

Visualize free electrons moving through a crowded medium. They collide with the atoms along the way.

As the temperature increases, what will happen to the average collision time,  $\tau$ ?

What will happen to the resistivity,  $\rho$ ?

- 1)  $\tau$  increases, and  $\rho$  increases.
- 2)  $\tau$  decreases, and  $\rho$  increases.
- 3)  $\tau$  increases, and  $\rho$  decreases.
- 4)  $\tau$  decreases, and  $\rho$  decreases.

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When the temperature is increased, the atoms in the medium are “vibrating” with faster average speed. Free electrons will collide with atoms more frequently. So the average collision time  $\tau$  is decreased.

The resistivity  $\rho = \frac{m}{n q^2 \tau}$ ; i.e.,  $\rho$  is inversely proportional to  $\tau$ . As the collision time decreases, resistivity increases.

Answer 2.