Chemistry 4000/5000/7001, Fall 2012, Assignment 9

Due: Friday, December 7, 9:00 a.m.
  Note the changed submission time.
Total marks: 17

1. Typical diffusion coefficients for small molecules in water are of the order of $10^{-9}\,\mathrm{m^2s^{-1}}$. Estimate the half-life at $25\,^\circ\mathrm{C}$ of a typical encounter pair for neutral molecules in which one reactant has a coordination number of 6. The mole density of water at this temperature is $55.33\,\mathrm{mol\,L^{-1}}$, and its viscosity is $8.91 \times 10^{-4}\,\mathrm{Pa\,s}$. [10 marks]

2. Considering once again our typical solute and assuming a normal-mode mass of $100\,\mathrm{g\,mol^{-1}}$ and a normal-mode frequency of $10^{13}\,\mathrm{s^{-1}}$, determine whether ordinary reactions occur in a low- or high-friction regime. [7 marks]