

Problems: Liquid crystals

In groups of 2 or 3 (maximum indicated in each question), choose one of the problems and provide a written solution. The groups must work on a different problem. During the oral assessment, expect questions related to the chosen problem and the concepts covered in this chapter.

See the erratum of Doi's book.

- 1) Problem 5.3 of Doi's book (max. 2 students);
- 2) Problem 5.4 of Doi's book (max. 2 students);
- 3) Landau-de Gennes theory (max. 3 students)
 - a. Relate the coefficients A_1 , A_2 and A_3 of the energy in S to the a_1 , a_2 and a_3 of the energy in Q_{ab} .
 - b. Obtain the transition temperature as a function of the coefficients;
 - c. Calculate the scalar order parameter of the S_N nematic as a function of temperature. When does this value become imaginary? Interpret and plot the free energy in this case.
 - d. Assume $S_N = \text{constant}$ and calculate the elastic term of Eq. 5.53 from Eq. 5.45. List the elastic coefficients in the two cases and interpret the meaning of each term in Eq. 5.45.
- 4) Fredericks transition (max. 2 students).
 - a. For directors aligned parallel to the plates and with a magnetic field perpendicular to it, as indicated in figure "a", calculate the minimum magnetic field necessary to align the directors parallel to it. How this setup could be used to measure the splay elastic constant K_1 ?
 - b. How the setup in figure "b" can be used to measure the bend elastic constant K_2 ?

