Physics 214 **Quiz 3-1 [20 points]**

A beam of electrons is accelerated through a potential of 1 Volt. This beam is incident on a screen with two slits separated by 1mm and detected on a screen 1m behind the slits.

1) [5 points] Find the de Broglie wavelength of the electrons.

$\lambda = h / (2 m_e E)^{0.5} = 1.23*10^{-9}$ m

2) [6 points] Sketch the pattern of electrons observed on the screen. What is the distance between maxima?

Sin^2 pattern, $y=L \lambda /d = 1.23*10^{(-6)}$ m

3) [4 points] If the electron beam were replaced by a beam of neutrons having the same kinetic energy, how would the observed pattern change?

Ratio of masses mn/me = 1836.
So pattern shrinks by a factor of 1/(1836)^(1/2) = 0.023
Alternatively: ynew = 2.86 *10^(-8) m

4) [5 points] Now imagine that the beam of electrons is replaced by a beam of xrays having the same momentum. What is the energy of the xrays (give your answer in eVs)?

Eph = p c = h c/ λ = c (2 me E)^(1/2) = 1.62 *10^(-16) J = 1011 eV