Resources needed

- Concept cartoon 14.11' (either as an OHT or as copies for pupils to look at in pairs)
- statement cards
- different sized balls, paper and pens, torches, modelling clay, black paper etc
- Taboo cards
- 'seeingscience' CD-ROM or access to the website **www.seeingscience.cclrc.ac.uk**

Possible homework

Give pupils a copy of all the statements used in the main activity. Ask them to 'traffic light' each statement according to how easily they could explain it to student from another pupil class. (Green statements are easy to explain, amber are hard to explain but possible, red cannot be explained). Choose one of the red or amber statements and decide how to explain it to a student in another class.

Key words

axis	model	eclipse
rotate	evaluate	satellite

Lesson 3 teacher notes

This lesson offers an opportunity for less able pupils to reinforce their ideas about the Solar System using models. Models are a vital teaching tool in helping pupils working at about level 4 to move to higher levels of understanding. It is important that pupils are taught to evaluate models which are used, to think about the limitations of the model and to then develop their own models. This process supports understanding giving access to more sophisticated ideas and encouraging more able students to extend their knowledge and understanding.

Starter

The 'Concept cartoon 14.11 - movement of the Sun' raises questions about the apparent movement of the Sun. To an observer in the northern hemisphere the Sun appears to rise in the east, go round the south and set in the west. However to an observer in the southern hemisphere the Sun appears to rise in the east, go round to the north and set in the west. This can be confusing to travellers who move from one hemisphere to another. This can be modelled using a globe, light source and blu-tak 'observers' positioned at various points on the globe. ICT links (email, web cam, phone) can allow this to be investigated directly - perhaps supported using video or photographic evidence.

As alternatives, use any other of the 'Concept cartoons' relating to this topic.

Snowballing (starting with one pupil having a minute or so to think about an idea before they share thoughts with a partner and then sharing with another pair) is used to encourage pupils to reflect on their previous learning and to provide an opportunity for them, and you, to assess the depth of understanding, including any misconceptions, that the pupils may still hold.

Main

This activity will need strict adherence to a time schedule, depending on the length of the lesson. It is important that this activity leaves sufficient time for a full plenary. Pupils are grouped according to their prior understanding. Statements are allocated to each group in line with the ability of the group.

It is essential that students have time to discuss the strengths and weaknesses of each model. More able pupils can be encouraged to suggest ideas to develop each model.

Plenary

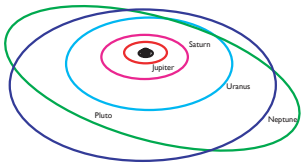
The plenary of this lesson will be determined by the outcome of the main activity. Several options should be planned for.

Instructions for Taboo

Taboo is a good activity to get pupils talking about what they think, which helps them to organise and refine their own thoughts and you to identify misconceptions. It can be a straightforward activity for groups of three pupils and is useful as a plenary session at any stage in a lesson. However if pupils are not familiar with this type of activity, more time may be needed.

One pupil acts as a describer, one as a listener/guesser, and the third as the referee. The describer is given a Taboo card with a key word printed in bold and various Taboo words. The guesser has to work out what the key word is from the describer's description. In this the describer is not allowed to say the key word or the Taboo words; the referee checks that the describer does not cheat and that no Taboo words are used. The describer therefore has to challenge their own understanding of the key word on the Taboo card and describe it in ways other than relying on scientific terminology. This raises the stakes in terms of 'thinking skills' and means pupils have to reconstruct scientific terms in a different way. When each word is guessed, roles pass around the trio. Each person therefore gets a turn to be guesser, describer or referee.

Images of the Solar System

	IMAGE	WHAT THIS SHOWS
Solar System		Shows the orbits of the planets around the Sun. Most lie in the 'ecliptic plane' which is the plane containing the Earth's orbit around the Sun so the Earth's inclination to it is 0. Details of websites with animated orbits are given at the end of the teacher notes.
planets orbiting		Shows the planets in order from the Sun. The inner planets are closer to the Sun, have solid surfaces and are made mainly of rock. The outer planets, the 'gas giants,' are made mostly of hydrogen and helium and do not have a solid surface. Pluto does not fit into the pattern that might be expected.

Useful websites

- Animations showing the orbits of the inner and outer planets, asteroid belt, Kuiper Belt and comets
http://janus.astro.umd.edu/javadir/orbits/ssv.html

- A simulation of the vast distances between the planets in the Solar System
www.classzone.com/books/earth_science/terc/content/visualizations/es2701/es2701page01.cfm?chapter_no=27

- Modelling the Solar System to scale: The thousand-yard model or The Earth as a peppercorn
www.noao.edu/education/peppercorn/pcmain.html