

Series of TD No. 03. Surface phenomena

Exercise: 1

A square metal frame with a side length of 5 cm is placed in a bath of fuel oil. To separate the frame from the liquid, a force of 7.32×10^{-3} N must be applied. Calculate the surface tension of the fuel oil (it is noted that separating the frame from the liquid creates two surfaces).

Exercise: 2

A liquid has a surface tension coefficient $\sigma = 25 \times 10^{-3}$ N/m. With this liquid, a soap bubble of radius $r = 3$ cm is blown.

1. Calculate the overpressure inside this bubble.
2. Calculate the total work done to blow the bubble.

Exercise: 3

1. A liquid that perfectly wets the glass and has a density $\rho = 1.05 \times 10^3$ kg/m³ rises to an average height $h = 1.5$ cm in a vertical glass capillary tube with an inner diameter $d = 1$ mm. Calculate the surface tension coefficient σ of the liquid.
2. What is the height reached in the same capillary tube if it is vertically immersed in mercury? Given $\sigma_{\text{Hg}} = 500 \times 10^{-3}$ N/m, $\rho_{\text{Hg}} = 13600$ kg/m³, and $\theta = 135^\circ$ (contact angle).

Exercise: 4

Let there be a tube with an inner diameter d vertically immersed in a liquid with surface tension σ and density ρ . Perfect wetting is assumed, and h represents the height difference of the liquid inside the tube.

With water, we find $h_0 = 92.3$ mm. Given: $\rho_0 = 0.9973 \times 10^3$ kg/m³, $\sigma_0 = 71.93 \times 10^{-3}$ N/m For benzene, we find $h = 42.4$ mm. Deduce the surface tension coefficient σ for benzene, knowing that its density ρ is 0.8840×10^3 kg/m³.