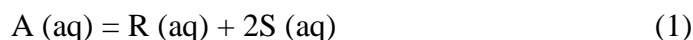


## 7. SIMULTANEOUS CHEMICAL EQUILIBRIA

### Problem 7-01 Two simultaneous reactions in solution, calculation of equilibrium constants

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Two simultaneous reactions, which can be schematically written as



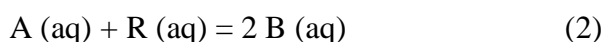
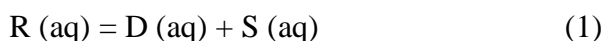
are taking place in a solution initially containing only A in concentration  $c_{A0} = 0.15 \text{ mol dm}^{-3}$ . Equilibrium mixture of A, B, R, and S contained 28.57 mol. % S and 35.71 mol. % B. Calculate equilibrium constants of both reactions assuming that all activity coefficients are equal to one. Standard state: infinite dilution,  $c^{\text{st}} = 1 \text{ mol dm}^{-3}$ .

$$[K_1 = 2.4 \cdot 10^{-3}; K_2 = 1.667]$$

### Problem 7-02 Two simultaneous reactions in solution, calculation of equilibrium constants

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In a solution initially containing the components A and R in concentrations  $c_{A0} = 0.07 \text{ mol dm}^{-3}$  and  $c_{R0} = 0.25 \text{ mol dm}^{-3}$  two simultaneous reactions are taking place:



Equilibrium mixture of A, R, B, D, and S contained 20 mol. % D and 22 mol. % B. Calculate the equilibrium constants for the standard states infinite dilution,  $c^{\text{st}} = 1 \text{ mol dm}^{-3}$ . Activity coefficients can be considered as equal to one.

$$[K_1 = 0.0508; K_2 = 2.3639]$$

### Problem 7-03 Two simultaneous reactions in solution, calculation of equilibrium composition

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Substance A decomposes in two possible ways



The equilibrium constants have the following values for the standard state infinite dilution,  $c^{\text{st}} = 1 \text{ mol dm}^{-3}$ :  $K_1 = 0.32$  and  $K_2 = 1.28$ . The equilibrium solution contains all components, A, B, D, R, and S. What is its composition (in mol. %)? The initial solution contained only the substance A in concentration  $c_{A0} = 0.1 \text{ mol dm}^{-3}$ . Assume that activity coefficients are equal to one.

$$[1.652 \text{ mol. \% A}; 16.391 \text{ mol. \% R}; 16.391 \text{ mol. \% S}; 32.783 \text{ mol. \% B}; 32.783 \text{ mol. \% D}]$$