Physics 2220
Spring 2005
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FIRST MIDTERM

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Name:______________________________

Discussion Instructor (circle): Gillman Rodriguez Shepherd Webb

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REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

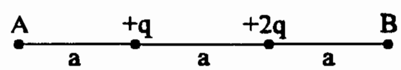
5p (a) Calculate the magnitude of the electric force between two electrons a distance 7.52×10^{-11} m apart.

$$F = k \cdot \frac{e^2}{r^2} = 4.07 \times 10^{-8} (N)$$

5p (b) A conducting sphere of radius 0.175 m is charged with a negative charge of 6.73×10^{-6} C. Calculate the potential at its surface.

$$V = k \cdot \frac{Q}{R} = -3.46 \times 10^{5} (V)$$

5p (c) For the arrangement shown, what is the potential difference V(B) - V(A)?



$$V(B) - V(A) = \frac{kq}{2a} (V) \quad \left[V(A) = \frac{kq}{a} + \frac{2qk}{2a} \quad V(B) = \frac{2kq}{a} + \frac{kq}{2a} \right]$$

5p (d) A very long, thin wire has a total charge of $Q = +1.57 \times 10^{-6}$ C uniformly distributed on its total length of 47.2 m. Calculate the magnitude of the electric field a distance 1.75 mm away from the center of the wire at a point nowhere near its ends. The wire has a radius of 1.00 mm.

$$E = \frac{\lambda}{2\pi\epsilon_0 r} = 3.42 \times 10^{5} (N/C), \quad \lambda = \frac{Q}{\ell}$$

5p (e) Calculate the coefficient involving the x^{12} term using the binomial expansion for $\frac{1}{(1-x^4)^{\frac{3}{2}}} = (1-x^4)^{-\frac{3}{2}}$

$$2.19 = \frac{35}{16} = \frac{1}{6}\left[\left(-\frac{3}{2}\right)\left(-\frac{3}{2}-1\right)\left(-\frac{3}{2}-2\right)\right](-1)$$