

Exercise 1

to be submitted by 18th Nov. 2019

Solubility and interfacial energy of oil in water

The solubility of butane in water is $61 \text{ mg}\cdot\text{l}^{-1}$ at 20°C .

Calculate the solubility of butane in terms of molar partition coefficient and chemical potential difference.

Calculate an effective interfacial tension between butane and water by estimating the surface area of butane. Compare the value to the surface tension of water.

Estimate how many water molecules form the first shell around butane? How large is the orientational restriction of these molecules and the corresponding hydrophobic entropic cost?

Recommended literature: D. Chandler, Nature 2005, vol. 437, pp.640-647

6points

Permeability of membranes

a) Calculate the permeability of a phospholipid membrane for a potassium ion by estimating or looking-up the values for membrane thickness, diffusion coefficient and partition coefficient.

b) Estimate the half time that a vesicle filled with a glycerol solution, can hold its load, if the diameter of the vesicle is 100 nm.

4points

Note: Use lecture notes, books, internet or web of science to obtain the necessary material constants or molecular values. Please QUOTE your sources.