**Summer days**

The average temperature is higher in summer than in winter.

It feels warmer in summer.



**a.** What is the length of day in summer?

Put a tick (✓) in the box next to the best answer.

|  |  |  |
| --- | --- | --- |
| **A** | A summer day is longer than a day in winter. |  |
|  |  |  |
| **B** | A summer day is the same length as a day in winter. |  |
|  |  |  |
| **C** | A summer day is shorter than a day in winter. |  |

**b.** What is the best reason for your last answer?

Put a tick (✓) in the box next to the best answer.

|  |  |  |
| --- | --- | --- |
| **A** | My half of the Earth is tilted towards the Sun in summer. |  |
|  |  |  |
| **B** | My half of the Earth is tilted away from the Sun in summer. |  |
|  |  |  |
| **C** | The Sun moves at a different speed in summer. |  |
|  |  |  |
| **D** | The Earth always spins at the same speed. |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Summer days** |

**Overview**

|  |  |
| --- | --- |
| 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: | Explain why days are longer in summer and shorter in winter. |
| Question type: | Two-tier multiple choice |
| Key words: | Season, tilt |

**What does the research say?**

One consequence of the Earth tilting towards the Sun in summer is the increase in the length of the day. Depending at which latitude students live, they are likely to have different perceptions of changes to day length. 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. Students are often able to suggest that this is caused by the tilt of the Earth, without being able to explain the mechanism (Baxter, 1989; Dunlop, 2000; Lelliott and Rollnick, 2009). A small proportion of 10- to 11-year-olds believe the Sun moves slower through the sky in the summer (Sharp, 1996).

Constructivist teaching strategies that challenge student misunderstandings were shown to significantly improve knowledge about the causes of seasons (Trumper, 2006) and elicit longer retention of the scientific concepts (Tsai and Chang, 2005).

**Ways to use this question**

Students should complete the questions 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. The follow on question will give you insights into how they are thinking and highlight specific misconceptions that some may hold.

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. A: a summer day is longer than a day in winter.

b. A: my half of the Earth is tilted towards the Sun in summer.

**How to respond - what next?**

Students are more likely *not to notice* a change of day length than think days are shorter in the summer.

In ***part b***, answer D is correct but not relevant to the correct answer.

Only a few student are likely to think the Sun changes its speed.

Many students are likely to choose answers A or B, but be *uncertain* of which is correct. These students are recalling earlier learning, but without full understanding. Whether students choose answer A or answer B, further investigation into what they understand will be necessary.

If students have misunderstandings or uncertainties about why days are longer in the summer, it can help to model the scientific explanation with the class. Asking students to explain what happens in their own words can help consolidate their understanding. 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 the increase in day length in summer:

* Response activity: Long days of summer

The following BEST ‘response activity’ could be used to investigate how students apply their understanding to new situations:

* Response activity: Which season?

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Images: <https://pixabay.com/vectors/vacation-recreation-beach-island-149960/>

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