

## Archimedes' Principle

Archimedes lived in the 3<sup>rd</sup> Century BC. His discovery of the reason objects float or sink due to the forces on them, prompting him to shout εὕρηκα (*Eureka!*) and run naked through the streets of Syracuse, is probably what he is best known for. In modern terms, his principle is:

*“An object wholly or partially immersed in a fluid displaces its own weight of fluid”*

Or...

*“The upthrust on a body in a fluid is equal to the weight of fluid displaced”*

### Easy starter for question 1

- Use Archimedes' Principle to show that the only necessary condition for any object to float in a fluid is that its density must be less than that of the fluid.
- Why is it that melting icebergs are not a problem for people living near coastal areas, but melting icecaps are?

### Continuation for question 2

- A solid object is floating, partly immersed, in a fluid. Show how the proportion of the object protruding from the fluid is related to the densities of the solid and fluid.
- How would you work out what proportions of an iceberg are above and under water?

### Question 3

You are in a boat floating on a lake. In the boat, you have a large steel anchor. You throw the anchor over the side of the boat and it sinks to the bottom of the lake.

- Will your boat now be floating higher or lower in the water? Explain why.
- What will happen to the level of the water in the lake? Explain why.
- Would the same effects be observed if the boat were in a swimming pool?

### Question 4

A canal boat passes over an aqueduct:



As it does so, does the water level in the aqueduct rise, fall or stay the same?

As it does so, does the downwards force on the aqueduct's pillars rise, fall or stay the same?

Are your answers above the same for a much heavier boat? What about an aircraft carrier passing over a particularly large aqueduct?