ADVANCED PHYSICS CLUB

FEBRUARY 25, 2024

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`http://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2023`
The practical information about the club and contacts can be found on the same web page.

Today's meeting

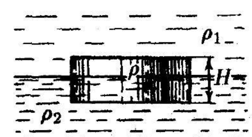
Today we solved all of the assigned problems on Kepler's laws. The next topic is hydrostatics: Paskal's and Archimedes laws.

Homework

1. A piston with the longitudinal cross section shown on the figure is located inside a pipe with water. Water pressure is P on both sides of the pipe. Is the piston in equilibrium?

2. A block of ice floating in a bucket with fresh water is melted.
  (a) How will the level of the water in the bucket change?
  (b) How will the answer change if the water in the bucket is salted?
  (c) What if the lead bullet is frozen into the ice?
  (d) A piece of cork is frozen into the ice?
  (e) The ice has an air bubble inside it?

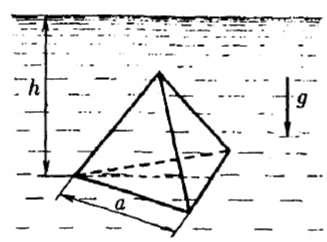
3. A puck with density ρ floats at the interface of two liquids with densities $\rho_1 < \rho < \rho_2$. Height of the puck is H. Find what part (by height) of the puck is immersed in the lower liquid.



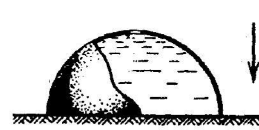
4. A vessel with water slides down an inclined plane. The plane makes angle α with the horizon, friction coefficient between the vessel and the plane is μ. What angle does the surface of the water in the vessel make with the horizon?

5. An entire planet is made out of incompressible liquid of density ρ. Find the pressure at distance r from the center if the whole planet has radius R. What is the pressure at the center of the planet? The gravitational constant G is given.

***6.** A regular tetrahedron floats under the surface of water in such a way that its bottom face is horizontal and at depth h. The tetrahedron side has length a, water density is ρ. Find the force exerted by the water on any other face (non-horizontal) of the tetrahedron.



***7.** A thin-walled metal hemisphere with a little hole at the top rests on a table. Hemisphere's edges fit snugly against the table. Water is being poured inside through the hole and when it rises all the way to the hole, it lifts the hemisphere and starts flowing underneath it. Find the mass of the hemisphere if its' internal radius is R and density of water is ρ.



For the next meeting

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **March 3**.