



# HOW FAST DOES THE WATER FLOW?

 9-11 years  20-30 minutes per station

## Introduction

Greenkeepers use maths on the golf course in many ways. They may need to know how fast the water in a stream is flowing.

In this session pupils will calculate the speed the water flows in a stream by timing how long a tennis ball travels along a set distance in the water. (Please note that pupils in the UK work in metric rather than imperial units.)

## Pupil Learning Objectives

By the end of the session pupils will be able to

- » measure time in seconds
- » state that speed is measured in metres per second
- » carry out an experiment to calculate the speed water flows in a stream.
- » calculate an average
- » convert units for time from minutes to seconds
- » convert the units for speed from metres per second to kilometres per second and metres per minute (extension)

## What is needed for the session

Item	Who will provide it
Tennis balls	Golf course
2 pairs of Wellington boots (suitable size for the pupils attending)	Golf course
Irrigation flags	Golf course
String and poles	Golf course
Stopwatches (one for each group of 4) If there are no stopwatches, the greenkeeper could centrally time and shout out how many seconds	Golf course or school
Long handled pond dipping nets to drop and collect tennis balls	Golf course/school
Calculators (one between 4)	School
Metre rulers or tape measures (one between 4)	School
Hi-visibility jackets for all pupils (not essential)	School
Pencil and clipboard for every pupil (not essential)	School
Printed worksheet for each pupil	Golf course

## What the greenkeeper needs to do

Prior to the visit discuss with the teacher in charge the risks associated with being near open water in this activity and whether this activity is suitable for the group of pupils attending. In advance of the session, identify a suitable part of a stream where the water is flowing at a reasonable speed to measure and it is shallow enough to stand in safely.

Suspend a string across the stream to represent the start and another one 10m downstream to represent the finish (shorter lengths could be used if required.) An alternative way to complete this activity would be for only the greenkeeper to enter the water to drop the tennis ball into the stream and collect it at the finish, but the pupils could still measure the time taken and do the calculations.

Activity	Equipment	Questions to ask
<p>1. Before heading to the stream discuss with the pupils the dangers of working near water and how they should behave.</p> <p>Explain to the pupils that they are going to calculate how fast the water in the stream is flowing by measuring the time it takes the tennis ball to travel 10 metres along the stream.</p>	<ul style="list-style-type: none"> <li>» Tennis balls</li> <li>» String and poles for marking start and finish</li> </ul>	<p>What are the dangers of being near water?</p> <p>How are you going to stay safe around the water?</p> <p>What might affect the speed of the tennis balls floating down the stream?</p>

Activity	Equipment	Questions to ask
<p>2. Get pupils to look at the stopwatch to ensure they know how to work it and tell them they have to measure the time in seconds not minutes. (If the stopwatch is measuring in minutes, check they know how to convert minutes to seconds and that they understand the stop watch display. Is it 1 minute 50 seconds, so 110 seconds or 1.5 minutes which is 1 minute 30 seconds, so 90 seconds?) Ask pupils how they will ensure their measurements are reliable? If they have not already mentioned this tell them that they will need to measure 5 uninterrupted runs down the stream. If the ball gets stuck, this would not be a valid result as it will distort the data so the time would have to be discarded and the run repeated.</p>	<ul style="list-style-type: none"> <li>» Tennis balls</li> <li>» String and poles for marking start and finish</li> </ul>	<p>What units will you use to measure time? (seconds)</p> <p>How can you convert minutes to seconds?</p> <p>What factors should we keep the same for each measurement? (tennis ball, distance the tennis ball travels, same stretch of stream)</p> <p>What are we going to measure in this experiment? (The time taken for the ball to travel down the stream.)</p> <p>What if the tennis ball gets stuck?</p> <p>How many runs should we measure to get a reliable result? (reliable means that the method used is producing similar results each time.)</p>
<p>3. Split the pupils into groups of 4 and get them to organise themselves to get reliable timings and be able to check for interrupted runs. Let the pupils suggest solutions as this might help any groups that are stuck.</p>		<p>How are you going to organize your group?</p>
<p>4. Explain to the pupils that they are going to calculate the speed of each run by dividing the distance travelled (m) by the time taken (s). They are then going to find the average of their 5 good runs. Remind them that they are going to add up the speeds from their 5 runs and divide by 5 (the number of runs).</p>	<ul style="list-style-type: none"> <li>» Calculators</li> <li>» Worksheet</li> </ul>	<p>What is an average and how do we calculate it?</p>
<p>5. Ask the pupils what things they will do to make the timing reliable</p> <ul style="list-style-type: none"> <li>» Make sure the stopwatch is started and stopped when it crosses the start and finish line.</li> <li>» Watch the tennis ball all the way to check for interruptions.</li> </ul>		<p>Who will have the stopwatch?</p> <p>How will you put the tennis ball into the stream?</p>
<p>6. Let the pupils do their experiment. Keep checking to make sure that they are safe and getting reliable results.</p>	<ul style="list-style-type: none"> <li>» Calculators</li> <li>» Worksheets</li> <li>» Tennis balls</li> </ul>	<p>Ask them questions rather than giving them any answers.</p>

## Key words

You may have to explain some of these words as pupils will not be familiar with them. Check that pupils know their meaning before using them too much.

**metres per second**

**average**

**fair test**

**reliable**

**method**

**valid**

**speed**

**mean**



## Lesson extension activities

Ask pupils to convert the speed they have calculated into kilometres per second, metres per minute or metres per hour.

## Support activities

Pupils could be given a set of speeds to calculate the average to make the maths easier.

# Information for the teacher

## National Curriculum links

### England

- » I can calculate and interpret the mean as an average.

### Wales

- » I can find and use the mean of a simple set of data to explain how the statistics do, or do not, support an argument

### Scotland

- » I can find the mean, median, mode and range of sets of numbers, decide which type of average is most appropriate to use

### Northern Ireland

- » I can understand, calculate and use mean and range

## Additional Resources that could be used to follow up the session

Click on the links below to access

- » [What is an average? – Census at school](#)

# Worksheet: How fast does the water flow?

Date ..... Golf Course .....

Pupil Name .....

Please answer the questions below while participating in the session.

## Measuring the speed water flows in a stream

**Method — What did you do? What did you keep the same?**

**What equipment did you use?**

**Diagram of your experiment**



## Results

Distance tennis ball travelled in metres =

Run	Time in seconds	Speed in metres per second
1		
2		
3		
4		
5		
Average speed		

To calculate speed

$$\frac{\text{distance in metres}}{\text{time in seconds}} \quad \frac{10}{15} = 0.66 \text{ m/s}$$

## Conclusion

Were all the speeds you calculated similar?

Were your results similar to other groups?

How close together were your results to other groups?

# Risk Assessment:

These are suggested risks, you will probably want to add some of your own.

School Name ..... School Representative .....

Golf Club Name .....

Greenkeeper Name ..... Date of Visit .....

What are the hazards?	Who/what is at risk?	What needs to be done to avoid accidents?	Who is to action?
There will be moving cars in the car park	Pupils	<ul style="list-style-type: none"> <li>» Inform pupils that they must follow instructions when leaving the minibus</li> <li>» All pupils to wear high visibility jackets whilst on the golf club (if the school requires)</li> </ul>	Teacher Greenkeeper
Pupils might get lost from the rest of the group	Pupils	<ul style="list-style-type: none"> <li>» All pupils to wear high visibility jackets whilst on the golf club (if the school requires)</li> <li>» Teacher to count pupils in every time they move between areas</li> </ul>	Teacher
Being hit by a golf ball	Pupils Teacher Greenkeeper	<ul style="list-style-type: none"> <li>» Inform pupils that there are some areas of the golf course that may be dangerous, therefore they need to avoid</li> <li>» All pupils to wear high visibility jackets whilst on the golf club (if the school requires)</li> </ul>	Teacher Greenkeeper
Animals are living creatures	Animals	<ul style="list-style-type: none"> <li>» Ask pupils not to disturb the habitats of any creatures</li> <li>» Ask pupils to observe rather than touch</li> </ul>	Teacher Greenkeeper
There will be other adults around the course	Pupils	<ul style="list-style-type: none"> <li>» Pupils to be told to report to the teacher if they have any concerns</li> </ul>	Teacher Greenkeeper
Open-water hazard	Pupils	<ul style="list-style-type: none"> <li>» Inform pupils that they must stand back from the edge if not entering the water</li> <li>» Ensure there is adequate supervision of pupils near water</li> <li>» Ensure that rescue devices are present</li> </ul>	Teacher Greenkeeper



What are the hazards?	Who/what is at risk?	What needs to be done to avoid accidents?	Who is to action?
Pupils entering the water (if applicable)	Pupils	<ul style="list-style-type: none"> <li>» Inform the pupils that entering the water is dangerous as it is slippery and they must take extra care.</li> <li>» Make sure pupils entering the water wear waterproof footwear like wellingtons.</li> </ul>	Teacher Greenkeeper