

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

Progression toolkit: Describing speed

Learning focus	Speed is a measure of how fast an object travels: how far it goes in a given time				
As students' conceptual understanding progresses they can:					
	Identify an object that has a higher speed because it travels further in a given time P	Identify an object that has a higher speed than another when they travel different distances in different times	Calculate the average speed of an object using $\text{speed} = \text{distance} \div \text{time}$	Explain why the average speed may be different to the instantaneous speed of an object	Identify when speed is changing the most quickly and acceleration is biggest
Diagnostic questions	High speed one	High speed two	Moving things	100m world record	Speed or acceleration?
					Acceleration
					Biggest acceleration
Response activities			Measuring top speed	Timing problems	B Is it accelerating?

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<h3>High speed one</h3> <p>BEST STUDENT WORKSHEET</p> <p>High speed one</p> <p>1. Two toy cars, blue and red, travel along a 2 metre track.</p> <p>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 (in) 10 cm ahead.</p> <p>a. Which car was faster? Put a tick (✓) in the box next to the best answer.</p> <p>A The blue car <input type="checkbox"/></p> <p>B The red car <input type="checkbox"/></p> <p>C Both had the same speed <input type="checkbox"/></p> <p>b. What is the best explanation for your answer? Put a tick (✓) in the box next to the best answer.</p> <p>A Both cars started and stopped at the same time <input type="checkbox"/></p> <p>B The blue car travelled further than the red car in the same time <input type="checkbox"/></p> <p>C The red car finished behind the blue car <input type="checkbox"/></p>	<h3>High speed two</h3> <p>BEST STUDENT WORKSHEET</p> <p>High speed two</p> <p>1. Two toy cars, red and blue, are having a race.</p> <p>The red car travels 4 metres in 4 seconds</p> <p>The blue car travels 4 metres in 5 seconds</p> <p>Which car was faster?</p> <p>A The red car <input type="checkbox"/></p> <p>B The blue car <input type="checkbox"/></p> <p>C Both had the same speed <input type="checkbox"/></p> <p>2. Two toy cars, red and blue, are having a race.</p> <p>3 metres in 2 seconds</p> <p>7 metres in 4 seconds</p> <p>Which car was faster?</p> <p>A The red car <input type="checkbox"/></p> <p>B The blue car <input type="checkbox"/></p> <p>C Both had the same speed <input type="checkbox"/></p>	<h3>Moving things</h3> <p>BEST STUDENT WORKSHEET</p> <p>Moving things</p> <p>All of these things are moving.</p> <p>Which statement is the odd one out? Put a tick (✓) in the box next to the best answer.</p> <p>A Miles a car travels in one hour <input type="checkbox"/></p> <p>B Kilometres a space craft travels in one second <input type="checkbox"/></p> <p>C Minutes an athlete runs each second <input type="checkbox"/></p> <p>D Hours a motor train to complete a journey <input type="checkbox"/></p> <p>E Centimetres a snail crawls each minute <input type="checkbox"/></p>	<h3>100m world record</h3> <p>BEST STUDENT WORKSHEET</p> <p>100m world record</p> <p>Flora Duffy (Jamaica) broke the 100m world record on July 16th 1988.</p> <p>Her first called her 'Flo-Jo'.</p> <p>More than thirty years later, her record still stands.</p> <p>Fill in the gaps to describe Flo-Jo's world record. Breaking 100m race.</p> <p>You should only use the words average and instantaneous.</p> <p>The race:</p> <p>In 1988 Flo-Jo ran the 100m in 10.49 seconds and set a new world record. Her _____ speed for the race was 9.5 m/s.</p> <p>As the starting gun went off her _____ speed was zero.</p> <p>She quickly sped up and at the 50m point her _____ speed was 11.0 m/s. For the first half of the race her _____ speed was 8.6 m/s.</p> <p>After the half-way point Flo-Jo slowed a little. Her _____ speed for the second half of the race was 10.7 m/s. In the last few metres she sped up again and on the finish line her _____ speed was 11.2 m/s.</p>	<h3>Speed or acceleration?</h3> <p>BEST STUDENT WORKSHEET</p> <p>Speed or acceleration?</p> <p>Both moving objects travel to school with a friend. Matthew has become very fit because there is a big hill on the way.</p> <p>Put a tick (✓) in the box next to the best answer. You should only use the words speed and acceleration.</p> <p>In the morning Matthew cycles to school.</p> <p>He sets off with steady _____ until he reaches the _____ he wants. Round the corner he sees his friend ahead. He catches up because he has a higher _____. They carry on together.</p> <p>On the way they cycle up a steep hill. They have to push much harder on their pedals to keep going with the same _____. Down the hill they keep pedalling hard so they have _____ all the way down. At the bottom they have a lot of _____, if they don't use their brakes they can freewheel all the way to school. As they freewheel they slowly lose their _____. If they stop quickly they have a big _____.</p>																								
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<h3>Acceleration</h3> <p>BEST STUDENT WORKSHEET</p> <p>Acceleration</p> <p>1. Consider the changes in speed, or acceleration, of each of these objects as they accelerate.</p> <p>a. Which has the biggest acceleration? Put a tick (✓) in the box next to the best answer.</p> <p>A Car <input type="checkbox"/></p> <p>B Lorry <input type="checkbox"/></p> <p>C Both the same <input type="checkbox"/></p> <p>b. What is the best reason for your answer? Put a tick (✓) in the box next to the best answer.</p> <p>A They both reach 60 mph <input type="checkbox"/></p> <p>B The car reaches 60 mph in a shorter time <input type="checkbox"/></p> <p>C The lorry weighs a lot more than the car <input type="checkbox"/></p> <p>D The car is accelerating to go fast <input type="checkbox"/></p>	<h3>Biggest acceleration</h3> <p>BEST STUDENT WORKSHEET</p> <p>Biggest acceleration</p> <p>1. On this motorway slip road a car and a lorry both speed up from 0 to 60 miles per hour.</p> <p>The car reaches 60 mph in 10 seconds.</p> <p>The lorry reaches 60 mph in 18 seconds.</p> <p>a. Which has the biggest acceleration? Put a tick (✓) in the box next to the best answer.</p> <p>A Car <input type="checkbox"/></p> <p>B Lorry <input type="checkbox"/></p> <p>C Both the same <input type="checkbox"/></p> <p>b. What is the best reason for your answer? 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Some of the statements are not needed.</p> <table border="1"> <tr> <td>Use a tape measure</td> <td>Count down: ready, steady, go!</td> </tr> <tr> <td>Repeat three times to get an average</td> <td>Use a metre rule</td> </tr> <tr> <td>Put the runner on the start line</td> <td>Measure a distance of ten metres</td> </tr> <tr> <td>Divide the distance (10m) by time taken</td> <td>Mark the start and finish with a pole</td> </tr> <tr> <td>Measure the time taken to run 10m</td> <td>Divide the time taken by ten</td> </tr> <tr> <td>Use a timer</td> <td>Let the runner have a run up</td> </tr> </table>	Use a tape measure	Count down: ready, steady, go!	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Some of the statements are not needed.</p> <table border="1"> <tr> <td>Use a 30 cm ruler</td> <td>Divide the time taken by ten</td> </tr> <tr> <td>Repeat three times to get an average</td> <td>Use a stopwatch</td> </tr> <tr> <td>Use a straw to mark where to release the trolley from</td> <td>Measure a distance of ten centimetres and mark with a straw</td> </tr> <tr> <td>Divide the distance by time taken</td> <td>Mark where to start timing with a straw</td> </tr> <tr> <td>Measure the time taken for the trolley to go the last 10 cm</td> <td>Give the trolley a good push</td> </tr> <tr> <td>Use a data logger</td> <td>Use a light gate</td> </tr> </table>	Use a 30 cm ruler	Divide the time taken by ten	Repeat three times to get an average	Use a stopwatch	Use a straw to mark where to release the trolley from	Measure a distance of ten centimetres and mark with a straw	Divide the distance by time taken	Mark where to start timing with a straw	Measure the time taken for the trolley to go the last 10 cm	Give the trolley a good push	Use a data logger	Use a light gate	<h3>Is it accelerating?</h3> <p>BEST STUDENT WORKSHEET</p> <p>Is it accelerating?</p> <p>Some children are talking about what happens when their school minibus slows down.</p> <p>James: It can't be accelerating because it is slowing down.</p> <p>Keller: It has a negative acceleration because its speed is changing to a smaller number.</p> <p>Mason: It had a big acceleration before it started to slow down.</p> <p>Uss: It is accelerating because it is changing speed.</p> <p>Use your answers to these questions</p> <ol style="list-style-type: none"> Who do you think is right about the acceleration? Explain your answer. What reasons do you think the other children need? What would you say to them to help them to understand?
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