ADVANCED PHYSICS CLUB

MAY 5, 2024

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=ay2023
The practical information about the club and contacts can be found on the same web page.

Today's meeting

Today we started solving the problems on capacitors and energy density of electric field. The remaining problems are reassigned.

Reassigned Homework

1. a) (discussed) Find the surface charge density on a plane separating two regions if these regions have different electric field E_1 and E_2 perpendicular to this separating plate. Find the force acting on unit area of the plate (this is also known as electric pressure). Consider the cases $E_1 = E, E_2 = 2E$ and $E_1 = E, E_2 = -2E$. Is the electric pressure different in these two cases? Why?
   *b) (not discussed yet) Will the answer change if E_1 and E_2 can point in any direction, not necessarily perpendicular to the plate?

2. What is the energy stored in a parallel plate capacitor charged to a certain charge Q? Express it in terms of the electric field inside and the volume of the capacitor. What quantity would you call energy density of the electric field? Compare to the results of the previous problem.

3. a) Geometric size of a capacitor is increased n times in all directions while keeping the voltage between the plates the same. How will the energy stored in the capacitor change? If the size is kept the same but the charge of plates is increased k times how many times will the energy change?
   *b) Understand the above result using the notion of energy density of electric field (the expression you derived in the previous problem holds in general).

Last Homework

Please prepare your favorite problem and be ready to explain it to others in 5-10 minutes. The choice of the problem is completely up to you, it can be on any topic, although it would be desirable that other participants can understand what it is about. Both the students and the instructors will participate in this.

For the next meeting

IMPORTANT: The next and last this year club's meeting is at 3:30pm, via Zoom, on Sunday, **May 12**. Come and share your favorite problem with everyone!