Electric Field (contd)

• A **Field** is a physical quantity that has certain value at any point of physical space (x,y,z), and time, t. In other words, it's a function defined in physical space & time.

• **Electric Field** = electric force acting on a probe charge q, divided by q:

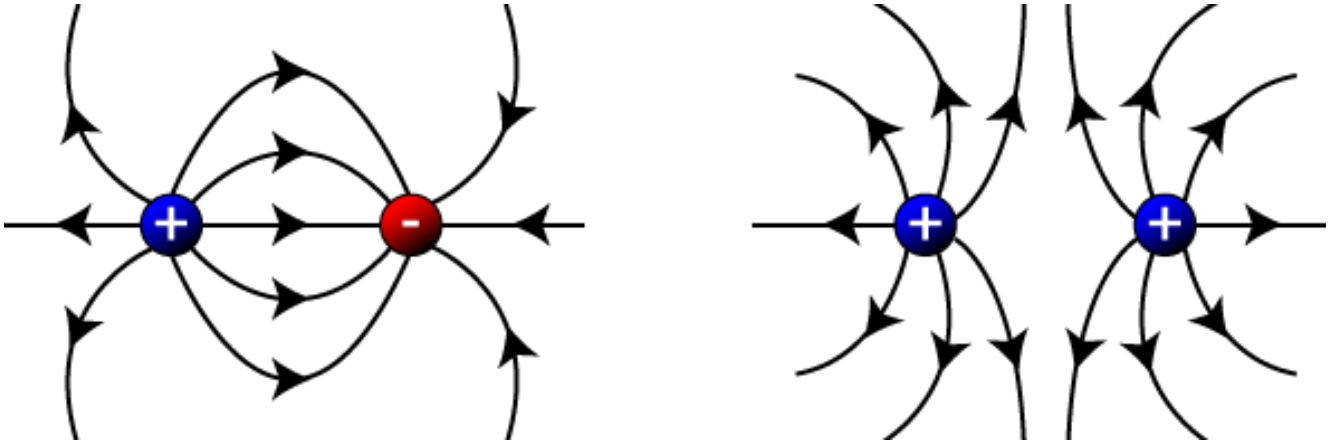
$$\vec{E} = \frac{\vec{F}_{elect}}{q}$$

• Once the electric field is known at certain point (x,y,z), one can find the electric force acting on any charge Q placed at that point:

$$\vec{F}_{elect} = Q\vec{E}$$

Electric Field Lines

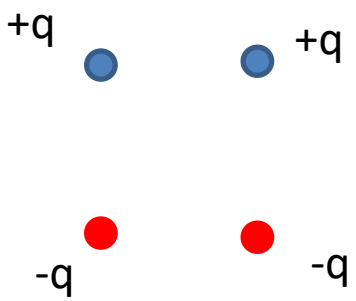
- The field line at any point of space is directed along the electric field
- Field lines start on positive charges, and terminate on negative ones
- Denser field lines = stronger field.



HOMEWORK

Problem 1 For the following cases, sketch electric field lines:

a)



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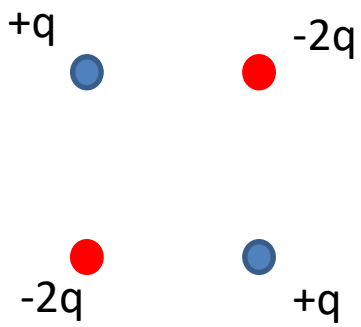
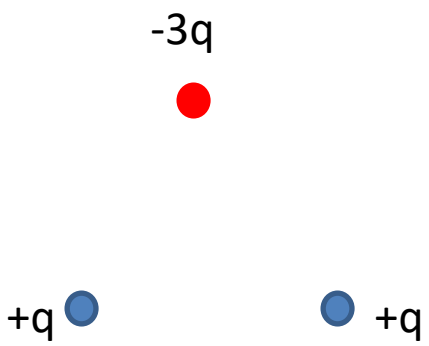
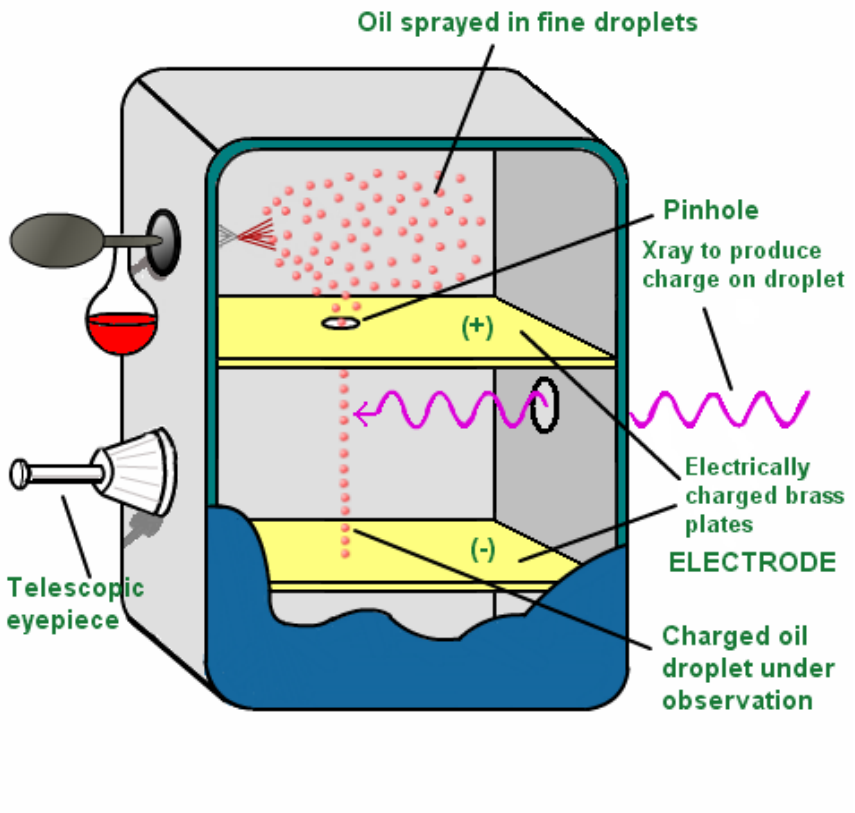


c)



Problem 2.

The figure shows an outline of the famous oil drop experiment by Millikan and Fletcher that was done at the University of Chicago in 1909-1913. The goal was to find the magnitude of electron's electric charge. In the experiment, tiny oil droplets were trapped between two electrodes. Electric field was used to balance gravity acting on them.



Imagine that a droplet of mass $m=10^{-11}$ g, that was originally completely neutral, lost exactly 10 electrons. What should be the magnitude of electric field needed to keep the droplet from falling? Include units in your answer. Charge of an electron is $e=1.6 \times 10^{-19}$C.