Physics 251 Fall 09 Test 1 **Name:** _____

- Show all of your work.
- Read the entire exam before starting.
- Calculators are allowed on this exam.

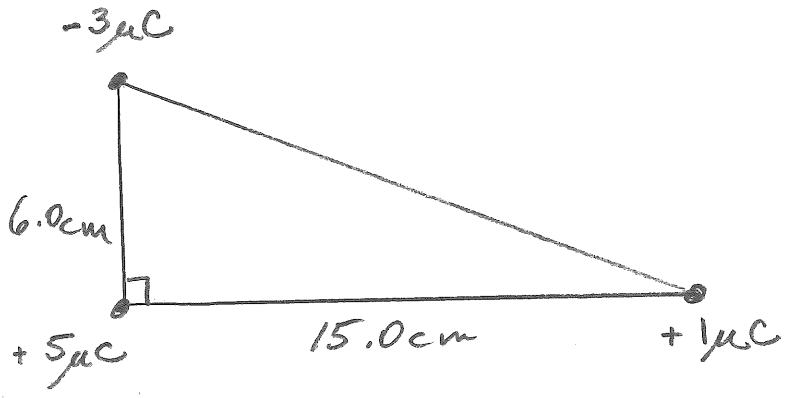
1. Nasa's new base on the moon has a clever experiment where two electrons are confined in a vertical arrangement. One electron is fixed at moon level and the other is free to move vertically. Assuming that the acceleration due to gravity on the moon is a constant. What is the distance between the two electrons?

$g_{moon} = 1.62\ m/s^2$

mass of electron $= 9.109 \times 10^{-31}$ kg

$r = 12.5m$

2. Three point charges are arranged according to the diagram. Determine the force on the 1.0 μC charge.



$\vec{F}_T = 1.12\,N \text{ @ } 20.3°$

3. Two point charges are separated by 2.0 m along a horizontal line. The charge on the left is $3q$. The charge on the right is $-q$.
   (a) What is the electric field at the midpoint of the charges?
   (b) Determine the point (other than infinity) where $\vec{\mathbf{E}} = 0$.
   (c) Explain your reasoning for part (b).

(b.) 2.73m

Physics 251 Fall 09 Test 1

4. A nonconducting charged rod extends from the origin to a point 3.0 m above the origin on the y axis. The rod carries a charge of $\lambda = \lambda_o\, y\, {}^{C}/_{\mathrm{m}}$. Set up the proper integral for the electric field at (0.0 m, 5.0 m).

$$E_y = k\lambda_o \int_0^{3m} \frac{y}{(5-y)^2}\, dy$$

5. Consider two concentric non-conducting spheres, one of radius 5.0 cm, the other of radius 10 cm. The inner sphere has a uniform surface charge that totals 3.0 μC. The outer sphere has a surface charge density of -4.00×10^{-5} C/m^2.

   (a) What is the magnitude and direction of the electric field at a point just *inside* the surface of the **outer** sphere?

   (b) What is the magnitude and direction of the electric field at a point just *outside* the surface of the **outer** sphere?

a.) $E = 2.7 \times 10^6 \frac{N}{C}$ Away from the center.

b.) $E = 1.8 \times 10^6 \frac{N}{C}$ Toward the center.