

## 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](https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2020)

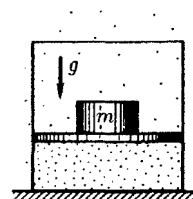
The practical information about the club and contacts can be found on the same web page.

## TODAY'S MEETING

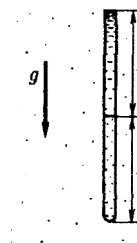
Today's homework begins discussion of thermodynamics with the topic of ideal gas laws.

## HOMEWORK

1. In order to make volume of a gas in a cylinder with a piston  $n$  times smaller one needs to place a block of mass  $m$  on the piston. What is mass of another block one needs to add to this one so that volume further becomes  $k$  times smaller? All processes happen isothermally.



2. How many strokes of a piston pump with a volume  $V$  are needed to increase pressure in a vessel with volume  $V_0$  from the atmospheric one  $P_0$  to some higher  $P$ ? Neglect heating of the gas.
3. Pressure of air in a bottle at  $7^\circ\text{C}$  is equal to the atmospheric pressure 100 kPa. How much does one need to heat the bottle so that a cork closing the bottle will be pushed out? Without heating the cork could be pulled out by force 10 N. Cross-section area of the cork is  $2\text{ cm}^2$ .
4. Gas is in a vessel at a pressure 2 MPa and temperature  $27^\circ\text{C}$ . After its' temperature is increased by  $50^\circ\text{C}$ , half (by mass) of the gas escapes the vessel. What is pressure in the new equilibrium state?
5. Balloon with holding capacity 50 liters is filled with air at  $27^\circ\text{C}$  up to pressure 10 MPa. What volume of water could be displaced from a ballast tank of a submarine at depth 40 m using the gas from this balloon? Temperature of air after expansion is  $3^\circ\text{C}$ .
- \*6. The bottom end of a vertical narrow tube of length  $2L$  is sealed and the upper end is open into the atmosphere. In the lower half of the tube there is gas at temperature  $T_0$  and the upper half is filled with mercury. Up to what minimal temperature should one heat the gas in the tube so that it displaces all of the mercury? Atmospheric pressure in units of mercury column is  $L$ .



## FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:00pm, via Zoom, on Sunday, **March 14.**