

Archimedes' Paradox

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The equipment proposed, innovating in its general structure, points out the study of Archimedes' principle and Stevino's Law.

The equipment is made up of 1.70 m high Plexiglas cylinder, in which we put some water until we reach the level of 1.60m. Two bodies are put inside the cylinder: the first is a hollow glass body, the second is a full gum body. Because of Archimedes' buoyancy, they keep their balance steady when half-dipped. The top of the cylinder is hermetically sealed by a stopper where there are three air chamber valves.

They will be used:

- First valve: to link pressure manometer of 6000 mbar capacity,
- Second valve: as a connecting orifice for manual pump,
- Third valve: to discharge the pressure.

On the lower part of the cylinder there is a tap by which the air into the tube is piped through a pump.

Moreover under the cylinder there is a halogen lamp that makes the phenomenon visible.

The phenomena that we can observe, in addition to their qualitative aspect, can have quantitative character because of their flexibility. In fact, by pumping air manually from the top into the cylinder, we can read the pressure value (it depends on the room temperature) and when the value of 1800 - 1900 mbar is reached the glass body starts its descent winning the superficial tension of the water. As the body descends, we can decrease the pressure value because the body feels the weight effects of the overhanging water column according to "Stevino's Law". We can make quantitative forecasts about the position taken by the body and about the pressure value referring to that depth. As the gum sphere doesn't feel the increase of the pressure, it stays steadily in its initial position. But is it possible to make the full gum sphere fall while keeping its previous physical characteristics? By pumping gas (air) from the bottom and by opening the valves on the top, the pressure values will become equal to zero and we will also notice air bubbles inside the tube. As a consequence we will observe the increase of the water volume and soon afterwards we will see the descent of the hollow body and of the full gum sphere (Archimedes' Paradox).

The visual effect arouses wonder and the audience will try to understand the phenomenon. A second cylinder, similar to the first one, contains two hollow spheres that are ballasted in the appropriate way. By pumping air from the top a pressure rise will be noticed on the manometer and, as a consequence, the Stevino's law.

The innovation is the fact that, at about middle depth of the cylinder, one sphere ascends and the other descends even if the pressure values remain steady.