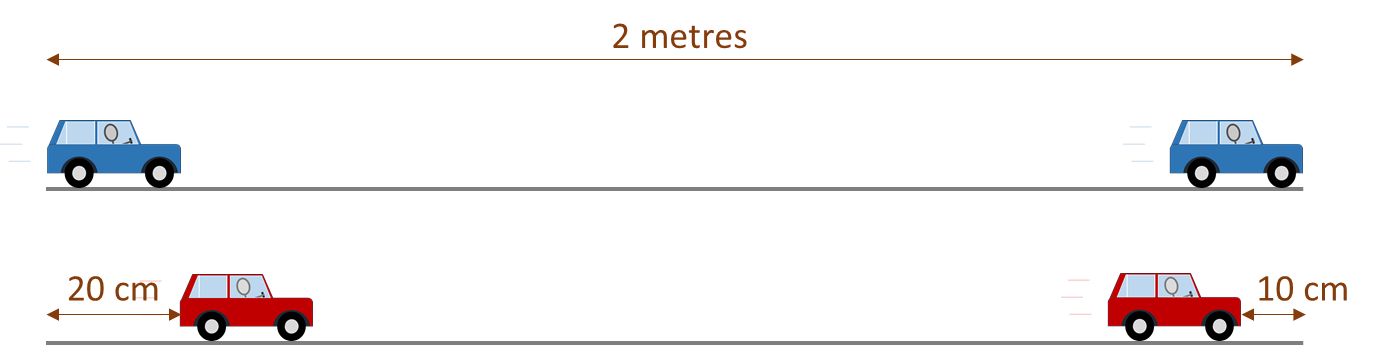
**High speed one**

1. Two toy cars, blue and red, travel along a 2 metre track.



The red car starts 20 cm ahead of the blue car.

Both cars start at the same time.

Both cars stop at the same time. The blue car is then 10 cm ahead.

**a.** Which car was faster?

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

|  |  |  |
| --- | --- | --- |
| **A** | The blue car |  |
|  |  |  |
| **B** | The red car |  |
|  |  |  |
| **C** | Both had the same speed |  |

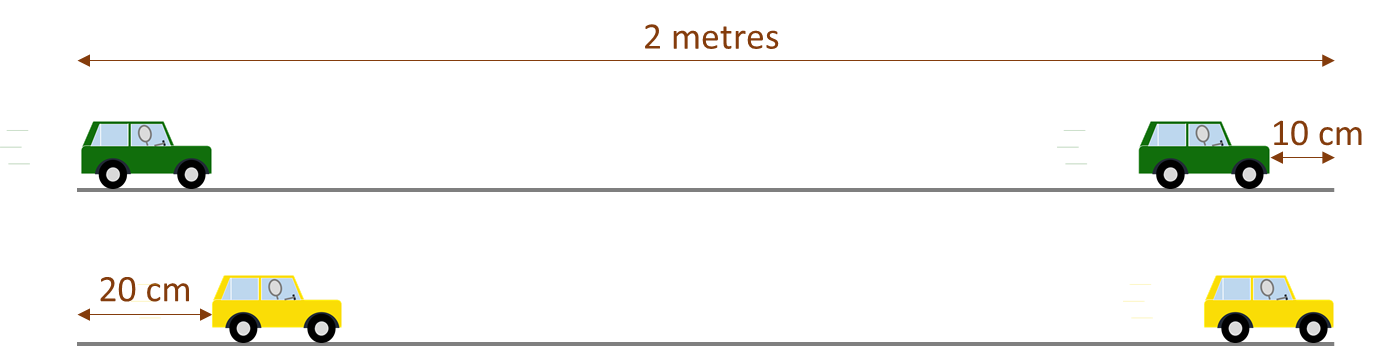
**b.** What is **the best explanation** for your answer?

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

|  |  |  |
| --- | --- | --- |
| **A** | Both cars started and stopped at the same time |  |
|  |  |  |
| **B** | The blue car travelled further than the red car in the same time |  |
|  |  |  |
| **C** | The red car finished behind the blue car |  |

**High speed one**

2. Two toy cars, green and yellow, travel along a 2 metre track.



The yellow car starts 20 cm ahead of the green car.

Both cars start at the same time.

Both cars stop at the same time. The yellow car is then 10 cm ahead.

**a.** Which car was faster?

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

|  |  |  |
| --- | --- | --- |
| **A** | The green car |  |
|  |  |  |
| **B** | The yellow car |  |
|  |  |  |
| **C** | Both had the same speed |  |

**b.** What is **the best explanation** for your answer?

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

|  |  |  |
| --- | --- | --- |
| **A** | Both cars started and stopped at the same time |  |
|  |  |  |
| **B** | The green car travelled further than the yellow car in the same time |  |
|  |  |  |
| **C** | At the end, the yellow car was further from the start position |  |

*Physics > Big idea PFM: Forces and motion > Topic PFM2: Moving by force > Key concept PFM2.1: Describing speed*

|  |
| --- |
| **Diagnostic question** |
| **High speed one** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Speed is a measure of how fast an object travels: how far it goes in a given time |
| Observable learning outcome: | Identify an object that has a higher speed because it travels further in a given time |
| Question type: | Two-tier multiple choice |
| Key words: | Speed |

|  |  |
| --- | --- |
| **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?**

When talking about speed the language that we use is important as what is clear to us may be easily misunderstood by students. Constant speed may be seen as ‘moving all the time’ and steady speed may be taken as ‘not too fast’. Going faster is often seen as ‘catching up’ and when one object overtakes another they are often described as having the same speed at the point of overtaking. (Driver et al., 1994)

‘[Students] need more than a routine manipulation of numbers. They need to think of an object at a greater speed both getting to a particular point in a shorter time and going further in the same time, so as to have an understanding of the practical implications of speed as distance covered in a unit time.’ (Driver et al., 1994)

These questions are about travelling further in the same amount of time. In the first question the faster car overtakes the slower one, and in the second question it does not and it is less obvious that the faster car has travelled further.

**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 misunderstandings 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. **A** Blue car

1b. **B** The blue car travelled further than the red car in the same time

2a. **A** Green car

2b. **B** The green car travelled further than the yellow car in the same time

**How to respond - what next?**

In question 1 it is obvious the blue car travels further as it overtakes the red car and reaches the *end* before it. A few students who are judging speed by the final position of each car may choose answers A, C. A few (probably fewer) students may choose answers C, A if they associate speed with just the time taken (as in ‘a fast journey doesn’t take very long’).

In question 2 it is less obvious that the green car has travelled further than the yellow one and those giving the right answers are likely to be secure in their understanding that travelling further in a given time means the speed is greater. Answers B, C highlight students who are judging speed on the final outcome.

If students have misunderstandings about speed being about an amount of time that is not necessarily linked to distance, it can help to ask students to walk at different speeds for a particular amount of time and to measure how far they have travelled.

For students who are judging speed on the final position of each car and not on the whole journey it can help to look again at each question and consider where the cars would finish if they started next to each other.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG), based on EPSE (Evidence-based Practice in Science Education project) questions F6-02 and F6-03

Images: Peter Fairhurst (UYSEG).

**References**

Driver, R., et al. (1994). *Making Sense of Secondary Science: Support Materials for Teachers,* London: Routledge.