

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=ay2024
 The practical information about the club and contacts can be found on the same web page.

TODAY'S MEETING

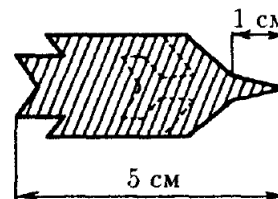
Today we welcomed all the participants into the club, discussed the normal form of operation and then solved a few nice physics problems.

The first homework has a few estimate problems and problems on kinematics of uniform motion. Please solve the problems at home! During the club meeting we will only have time to discuss the solutions that you already have. You can also think in advance which problem(s) you may want to present at our the meeting.

Problems are listed in no particular order. Problems marked with a star are somewhat more challenging. If you feel like you need some clarification about the formulation of any problem, you are always welcome to email apc@schoolnova.org

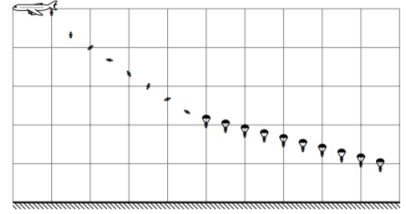
HOMEWORK

- An important skill for any physicist is to quickly estimate some quantity without a detailed calculation. In this set of problems you are asked for an *estimate* which means that it is totally fine to be wrong by a factor of ~ 10 . You can google some background information as needed, but try to use your intuition and common sense first. Don't be afraid to make guesses in some of the intermediate steps, especially if you are unsure how to proceed. For inspiration and more problems of this kind google *Fermi estimate problems*.
 - How far does an average person walk in their lifetime? Try to find a natural scale to compare it to.
 - How many air molecules are in your room?
 - What is the power consumed by an electric kettle?
 - You fill a glass with tap water. What is the probability that it has a water molecule that at some point was in Abraham Lincoln's blood?
- The figure shows a "blurry photo" of a moving airplane. Length of the whole plane is 30 m and nose of the plane is 10 m. Knowing the camera exposure time 0.1 seconds find speed of the airplane. Shape of the airplane is shown by a dashed line.



- Jack and John participate in a running competition. They are supposed to run 3 km. Jack got tired after running $\frac{3}{4}$ of the distance and walked the rest of the distance sometimes stopping for rest. John only ran $\frac{1}{4}$ of the distance and then walked without stopping. They finished at the same time. For how long did Jack stop in total? Both of them run with speed 12 km/h and walk with speed 6 km/h.

4. An airplane full of skydivers flies horizontally with a constant speed. Skydivers jump out of the plane keeping the constant time interval after the previous skydiver. They very quickly reach constant (and same for all of them) terminal speed v and move with it until opening the parachute. After opening the parachute at some particular height their speed quickly becomes u (also the same for all of them). The arrangement of skydivers is shown on the figure. Assuming they move strictly vertically, find ratio of speeds $\frac{v}{u}$.



- *5. A billiard table has length a and width b . A ball is launched from the middle of the side b at some angle α to that side. Find all α such that after several collisions the ball returns exactly to the initial point ?

FOR THE NEXT MEETING

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **September 29**.