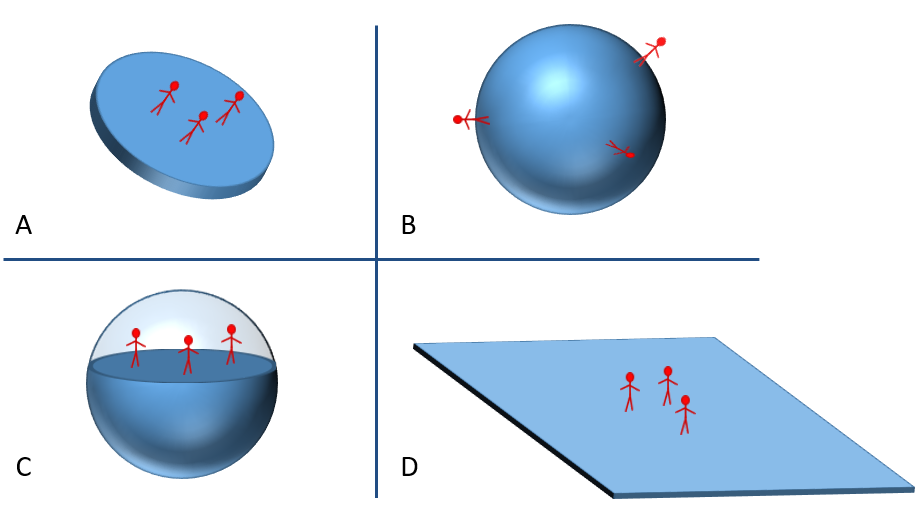
**The Earth**

We live on the planet Earth.

Which picture best shows what the Earth is like?



Can you explain why you think this?

*BEST> Earth and space> The Earth*

|  |
| --- |
| **Diagnostic question** |
| **The Earth** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | In the Solar System: eight planets orbit a star called the Sun; moons orbit most of the planets; and the planets spin on their axes. We live on the planet called Earth. |
| Observable learning outcome: | Identify that we live on the surface of the planet Earth, which is a solid sphere. |
| Question type: | Simple multiple choice |
| Key words: | Earth, planet, sphere |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition to later stages of learning. |

**Common preconceptions and misunderstandings**

This diagnostic question targets the following misunderstandings that pupils might have:

* The Earth is flat.
* The Earth is a hollow sphere.

What to know more? Read *What does the research say?* towards the end of the Teacher Notes.

**Ways to use this question**

Children should complete the questions individually in order to capture their current understanding. They should be reassured that the questions are designed to uncover their thinking and that ‘getting the answers right’ at this stage is not the most important thing. There will be time for them to share and discuss their ideas with others at a later stage.

Provide sufficient time for the children to think. They should look carefully at the pictures and consider which one best represents how we live on planet Earth and then try their best to explain why they think that. This might range from an uncertain, ‘I am not sure why,’ to a more confident and detailed response.

Answers could be recorded formally as a pencil and paper exercise (using the activity sheet) or you could make a ‘card sort’ for them to place into piles; or play a game of ‘corners’ where children physically move to areas of the room displaying response options.

Alternatively, you could use the accompanying presentation with an electronic voting system or mini white boards and take additional verbal feedback from children in order for them to explain their reasoning. The range of answers will show you whether children understand the concept sufficiently well to apply it correctly.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations, it may be more appropriate for a teaching assistant to read and/or scribe for a selected number of children.

**Expected answers**

B – the Earth is a solid sphere and we live on the surface.

**How to respond - what next?**

If there is a range of answers, an effective way to respond is through structured class discussion. Ask one child to explain why they gave the answer they did; ask another child to explain why they agree with them; ask another to explain why they disagree, and so on until some sort of shared understanding has been reached. This sort of discussion gives children the opportunity to explore their thinking and for you to really understand their learning needs.

Research tells us that about half of children aged 8-9 imagine the Earth to be flat (as shown in response options: A or D) and another 40% combine a flat Earth model with the idea that the Earth is a sphere by adopting model C.

Option A is an alternative way of linking a flat Earth view with two-dimensional drawings of the Earth in books. To an individual stood on the Earth the surrounding land does look ‘flat’ so these views are reasonable. The change to a correct scientific understanding ~~is~~ does appear to be partly limited by age and experience., however, can be helped by planning meaningful teaching sequences, for example:

If children have misunderstandings about the shape of the Earth, they may not have made a connection between a globe and where we live. Asking them to find different countries and places they know on a globe map can help them make this connection.

Satellite images that show the Earth as three-dimensional can also reinforce the scientific view (Allen, 2014). The 1972 Apollo 17 image ‘Blue Marble’ marks the last time humans have been far enough into space to take a picture that shows the entire Earth in this way. Children could use the internet as a secondary source of information to search for images showing the curvature of the Earth captured by modern satellites and high-powered telescopes. They might research how crew members take publicly available images of Earth from the International Space Station.

Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas (meaning making) through dialogue. Children could record their evolving ideas using the statement: I used to think this … because … and now I think this … because … This is an opportunity for them to evidence any progress in learning.

It is our intention to link each diagnostic question to a dedicated response activity relevant to primary. In the meantime, we refer you to the existing BEST 11-14 activity, which can be found in the ‘Planets and the solar system’ folder at [www.stem.org.uk/best/physics/big-idea-earth-space](http://www.stem.org.uk/best/physics/big-idea-earth-space), and ask you to use and adapt where you feel appropriate.

* Response activity: Modelling the Earth

**What does the research say?**

Research has shown that the majority of young children aged 8-10 have a naïve understanding of the Earth as being flat. By age 12 most understand the Earth to be spherical, although for many correct ideas about gravity tend to develop later (Nussbaum, 1985; Driver et al., 1994; Baxter, 1989).

Over four studies it was found that a flat Earth model (A or D) is held by about a sixth of 11-12 year-olds, the hollow Earth model (C) by another sixth, and two-thirds understand that the Earth is a solid sphere. By age 13-14 the latter number increases to about 95% (Nussbaum, 1985).

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG) and Nicky Waller (CIEC), based on illustrations in *Making Sense of Secondary Science (Driver et al., 1994)*.

Images: Peter Fairhurst (UYSEG)

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