### 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) \( n = \frac{p}{m} \)

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

(c) \( n = 0 \) (constant independent of \( p \))

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

(e) None of the above

\[
\frac{dE}{dp} \quad \text{. 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 \( E(p) = E_c + Kp^d \) has a velocity \( n(E) \) (\( d \): number of dimensions, \( K \): positive constant)

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

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

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

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

(e) none of the above

\[
(E) = \frac{dE}{dp} = Kp^{1-(1/)} \sim (E - E_c)^{1+(1/)}
\]