

Suspensions and polymer solutions

Exercise 2

6 November 2006

1. A molecule having a fixed dipole moment μ is held at temperature T in a uniform electric field \vec{E} . Show that, to linear order in E , the induced dipole moment is $\vec{\mu}^{\text{ind}} = \alpha\vec{E}$, with the polarizability $\alpha = \mu^2/(3k_{\text{B}}T)$.
2. A water molecule lies at a height h above the surface of a semi-infinite bulk of water. The van der Waals interaction coefficient for water is $C = 1.4 \times 10^{-58}$ erg cm⁶, and water mass density is 1 g/cm³.
 - (a) Derive the expression for the van der Waals attraction energy between the molecule and the bulk as a function of h .
 - (b) At what height h will the van der Waals force on the molecule be equal to the gravitational one?