固物 2018 期末答案

Deschain

2022 年 6 月 15 日

1.

(1) ①X 射线衍射/中子衍射/电子衍射②中子非弹性散射/拉曼散射/布里渊散射/光子非弹性散射/X 射线散射/X 射线衍射（写出一种即可）

(2) ①电子的自旋磁矩②电子的轨道磁矩③电子的感生磁矩④铁磁性⑤亚铁磁性⑥反铁磁性⑦ 正⑧负

(3) ①匀加速②晶格

(4) ①迁移率②载流子浓度③总掺杂

(5) ①$[-\frac{\pi}{2a},\frac{\pi}{2a}]$②$\sqrt{15}:1$

(6) ①$24N_A$②$16N_A$③$8N_A$④$\frac{4\pi}{G}$

(7) ①$-\frac{A}{r^6}$②$\frac{B}{r^{12}}$③$\sqrt[6]{\frac{2B}{A}}$④$-\frac{NA^2}{8B}$

(8) ①$4.14\times10^{-15}J$②$8.48°$

(9) ①$38.4cm/\Omega(\mu_n=300,\mu_p=150)$

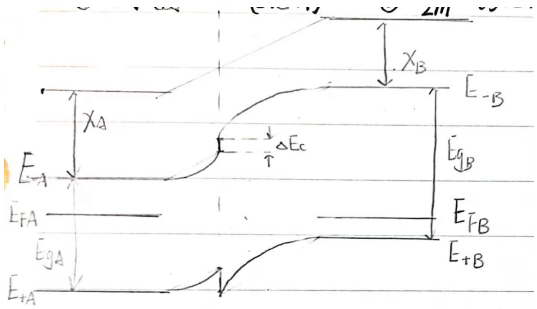
(10) ①$-1.28\times10^{-5}m^3/C$②$4.88\times10^{23}m^{-3}$

(11) ①$1.43\times10^{-24}m/s$②$2.78\times10^{-15}$③$3.98\times10^{-39}$

(12) ①独立②统一

(13) ①球面②$(3\pi^2n)^{\frac{1}{3}}$③$\frac{\hbar^2}{2m}(3\pi^2n)^{\frac{2}{3}}$④略低

2.)



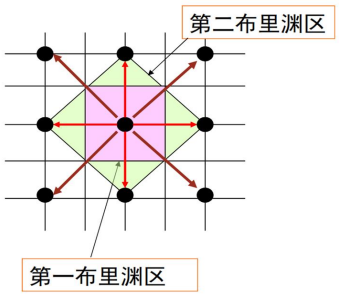
$$\Delta E_C=\chi_A-\chi_B=0.17eV$$

$$\Delta E_V=|\chi_A+E_{g_A}-(\chi_B+E_{g_B})|=0.3eV$$

$$V_D=|\frac{1}{e}(E_{F_A}-E_{F_B})|=0.3V$$

3.

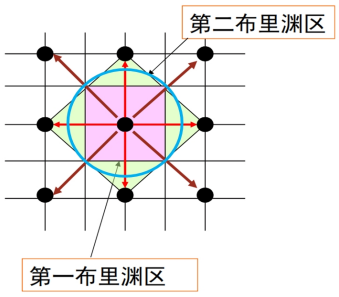
(1)



(2)

$$k_F = \sqrt{2\pi n} = \sqrt{\frac{\pi}{2A^2}}$$

(3)



4.

(1)

$$n_{iSi} = (N_- N_+)^{\frac{1}{2}} e^{-\frac{Eg_{Si}}{2k_B T}} = \frac{2}{h^3}(2\pi k_B T)^{\frac{3}{2}}(m_n^* m_p^*)^{\frac{3}{4}} e^{-\frac{Eg_{Si}}{2k_B T}} = 9.40 \times 10^{11} cm^{-3} < N_D$$

$$n_{iGe} = (N_- N_+)^{\frac{1}{2}} e^{-\frac{Eg_{Ge}}{2k_B T}} = \frac{2}{h^3}(2\pi k_B T)^{\frac{3}{2}}(m_n^* m_p^*)^{\frac{3}{4}} e^{-\frac{Eg_{Ge}}{2k_B T}} = 2.15 \times 10^{14} cm^{-3} > N_D$$

(2) Si 可以形成 N 结

(3)

$$V_D = \frac{1}{e}(E_{Fn} - E_{Fp}) = \frac{k_B T}{e} ln(\frac{N_D N_A}{n_{iSi}^2}) = 0.3745V$$

5.

(1)

$$W(x) = \sum V_n e^{j\frac{2\pi n}{a}x}, V_n = \frac{1}{a}\int_{-\frac{a}{2}}^{\frac{a}{2}} W(x) e^{-j\frac{2\pi n}{a}x} dx = \frac{2V_0}{a} cos(\frac{2\pi n b}{a})$$

$$V_{g_1} = |2V_1| = \frac{4V_0}{a} cos(\frac{2b}{a}\pi), V_{g_2} = |2V_2| = \frac{4V_0}{a} cos(\frac{4b}{a}\pi)$$

(2) $a > 4b$ 不是导体，$a = 4b$ 是导体。

(3) $a = 8b$