Tutorial problems and questions

1. Given $D_0 = 190 \times 10^{-6}$ ms^2 and Q = 179.7 kJ/mol for self-diffsion in pure nickel, calculate the self-diffusivity in pure nickel at 300, 700 and 1200 K.

   Answer

   Using Eq. 11, we obtain
   D(300) = 3.8$\times$ 10^{-57} m^2/sec
   D(700) = 2.6 $\times$ 10^{-25} m^2/sec
   D(1200) = 1.3 $\times$ 10^{-16} m^2/sec

   Thus, we can see that diusional processes are extremely slow at room temperature in Nickel.

2. The following is the data on melting temperature, D_0 and Q (for self-diffusivity) for a few fcc metals. Calculate the slef-diffusivity in these metals at their respective melting temperatures.

   Nickel: 1726 K, 190×10^{-6}6 m^2s^{-1}, 279.7 kJ/mol

   Copper: 1356 K, 31×10^{-6}6 m^2s^{-1}, 200.3 kJ/mol

   Silver: 1234 K, 40×10^{-6} m^2s^{-1}, 184.6 kJ/mol

   Answer

   Again using Eq. 11, we obtain
   D(Tm) of nickel: 6.5 $\times$ 10^{-13} m^2/sec
   D(Tm) of copper: 6.0$\times$ 10^{-13} m^2/sec
   D(Tm) of copper: 6.1 $\times$$10^{-13}$ m^2/sec

   Thus, we can see that the diusivities become more or less a constant at the melting temperature for these metals.