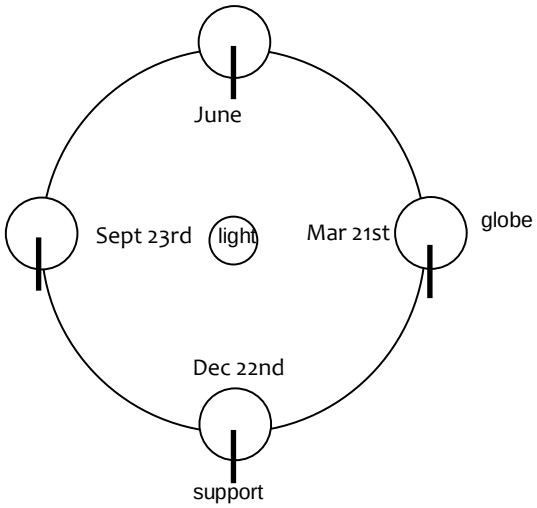
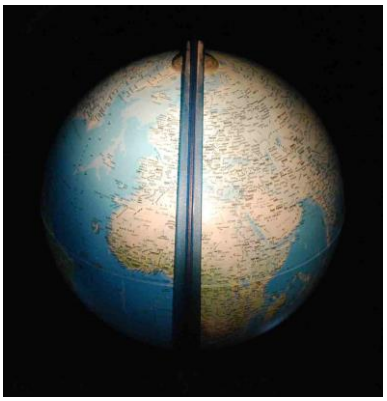
Seasons: - the effect of our tilted Earth

An indoor demonstration explaining the changing seasons

Use a lamp and a globe in the classroom to show how the seasons 'work'.
If possible, arrange the class in a circle, with space in the middle. Set up a bright light in the centre of the circle, to represent the Sun. Take a globe and 'walk' it gradually anticlockwise round the circle, keeping the 23½ ^{o} tilt **facing the same way all the time and not rotating the globe.** Ask the class to observe which parts of the globe are lit up at four key dates in the year, around the 21st to 23rd of December, March, June and September respectively. For schools in the Northern Hemisphere, around the 21st June is the Summer Solstice and around the 22nd December is the Winter Solstice. Around 21st March and 23rd September are the Spring and Autumn Equinoxes respectively. For schools in the Southern Hemisphere the opposite applies.
The diagram and photographs show the set up and the appearance of the globe at each date.

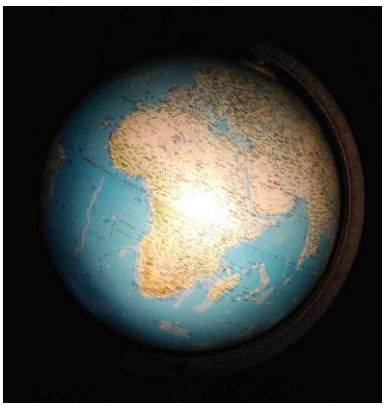


The arrangement, seen from above

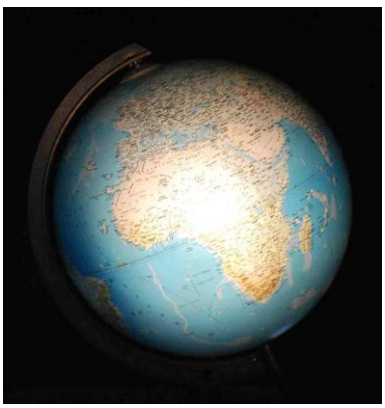


June 21st

December 22nd



March 21st



September 21st (Photos: *Peter Kennett*)

Now repeat the 'walk' round the year, only this time, pause at each date and slowly rotate the globe. Ask pupils to observe the relative length of daylight and night time for their own latitude. Point out as many of the 'underlying principles' given below as would be appropriate for the age of the pupils.

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The back up

Title: Seasons: - the effect of our tilted Earth

Subtitle: An indoor demonstration explaining the changing seasons

Topic: A globe is 'walked' round a circle of pupils, with a bright light at the centre, to show how the tilt of the Earth relative to the Sun creates different seasons.

Age range of pupils: 9 – 16 years

Time needed to complete activity: 15 minutes

Pupil learning outcomes: Pupils can:

- explain how the half of the Earth bathed in sunlight at any one time is experiencing day, whilst the other half is experiencing night;
- point out and explain the day/night dividing lines of dawn and dusk;
- explain why night and day are of equal length at the equinoxes.
- point out and explain how polar regions are lit in the summer but are in darkness in the winter;
- explain why winter and summer are at the opposite ends of the year in the other hemisphere, compared to their own;
- explain why equatorial regions have no seasons.

Context: By sitting the class in a circle surrounding the demonstration, they can become involved in the way in which the Earth's orbit around the Sun influences the seasons. The photographs give the view as seen from 'the Sun' and pupils can be asked to compare those views with the ones seen from their own position in the circle.

Following up the activity: Revise the learning by repeating the exercise on a different occasion, but this time, ask each quarter of the class to describe the pattern of light that they can see on the globe and ask them what season it shows. Choose a consistently sunny day and take the class outside, with a large globe, to reinforce their indoor learning, following the Earthlearningidea activity "Earth on Earth; using a globe in the sunshine to show how day/night and the seasons work".
Pupils could also try the ELI 'Hot or not? - investigating how latitude affects the amount of solar radiation received' to explain why it is not as hot in high latitudes as it is in equatorial regions

Underlying principles:

- The model Earth responds in exactly the same way to sunlight as the real Earth.
- It is day in the area of the Earth that is in sunlight and night in the area that is not; the boundaries between the two mark dusk and dawn as the Earth rotates on itself.
- When we are experiencing summer, the pole tilted towards the Sun is experiencing daylight, and the pole tilted away from the Sun, darkness.
- At the poles, there is 24 hour daylight in the summer months and 24 hour darkness in the winter.
- At the equator, as the Sun appears high in the sky all the time and there is little variation in length of day, seasons are not experienced.

Thinking skill development:
Linking understanding of the model globe to the real world requires bridging skills and elements of three dimensional thinking. Predictions based on the model require construction (pattern-seeking) skills. Explaining how the model reflects the real Earth needs bridging and metacognitive skills.

Resource list:

- a globe
- a strong light source
- (optional) – blackout for the room

Useful links: See the other Earthlearningidea activities in the box below.

Source: A well-known classroom activity, written in this form by Peter Kennett of the Earthlearningidea team.

Earthlearningidea	Strategies and skills developed
A screaming roller coaster: how fast am I travelling (due to Earth's spin and Earth's orbit)?	A quick 'starter' to remind pupils that the 'stable' Earth on which they live is in fact spinning in space (whilst orbiting the Sun)
Hot or not? Investigating how latitude affects the amount of solar radiation received	An activity to help pupils to visualise why solar radiation is more intense in equatorial regions than polar ones, involving abstract thinking to relate the activity to the Earth, together with construction and metacognition skills
The seasons: An indoor demonstration of the seasons	An indoor activity to enable pupils to understand how the tilt of the Earth affects the seasons throughout the year, involving skills of construction and bridging to the real situation.
Earth on Earth: using a globe in the sunshine to show how day/night and the seasons work	A model Earth in the real sunlight brings the abstract nature of day/night and the seasons into a more concrete understanding, allowing the development of three dimensional skills and the use of construction, metacognition and bridging skills.