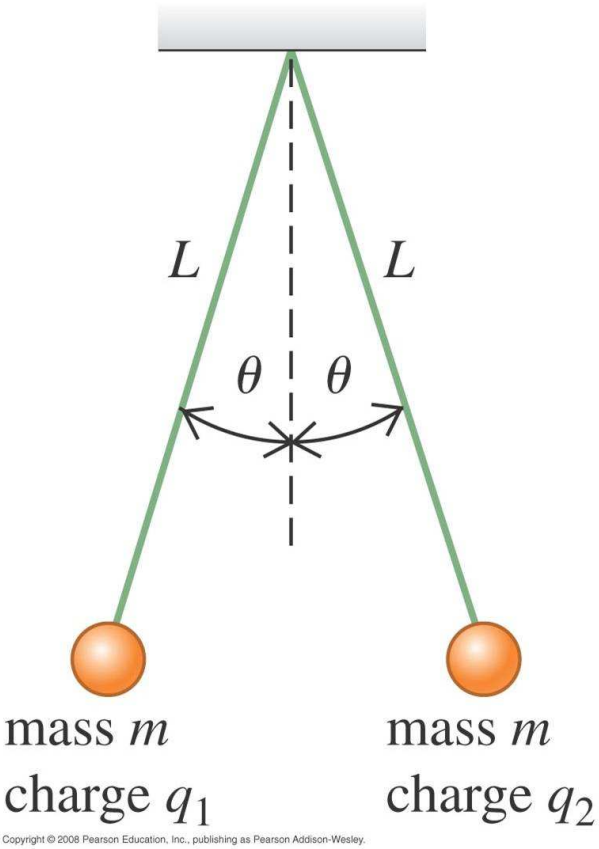
PHYS 161
Summer 2013
Homework Assignment #1
Due June 7

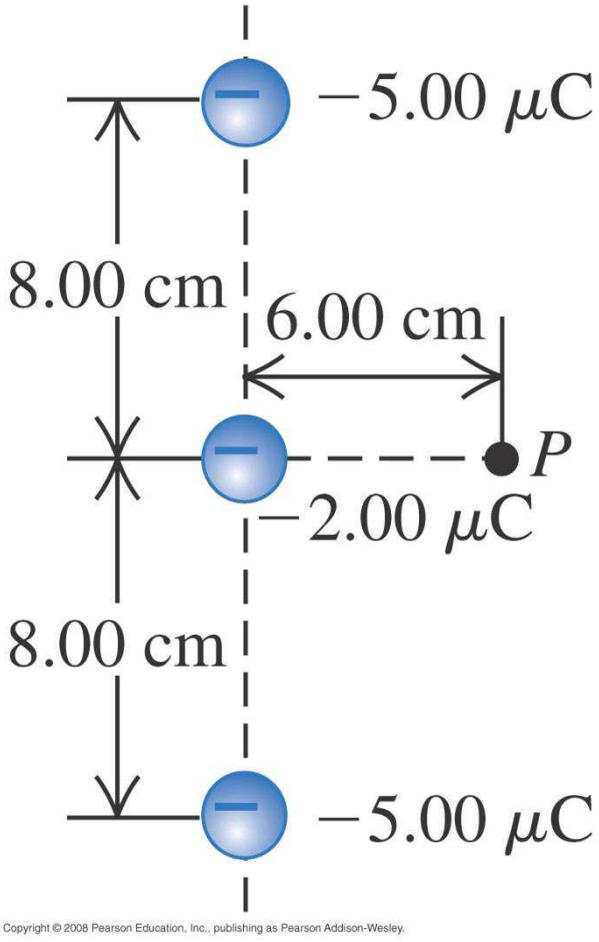
#1 **Electric Force Within the Nucleus** Typical dimensions of atomic nuclei are of the order of $10^{-15}\,m$ ($1\,fm$). If two protons in a nucleus are $2.0\,fm$ apart, find the magnitude of the electric force each one exerts on the other. Express the answer in newtons and in pounds. Would this force be large enough for a person to feel? Since the protons repel each other so strongly, why don't they shoot out of the nucleus?

#2 (a) What must the charge (sign and magnitude) of a $1.15\,g$ particle be for it to remain stationary when placed in a downward-directed electric field of magnitude $750\,N/C$? (b) What is the magnitude of an electric field in which the electric force on a proton is equal in magnitude to its weight?

#3 The two small spheres with mass $m = 25.0\,g$ are hung by silk threads of length $L = 1.50\,m$ from a common point (Fig. 21.44). When the spheres are given equal quantities of negative charge, so that $q_1 = q_2 = q$, each thread hangs at $\theta = 25.0°$ from the vertical. (a) Draw a diagram showing the forces on each sphere. Treat the spheres as point particles. (b) Find the magnitude of q. (c) Both threads are now shortened to length $L = 0.600\,m$, while the charges q_1 and q_2 remain unchanged. What new angle will each thread make with the vertical?



#4 Three negative point charges lie along a line as shown in Fig. 21.40. Find the magnitude and direction of the electric field this combination of charges produces at point P, which lies $6.00\,cm$ from the -2.00-μC charge measured perpendicular to the line connecting the three charges.



#5 **Operation of an Inkjet Printer** In an inkjet printer, letters are built up by squirting drops of ink at the paper from a rapidly moving nozzle. The ink drops, which have a mass of $1.0 \times 10^{-8}\, g$ each, leave the nozzle and travel toward the paper at $20\, m/s$, passing through a charging unit that gives each drop a positive charge q by removing some electrons from it. The drops then pass between parallel deflecting plates $2.5\, cm$ long where there is a uniform vertical electric field with magnitude $9.0 \times 10^4\, N/C$. If a drop is to be deflected $0.50\, mm$ by the time it reaches the end of the deflection plates, what magnitude of charge must be given to the drop?