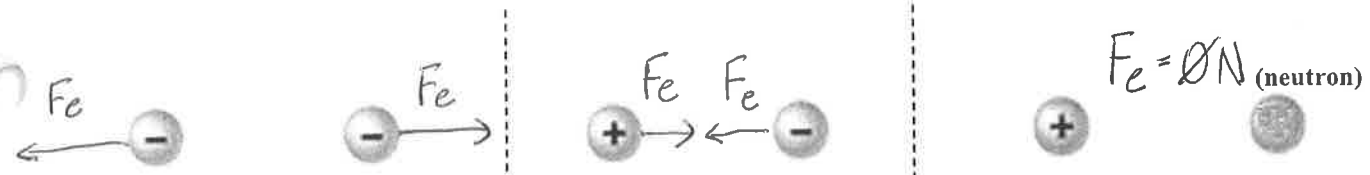
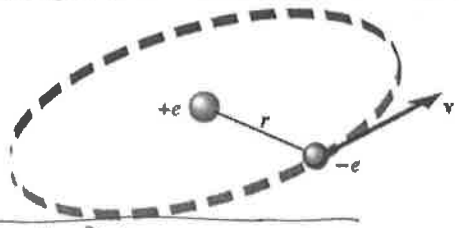
2. Sketch the directions of the electrostatic forces ~~and the gravitational forces~~ in each pairing below.



Ignore force of gravity when calculating electric force.

3. In the Bohr model of the hydrogen atom, the electron ($-e$) is in orbit about the nuclear proton ($+e$) at a radius of $r = 5.29\times10^{-11}$ m. Determine the speed of the electron, assuming the orbit to be circular.



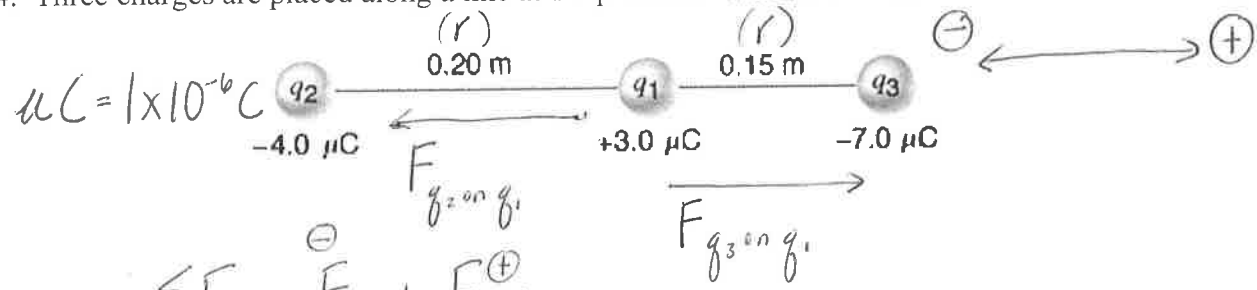
m = mass of electron

$\Sigma F_{in} = ma_c = \frac{mv^2}{r}$

$F_e = \frac{Kq_1q_2}{r^2} = \frac{mv^2}{r}$

$v = \sqrt{\frac{Kq_1q_2}{mr}} = \sqrt{\frac{(8.99\times10^9 \frac{Nm^2}{C^2})(1.6\times10^{-19}C)^2}{(9.11\times10^{-31}kg)(5.29\times10^{-11}m)}} = \boxed{2.2\times10^6 \frac{m}{s}}$

4. Three charges are placed along a line at the positions indicated. What is the net force on charge q_1?



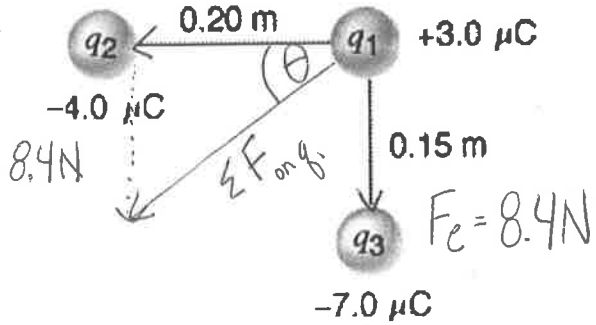
$\Sigma F_{q_1} = F_{2,1} + F_{3,1}$

$\Sigma F_{q_1} = \frac{Kq_2q_1}{r^2} + \frac{Kq_3q_1}{r^2} = \boxed{5.7N}$

(2.7N) + (8.4N)

$F_e = 2.7N$

5. The three charges are now placed at right angles, as shown. What is the net force on charge q_1?



$\Sigma F_{e \text{ on } q_1} = \sqrt{(F_{2,1})^2 + (F_{3,1})^2}$

$\boxed{\Sigma F_e = 8.8N}$

$\tan\theta = \frac{8.4N}{2.7N}$

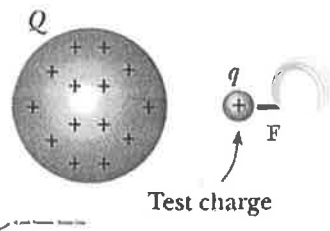
$\theta = 72°$

at 72° below horizontal

Electric Fields

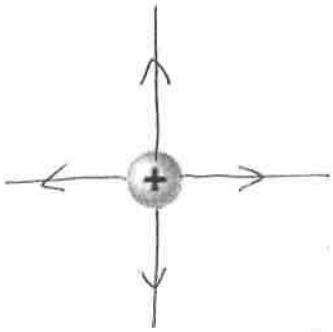
Electric field: A region in space surrounding a charged object in which a second charged object experiences an electric force.

Test charge: A small positive charge used to test electric fields. It's small enough that it's own charge does not distort the field it is testing.

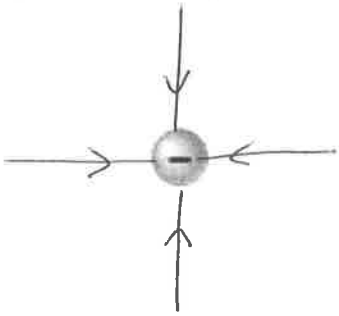


Electric Field Diagrams

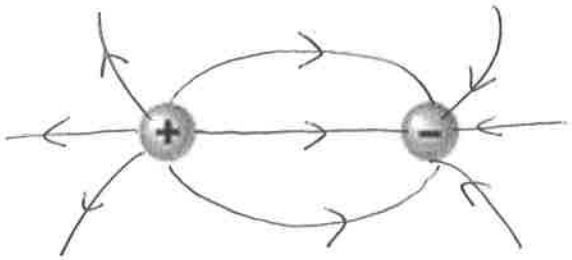
1. Electric field around a positively charged object



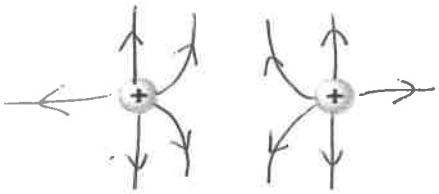
2. Electric field around a negatively charged object



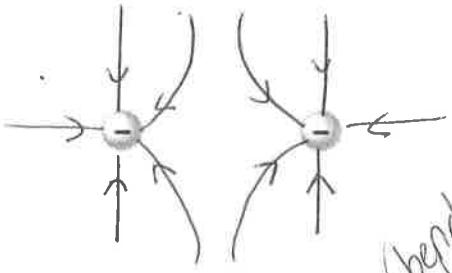
3. Electric field around unlike charges



4. Electric field around two positive charges

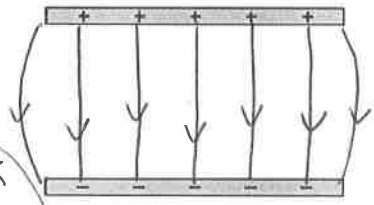


5. Electric field around two negative charges



6. Electric field between two oppositely charged parallel plates

$\vec{a}$ is constant



bends at edges

field is uniform between the plates so F_e is constant

Properties of Electric Field Lines

a) They show the direction of net force on a small positive test charge (out of positive, into negative).

b) They never cross since this would indicate that the resultant force is in two different directions at once.

c) The direction of the electric field at any point is tangent to the field lines

d) The density of the field lines is proportional to the strength of the field (density = intensity). The field is most intense where the field lines are most dense.