Resources needed

- light source
- football
- tennis ball
- globe
- selection of luminous and non-luminous objects
- A4 blank paper
- laptop and data projector or access to network room and screen
- 'seeingscience' CD-ROM
- images of planets, asteroids, comet, printed on card and cut out

Worksheets

Starter activity 'True/false'

Safety

Warn pupils not to look directly at the Sun.

Homework

Draw an accurate labelled picture of the Solar System following what was covered in the lesson.

Extension materials

Choose questions from 'Challenging Questions on the Solar System'.

Key words

constellation
eclipse
hemisphere
luminous
non-luminous
orbit
star
planet
satellite
shadow
Solar System
spherical

Lesson 1 teacher notes

The aim of the first two lessons is to provide basic coverage for the objectives outlined on the objective map (Introduction - Solar System and beyond). Later lessons build on this learning and develop the 'ideas and evidence' work.

Starter

The true/false starter activity covers many of these objectives and the initial feedback will determine what the focus of the lesson should be. Give the pupils a set amount of time to fill in 'true' or 'false' for each of the statements. Whenever the answer given is 'false' the pupils should write a short reason for their answer.

Main

The emphasis of the drawing activity is on what is drawn and where, not on the quality of the drawing. Pupils might assess each other's drawings.

When looking at the luminous objects, discuss with pupils why stars appear to move and why they vary in brightness (affected by the distance away and how hot the star is). The work on non-luminous objects should focus on explaining why we can see the planets and the Moon.

- Use a film canister to demonstrate that reflected light is responsible for making the planets visible. Pierce a hole in the side of a film canister. On the opposite side to the hole, place a small piece of plasticene inside the film canister. When the lid is on you cannot see the plasticene; when the lid is off, you can.

- Take a fluorescent coat or piece of fluorescent material into a room or cupboard with no light. Pupils may be surprised that they cannot see it.

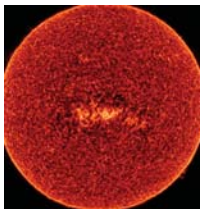
Plenary

The answers to the true/false activity could be collected in if further feedback is required about pupils' misconceptions.

Useful website

www.seds.org/nineplanets/nineplanets/ provides a wealth of information and images of the Solar System

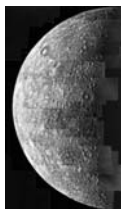
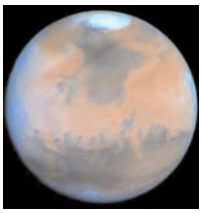
Images available to support work in the main activity

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
crescent Moon		A beautiful crescent Moon (with crescent of Venus below). Ask the pupils to show how this can be modelled with the football, tennis ball and torch.
Earth		Clouds over the Earth's surface. Also shows the tilt of the Earth as the South Pole can be seen but not the North Pole.
Moon		Features such as craters can be seen clearly on the surface.
SOHO_EIT	Animation	This animation of the Sun in UV (hence the need to use a false colour, green) shows a dynamic, spinning, star.
Sun		Image from the SOHO mission which is studying the Sun.
Apollo image of Earth from the Moon		A stunning image taken from the curved surface of the Moon looking back to Earth.
Daynight Earth		This clearly shows the Earth illuminated on the day-side with the other side in the dark. Ask the pupils to model this.

Images available to support work in the main activity

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
sunset from the Shuttle		This image could be used to start a discussion. What does it show? If this is taken at sunset, which way is the Earth spinning? What would the image look like at sunrise? (The shadow (night) would be on the left, the light (day) on the right. The curve would be the other way. If in doubt try and model this with a torch and a globe)
startrails		These show that, because the Earth rotates on its axis, the stars (which are fixed) leave a light trail over time; the greater the time lapse, the longer the trail. The star that does not seem to move is the Pole Star, which lies along the same axis as the Earth's axis of rotation.
24 hour video	Video clip	24 hour video at the CCLRC Rutherford Appleton Laboratory (RAL) Evidence for day/night The clip is 2.2 minutes long. It shows a day in early June starting at midnight and finishing 24 hours later. There is commentary at the beginning and end, but in the middle you may like to discuss: ■ evidence for the time of year (leaves on trees, day length, date on video) ■ times of the working day (cars arriving at 8.30am and leaving at 5pm) ■ weather ■ path of the Sun ■ how the video would be different if it had been filmed on a day in spring, autumn or winter (eg the angle of tilt of the dish whilst tracking the American Advanced Composition Explorer satellite (ACE)) The dish swivels round each day to prevent the cables from getting tangled. This happens during the working day rather than at the end of the tracking period in case there is a problem.

Images available to support work in the main activity

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
Mercury		
Venus		
Earth		
Mars		
Asteroids		The asteroid belt lies between Mars and Jupiter. The first asteroid (Ceres) was discovered in 1801 by Guiseppe Piazzi. The largest asteroid (Ceres) is 1000km across. There are100 000 uncharted, observable asteroids.
Jupiter		
Saturn		

Images available to support work in the main activity

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
Uranus		
Neptune		
Pluto and Charon		
Comet		

Evidence for the Sun, Earth and Moon being approximately spherical

In ancient times people thought the Sun, Earth and Moon were round and flat. Nowadays, though, we have wonderful images taken from space (see list of images).

Aristotle and others realised that the shapes of shadows cast by the heavenly bodies on each other could only be explained if they are spherical.

Pythagoras used the evidence that if you went as far as you could east, you found elephants (Indian) and if you went as far as possible west, you also found elephants (African). Because elephants were so unusual, Pythagoras assumed they were the same animals and therefore the Earth must be round. So, he drew the right conclusion from false evidence!

Evidence that the position of the Sun changes during the day and that shadows change as a result

This happens because the Earth rotates. In summer, the Sun is higher in the sky than in winter because of the relative angles of the Earth and Sun. Sundials make use of this to tell the time. The background notes have more information about how sundials work.