

Question 33886

Archimedes principle is the following:

“Any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object”.

It means that whenever object (or part of object) we immerse into fluid, it displaces exactly the same volume of fluid like the one of submerged body not depending on type of body. Principle is one of the fundamental in physics, and was formulated by Archimedes of Syracuse.

Mathematically, Archimedes principle is the following:

$$F_A = \rho g V ,$$

where F_A is the buoyancy force (Archimedes force), ρ is the density of the fluid, g is the gravitational constant, V is the volume of object, immersed into water.

There are lots of ways to derive latter formula.

The most simple one is one which supposes that immersed body is has a form of a box.

Then the force is $F = \Delta p \cdot S = (p_2 - p_1) S = \rho_{fluid} g (h_2 - h_1) S = \rho_{fluid} g V$.

Archimedes principle defines the conditions under which object can float or drown in fluid. If $F_A > mg$, then according to 2nd Newtons law there is an upward acceleration, if

$F_A = mg$, then body has reached equilibrium, being immersed to some height into fluid. If $F_A < mg$, then body starts drowning.