ADVANCED PHYSICS CLUB

MARCH 1, 2026

Useful resources

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:
`https://schoolnova.org/classinfo?class_id=2252&sem_id=74`
The practical information about the club and contacts can be found on the same web page.

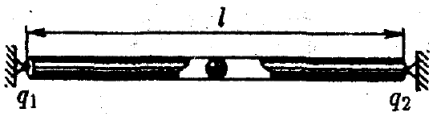
Today's meeting

We begin a new big topic : electricity and magnetism. Our first assignment is on Coulomb's law.

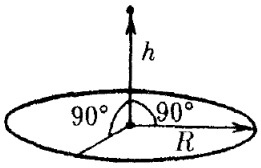
New homework

1. Assume that somebody managed to completely separate the positive and negative charges in 1 g of water and these charges were put 150 million km apart (the distance between the Earth and the Sun). What would be the force of attraction between these charges?

2. Two positive charges q_1 and q_2 are located at the ends of a horizontal tube of length l. Find the equilibrium position of a bead with positive charge q inside the tube. Is this equilibrium stable? Would the equilibrium be stable for a negatively charged bead?



3. What is the electric field at the center of a uniformly charged thin ring of radius R? What is the electric field on the axis of the ring at distance h from its center? The charge of the ring is Q.



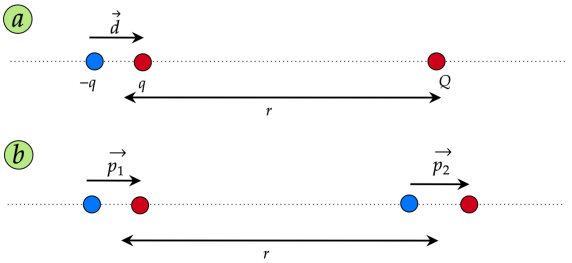
4. a) A metal ring with more and more electric charge steadily put onto it was torn by the Coulomb force when its charge reached Q. Another ring with exactly the same dimensions was made out of a material 10 times more durable than the first one. What charge would tear the new ring?

b) If the first material is used to make a ring with all dimensions three times larger than the first one, what charge would tear such a ring?

5. A rigid configuration of a positive and a negative charge of the same magnitude q, separated by a small distance d, is called an electric dipole. The vector $\vec{p} = q\vec{d}$ is known as the dipole moment, where $\vec{d}$ is a vector pointing from the negative charge to the positive charge.

(a) Find the force of interaction between a dipole with dipole moment p and a charge $+Q$ located at a distance $r \gg d$ along the direction of the dipole moment.

(b) Find the force of interaction between two dipoles with moments p_1 and p_2 pointing in the same direction, and located at a distance $r \gg d_1, d_2$ along the same direction.



6. Consider a fixed positive charge Q and a negative charge $-q$ that is free to move around it, and is not subject to any other forces. Could you formulate an analogue of "Kelper's laws" for its motion?

For the next meeting

IMPORTANT: The next club's meeting is at 2:40pm, in person, on Sunday, **March 8**.