Problem 2

$$\frac{2 \cdot \frac{4\pi K_F^3}{3}}{\left(\frac{2\pi}{L}\right)^3} = N \qquad K_F^3 = \frac{N}{V} 3\pi^2$$

2 from spin degeneracy

$\frac{N}{V}$ = number of electrons per primitive cell

$$\frac{N}{V} = \frac{1}{a^3}$$

$$\sqrt[3]{K_F^3} = \sqrt[3]{\frac{1}{a^3} 3\pi^2} = 0.773 \text{ Å}^{-1} \quad \text{when } a = 4 \text{ Å}$$

For a S.C. lattice the 1st B.Z. has sides of $\frac{2\pi}{a}$

$$\frac{K_F}{\frac{2\pi}{a}} = 0.98$$

This means the free electron F.S. just barely misses the B.Z. boundary — but if we have a weak periodic potential this will cause the F.S. to form a "neck" at the closest approach to the B.Z.