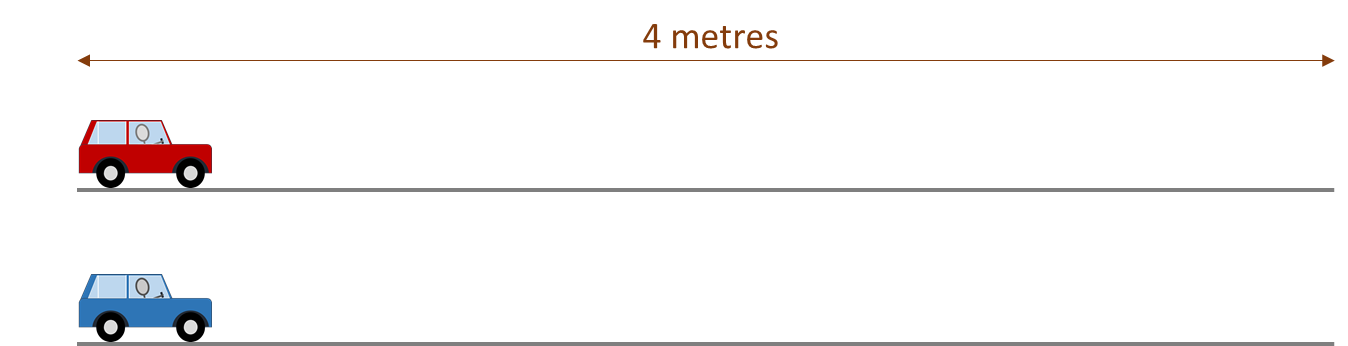
**High speed two**

1. Two toy cars, red and blue, are having a race.



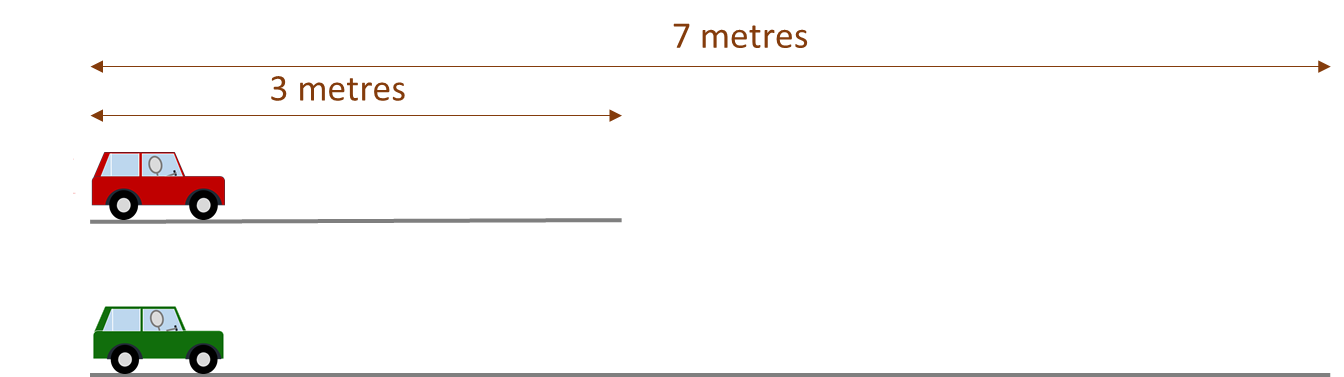
The blue car travels 4 metres in 5 seconds

The red car travels 4 metres in 4 seconds

Which car was faster?

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

2. Two toy cars, red and blue, are having a race.



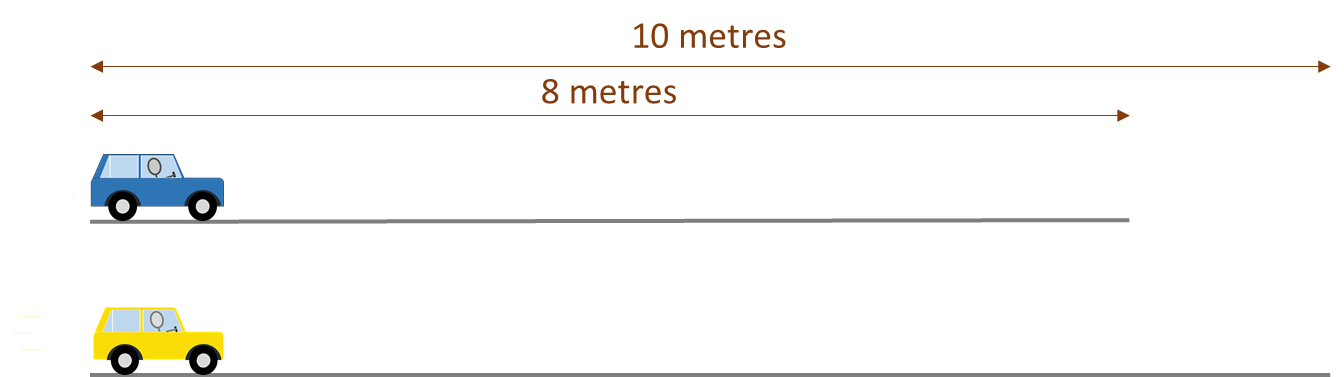
3 metres in 2 seconds

7 metres in 4 seconds

Which car was faster?

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

3. Two toy cars, blue and yellow, are having a race.



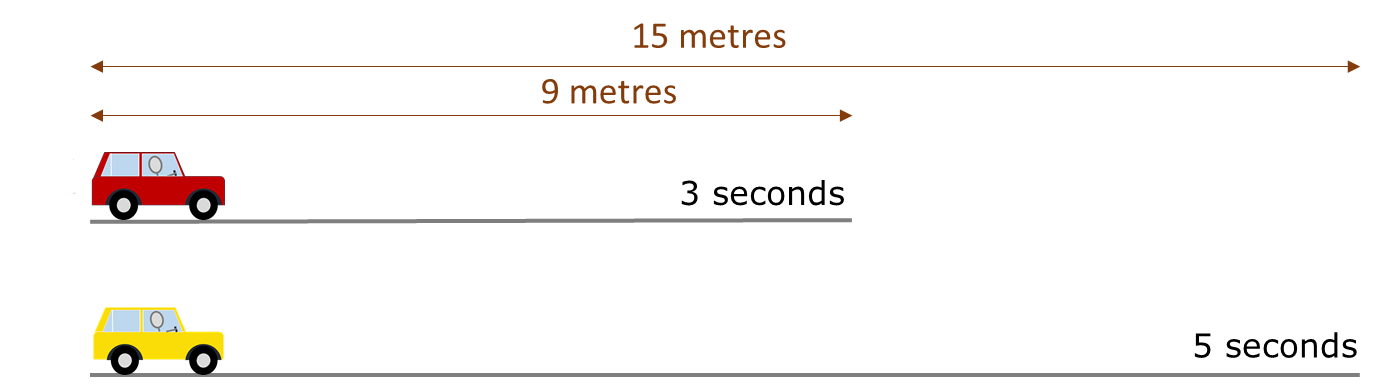
10 metres in 6 seconds

8 metres in 4 seconds

Which car was faster?

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

4. Two toy cars, red and blue, are having a race.



Which car was faster?

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

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

|  |
| --- |
| **Diagnostic question** |
| **High speed two** |

**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 than another when they travel different distances in different times |
| Question type: | Simple multiple choice |
| Key words: | Speed |

**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., 1994b). Making sure that students have a clear qualitative understanding of speed is necessary before introducing quantitative approaches (Driver et al., 1994a).

‘[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., 1994b)

The first question in this set checks what students think about the speed of an object travelling the same distance in a shorter time. The other three questions investigate how effectively students can use proportionality to compare speeds of two objects. This idea is necessary for understanding quantitative measures of speed.

**Ways to use this question**

Students should complete the question 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 answers to the question will show you whether students understood the concept sufficiently well to apply it correctly.

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**

1 A, 2 B, 3 A, 4 C

**How to respond - what next?**

Most students should answer Q1 correctly.

In Q2 if the red car carried on at the same speed for four seconds it would travel 6 metres.

In Q3 the blue car travels 8 metres in 4 seconds and at the same speed would travel 10 metres in 5 seconds.

In Q4, 9m in 3s means the red car travels 3m in every second. It would travel 5 x 3 = 15m in 5s.

All of these questions can be reasoned by working out how many metres each car travels in one second, which gives a common comparison that we call speed. This allows the motion of cars in different questions to be compared.

If students have misunderstandings about how to compare relative speeds, it can help to model these questions, and others, with students. One way to do this is to have one student pace out a distance (say 8m in 4s). Before they start pacing they can suggest how many paces they need to take in each second. By counting out that number of paces each ‘second’ they can check whether they reach the correct distance in the time. If they are right they can pace out the comparison distance (or time) at the same pace to see which is quicker (or farther).

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Developed by Peter Fairhurst (UYSEG), based on EPSE (Evidence-based Practice in Science Education project) questions F6-06, F6-07, F6-08 and F6-09.

Images: Peter Fairhurst (UYSEG).

**References**

Driver, R., et al. (1994a). *Making Sense of Secondary Science: Research into Children's Ideas,* London, UK: Routledge.

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