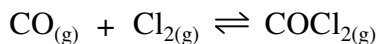


Problems of Gas phase equilibria

1) Consider the following reaction:



The initial partial pressures are $P(\text{CO}) = 2 \text{ atm}$ and $P(\text{Cl}_2) = 2 \text{ atm}$. When the reaction reaches equilibrium the partial pressure of CO is 0.05525 atm. Determine:

- Partial pressure (in atm) of each substance at equilibrium.
- Equilibrium constant K_p (with partial pressures in atm).
- Total pressure (in atm) at equilibrium.

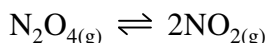
2) In a piston the initial pressure of SbCl_5 is 3 atm. This substance reacts according the following reaction:



When the reaction reaches equilibrium at 605 °C the degree of dissociation of SbCl_5 is 6.49 %. Calculate:

- Partial pressure (in atm) of each substance at equilibrium.
- Equilibrium constant K_p (with partial pressures in atm).

3) In a flask at 30 °C the N_2O_4 reacts according the following chemical equation:



When the reaction reaches equilibrium the total pressure is 6.509 atm and the degree of dissociation of N_2O_4 is 35.6 %. Find out:

- Partial pressure (in atm) of each substance at equilibrium.
- Equilibrium constant K_p (with partial pressures in atm).
- Equilibrium constant K_C (in molarities).

4) A balloon with a volume of 4 L contains 12 mol NO that react according to the following equation:



When the reaction reaches equilibrium 5.733 mol N_2 are found. Calculate:

- Moles of each substance at the equilibrium.
- Equilibrium constant K_C (in mol/L).
- Molarity of each substance at the equilibrium.

5) In a flask of 4 L at 205 °C we have 22.4 mol PCl_5 that react according the following reaction:

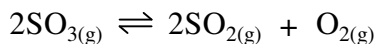


When this reaction reaches equilibrium the degree of dissociation of PCl_5 is 8.48 %. Calculate:

- Moles of each substance at the equilibrium.
- Equilibrium constant K_C (in mol/L).
- Equilibrium constant K_p (with partial pressures in atm).

Problems of Gas phase equilibria

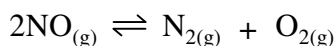
6) Given the reaction:



The initial pressure of SO_3 is 3.2 atm. When the reaction reaches equilibrium the partial pressure of O_2 is 0.4445 atm. Determine:

- Partial pressure (in atm) of each substance at equilibrium.
- Equilibrium constant K_p (with partial pressures in atm).
- Degree of dissociation of SO_3 .

7) In a piston the following reaction occurs:



The initial molar concentration(s) is(are) 3 mol/L NO. The equilibrium constant is $K_C = 106$. Determine:

- Molarity of each substance at the equilibrium.
- Degree of dissociation of NO.

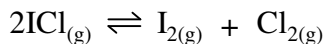
8) In a flask the following reaction occurs:



The initial pressure of PCl_5 is 3 atm. The equilibrium constant is $K_p = 3.3$ atm. Calculate:

- Partial pressure (in atm) of each substance at equilibrium.
- Degree of dissociation of PCl_5 .

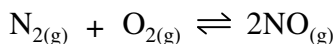
9) Consider the following reaction at a temperature of 15 °C:



At the equilibrium the total pressure is 5 atm and the equilibrium constant is $K_p = 73.7$. Determine:

- Partial pressure (in atm) of each substance at equilibrium.
- Degree of dissociation of ICl.

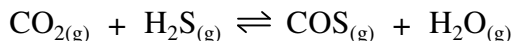
10) A piston at 485 °C contains initially 22.5 mol N_2 and 36 mol O_2 that react according the following reaction:



At equilibrium the total pressure is 6.5 atm and the equilibrium constant is $K_p = 0.0158$. Calculate:

- Partial pressure (in atm) of each substance at equilibrium.
- Equilibrium constant K_C (in mol/L).

11) A flask with a volume of 9 L contains 18 mol CO_2 and 18 mol H_2S that react according the following reaction:



The equilibrium constant is $K_C = 0.137$. Calculate:

- Molarity of each substance at the equilibrium.

Problems of Gas phase equilibria

12) In a flask the following reaction occurs:



The initial molar concentration(s) is(are) 2.8 mol/L SO_2Cl_2 . The equilibrium constant is $K_C = 15.3$ mol/L.

Calculate:

- Molarity of each substance at the equilibrium.
- Degree of dissociation of SO_2Cl_2 .

Answers:

- $P(\text{COCl}_2) = 1.945$ atm, $P(\text{CO}) = 0.05525$ atm and $P(\text{Cl}_2) = 0.05525$ atm.
 - $K_p = 637$ atm⁻¹ c) 2.055 atm.
- $P(\text{SbCl}_5) = 2.805$ atm, $P(\text{SbCl}_3) = 0.1947$ atm and $P(\text{Cl}_2) = 0.1947$ atm.
 - $K_p = 0.0135$ atm.
- $P(\text{N}_2\text{O}_4) = 3.091$ atm and $P(\text{NO}_2) = 3.418$ atm.
 - $K_p = 3.78$ atm c) $K_C = 0.152$ mol/L.
- 0.5338 mol NO, 5.733 mol N_2 and 5.733 mol O_2 .
 - $K_C = 115$.
 - $[\text{NO}] = 0.1334$ mol/L, $[\text{N}_2] = 1.433$ mol/L and $[\text{O}_2] = 1.433$ mol/L.
- 20.5 mol PCl_5 , 1.9 mol PCl_3 and 1.9 mol Cl_2 .
 - $K_C = 0.044$ mol/L c) $K_p = 1.73$ atm.
- $P(\text{SO}_3) = 2.311$ atm, $P(\text{SO}_2) = 0.889$ atm and $P(\text{O}_2) = 0.4445$ atm.
 - $K_p = 0.0658$ atm c) 27.8 %.
- 0.1388 mol/L NO, 1.431 mol/L N_2 and 1.431 mol/L O_2 .
 - 95.37 %.
- $P(\text{PCl}_5) = 1.098$ atm, $P(\text{PCl}_3) = 1.902$ atm and $P(\text{Cl}_2) = 1.902$ atm.
 - 63.4 %.
- $P(\text{ICl}) = 0.2752$ atm, $P(\text{I}_2) = 2.362$ atm and $P(\text{Cl}_2) = 2.362$ atm.
 - 94.5 %.
- $P(\text{NO}) = 0.3731$ atm, $P(\text{N}_2) = 2.313$ atm and $P(\text{O}_2) = 3.813$ atm.
 - $K_C = 0.0158$.
- 1.46 mol/L CO_2 , 1.46 mol/L H_2S , 0.5396 mol/L COS and 0.5396 mol/L H_2O .
- 0.3826 mol/L SO_2Cl_2 , 2.417 mol/L SO_2 and 2.417 mol/L Cl_2 .
 - 86.3 %.