Assignment II. solution.

2D electron gas. density $10^{11}\ cm^{-2}$.

(a): p_F $\quad 2 \cdot \dfrac{\pi p_F^2}{(2\pi\hbar)^2} = n_{2D} = 10^{11}\ cm^{-2}$

$$p_F = (2\pi \cdot 10^{11}\ cm^{-1})^{1/2}\ \hbar = 8.35 \times 10^{-22}\ g\ cm/sec$$

$$\hbar = 1.054 \times 10^{-27}\ g \cdot \frac{cm^2}{s}$$

(b) $E_F = p_F^2/2m$ $\quad m = 9.1 \times 10^{-28}\ g$ $\quad T_F = \dfrac{E_F}{k_B}$

$= 3.8 \times 10^{-16}\ erg = 2.38 \times 10^{-4}\ eV$ $\quad = 2.77\ K$

(note electron charge $= 1.6 \times 10^{-19}$ Coulomb

$1\ eV = 1.6 \times 10^{-19}\ J = 1.6 \times 10^{-12}\ erg$)

$k_B = 1.38 \times 10^{-16}\ erg/K$

(c) density of states per spin =

$$N(\varepsilon): \quad \frac{2\pi p\,dp}{(2\pi\hbar)^2 d\varepsilon} = \frac{m}{2\pi\hbar^2} : \quad 1.3 \times 10^{26}\ cm^{-2} erg^{-1}$$

$$2.08 \times 10^{14}\ cm^{-2} eV^{-1}$$

check: $\quad 2N(\varepsilon) \cdot E_F = n_{2D}$

* advice: always check your dimension