Physics 2321. Electricity and Magnetism

Quiz 4. Capacitance, Current **Name:** _____

Constants: $k = 9 \times 10^9$, $\epsilon_0 = 8.85 \times 10^{-12}\ C^2 N^{-1} m^{-2}$

1. **(2pt) Here are the formulae for the capacitance of four common capacitors:**

   1. $C = \epsilon_0 \frac{A}{d}$ **2.** $C = \frac{ab}{k(b-a)}$ **3.** $C = \frac{l}{2k_e \ln(b/a)}$ **4.** $C = \frac{a}{k}$

   - **Which is the capacitance for a single sphere?** _____
   - **Which is the capacitance for nested spheres?** _____
   - **Which is the capacitance for nested cylinders?** _____
   - **Which is the capacitance for parallel plates?** _____

2. **(1pt) Find the capacitance of a parallel plate capacitor with area 0.0009 m^2 and plate separation .01 m.**

3. **(1pt) How much energy is stored in a cylindrical capacitor with capacitance 8 pF when a voltage of 10 V is applied? (1pF = 10^{-12} F)**

   (a) 8.0×10^{-12} **J** **(b)** 2.5×10^{-10} **J** **(c)** 4.0×10^{-10} **J** **(d)** 1.25×10^{-10} **J** **(e)** 4.1×10^{-9} **J**

4. **(2pt) If the charge (in C) passing a point in a circuit is given by $q(t) = 5t^2 + 3$, then ...**

   (a) how much charge passes that point between $t = 0$ and $t = 3$ seconds?

   (b) What is the instantaneous current at $t = 2$ seconds?

5. **(1pt) What is the average current density, J, in a wire of cross-sectional area $A = 10^{-6}$ m^2 when carrying a current $I = 3$ A? (Include units.)**

6. **(1pt) Copper contains 8.4×10^{28} free electrons/m^3. A copper wire of cross-sectional area 7.4×10^{-7} m^2 carries a current of 1 A. The electron drift speed is approximately:**

   (a) 3×10^8 **m/s** **(b)** 10^3 **m/s** **(c) 1 m/s** **(d)** 10^{-4} **m/s** **(e)** 10^{-23} **m/s**