

USEFUL RESOURCES

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=ay2022](http://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2022)

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

TODAY'S MEETING

Today we finished solving problems on tension and friction and then watched a few physics Youtube videos. The next topic is momentum conservation.

F=MA PREPARATION

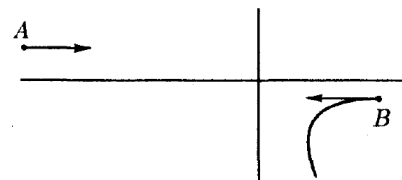
Solve  $F = ma$  exam 2017 and time yourself. You can download exam problems here:

<https://www.aapt.org/physicsteam/2018/upload/2017-Fma-exam.pdf>

If you don't have time for the entire exam, at least look through the problems to choose the ones most interesting/unclear to you. We will discuss the suggested problems at the beginning of the next meeting.

NEW HOMEWORK

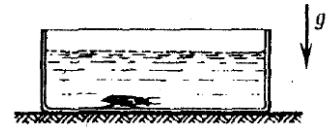
1. A proton with initial speed  $v$  flies right onto a helium nucleus which was initially at rest. What are the speeds of the particles at the moment when they are at the smallest distance from each other? Mass of helium nucleus is about four times larger than the proton's mass.
2. A missile is torn into two identical pieces at the highest point of its' trajectory which is at distance  $L$  in the horizontal direction from the launch point. On of the pieces returns exactly to the launch point. Where does the other piece land?
3. Two charged particles have masses  $m$  and  $2m$  and initial speeds  $2v$  and  $v$  respectively. They start moving from points  $A$  and  $B$  towards each other, as shown on the figure. The particles only interact with each other. Knowing the trajectory of particle  $2m$ , restore the trajectory of the particle  $m$  on the figure.



4. While preparing to jump a snake is lifting its body at a constant vertical speed  $v$ . Mass of the snake is  $m$ , assume that it is uniformly distributed along the length  $l$  of the snake. Find the force the snake is pushing against the floor with.
5. Two long carts of mass  $M$  each are moving in the same direction with initial speeds  $v_1$  and  $v_2$ . A block of mass  $m$  which was initially lying on the first cart is thrown (with almost zero speed relative to the first cart) to the second cart. After that it is thrown with almost zero speed relative to the second cart back to the first cart. This process is repeated  $N$  times. What will be the difference in speeds of the carts after this? Separate question: try to explain qualitatively viscosity of a gas which occurs when two layers of gas are sliding with respect to each other.



- \*6. A tank with water with density  $\rho_0$  rests on a frictionless table. Volume of water is  $V_0$ . There is a bug with volume  $V$  and density  $\rho$  at the bottom of the tank. The bug starts to move with horizontal velocity  $v$  with respect to the tank. With what velocity will the tank move on the table? Neglect mass of the tank. Water level stays horizontal at all times.



FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:30pm, via Zoom, on Sunday, **January 8**.