2.8 According to classical physics, the average energy of an electron in an electron gas at thermal equilibrium is $3kT/2$. Determine, for $T = 300$ K, the average electron energy (in eV), average electron momentum, and the de Broglie wavelength.

Given, $K.E. = 3k_B T / 2 = 3(8.617333\times10^{-5}\text{ eV/K})300\text{K} / 2$ $\Rightarrow$ **$K.E. = 0.038778$ eV**

From classical physics, $K.E. = p^2/2m$ $\Rightarrow$

$$p = \sqrt{2m_0(K.E.)} = \sqrt{2(9.1093837\times10^{-31})0.038778(1.6021766\times10^{-19})}$$

$\Rightarrow$ **$p = 1.06392\times10^{-25}$ kg-m/s**

Per (2.3), the deBroglie wavelength is

$$\lambda = \frac{h}{p} = \frac{6.62607015\times10^{-34}}{1.06392\times10^{-25}} \quad \Rightarrow \quad \textbf{$\lambda = 6.2280\times10^{-9}$ m = 6.228 nm = 62.28 Å}$$