# XtraWrk – Chapter 16: Electrical energy and capacitance

16.1) An electron, initially at rest, is acted upon by a uniform electric field pointing in the +x direction with a magnitude of 375 N/C. The electron moves a distance of 3.20 cm due to the field.

a) How much work was done on the electron by the electric field?
b) What was the change in potential energy of the electron
c) What's the electron's velocity?

16. 3) For the sodium-potassium pump to work in a cell, a potential difference is required to move a positive sodium ion from the inside of the cell to the outside. If the potential difference between the inner and outer membranes of the cell is 90 mV, how much work is required to move that Na+ ion?

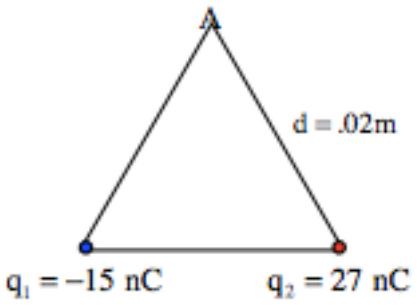
16.7) The plates in a parallel plate capacitor are 5.33 mm apart, and the potential difference between them if 600 V.

a) How big is the electric field between the plates?
b) If an electron was between the plate, how big a force would be exerted up on it?
c) If the electron was initially 2.90 mm away from the positive plate, how much work is required to move that electron to the negative plate?

16.8) An electron moving at $2.85 \times 10^7$ m/s required a potential difference to bring it to rest.

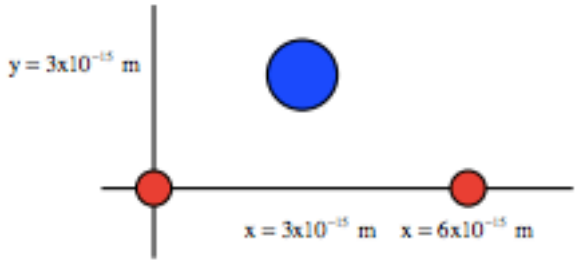
a) Calculate this "stopping potential" for an electron.
b) What if it was a proton, traveling at the same speed? Would the stopping potential change, and if so, would it be greater or smaller? Explain.
c) Derive an expression for the ratio of the stopping potential for a proton compared to an electron (that is, $\Delta V_p / \Delta V_e$ ) in terms of the mass of each object ($m_p$ and $m_e$).

16.12) Assuming an equilateral triangle of sides d = 0.020 m as shown here, calculate the electric potential at point A (the apex of the triangle) and point B (halfway between the two charges).



16.19) a) Calculate the electric potential energy in a system with two protons located 6 x $10^{-15}$ m apart

b) Now, an alpha particle (shown in blue; q = 2e and mass = 6.64 x $10^{-27}$ kg) is placed as shown. Calculate the electric potential energy in the system now.




c) What's the change in electric potential energy if the alpha particle is removed?
d) What's the speed of the alpha particle at infinity? (hint: use conservation of energy)
e) What if instead the alpha particle remains in place, and the protons are released from rest – calculate their speeds at infinity.

16.60) For the system shown here:

a) What's $q_1$'s electric potential at point P?
b) What's $q_2$'s electric potential at P?
c) What's the total electric potential at P?
d) What's the work required to move 2 microCoulomb charge from infinity to P?