Hydrostatic Paradox

Apparatus

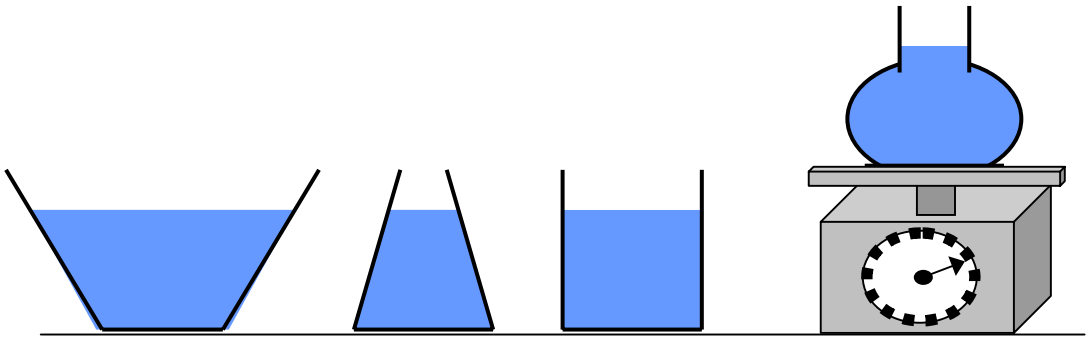
set of containers with different shapes but same base area, filled to same height with liquid, scales to weigh the containers on

Action

The students fill the containers to the same height, and predict which will be heaviest and lightest. The students then consider how the force can be the same on the bottom of each container, as they each have the same depth of fluid, yet the weight, which is the force of the container on the scales, is different.

The Physics

The pressure is the same at the bottom of each container (because they are filled to the same height). But they all have the same base area, so the force experienced by the base of each container is the same. Therefore, they should all give the same reading on the scale. This second argument is wrong because we have only considered the force of the water on the base of the containers. When calculating the force of the water on the container, we must include the forces on the sides, which may have a component in the vertical direction. The containers have different masses because they contain different masses of water.



Accompanying sheet

Hydrostatic Paradox

The vessels have the same base area and are filled with water to the same depth.

Which contains the greatest volume of water?

Which has the greatest weight of water in it?
Which has the greatest mass of water in it?

Which has the greatest pressure on its bottom?