Phys 214 **Quiz 3-2 [20 points]**

Buckyballs are soccerball-shaped molecules consisting of 60 carbon atoms (mass of single C atom = 12.0 amu, 1 amu = $1.67 \cdot 10^{-27}$ kg) with an approximate diameter of 1nm. A beam of buckyballs with each molecule carrying a kinetic energy of 0.80 eV is normally incident on a grating with a slit width of 10 nm. We detect these molecules with suitable equipment placed at a distance of 1.5m behind the grating.

1) [4 points] What is the wavelength λ of these buckyballs? How does it compare to their diameter?

2) [4 points] How far do we have to move the detector off the forward direction to find the first maximum of intensity?

3) [3 points] How would the intensity distribution change if our incident beam were so weak that no more than a single buckyball passed through the grating at a time? Explain your answer.

4) [5 points] Now our beam has regular intensity again. Suppose some further detectors were able to track through which of the grating slits each buckyball is passing through. How does the detected intensity distribution change when we turn this tracking device on? Justify your answer.

5) [4 points] If a photon had the same energy as a buckyball of momentum p, what would be its wavelength λ_{ph}? Give an algebraic answer in terms of p, m_{C60}, h, and c only.