Exercises 6

1 What statement regarding the driving force of a chemical reaction is correct?*

a) the essential condition for a spontaneously occurring chemical reaction is a negative change of the free enthalpy ($\Delta G < 0$)
b) the essential condition for a spontaneously occurring chemical reaction is the emission of heat
c) the essential condition for a spontaneously occurring chemical reaction is the creation of local disorder
d) If a spontaneous chemical reaction leads to the increase of local order, it has to be connected with the emission of heat

2 Assume that you want to perform a chemical reaction which is connected to the generation of a large, well ordered molecule, e.g. a long molecular chain. How can you possibly drive this reaction? Discuss two alternative approaches.

3 You observe a spontaneous reaction which is connected to the absorption of heat, so the reaction mixture is cooling down. What conclusion can you draw for the change of the internal molecular order?

4 Among all reactions known in nature and in technology, there are far more exothermic than endothermic ones. Try to explain for this fact based on your knowledge on the driving force of chemical reactions.

5 How can you prove experimentally that a given reaction A $\rightarrow$ B shows first-order kinetics? Describe a set of experiments and give an equation for the rate constant k.

6 A chemical reaction A + B + C $\rightarrow$ D is analyzed for its reaction kinetics. It is found that the velocity of the reaction is proportional to the concentration of reaction partner A, proportional to the concentration of the reaction partner B, but independent on the concentration of the reaction partner C. Postulate a simple equation for the reaction velocity (v = …). Draw estimated plots of the time dependence of the concentrations of A, B, and C during the course of the reaction (c_A, c_B, and c_C vs. time).

7 A chemical reaction A + B + C $\rightarrow$ D is analyzed for its reaction kinetics. It is found that the velocity of the reaction is independent of the concentration of reaction partner A, proportional to the concentration of the reaction partner B, and proportional to the square of the concentration of the reaction partner C. Postulate a simple equation for the reaction velocity (v = …). What are the possible measures you can take in order to increase the reaction velocity?

8 Assumed you want to inhibit an undesired corrosion process. Based on all your knowledge on driving forces of chemical reactions and reaction kinetics, what measures would you propose?

* One or several answers may be correct. Please indicate appropriately by repeating the assignments a), b), c), … followed by the statements "right" or "wrong" on your answer sheet.