**Changing seasons**

Countries away from the Equator have winter and summer.



These statements are about summer.

For each statement, tick (✓) **one** column to show what you think*.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | The Sun is higher in the sky in summer. |  |  |  |  |
| **B** | Days are longer in the summer. |  |  |  |  |
| **C** | The Sun heats more strongly in the summer. |  |  |  |  |
| **D** | It is summer in Canada and Argentina at the same time. |  |  |  |  |

*Physics > Big idea PES: Earth in space > Topic PES2: Earth and Sun > Key concept PES2.1: Days and seasons*

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| --- |
| **Diagnostic question** |
| **Changing seasons** |

**Overview**

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| --- | --- |
| Learning focus: | The temperature is higher in the summer because the tilt of the spinning Earth increases the length of a day *and* increases the heating effect of the Sun’s radiation. |
| Observable learning outcome: | Describe the effect of seasons on temperature, day length and the apparent movement of the Sun. |
| Question type: | Confidence grid |
| Key words: | Season |

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

**What does the research say?**

Depending at which latitude students live, they are likely to have different perceptions of seasonal change. In Greece, Bakas and Mikropoulos (2003) found just 17% (n=102) of 11- to 13-year-olds realised day lengths changed through the year, whereas the phenomenon would be obvious to students in Scandinavia. Bakas and Mikropoulos also found that Greek students aged 11-13 (n=102) could often explain that higher temperatures in summer are caused by the Sun being higher in the sky, or because the days are longer, but without explaining the cause of these phenomena.

It is relatively common for students to think that each season happens at the same time across the Earth. This is likely to link with the misunderstanding that it is warmer in the summer because the Earth is closer to the Sun at that time (Allen, 2014; Driver et al., 1994; Baxter, 1989).

This question elicits the observations that can be made about the changing seasons and investigates which ones students are aware of.

**Ways to use this question**

Students should complete the confidence grid individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*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 for one or two students.

**Expected answers**

A, B and C are correct: The Sun is higher in the sky, the days are longer and the Sun heats more strongly.

D is wrong, because it is winter in Argentina when it is summer in Canada, and vice-versa.

**How to respond - what next?**

Students may not individually recognise all of the observations about summer, but it is likely that significant numbers will have observed each of the first three phenomena.

It is quite common for students to think that it is summer at the same time everywhere on the planet. As most of the countries in the southern hemisphere are relatively close to the equator, then it can feel like it is summer for those travelling to these places from northern Europe or North America during the northern summer.

If students have misunderstandings about the phenomena we experience in summer, it can help students to use the internet to investigate the weather at different times of the year in different locations around the world. Three locations away from the equator are recommended, with one in a different hemisphere from the other two. Students working in pairs or small groups will promote discussion and encourage social construction of new ideas through dialogue.

The following BEST ‘response activity’ could be used in follow-up to this diagnostic question to help students understand and explain the scientific explanation for these observations:

* Response activity: Long days of summer

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG); summer in Canada: <https://pixabay.com/photos/nature-landscape-mountain-travel-3039901/>; winter in Argentina: <https://pixabay.com/photos/glacier-argentina-patagonia-530050/>; globe: <https://pixabay.com/vectors/globe-earth-continents-planet-296471/>.

**References**

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