

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

TODAY'S MEETING

Today we solved several problems on various topics. Two problems on electricity which we didn't have time to discuss are reassigned for the next meeting.

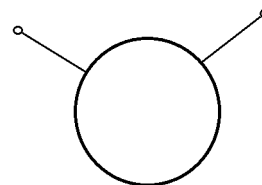
Starting from this homework we will discuss mechanics systematically. Our first topic is kinematics of motion with constant speed.

IMPORTANT: Homework is crucial for the success of the program. Club members will have a dedicated Discord server where they can discuss problems and solve them together. The link to join the Discord server will be distributed through our mailing list.

REASSIGNED HOMEWORK

In some problems you might need to use some physical constants or material properties which were not given in order not to hint on the solution. You could use Google search (try to choose a credible source).

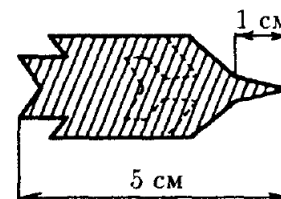
1. What would be the charge of a piece of iron with volume 1 cm^3 if someone managed to take away 1% of electrons contained in it? What would be the force of interaction between two such pieces of iron placed 1 km apart from each other?
2. There is a wire with total resistance 10Ω . A ring is made out of this wire. Where should one attach two other wires (of negligible resistance) to it so that the resistance between the free ends becomes 1Ω ?



NEW HOMEWORK

Problems marked with a star are in general more complicated than the ones without a star (which is not a reason to be afraid of them, rather to be proud of yourself when you solve them).

1. 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.



2. Athletes form a line of length l and run together with speed v in the direction of this line. A coach runs towards them with speed $u < v$. Upon meeting the coach each athlete instantly turns around and starts running in the opposite direction with the same speed v . What will be the length of the line of athletes after they all turn around?
- *3. A billiard table has length a and width b . A ball is launched from the middle of the side b . At what angle to side b should the ball be launched in order to return exactly to the initial point after several collisions? Find **all** possible answers.

- *4. It's raining and the rain drops are falling down vertically with velocity u . On the ground a round ball (say, a soccer ball) is rolling horizontally with velocity v . How many times more rain drops will fall on this ball compared to the same one, lying still, during the same amount of time? Would the answer be different, if the ball wasn't round (say, a football)?
- *5. A supersonic airplane is flying horizontally. Two microphones are located on the same vertical line, one below the other by distance l . They have detected arrival of the sound wave from the plane with a relative delay Δt . Speed of sound in the air is c . What is the speed of the plane?

FOR THE NEXT MEETING

IMPORTANT: The next club's meeting is at 3:30pm, via Zoom, on Sunday, **October 16**.