1 Pressure and entropy of a degenerate Fermi gas

(a) Show that a Fermi electron gas in the ground state exerts a pressure

$$p = \frac{(3\pi^2)^{\frac{2}{3}}}{5}\frac{\hbar^2}{m}\left(\frac{N}{V}\right)^{\frac{5}{3}} \tag{1}$$

In a uniform decrease of the volume of a cube every orbital has its energy raised: The energy of each orbital is proportional to $\frac{1}{L^2}$ or to $\frac{1}{V^{\frac{2}{3}}}$.

(b) Find an expression for the entropy of a Fermi electron gas in the region $kT \ll \varepsilon_F$. Notice that $S \to 0$ as $T \to 0$.