Home work: no need to hand in

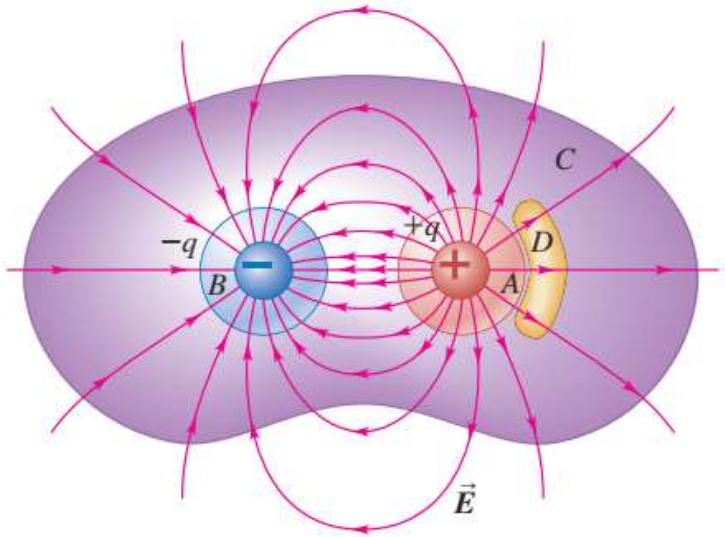
Q22.1 A rubber balloon has a single point charge in its interior. Does the electric flux through the balloon depend on whether or not it is fully inflated? Explain your reasoning.

Q22.4 A certain region of space bounded by an imaginary closed surface contains no charge. Is the electric field always zero everywhere on the surface? If not, under what circumstances is it zero on the surface?

Q22.2 Suppose that in Fig. 22.15 both charges were positive. What would be the fluxes through each of the four surfaces in the example?

Q22.3 In Fig. 22.15, suppose a third point charge were placed outside the purple Gaussian surface C. Would this affect the electric flux through any of the surfaces A, B, C, or D in the figure? Why or why not?

22.15 The net number of field lines leaving a closed surface is proportional to the total charge enclosed by that surface.



Home work: hand in required

22.1 • A flat sheet of paper of area 0.250 m^2 is oriented so that the normal to the sheet is at an angle of 60° to a uniform electric field of magnitude 14 N/C. (a) Find the magnitude of the electric flux through the sheet. (b) Does the answer to part (a) depend on the shape of the sheet? Why or why not? (c) For what angle ϕ between the normal to the sheet and the electric field is the magnitude of the flux through the sheet (i) largest and (ii) smallest? Explain your answers.

Home work: hand in required

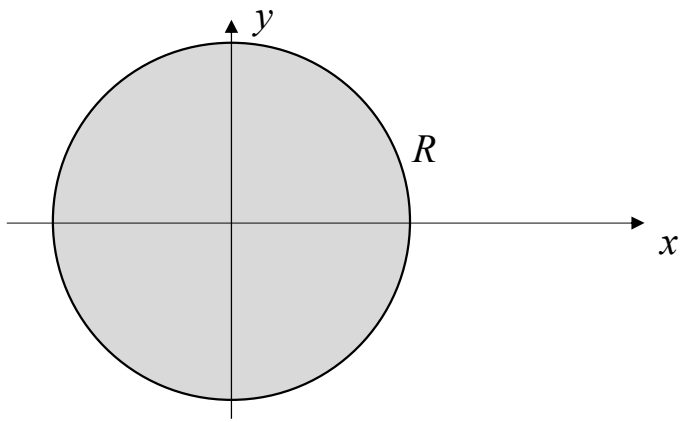
1. Please work out the field of a dipole of $P=Ql_0$, assuming the dipole is along positive z direction and located at origin. Write the field $E(x, y, z)$ as a vector at point $(x, 0, 0)$ and $(0, 0, z)$. What is the field is the distance between the field point and the dipole is much larger than l_0?
2. Please write down the force and torque that the dipole experiences in arbitrary homogeneous field (arbitrary direction and magnitude).
3. Considering a circular plane with homogeneous charge distribution as follows, please use Coulomb's law to calculate the field at point (0,0,z) generated by the plane, and answer the following questions:

    3.1 what else necessary quantities do you need to deal with the problem?

    3.2 can you please vary the value of R as 2z, 5z, 10z, 100z, and compare the field at these assumptions?

    3.3 How large is R that you consider the plane close enough to infinite?

    3.4 Can you prove the field value of infinite plane we learned during the class (from Gauss's law) using the result you get from this problem? (you can either use a mathematical limit, or use a large number of R to have an approximate proof).



Home work: hand in required

4. You know the electric potential in a static electric field as

$$\phi(x, y, z) = 3x + 2y \ (\mathrm{V/m})$$

Then, can you write down the field in vector form?

5. You know the electric potential in a static electric field as

$$\phi(x, y, z) = x^2 + y^2 + z^2 \ (\mathrm{V/m})$$

Then, can you write down the field in vector form?
What kind of charge distribution is involved in this problem?