Quals questions, L. Hesselink, 2012

1. Please consider a two-slit diffraction problem. (a picture of the set up is provided).
   a. Sketch the diffraction pattern that results.
      i. Describe the solution in mathematical terms
2. Now let the slit size become significantly less (say 10x) than the wavelength of the illumination light
   a. Describe the changes in the diffraction problem between case 1 and 2
3. In case 2, what is the effect of the polarization of the light source?
4. Now consider shortening the wavelength, i.e. use electrons
5. What is the wavelength of an electron for a given energy?
6. What happens when a lot of electrons flow through a looped wire?
   a. Calculate the magnetic field some distance R away from the loop
7. How can we create a bundle of closely spaced parallel B-field lines?
8. Describe the diffraction pattern that results when we use electrons of certain energy in set up of question 2.
9. We now place a small bundle of magnetic field lines close to the center between the slits.
   a. What will be the effect on the diffraction pattern? Why?