Answer on Question #84469 - physics - Thermodynamics

1.A square lattice has a side of 3.2 Å. Calculate the momentum and energy of an electron whose wave terminates at the boundary of the first Brillouin zone.

Answer:

Calculate the energy of the free electron by the relation as follows:

$$E = \frac{h^2\pi^2}{ma^2}$$

Here , h is the plank constant , m is the mass of electron and a is the side of lattice.

$$E = \frac{(6.62 \times 10^{-34})^2(3.14)^2}{(9.1 \times 10^{-31})(3.2 \times 10^{-10})^2}$$

$E = 4.63 \times 10^{-17}$ joule

Calculate the momentum of electron by the relation as follows:

$$P = \sqrt{2m(E)}$$

$$P = \sqrt{2(9.1 \times 10^{-31})(4.63 \times 10^{-17})}$$

$$P = \sqrt{126.4 \times 10^{-48}}$$

$P = 11.24 \times 10^{-24}$ kg-m/s

Answer:

$E = 4.63 \times 10^{-17}$ joule

$P = 11.24 \times 10^{-24}$ kg-m/s