

Chemical physics of polymer solutions

Exercise 8

19 January 2004

Consider a semidilute solution of volume fraction ϕ in a good solvent, containing chains of N Kuhn monomers of length a and with excluded-volume parameter v . One of the chains is trapped at its two ends and stretched by an external force.

1. Calculate the free energy of imposing on the chain an end-to-end distance R . Find the required stretching force f . Assume that the stretching is weak enough such that the tension blob is smaller than the correlation (screening) length.
2. The same, but now assume that the tension blob is larger than the correlation length.
3. What values of R and f correspond to each of these two regimes?