Physics-306 (142)
Homework Set (1)

The main objective of this problem set is for you to review what you studied in earlier Electricity and Magnetism courses

This set is due by Tuesday 14th of Rabi-II, 1436 (February 3rd 2015) at 10.00 p.m. (*).

In *all homeworks*, please solve *fully* and *clearly*, *state assumptions*, and *comment* wisely (when applicable).

Please circle your final answer, and identify which of the multiple choices is the correct answer.

Feel free to study from books, and discuss with your instructor, but do *not* consult others (colleagues, professors, electronic forums…etc.) for this problem set!

I wish you well, wa assalam alaikum!!

Zain Yamani
Phys-306 Instructor

(*) slip it under my Office door, in 15-3100

Question-1:

Four 2-dimensional vectors are as follows A:(4,8), B:(-4,6), C:(-6,-10), and D:(5,5).

- Using graph paper, draw the four vectors.
- Graphically add the vectors A+B. Then add the resultant to C. Add the new resultant to D.
- Graphically add the vectors A+C. Then add the resultant to D. Add the new resultant to B.
- Add the vectors algebraically and compared your findings.

Question-2:

A charged particle has a mass of 2.0×10^{-4} kg. If it is held stationary by a downward 300 N/C electric field, what is the charge of the particle?

Question-3:

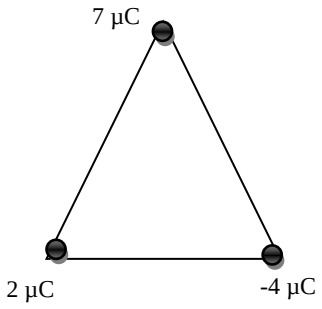
Prove that the Laplacian of 1/r is equal to $-4\pi\delta(r)$.

Question-4:

An electric dipole, consisting of charges q and –q and separated by a distance d, is placed perpendicular to a uniform electric field of magnitude 10^5 N/C. How much work must be applied by an external agent in order to align the dipole opposite to the field? q = 1 μC and d = 2 mm.

Question-5:

Three point charges of 2 μC, 7 μC, and - 4 μC are located at the corners of an equilateral triangle of side length 0.5 m (as shown in the below figure). Calculate the net force on the 7 μC charge. (Please draw the relevant forces on the figure).



Question-6:

Explain which one(s) of the below statements is(are) false:

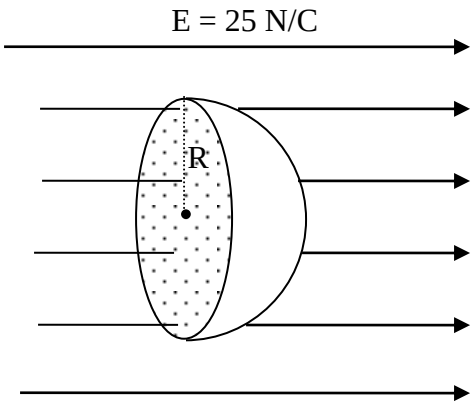
a- Life and physical laws would change if electrons where positively charged and protons where negatively charged.
b- Electric fields are vector fields.
c- The principle of superposition applies to electric fields as well as to electrostatic forces.
d- When you rub a plastic ruler with a cloth, it attracts small pieces of paper only if the pieces are charged to begin with. It will not attract neutral pieces of paper .
e- When an electric dipole is placed in a uniform field, the net force on the dipole is zero.

Question-7:

A thin insulating disc, of radius R, is uniformly charges with a surface density σ.
Find the electric field at a point which lies a distance "s" away, along the line perpendicular to the disc through its center.

Question-8:

If the constant electric field in the below has a magnitude E = 25 N/C, calculate the electric flux through the curved surface of the hemisphere (half a sphere of radius R = 5.0 cm). (Knowing that the electric field is perpendicular to the flat surface and that the hemisphere encloses no electric charges.)



Question-9:

What is the electric field between two parallel plate infinite planes of charge, one with a charge per unit area 6×10^{-7} C/m^2 and the other with charge per unit area 9×10^{-7} C/m^2?

Question-10:

Eight isolated identical spherical raindrops are each at a potential of 100 V at the surface, relative to the potential at infinity. They are combined together to make one spherical raindrop. What will the potential at the surface of the resulting drop be?