



**Thames Sailing Barge Trust**  
**Pudge Project**  
**Upper Key Stage 2 Science: Forces**



**Water Resistance (approx. 40 mins + practical)**

**Objectives:**

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of water resistance, that acts between moving surfaces
- Investigate and identify the effect of boat shape on water resistance
- Investigate and identify the effect of salty water on water resistance
- Present findings and recommendations, based on scientific evidence, in written form
- Investigate and identify which shape of boat is best to beat the water resistance of a river, offering an explanation
- Make recommendations for the best boat shape and waterway to get the meteorite across, based on scientific evidence

**Working Scientifically:**

- plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- record data and results of increasing complexity using scientific diagrams and labels and tables
- use test results to make predictions to set up further comparative and fair tests
- report and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in written forms

**Curriculum Links: Maths:**

- Use all four operations to solve problems involving measure using decimal notation, including scaling
- Scale weights and lengths using appropriate calculations

**Resources:** Laptop, digital computer screen, *table salt*, *rolls of tin foil*, *figures: one tied on to string (Provided in the TSBT Bargeman's Box to be checked and returned)* and *two water trays, diennes cubes and a fan from school.*

**Introduction:** **SLIDE 1** Following on from your previous session with ( *Jenny & John* ) We're going to continue to look at how FORCES help the barges with their work. Discuss: do you sink or float when in a pool (when not swimming!). **SLIDE 2** Think about the science of being vertical in a pool and sinking; what if you make a star shape in the water, do you float?; **SLIDE 3** What if you surface dive to the bottom of the pool to retrieve something or 'run' through the water? How can you both float and sink in water, even though you don't change weight - what makes you sink (what shape they are), what makes you float (again what shape they are)? In the deep end of a pool they might be 3m above the ground. **SLIDE 4** What would happen if they were 3m above the ground in air? They would hit the ground fast! Why don't they hit the ground fast in water? Even when they try to sink? What slows them down? **SLIDE 5** Demonstrate a toy figure in a bowl of water to reconstruct the first two of these 'experiences' (make it sink - drop it in straight up/down and float – lie it out flat?). Discuss that changing the shape can change the 'experience' then attach the toy figure to a piece of string lowered into a bowl of water – note that the string shortens in length when it hits the water – the resistance is greater in the density of water.

1. Explain how apparent loss of weight is due to the 'up thrust' of the liquid trying to support the objects. **SLIDE 6** Remember that every force has an equal and opposite reaction. When things travel through air they experience

air resistance, so what do you think things experience when they travel through water? What's the technical term for it? Water resistance!

SLIDE 7 <https://www.bbc.co.uk/bitesize/topics/zc89k7h/articles/zytqj6f> (52 seconds)

2. Do you think a greater or smaller surface area increases the ability to float? We're going to be investigating this today. Ask: even though the weight 'appears' to change, what stays the same? (The amount of 'stuff', i.e. the mass). Watch video on water resistance SLIDE 8 <https://www.bbc.co.uk/teach/class-clips-video/investigating-air-and-water-resistance/z4m6nrd> (3.44 mins) You are now going to do one of two investigations, and be prepared to report back to the rest of your class. SLIDE 9 Half of you will make three boats, for the Barge boats, which are used when moored up away from the shore, SLIDE 10 to find out which boat shape you should use to get across from the Barge to the shore most efficiently? Remember, the barges are flat bottomed to enable them to travel as far as possibly up tidal rivers and make the most of their hold capacity. SLIDE 11 The other half will test one boat on two different water trays: one with a high salt content, one with fresh water. SLIDE 12

3. ***In mixed ability groups, support and question:*** Each half of the class to present their findings to the other half. Boat shape investigation: you need to test the different shapes of boat (see images), but are to organise the experiment yourselves. What variables do you think you'll need and what will stay the same? Record your observations on the sheet and the time each boat took (as speed). Remember to make recommendations based on your findings.

4. ***In mixed ability groups, support and question:*** Each half of the class to present their findings to the other half. Salty water investigation: you will test out a boat in salty and non-salty water by loading it up until it sinks - which carries the greater weight? You are also to organise the experiment yourselves. What variables do you think you'll need and what will stay the same? Record your observations on the sheet. Can you make a suggestion as to why this is the case?

**N.B Teachers: Use both investigations as an assessment of 'Working Scientifically' progress and identify next steps.**

20 inutes to carry out the two investigations

5. Now it's time to share your groups findings and explain the science behind what you concluded. SLIDE 13 Boat shape investigation: Discuss the effect of the shape on speed and therefore its level of water resistance. Salty water investigation: What is happening with the salty water and discuss the greater density of the molecules?
6. **Conclusion** SLIDE 14 What else might be worth investigating? (How much weight they can carry or the shape of the hull that is under the water). You could always repeat the salty water experiment but use warm water/cold water then fizzy water and still water. Barge skippers used to measure the density of the water in terms of whether it was fresh or sea water when loading cargoes. And when a port was up River from the sea they would get different readings.

Clips to consolidate learning:

<https://www.bbc.co.uk/teach/class-clips-video/investigating-air-and-water-resistance/z4m6nrd> (3.44 mins)

<https://www.bbc.co.uk/bitesize/topics/zc89k7h/articles/zytqj6f> (52 seconds) What is Buoyancy?

<https://www.bbc.co.uk/bitesize/topics/zsxxsbk/articles/zxw6gdm> (1.18 mins) What are water and air resistance?

**Class Teachers:** We want these resources to work for you – please do give us any feedback on the lessons: were they pitched at the right level? Did some parts drag? Could we have spent more time on other parts? Any suggestions are really appreciated. Email: [education@bargetrust.org](mailto:education@bargetrust.org)

**Reference materials:** Provided by STEM and Hamilton Trust.

<https://www.hamilton-trust.org.uk/science/year-5-science/forces-may-forces-be-you/>

These sessions have been written in line with the new national curriculum (published in 2014)

Thames Sailing Barge Trust  
A company limited by guarantee registered in England and Wales No. 04726591  
A non-profitmaking organisation –  
Registered Office as above  
Registered Charity No. 1102840



FOYLE FOUNDATION

