – rock and ice

C – rock, metal and carbon

- Where do asteroids come from?

A – they are formed far outside the Solar System

B – they are leftovers from when the Solar System was formed

C – they are formed when moons break up

Advanced

- What is a tiny asteroid that burns up in our atmosphere known as?

A – a meteoroid

B – a meteor

C – a comet

- What is an asteroid which survives entry into Earth's atmosphere known as?

A – a meteorite

B – a meteor

C – a comet

- How long do asteroids usually take to orbit the Sun?

A – around 1 year

B – between 3 and 6 years

C – over 10 years

- When did a large explosion occur in Tunguska in Siberia?

A – 1878

B – 1908

C – 1923

- What area did this destroy?

A – 1000km²

B – 2000km²

C – 10,000km²

What Are Asteroids?

Basic

• What are comets made of?

A – metal

B – rock and ice

C – rock, metal and carbon

Advanced

• How many years ago was the asteroid impact which caused the extinction of the dinosaurs?

A – 65 million years

B – 100 million years

C – 225 million years