FIRST GREEN
GCSAA BIGGA

HOW FAST DOES THE WATER FLOW?

11-14 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 students 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 students in the UK work in metric rather than imperial units.)

Student Learning Objectives

By the end of the session students will be able to

- carry out an experiment to calculate the speed water flows in a stream
- explain that reliable results are those that can be reproduced consistently using the same method
- state that speed is measured in metres per second (m/s)
- convert the units for speed from metres per second to kilometres per second and metres per minute

BIGGA British and International Golf Greenkeepers Association

STEM LEARNING

What is needed for the session

Item	Who will provide it
Tennis balls	Golf course
2 pairs of Wellington boots (suitable size for the students 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 students (not essential)	School
Pencil and clipboard for every student (not essential)	School
Printed worksheet for each student	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 students 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 students could still measure the time taken and calculations.

Activity	Equipment	Questions to ask
1. Before heading to the stream discuss with the students the dangers of working near water and how they should behave. Explain to the students that they are going to measure how fast the stream is flowing by timing how long it takes the tennis ball to run 10 metres along the stream	» Tennis balls » String and poles for marking start and finish	What are the dangers of being near water? How are you going to stay safe around the water? What might affect the speed of the tennis balls floating down the stream?

Activity	Equipment	Questions to ask
2. Ask the students how they can ensure that the results of their experiment are reliable. (Reliable results are those where the same method produces results which are close in value.) If they have not already mentioned this tell them that they will need to measure 5 uninterrupted runs down the stream and then find the mean. If the ball gets stuck, this would be an anomalous (odd) result so the time would have to be discarded and the run repeated.	» Tennis balls » String and poles for marking start and finish	How can you ensure the results of the experiment are reliable? (For each run use the same tennis ball, same distance the tennis ball travels, same stretch of stream, repeat the measurements, etc) What are we going to measure in this experiment? (The time taken for the ball to travel down the stream.) What if the tennis ball gets stuck? How many runs should we measure to get a reliable result?
3. Split the students into groups of 4 and get them to organise themselves to get accurate timings and be able to check for interrupted runs. Let the students suggest solutions as this might help any groups that are stuck.		How are you going to organize your group?
4. Ask students if they know how to calculate speed. Explain to the students 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 mean speed 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).	» Calculators » Worksheet	How is speed calculated? (divide the distance travelled (m) by the time taken (s)) What is the mean and how do we calculate it?
5. Ask the students what things they will do to ensure their time measurement is accurate. » Make sure the stopwatch is started and stopped when it crosses the start and finish line. » Watch the tennis ball all the way to check it doesn't get stopped.		Who will have the stopwatch? How will you put the tennis ball into the stream?
6. Let the students do their experiment. Keep checking to make sure that they are safe and getting reliable results.	» Calculators » Worksheets » Tennis balls	Ask them questions rather than giving them any answers.

Key words

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

metres per second (m/s)

mean

anomalous

speed

method

accurate

reliable

conclusion

Lesson extension activities

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

Support activities

Students could be given a set of scores to calculate the mean to make the maths easier

Information for the teacher

National Curriculum links

England

» I can describe speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)

Wales

» Students systematically observe and measure, justifying any amendments made to the method. They use some quantitative definitions and perform calculations using the correct units

Scotland

» I can use appropriate methods to measure, calculate and display graphically the speed of an object.

Northern Ireland

» Develop skills in scientific methods of enquiry to further scientific knowledge and understanding: planning for investigations, obtaining evidence, presenting and interpreting results;

Additional Resources that could be used to follow up the session

Click on the links below to access

» **Averages — Just Maths**
» **What is an average? — Census at school**

Worksheet: How fast does the water flow?

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

Student 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 equipment did you use?
How did you ensure your results were reliable?	
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 $\frac{\text{distance in metres}}{\text{time in seconds}}$ $\frac{10}{15}$ = 0.66 m/s

Conclusion

Were all the speeds you calculated similar?

Were your results similar to other groups?

How reliable (close together) were your results?

Risk Assesment:

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	Students	» Inform students that they must follow instructions when leaving the minibus » All students to wear high visibility jackets whilst on the golf club (if the school requires)	Teacher Greenkeeper
Students might get lost from the rest of the group	Students	» All students to wear high visibility jackets whilst on the golf club (if the school requires) » Teacher to count Students in every time they move between areas	Teacher
Being hit by a golf ball	Students Teacher Greenkeeper	» Inform students that there are some areas of the golf course that may be dangerous, therefore they need to avoid » All students to wear high visibility jackets whilst on the golf club (if the school requires)	Teacher Greenkeeper
Animals are living creatures	Animals	» Ask students not to disturb the habitats of any creatures	Teacher Greenkeeper
There will be other adults around the course	Students	» Students to be told to report to the teacher if they have any concerns	Teacher Greenkeeper
Open-water hazard	Students	» Inform students that they must stand back from the edge of the water » Ensure there is adequate supervision of students near water » Ensure that rescue devices are present	Teacher Greenkeeper

What are the hazards?	Who/what is at risk?	What needs to be done to avoid accidents?	Who is to action?
Students entering the water (if applicable)	Students	» Inform the students that entering the water is dangerous as it is slippery and they must take extra care. » Make sure students entering the water wear waterproof footwear like wellingtons.	Teacher Greenkeeper