

USEFUL RESOURCES

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:

https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2020

The practical information about the club and contacts can be found on the same web page.

TODAY'S MEETING

Today we had an organizational meeting of the club. The main meetings of the club will happen via Zoom at 3:00-4:30 pm on Sundays. At every meeting, the problems will be assigned to be solved by club participants by the next meeting. At the meetings, we will be solving additional problems and discussing various subtleties and tricks.

IMPORTANT: Homework is crucial for the success of the program. Club members will have a dedicated Discord channel at the SchoolNova server where they can discuss problems and solve them together.

HOMEWORK

1. Review Pascal's law and Archimedes principle. You might find the following web pages useful:

Static Fluid Pressure and Pascal's Law:

<http://hyperphysics.phy-astr.gsu.edu/hbase/pflu.html>

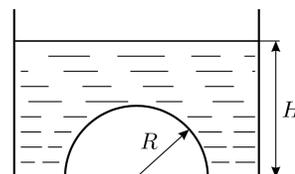
<http://hyperphysics.phy-astr.gsu.edu/hbase/pasc.html>

Buoyancy and Archimedes' Principle:

<http://hyperphysics.phy-astr.gsu.edu/hbase/pbuoy.html>

2. A tank is filled with a liquid of the density ρ_1 up to the height h_1 and then, on top of the first liquid by another liquid of the density ρ_2 for the additional height of h_2 . Liquids do not mix.
 - (a) Find the pressure inside the tank as a function of the depth h from the top of the liquid.
 - (b) Make a graph $P(h)$.
 - (c) How will the answer change if there is a very thin but heavy metal plate of the mass M at the interface between liquids? The size of the plate is $L \times L$ and it is free to move up and down.
3. A wooden block of the density ρ_{wood} is floating at the surface of the water. What fraction of the block's height is under water?
4. 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?

- *5. The hole in the horizontal bottom of the vessel is closed with a light cap having a shape of hemisphere of radius R (see figure). The vessel is filled with a liquid of density ρ . The bottom is at a depth H . Find the force with which the cap presses on the bottom of the vessel. The acceleration due to gravity is g .



FOR THE NEXT MEETING

Next time we continue to talk about buoyancy, Archimedes principle, Pascal's law and moving fluids.

IMPORTANT: The next club's meeting is at 3:00pm, via Zoom, on Sunday, **September 27**.