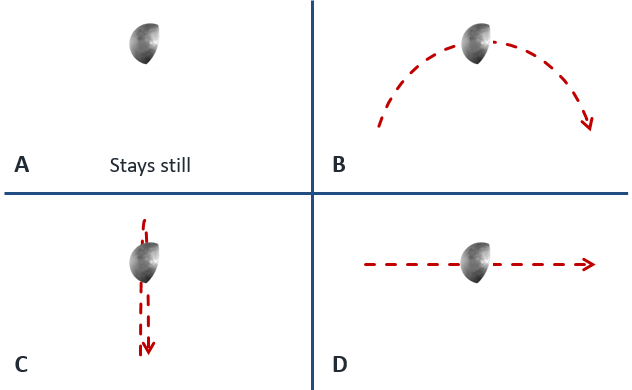
**Moon and stars**

On a clear night stars can be seen in the sky.

Often the Moon is seen as well.

1 a. **What does the Moon do at night?**

****

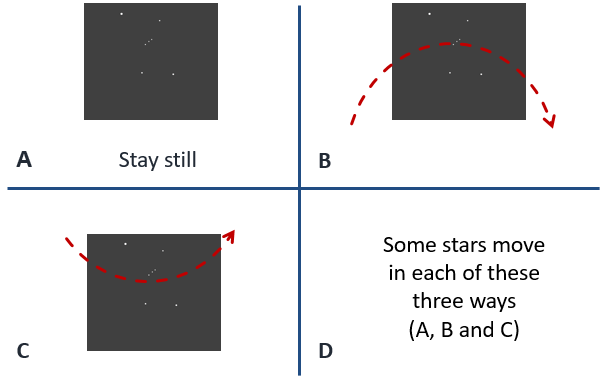
1 b. **Why do you think the Moon does this?**

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

|  |  |  |
| --- | --- | --- |
| **A** | The Moon is always there and can be seen when it is dark |  |
|  |  |  |
| **B** | The Earth spins on its axis once each day |  |
|  |  |  |
| **C** | The Moon goes round the Earth once each day |  |
|  |  |  |
| **D** | The Moon swaps places with the Sun |  |

**Moon and stars**

2 a. **What do the stars do at night?**

****

2 b. **Why do you think the stars do this?**

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

|  |  |  |
| --- | --- | --- |
| **A** | The Earth spins on its axis once each day |  |
|  |  |  |
| **B** | The stars swap places with the Sun |  |
|  |  |  |
| **C** | The stars go round the Earth once each day |  |
|  |  |  |
| **D** | The stars are always there and can be seen when it is dark |  |

*Physics > Big idea PES: Earth in space> Topic PES1: Solar System and beyond > Key concept PES1.3: Night sky, stars and galaxies*

|  |
| --- |
| **Diagnostic question** |
| **Moon and stars** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The Sun is one of billions of stars in our galaxy and our galaxy is one of many billions of galaxies in the universe. |
| Observable learning outcome: | * Describe how the stars (and Moon) appear to move in the sky |
| Question type: | Diagnostic, two-tier multiple choice |
| Key words: | Moon, stars |

**What does the research say?**

In a study (n=25 for each age range) about half of students aged 11-12 thought that night and day were caused by the movement of the Sun with just 20% giving the correct explanation; by age 13 or 14 about half could explain how day and night are caused by the Earth spinning on its axis (Baxter, 1989).

When asked to describe their observations of the night sky, students could more readily describe the daily motion of the Moon than the stars (Plummer and Krajcik, 2010). In a sample of 13- to 14-year-old students (n=60) 60% knew that the Moon rose and set in the sky compared to 15% who knew that stars do the same. Only 40% of these students knew that stars appear to move (at all) during the night. These findings support Plummer and Krajcik's (2010) recommendation that a learning progression on celestial motion describes the apparent motions first of the Sun, then of the Moon and finally of the stars.

These questions identify what students know about the apparent movement of the Moon and stars during the night. Understanding that these apparent motions are caused by the spinning Earth, rather than the movement of the Moon or stars, supports an accurate understanding of the structure of space.

**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**

1a. B, 1b. B

2a. D, 2b. A

**How to respond - what next?**

Students’ answers to question 1a are likely to be based on their own observations. Each wrong answer describes a part of the correct motion of the Moon across the sky, but the full picture is not readily observable because at any one instance the Moon appears still in the sky. (In the southern hemisphere the Moon moves in an arc from right to left.)

For 1b, answers C and D indicate that students are using the wrong model of the Sun, Moon and Earth. Answer A suggests that they understand that the Moon can be in the sky during the day, but it also indicates that the students are likely to be using a model of the Sun orbiting the Earth and Moon once each day.

For question 2a all motions are visible because there are stars all around the Earth. As the Earth spins, those stars straight above the pole do not appear to move, those stars towards the pole can be seen to move in circles around the pole. Looking in the opposite direction towards the equator the stars appear to rise and set in the same way as the Moon does. These observations are difficult to understand, at this stage students need only be aware that the stars apparent motion is caused by the spinning Earth.

If students have misunderstandings about the motion of the Moon or stars through the sky, then observations (perhaps for a homework) can be made to see first-hand how they appear to move. Alternatively an internet search for videos of ‘time lapse Moon’ or ‘time lapse stars’ should find film clips that can be viewed.

The photograph on the PowerPoint presentation ‘Moon and Stars’ shows evidence that the motion is caused by the rotating Earth, and had the three types of apparent motion of stars indicated.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG)

Images: Peter Fairhurst (UYSEG), stars: photo by Nathan Anderson on Unsplash

**References**

Baxter, J. (1989). Children's understanding of familiar astronomical events. *International Journal of Science Education,* 11 (Special Issue)**,** 502-13.

Plummer, J. and Krajcik, J. (2010). Building a learning progression for celestial motion: elementary levels from an Earth-based perspective. *Journal of Research in Science Teaching,* 47(7)**,** 768-787.