**Homework Assignment #1 (due in class Wed 9/4)**

Instructions:
■ You may work with other students (in fact, I recommend that) but do not copy solutions. Write your own solutions in your own words.
■ Solutions should be complete but concise, and legible.
■ To aid in grading, draw a box around your final answer, using red pencil.

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1-1. How many electrons are in a liter of water?

1-2. What are the **_exact_** values of $\epsilon_0$ and $\mu_0$? Also, what are the *decimal values* accurate to 4 significant figures?

1-3. (a) Draw a picture of an isolated electron at rest.

(b) Draw a picture of an isolated electron that is moving with constant velocity $\vec{v} = 0.9$ c $\hat{e}_z$

1-4. Consider a metal sphere with radius a centered at the origin. The charge of the sphere is 0, and there is a point-like charge q at (x,y,z) = (2a,0,0).
(a) Determine the electric field at (0,0,2a).
(b) Determine the electric field at (−2a,0,0).

Express the answers in the form $\vec{E} = \frac{q}{4\pi\epsilon_0 a^2} (f_x, f_y, f_z)$.

1-5. Consider a magnetostatic system with current density $\vec{J}(\vec{x})$. Assume $\vec{J}(\vec{x}) = 0$ outside a finite volume $\Omega$. Determine an integral formula for $\vec{A}(\vec{x})$, valid for all $\vec{x}$