Physics 103 Quiz #10, Thursday (4/11/2013)
Show all work in order to obtain points for problems

Name:_____

1. (2 pts.) Two point charges, separated by 1.5 cm, have charge values of +2.0 μC, and –4.0 μC, respectively. What is the value of the mutual force between them? ($k_e = 8.99 \times 10^9$ N·m^2/C^2)

   a. 320 N
   b. 3.6×10^{-8} N
   c. 8.0×10^{-12} N
   d. 3.1×10^{-3} N

$$F = \frac{q_1 q_2 k}{r^2} = \frac{(2.0\times10^{-6}\,C)(-4.0\times10^{-6}\,C)\ 8.99\times10^{9}\ N\cdot m^2/C^2}{(1.5\times10^{-2}\,m)}$$

$$= -320$$

2. (4 pts.) About how many electrons are in 30 grams of water (H_2O)?

   a. 10^{25}
   b. 10^{23}
   c. 10^{21}
   d. 10^{19}

$MW = 18\,g/mole$

$$30g * \left(\frac{1\,mole}{18\,g}\right)(6.022\times10^{23}\ molecules/mole) * \left(2+8\right)\frac{elec}{molecule}$$

$$= 1.0\times10^{25}$$

3. (4 pts.) An electron with a charge value of 1.6×10^{-19} C is moving in the presence of an electric field of 400 N/C. What force does the electron experience? What is the velocity after 10 seconds (mass = 9.1 x10^{-31} kg)? Is this possible?

- $F = qE$ (magnitude)

$$= 1.6\times10^{-19}\,C * 400\,N/C = 6.4\times10^{-17}\,N$$

- $V_f = V_i + at$ $\quad V_i = 0$

$a = F/m$

$$V_f = (F/m)t = \left(\frac{6.4\times10^{-17}\,N}{9.1\times10^{-31}\,kg}\right) * 10\,sec$$

$\rightarrow 7.0\times10^{14}$ m/s not possible

$V > C$ speed of light