13. Diffraction from crystals

Problems

13.1. Pure Cu has the f*cc* structure, with a lattice constant of $a = 0.360\ \text{nm}$.

The electron-scattering amplitude (form factor) at energy E and scattering parameter $s = g/2$ is approximately:

$$f(s) = \left(1 + \frac{E}{m_0 c^2}\right) \cdot A \cdot \mathrm{e}^{-B \cdot s}$$

The parameters for this element are *A*=0.570 nm, *B*=0.281 nm.

The Fourier components of the structure function are $U_{hkl} = F_{hkl}/(\pi v)$, where v is the unit-cell volume. The extinction distance is $\xi_{hkl} = 1/(\lambda U_{hkl})$.

Create a table as shown below containing values at $E = 200\ \text{KeV}$ for each reflection listed in the first column:

$hk\ell$	i) g_{hkl} (nm^{-1})	ii) $f(s)$ (nm)	iii) $\lvert U_{hkl}\rvert$ (nm^{-2})	iv) $\lvert \xi_{hkl}\rvert$ (nm)
a) 111				
b) 200				
c) 220				

Please show work and organize your answers.