1. See Problem 5 in Problem Set 8 Solutions.

3a. Assuming Random Walk \( < R^2 > = n l^2 \)
   i). \( < R^2 > = n l^2 \Rightarrow f = 1 \). Random Walk. Jumps not correlated.
   ii). \( < R^2 > = 0 \Rightarrow f = 0 \Rightarrow \) Jumps completely correlated.
   iii). \( n l^2 < R^2 > n^2 l^2 \ldots f > 1 \). Future jumps are biased by prior jumps.

4. 

   Diffusion mechanism is temperature dependent. At 150°, you are in extrinsic rather than intrinsic regime. Grain boundaries, defects increase rate of diffusion.

5. 

   \[ \Delta g_b = -2000 \text{J/mol} \]
   \[ \gamma = 100 \text{mJ/m}^2 \]
   \[ \Gamma_c = \frac{-2 \gamma}{\Delta g_B} \]
   \[ \Delta g_B = -2000 \text{J/mol} \times \frac{1 \text{mole}}{6.02 \times 10^{23} \text{atoms}} \times \frac{4 \text{atoms}}{1 \text{ unit cell}} \times \frac{1 \text{ unit cell}}{(3.8 \times 10^{-10})^3} = -2.42 \times 10^8 \text{J/m}^3 \]
   \[ \Gamma_c = \frac{-2(100 \times 10^{-3})}{-2.42 \times 10^8 \text{J/m}^3} = 8.3 \times 10^{-10} \text{m} \]
   \[ \Delta G_c = \frac{16 \pi \gamma^3}{3 \Delta g_B^2} = 2.9 \times 10^{-19} \text{J} \]
   \[ \# \text{ Atoms} = 4 \times \left[ \frac{4 \pi \Gamma_c^3}{a^3} \right] = 174 \text{ atoms} \]
   \[ \Delta G_c = 2.9 \times 10^{-19} \text{J} \]
   \[ kT = 1.38 \times 10^{-23} \times 800 = 1.1 \times 10^{-20} \]
$76kT = 8.4 \times 10^{-19} \text{J} \ [\text{@800K}]$

$\Delta G_c \approx 26.4kT < 76kT$, nucleation is likely observable.