

Archimedes yacht

(Ireland)

Background

What happens when a small boat on a finely balanced trough of water travels from one end of the trough to the other?

A small boat is floated in a trough made from a cut away two litre plastic drinks bottle. The trough is filled to a depth of about two centimeters with coloured water (for extra visibility). The bottle trough is placed on a wooden frame for stability, consisting of a flat base and two half metre wood slats to hold the bottle in position. This is then placed over the edge of a raised block so that it “just” balances.

Follow these steps:

1. Show that the trough is critically balanced and will topple if even a small weight is added to the timber beyond the fulcrum.
2. Then the small boat is gently placed in the water above the supported end of the critically balanced trough. The trough and boat will not tip over.
3. Gently move the boat so that it sails to the unsupported end of the trough

So what happened?

The trough remained in a horizontal plane. The boat did not cause it to topple. The explanation lies in Archimedes principle that a body immersed in water displaces its own weight of water which is evenly distributed throughout the length of the trough preserving the state of balance.

What next?

You could explore what happens when the boat has a small hole in it and takes on water gradually

- (a) at the supported end,
- (b) at the unsupported end.

