For an ohmic conductor, we have

$$V_{\text{drift}} = a\,\tau,\ a = \frac{q\,E}{m},\ \text{and}\ J = n\,q\,v_{\text{drift}}.$$

So the drift speed or the current density is proportional to E. This relation holds only if τ is strictly constant.

Estimate how much will τ be changed, if v_{drift} is doubled, for a typical case where the average thermal speed is $v_{\text{th}} \approx 10^3\,\text{km/s}$, and average drift speed, $v_{\text{drift}} \approx 10^{-4}\,\text{m/s}$.

1) It increases by more than 0.01%.

2) It stays essentially the same; *i.e.*, the change is less than 0.01%.

3) In decreases by more than 0.01%.

Based on thermo energy considerations the reader should convince himself/herself that the percentage of the maximum change in in v is less than

$\frac{2\,v_{\text{drift}}}{v_{\text{th}}} = \frac{2 \times 10^{-4}}{10^{6}} = 2 \times 10^{-8}\%$. This is less than 0.01%.

Answer 2.

27.05-01˙Average˙Collision˙Time 2004-3-24