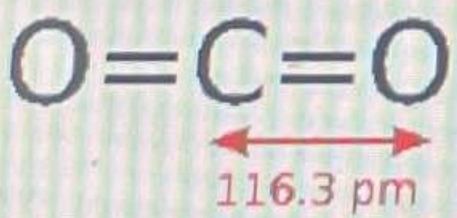
2. (20 points) Carbon dioxide is a linear molecule shown below



For a carbon dioxide that is positioned along the x axis of the space, we can write out the coordinates of each atom as:

O1 (first oxygen): $\vec{r}_{o1}$ =(-a, 0, 0)
C (carbon): $\vec{r}_{C}$ =(0, 0, 0)
O2(second oxygen): $\vec{r}_{o2}$ =(a, 0, 0)
Here a=1.16 Å
(You can use the symbols for 1) to 3) for your solutions. For question 4), please have the numerical value.)

1) (5 points) Please write the generalized scattering length density function, $\rho(\vec{r})$, of this molecule. (Express the coherent scattering length function using the δ function form.) (The coherent scattering length of C, O are b_C and b_O respectively. (There is no need to find the numerical value of b_C and b_O.)
2) (5 points) Please find the shape function, $F(Q)$, using the 3D Fourier transformation $F(\vec{Q}) = \int \rho(\vec{r}) e^{-i\vec{Q}\cdot\vec{r}}$
3) (5 points) Calculate the static scattering function of this molecule, $I(\vec{Q})$.
4) (5 points) evaluate the numerical value of $I(\vec{Q} = 0)$.