Домашняя работа №6

№6.221

Дано:
$T = 0$
$\frac{1}{2}E_{max} \div E_{max}$

Найти:
$\frac{n(E)}{n}$ - ?

Решение:

$$E_{max} = \frac{\hbar^2 (3\pi^2 n)^{2/3}}{2m} \text{ — энерг Ферми}$$

$$dn(E) = \frac{1}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} \sqrt{E}^{\frac{1}{2}} dE$$

$$n(E) = \frac{1}{2\pi^2}\cdot\left(\frac{2m}{\hbar}\right)^{3/2} \int\limits_{\frac{1}{2}E_{max}}^{E_{max}} \sqrt{E}^{1} dE =$$

$$= \frac{1}{2\pi^2}\cdot\left(\frac{2m}{\hbar^2}\right)^{3/2}\cdot\frac{2}{3}\cdot E_{max}^{3/2}\left(1 - \left(\frac{1}{2}\right)^{3/2}\right)$$

Своб. e: $n = \frac{1}{3\pi^2}\left(\frac{2mE_{max}}{\hbar^2}\right)^{3/2}$

$$\frac{n(E)}{n} = \left(1 - \left(\frac{1}{2}\right)^{3/2}\right) \approx 0{,}65 \Rightarrow 65\,\%$$

№ 6.223

Дано:
$T_{медь}$

Найти:
T - ?

Решение:

$$F(E) = \begin{cases} \dfrac{\sqrt{2}\, m_0^{3/2}}{\pi^2 \hbar^3}\sqrt{E}, & E < E_F(0) \\ 0, & E > E_F(0) \end{cases}$$

$$\langle E \rangle = \frac{\int_0^\infty E \cdot F(E)\, dE}{\int_0^\infty F(E)\, dE} = \frac{\int_0^{E_F} E^{3/2}\, dE}{\int_0^{E_F} \sqrt{E}\, dE} = \frac{3}{5} E_F$$

$$\langle E \rangle = \langle E \rangle_{кл} \Rightarrow \frac{3}{5} E_F = \frac{3}{2} kT$$

$$\Downarrow$$

$$T = \frac{2}{5} \cdot \frac{E_F}{k} \approx 3 \cdot 10^4 \text{ K}$$