

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Kinetic Processes in Materials

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Problem Set 5: Due Fri. March 23, Before 5PM in 13-5049

Exercise 5.1

A method was used in the lectures to show that in three dimensions the diffusivity could be related to the average jump distance and the frequency of successful uncorrelated hops by the relationship $D = \Gamma \langle r \rangle^2 / 6$. Use a similar method for one and two dimensions to demonstrate the general relationship $D = \Gamma \langle r \rangle^2 / 2d$, where d is the dimensionality.

Exercise 5.2

Extend the result for the rate of crossing a square well barrier as an activated process to the model suggested by the simulation that was demonstrated in lecture. Specifically, consider Figure 14-2 of the lecture notes. Calculate the time dependence of the expected number of particles in the square potential well of length L_{min} and width E_{min_1} , containing N particles at time $t = 0$, that is separated from another well of depth E_{min_2} and width L_{min} by an activation barrier of height E_A and width L_A .

Exercise 5.3

Write a short poem about random-walk or activated processes. If you wish your poem to be included in the ever-growing compendium of kinetic poetry, please email your entry to ccarter@mit.edu. Multiple entries per group are highly encouraged.