

### Homework

The concept map, possibly started in the plenary activity, could be completed for homework. Less able pupils could match up the words on the Space glossary. Alternatively, pupils could produce their own flicker book to show the phases of the Moon - an example is given.

### Extension materials

■ More able pupils - choose questions from the 'Challenging Questions'

■ Less able pupils - use the 'Space glossary' to consolidate the concepts

### Resources needed

- football
- tennis ball
- globe
- Moon ball / half black polystyrene ball
- A4 blank paper
- laptop and data projector or access to network room and screen
- CD-ROM from the CCLRC with images and video clips

### Worksheets Starter

- card sort game

### Main

- orbits
- 1999 solar eclipse sheet - 'A day to remember'

### Plenary

- Solar System Loop game, pre-prepared
- sample Solar System concept map
- Space glossary
- 'phases of the Moon' flicker book

### Key words

axis	phase	Universe
eclipse	season	
galaxy	tilt	

### Starter

If the true/false activity from lesson 1 has been collected, brief feedback could be given from this to indicate what work still needs to be done.

The answers to the card sort game are as follows:

TERM	DEFINITION
Earth	<i>a planet that completes one rotation on its axis every 24 hours</i>
orbit	<i>a path taken by a planet around the Sun</i>
seasons	<i>these occur because the Earth's axis is tilted</i>
Sun	<i>large, luminous object at the centre of the Solar System</i>
non-luminous	<i>an object that does not give out light</i>
Moon	<i>an object that takes around 28 days to orbit the earth</i>
eclipses	<i>these occur when the Sun, Earth and Moon are all along one line</i>
Solar System	<i>made up of the Sun and its planets</i>
galaxy	<i>made up of millions of stars</i>
Universe	<i>made up of many galaxies</i>
planets	<i>the Earth is one, so are Mars and Venus</i>
star	<i>a luminous object that is a continuous source of light</i>

### Main

Much research is often carried out by pupils on the planets so it is worth emphasising that they do not need to know lots of information, but they do have to understand the positions of the planets and how they move.

### Plenary

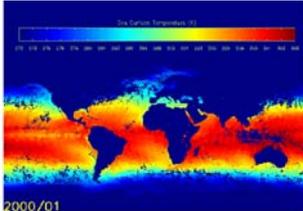
Several activities exist which can consolidate the learning and assess pupils' understanding:

- Loop game. The cards should be cut out and stuck beforehand. Give out the shuffled cards. Start with the card marked 'Start'. The pupil having the correct answer should respond and then ask the question on the reverse and so on until the answer 'Mercury' is reached. The cards are in sequence on the worksheet, for example the 'a planet which has clouds of acid' is 'Venus', the 'third planet from the Sun' is the 'Earth' and so on.
- A sample Solar System concept map is provided. This could be edited to omit the linking words or the objects so there is some structure as a starting point.
- Use the 'Space glossary' to match definitions.
- Ask the students to make a 'phases of the Moon' flicker book or if more appropriate use the one provided but ask them how it could be improved, for example by having more phases and completing the sequence with another new Moon.

### Useful websites

- [www.kids.msfc.nasa.gov/](http://www.kids.msfc.nasa.gov/)
- [www.nasa.gov/home/index.html](http://www.nasa.gov/home/index.html)
- [www.atrs.rl.ac.uk/](http://www.atrs.rl.ac.uk/)
- [www.orbits.esa.int/orbits/index.html](http://www.orbits.esa.int/orbits/index.html)

Useful images and animations for this lesson:

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
seasons animation (Earth orbit)	Animation	<p>This animation shows the Earth at four stages during its orbit of the Sun. To begin with, the North Pole points away from the Sun. It is winter in the north and the days are short (indeed, near the North Pole, it is dark all day!). Next, the Earth moves to a position where the north and south poles are the same distance from the Sun. This is the Spring Equinox. Day and night are the same length all over the planet. Next the animation shows the Earth during the northern summer. The north pole is tilted towards the Sun and so days are much longer here (near the North Pole, it is daylight all day!). Finally, the animation shows the Earth during the Autumn Equinox. Again, the North and South poles are the same distance from the Sun and the day and night are the same length all over the planet. How do you think your year would be different if you lived at the South Pole?</p>
Earth spinning to show the seasons	Animation	<p>This animation shows the view of the Earth from the Sun for the same four times of year as for the Earth orbit animation. To begin with, the North Pole points away from the Sun. It is winter in the north and the days are short (indeed, near the north pole, it is dark all day!). Next, the Earth moves to a position where the North and South poles are the same distance from the Sun. This is the Spring Equinox. Day and night are the same length all over the planet. Next the animation shows the Earth during the northern summer. The North Pole is tilted towards the Sun and so days are much longer here (near the North Pole, it is daylight all day!). Finally, the animation shows the Earth during the Autumn Equinox. Again, the North and South Poles are the same distance from the Sun and the day and night are the same length all over the planet.</p>
the ATSR animation		<p>Shows the sea surface temperature changing with the seasons. The false-colour image shows cold seas in blue, changing to green, yellow, orange then red as the temperature increases. As the animation runs through the months, the warm band around the equator moves north in June and July for the northern hemisphere summer and then south in December for the northern winter. Look for changes in the sea surface temperature around Britain over the year.</p>

Useful images and animations for this lesson:

FILE NAME	IMAGE/MULTIMEDIA	WHAT THIS SHOWS
phases of the Moon - what we see from Earth	animation	This shows the view of the Moon from the Earth for one complete lunar orbit (around 28 days). To begin with, the Moon and Earth are the same distance from the Sun and so half the lunar disk is visible from the Earth. As the Moon moves in its orbit it moves between the Sun and the Earth and less and less of the sunlit side faces the Earth. At these times, the Moon appears as a thin crescent in the sky. As the Moon travels away from the Sun in its orbit, the amount of the sunlit disk increases until the entire disk is sunlit at full Moon.
phases of the Moon - the Moon going round the Earth	animation	The Moon takes around 28 days (Earth rotations) to orbit the Earth. The animation shows that, while the Sun shines from the same direction, the side of the Moon that reflects this light is not always pointing towards the Earth. When the Moon is closer to the Sun than the Earth, the dark side of the Moon faces the Earth and the Moon is not visible. When the Moon is further from the Sun than the Earth, the sunlit side of the Moon faces the Earth and the Moon appears to be full.

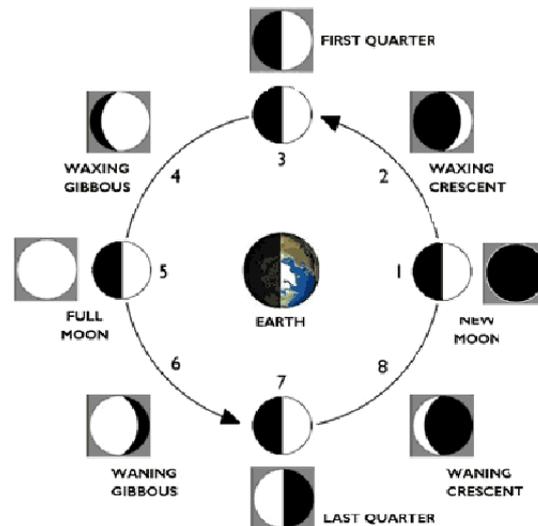
## Answers to 'A day to remember'

Chris went to CORNWALL to see the 1999 eclipse.

- |   |              |
|---|--------------|
| 1 | corona       |
| 2 | diamond ring |
| 3 | birds        |
| 4 | Moon         |
| 5 | whooping     |
| 6 | total        |
| 7 | cloudy       |
| 8 | solar        |

## Phases and eclipses

Diagrams explaining the phases of the Moon are easily misunderstood when drawn in two dimensions. The following points may help to avoid confusion. First, there is only one Moon going round the Earth! Second, as the Moon moves round we see different amounts of its sunlit side. Sometimes we see all of it (as in 5) and we call this a full Moon. Sometimes we cannot see any of it and we call this a new Moon (as in 1). In between we have waxing and waning crescents (waxing means getting bigger; waning means getting smaller) and waxing and waning gibbous moons which are more than half illuminated (gibbous means swollen or bulging, from the Latin *gibbus* meaning hump)



The diagram seems to show that the Moon would get in the way of the Sun's light every month but this is not true. Sometimes the new Moon is above the line between the Earth and the Sun and sometimes it is below. Only when the Moon is on the line and in front of the Sun (a special case) is there an eclipse of the Sun. Similarly, when the Moon goes into the shadow of the Earth, there is an eclipse of the Moon.