

**Physics 217**  
**Problem Set 3**  
**Due: Friday, September 21, 2018**

1. (10 points) Make a plot of de Broglie wavelength against kinetic energy for (a) electrons and (b) protons. Restrict the range of energy values to those in which classical mechanics applies reasonably well (so the maximum in each plot should correspond to about 5% of the rest energy  $m_0c^2$ ).
2. (10 points) (a) Prove that Planck's constant has the dimension of angular momentum. (b) Compare the gravitational attraction of an electron and a proton in the ground state of a hydrogen atom to the Coulomb attraction. Are we justified in ignoring the gravitational force?
3. (20 points) In the ground state of the hydrogen atom, according to Bohr's model, what are (a) the quantum number, (b) the orbit radius, (c) the angular momentum, (d) the linear momentum, (e) the angular velocity, (f) the linear speed, (g) the force on the electron, (h) the acceleration of the electron, (i) the kinetic energy, (j) the potential energy, and (k) the total energy? How do quantities (b) and (k) vary with the quantum number?