In-class problems, Mon Feb 17, 2020

22.1 22.2 electric field: definition, line, from a point charge

1. A test charge of +3pC is at point P. By measuring the force on the test charge, it's determined that there's a pre-existing electric field of 4 kN/C to the right at point P.

   The test charge is replaced by a -6pC test charge. What happens to the pre-existing electric field? It

   (a) is unaffected.
   (b) switches direction
   (c) gets stronger
   (d) B and C
   (e) changes, but we can't tell how.

2. In a lightning storm, a charged raindrop carrying $+10\mu$C of charge experiences an electrical force of 0.30N the $+z$ direction. Calculate the

   (a) electric field at this point.
   (b) force on a -5μC raindrop.

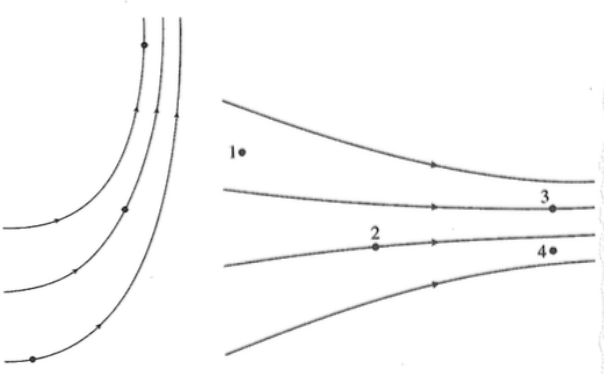
   For both, provide magnitude and direction. Note that fields of 10^2, 10^3 N/C are common. Fields of 3 MN/C will tear electrons from air molecules.

3. The electron in a hydrogen atom is 52.9pm from the proton. At this distance, what's the strength of the electric field due to the proton?

4. A point charge of $-10\mu C$ is at (-3, -1).

   (a) Sketch this problem. (b) Calculate its electric field at (2,2). Give a magnitude and direction, or components.
   (c) Determine the position (x,y) at which the electric field will be 36 kN/C pointing at -30^o.

5. Electric field lines in two regions of space are given below. Draw the electric field vectors at the dots. The length of the vector should indicate the relative strength of $\vec{E}$ at that point.



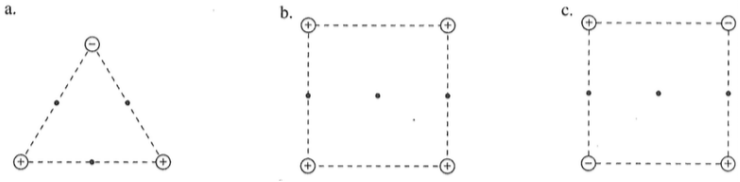
Due Tue Feb 12, 2020, beginning of class

22-2, 22-3 E from point charges, dipoles

Read 22.2, 22.3

1. Electric fields are vectors. They obey the *principle of superposition*. Write an equation that conveys the *principle of superposition* for electric fields.

2. For each figure, draw and label the net electric field vector, $\vec{E}_{\text{net}}$ at each of the points marked with a dot. Or, if appropriate, label the dot $\vec{E}_{\text{net}} = 0$. The lengths of your vectors should indicate the magnitude of $\vec{E}$ at each point.



3. What's an electric dipole? Describe it

   (a) in words (one sentence)
   (b) by sketching a picture.

   What's the electric field from a dipole? Give

   (c) an equation
   (d) a sketch of the field lines