Fundamentals of Nanoelectronics, II: Energy Band Model

Prof. Supriyo Datta

L2.2 Quiz

Answers

2.2. E(p) or E(k) relations

2.2a. The velocity $n(E)$ is ***always*** related to the momentum $p(E)$ by the relation

(a) $n = \dfrac{p}{m}$

(b) $n = \dfrac{p^2}{2m}$

(c) $n = n_0$ (constant independent of p)

(d) $n = \sqrt{\dfrac{2p}{m}}$

(e) None of the above

$n = \dfrac{dE}{dp}$, actual relation between velocity and momentum depends on energy-momentum relation. Parabolic E(p) gives choice (a).

2.2b. A material with an energy momentum relation $E(p) = E_c + K\,p^{a}$, has a velocity $n(E)$ (d: number of dimensions, K: positive constant)

(a) $n(E) \sim (E - E_c)^{1+(d/a)}$

(b) $n(E) \sim (E - E_c)^{1+(1/a)}$

(c) $n(E) \sim (E - E_c)^{1-(1/a)}$

(d) $n(E) \sim (E - E_c)^{1-(d/a)}$

(e) none of the above

$$n(E) = \frac{dE}{dp} = aK\,p^{a-1} \sim (E - E_c)^{(a-1)/a}$$