**Measuring top speed**



*Jesse Owens – Berlin Olympics 1936*

Jessie Owens won four gold medals in the 1936 Olympic Games:

100m sprint

200m sprint

Long jump

4 x 100m relay

How would you measure his top speed?

**To do**

Use these statements to describe **how to measure the top speed of a runner**.

Some of the statements are *not* needed.

|  |  |  |
| --- | --- | --- |
| Use a tape measure |  | Count down: ready, steady, go! |
|  |  |  |
| Repeat three times to get an average |  | Use a metre rule |
|  |  |  |
| Put the runner on the start line |  | Measure a distance of ten metres |
|  |  |  |
| Divide the distance (10m) by time taken |  | Mark the start and finish with a pole |
|  |  |  |
| Measure the time taken to run 10m |  | Divide the time taken by ten |
|  |  |  |
| Use a timer |  | Let the runner have a run up |

Sort cards for: **Measuring top speed**

|  |  |
| --- | --- |
| Use a tape measure | Count down: ready, steady, go! |
| Repeat three times to get an average | Use a metre rule |
| Put the runner on the start line | Measure a distance of ten metres |
| Divide the distance (10m) by time taken | Mark the start and finish with a pole |
| Measure the time taken to run 10m | Divide the time taken by ten |
| Use a timer | Let the runner have a run up |

Sort cards for: **Measuring top speed**

|  |  |
| --- | --- |
| Use a tape measure | Count down: ready, steady, go! |
| Repeat three times to get an average | Use a metre rule |
| Put the runner on the start line | Measure a distance of ten metres |
| Divide the distance (10m) by time taken | Mark the start and finish with a pole |
| Measure the time taken to run 10m | Divide the time taken by ten |
| Use a timer | Let the runner have a run up |

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

|  |
| --- |
| **Response activity** |
| **Measuring top speed** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Speed is a measure of how fast an object travels: how far it goes in a given time |
| Observable learning outcome: | Calculate the average speed of an object using speed = distance ÷ time |
| Activity type: | Sequencing process - practical |
| Key words: | Speed, average speed |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Moving things

**What does the research say?**

Practical work gives students the opportunity to measure distance and time in order to calculate average speeds of moving objects and to observe their motion in detail. (Kibble, 2011; Driver et al., 1994)

When dividing distance by time to calculate average speed different units are involved that combine to form a *compound measure*. For example, if a ball rolls 8 metres along the ground in 2 seconds, its average speed can be calculated. Here, the division has been done in two steps for emphasis – first the units and then the numbers.

In science, it is good practice always to include units as part of the calculation, in order to keep track of what the numbers mean. (Boohan, 2016)

This activity can be used following practical work in which students have measured distance and time in order to calculate the speed of objects. It consolidates an understanding of how to measure an average speed and introduces the idea that the speed of an object is not necessarily constant.

**Ways to use this activity**

Students should complete a practical to measure distance and time in order to calculate average speed.

After the practical work, students should complete the sequencing activity in pairs or small groups, and the focus should be on the discussions. The statements are also provided as cut-out cards for students to physically organise.

Listening in to the conversations of each group will often give you insights into how your students are thinking. Each member of a group should be able to explain why the statements were put in the chosen order. Once this activity has been completed it may be helpful to challenge students to independently write down their own description.

*Differentiation*

You may choose to use simplified statements for some students, or give them the starting statement to start them off. In some situations it may be more appropriate for a teaching assistant to read the statements with one or two students.

**Expected answers**

An approximate order is:

1. Use a tape measure
2. Measure a distance of ten metres
3. Mark the start and finish with a pole
4. Use a timer
5. Let the runner have a run up
6. Measure the time taken to run 10m
7. Divide the distance (10m) by time taken
8. Repeat three times to get an average

~~Put the runner on the start line~~

~~Count down: ready, steady, go!~~

~~Use a metre rule~~

~~Divide the time taken by ten~~

NB The runner needs a run up in order to reach their top speed. This sequencing exercise encourages students to consider how speeds change, and how the equation for speed measures the average speed. To measure a top speed of a runner, the time to cover a small distance needs to be measured at the right point in the run.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Image: Jesse Owenshttps://pixabay.com/en/sprinter-athletes-jesse-owens-63157/

**References**

Boohan, R. (2016). *The Language of Mathematics in Science: A guide for teachers of 11-16 science* Hartfield, Herts: Association for Science Education.

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

Kibble, B. (2011). Forces. In Sang, D. (ed.) *Teaching secondary physics.* London: Hodder Education.