National Curriculum Objectives:
(Statutory Requirements)
Pupils should be taught to:

a) describe the movement of the Earth, and other planets, relative to the Sun in the solar system
b) describe the movement of the Moon relative to the Earth
c) describe the Sun, Earth and Moon as approximately spherical bodies
d) use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Experimental and investigative work focuses on:

Planning an investigation:	Obtaining and evaluating evidence:
1. planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary	2. taking measurements, using a wide range of scientific equipment with increasing accuracy and precision, taking repeat readings where appropriate 3. recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs 4. using test results to make predicitons to set up further comparative and fair tests 5. reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations 6. identify scientific evidence that has been used to support or refute ideas or arguments

Most children will:

- Describe the Sun, Earth and Moon as spherical.
  Name the planets in the solar system independently.
- Distinguish between heliocentric and geocentric ideas of planetary movement.
- Explain that day and night is due to rotation of the Earth.
- Support the idea that different places on Earth experience night and day at different times with evidence.
- Explain how the Moon moves relative to the Earth.

Some will progress less and will:

- describe a sphere
- Name the planets in the solar system with support.
- Explain how the planets orbit the Sun.
- Explain how night and day occur.
- Make predictions about night and day in different places on Earth.
- Explain that the Moon orbits the Earth not the Sun.

Others will progress further and will:

- Name at least two different shapes the Earth was thought to be.
- Describe some features of the planets.
- Place the planets in the solar system in the correct order.

- Explain theories of planetary movement in the solar system using evidence.
- Explain using evidence how night and day occur.
- Explain why night and day occur at different times in different places on Earth.
- Explain how the Earth and Moon move relative to the Sun.

Key vocabulary:

Previously taught: sun, light, dark, moon stars, day, night, shadows, axis, spin, rotate, transparent, translucent, opaque, direction, light travels

New: sphere, revolve, orbit, sunrise, sunset, position, relationship

Session	Learning Objectives	Introduction	Main activity	Application and review	Resources
1	**LO: What I know about the Earth, Sun and moon.** **Assessment: c, 6**	Start this unit by finding out what the chn already know. Ask: *what would the Earth, sun and moon look like if you were travelling in outer space? What would it look like as viewed through the cockpit of a space ship?* **Title: what I know about the Earth, sun and moon.** Encourage the chn to draw what it would look like and to record their ideas/ knowledge about each. Discuss their ideas with a partner and consider the questions on the board. What shape is the Earth? Which is the biggest- the Earth, the sun or the moon? How do they move? Listen to the children's ideas as they discuss. Ask children what they would like to find out in this unit (record and display).	Provide chn with pictures (on flipchart). How do they compare with their drawings? What does the Earth look like? Why? (http://www.bbc.co.uk/learningzone/clips/earth-the-goldilocks-planet/1590.html) What shape is the Earth? How do they know? Explain that these pictures are taken by powerful satellites and telescopes. But these have only become available in the last 50 years. What other evidence do they know about that would support the idea that the Earth is spherical. (A large ship can be seen to disappear over the horizon gradually & if you then climb a high hill you can see it again! A ship can sail away, disappear and then turn round and reappear.) http://www.bbc.co.uk/education/clips/zd3fb9q Looking at the flipchart page with questions on **Q: Have people always thought that?** The Ancient Greeks realised Earth was round - different star constellations could be seen from different parts of the world, but the Mediaeval Church thought it was flat and sea farers would be nervous in uncharted waters in case they fell off the edge! **Q: What evidence were people using to make them think the Earth was flat?** (Direct evidence of the senses:	Do children understand the Earth is spherical?	Pictures Clear beakers of water

			the Earth looks flat, the Earth feels flat) It was also a question of common sense – before Isaac Newton came along and explained about gravity to people, they wouldn't have accepted the Earth was a sphere, because they would have thought that the people on the other side of the planet (Australia) would have fallen off the world. **Q: Were people using good scientific evidence to conclude the Earth was flat?** (They may say no – but remind them that we often tell them to use their senses in science, and that evidence of the senses is useful and necessary – we have to use our senses to make observations and collect data. There is nothing wrong with saying that the Earth **looks** flat – it does look flat! What is wrong is to jump to the conclusion that because it looks flat, it is flat. Children to record the answer to the question How do we know the Earth is spherical. **Activity** (mixed ability groups): One transparent cup on each table half-filled with water. Each child to have a go at putting a pencil in the water, and complete the questions on the sheet: **1. What do you observe? How does the pencil look?** (bent where it enters the water) **2. Does this mean the pencil really is bent?** (no) **3. How do you know? What evidence can you give?** (take it out of the water, feel it) Children to fill in Activity sheet and stick into books and draw a diagram to accompany.		

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2	**L O:To understand the relative sizes of the Earth, Moon.** *Assessment: c*	Recap with the children the shapes of the earth, sun and moon. Can they identify objects in the room that are spherical? Get children to sit in a circle and put all the spherical objects in the middle. These will include various sized balls from PE cupboard, as well as an orange, a pea, a peppercorn and a tiny bead. Ask the children to choose the three that best represent the relative size of the Earth, Sun and Moon. [peppercorn = moon, pea = earth, large beach ball = sun]. Tell the children that this is still not quite accurate, but it gives them an idea. In terms of distance, if you put the peppercorn about 25 cm from the pea, the beach ball needs to be about 93 metres away. **What are the relative sizes of the Earth, Sun and Moon?** Show children the BBC video (see below). http://www.bbc.co.uk/education/clips/zj3fb9q	Tell children that the practical difficulties of showing the Earth, Sun and Moon to scale is not a bad thing – it just shows them how huge the size and distance of the Sun is in relation to the Earth. Children to draw this representation into their books. Provide the chn with post-its. Write facts that are true and that are false about the sun, Earth and moon. Pass them to another table. Can they sort them into those that are true and those that are false? Photograph for books.	Discuss actual sizes of the Earth, Sun & Moon. They are huge numbers! Sun diameter (what does 'diameter' mean for a 3D sphere?) = 1,392,530km, Earth diameter = 12,756km, Moon diameter = 3,476km. Distance of Earth from Sun = 152,000,000km, Moon from Earth = 384,622km. If time, look at other facts about each.	Balls of varying sizes, orange, peppercorn, pear, large beach ball Post-its
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3	**LO: To know that the earth rotates on its axis to create night and day.** **Assessment: d**	Ask the children to consider three explanations for the changing shape and position of the shadows: 1. The sun moves from one side of the sky to the other. 2. The Sun goes around the Earth 3. The Earth turns around so the Sun seems to move. **Q: Is the direct evidence of the Sun and the shadows enough to tell us which explanation is**	**Activity 1 (Outside).** Get everyone to link hands in a circle facing outwards. Then remove four children. Make them make a smaller circle, hands joined looking outwards. Tell the large circle it represents the Sun, and the small circle it represents the Earth. Tell children that the Sun is about 100 times the diameter of the Earth. So if the Earth's diameter is made from 4 children, how many children should be making the Sun? About 400 – put this number in the context of your school. [Make sure higher ability children understand that although the Sun is 100 times the	Where in the world is it the same time as in the UK? Despite being far away, South Africa has the same time as us because we both face the Sun at the same time. Show children	**Day and night website:** http://www.childrensuniversity.manchester.ac.uk/interactives/science/earthandbeyond/dayandnight/

		right? Ask children to think if they've been in a car or a train when the car or train next to them seems to move, and they thought it was theirs? This helps to show why the evidence from the senses can be explained in different ways – it can mean the vehicle you are in is moving past the other one – or that vehicle is passing yours. Similarly, the turning of the Earth means the Sun is facing different parts of the surface at different times which makes it seem to travel across the sky.	diameter of the Earth, it is much bigger than that in terms of volume or mass] The Sun should stand still. The Earth should rotate in its circle in an anticlockwise direction [NB – just rotating on its 'axis' – not orbiting the sun – that is happening in next session]. Tell the children this explains why the Sun looks like it moves across the sky. Repeat the activity a few times with other children experiencing the view from 'Earth'. Ask: **Q: What causes day and night?** **Q: Why is it dark at night?** **Q: Is it night for the whole planet at the same time or different times?** **Q: When it is noon in one part of the world, where will it be midnight?** **Q: In what direction does the Sun appear to rise? Why?** **Q: In what direction does the Sun appear to set? Why?** The direction of sunrise and sunset is caused by the planet rotating in an anticlockwise direction. **<u>Activity 2 (classroom)</u>** Introduce the words: Rotation, Spin, Axis & discuss meaning. The scientific explanation for the Earth's movement is that 'it spins or rotates on its axis'. **Q: How long does it take the Earth to rotate once?** 24 hours – which we call a day. Show the children the Day and Night website. Show the children a globe and identify the North and South pole, and where its axis would be. Locate various continents on the globe. Get a child to stand up to represent the sun. Ask other children to identify where in the world it is day and night as you rotate the Earth on its axis – NB should rotate anticlockwise. Children should see that it is day in China before it is day in UK – this explains time difference between countries. Show children BBC clip.	Sunrise and sunset clip.	**BBC Clip:** http://www.bbc.co.uk/learningzone/clips/day-and-night-on-earth/1874.html **Sunrise and Sunset website:** http://www.childrensuniversity.manchester.ac.uk/interactives/science/earthandbeyond/sunrisesunset

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4	**LO: To know that the earth rotates on its axis at an angle and as it orbits the sun that is how we get seasons.** **To know that an orbit around the sun takes 365 and a quarter days.** Assessment: a	Revise key points from previous two sessions. The Earth, Sun and Moon are roughly spherical, due to the distances involved, the Sun looks small but is actually 1 million times larger in volume than Earth (i.e. a million Earth's would fit inside the Sun if squashed together)! Remind chn that the Earth revolves once in 24 hours to create night and day & than the Sun's diameter is 108 times longer than the Earth's. See http://www.bbc.co.uk/learningzone/clips/how-big-is-the-sun-in-relation-to-earth/8950.html. Remind chn that not only does the Earth rotate on its axis, but it also orbits the Sun once a year in an anticlockwise direction. Demonstrate this for chn using a large ball and a globe. One chd standing still holding the large ball while the smaller globe (Earth) starts to spin on its own axis. Place a figure on globe reinforcing the creation of night and day. With Earth still spinning ask the chd to orbit the Sun. Take a look at animated simulations of this such as the excellent BBC mini clip http://www.bbc.co.uk/schools/scienceclips/ages/9_10/earth_sun_moon.shtml.	Take a look at the UK daylight hours information. Which months have the longest amount of daylight? Look at the four seasons of the year. What do we know about each? What annual events occur in them? Which is closest to their birthday for example? Draw out words Spring, Summer, Autumn and Winter - our seasons (in the UK – whereas in tropical countries there are only two seasons – dry and rainy). How do seasons differ? How long are the days? When do the longest & shortest days occur? What weather conditions do we associate with them? Ask a chd to hold a bright torch and start to spin the Earth with pencil through it on its 23.5 degree angle. Ask chn to notice how one hemisphere is always tilting towards the sun and therefore warmer. Meanwhile in the other hemisphere which leans away from the Sun, the angle means the Sun's rays are spread over a larger area and therefore it is cooler. Show this using a torch beam hitting the equator of a globe (circle of light) and then hitting an area nearer the poles – the light takes on a more oval shape & is more spread out. Then compare the beam falling on areas tilting towards & away from the Sun (use a felt tip pen to draw around the area of light in different 'seasons' to show this).	Record data and results using scientific diagrams and labels and models **Present findings in written form. MAIN outcome** Able pupils to be able to explain why the day length is shorter. Can complete a line graph to show the comparison of temperature and hours of the day on a set of given axis	
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5	To investigate the Moon's phases and orbit of the Earth	Show class James Nasmyth's drawing called 'Copernicus'. By prompting with questions, see if they can guess what the drawing shows. Explain that this is a drawing of a crater on the moon, observed through a telescope by James Nasmyth in the 1800s, who then drew with	Ask the children to record the facts about the Moon in their books ensure they include the following: 1. It is about a quarter of the size of Earth 2. It is about 250,000 miles away in space 3. It orbits the Earth in the same direction as the Earth is spinning and takes about 28 days to complete its orbit	Do the children understand what the moon is? Are they able to explain what a month is?	Netbooks Image of James Nasmyth's Copernicus.

	Assessment: b	chalk what he saw. **Q: What is the moon?** Discuss, then show http://www.bbc.co.uk/learningzone/clips/what-does-the-moon-look-like-why/8957.html **Q: What is a month?** Read and discuss the following: The first calendar was probably made by the people of Mesopotamia (where Iran is now) about 6000 years ago. Calendars were needed to help farmers know when to plant their crops ready for the summer, and when to pick them before the winter came. They also needed to know when rain would be likely to fall, or rivers likely to flood. So they took a lot of interest in the changing seasons. They noticed that the seasons followed a regular pattern, or cycle: spring, summer, autumn, winter. We call this cycle one year. The trouble is, seasons do not start and finish on one particular day each year. Spring arrives late some years, and summer may stretch on longer in some years than others. People needed some more accurate way in which to divide up the year. Some of the sky-watchers (astronomers) noticed that the Sun was not the only object that seemed to move across the sky. So did the moon. Also the moon changed its shape from a thin crescent like a thumbnail (called the New Moon) to a complete circle (full moon) and back again to a new moon, roughly every 28 nights. The astronomers noticed that this cycle happened between 12 and 13 times a year. That is why, to this day, we divide a year up into months (moons). Because the Moon orbits the Earth, we call it a satellite of the Earth. Now humans have put lots of man-made satellites into space which orbit the Earth – so some people call the moon	**Q: What do we see when we look at the Moon each night for a month?** Show http://www.bbc.co.uk/learningzone/clips/the-moon-and-its-orbit-around-the-earth/1596.html **Activity** (Mixed Ability pairs): Give children time to investigate the three websites below. Both involve the children using all of the knowledge they have gained so far in terms of orbits. This is a complex topic and research suggests that seeing it explained in a number of ways helps rather than hinders understanding. http://www.bbc.co.uk/schools/ks2bitesize/science/physical_processes/earth_sun_moon/play.shtml BBC game about orbit of earth and moon around sun. Interactive. http://www.earthsunmoon.co.uk/ Good interactive website. Can be designed for 2 players/children. Games mixed with research		

		a 'natural satellite'			
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6	To learn about our Solar System Assessment: a	Ask the children to name the planets of the solar system. Can they name them all? Which are closest to the sun? Ask them if Pluto is a planet? Ask the children to order the planets from the sun. On the next flipchart page children can check their answers.	Show children the different planet videos and ask them to take notes in preparation for a presentation on the planets. Once children have taken notes tell them that they are free to present how they like, a poster, a non-chronological report, a lift the flap information booklet etc.	**Q: How many planets are there in our solar system?** 8 – Pluto was down-graded in 2006. **Q: What are their names?** Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune	Orrery picture, netbooks,