Answer on Question #52490 – Chemistry – Inorganic Chemistry

Question:

a) If 1.00 mol of H_2 is allowed to react with 1.00 mol of I_2 in a 10.L reaction vessel at 700 K, what are the concentrations of H_2, I_2, and Hl at equilibrium given that Kc is 57.0?

b) What are their concentrations in mol/L?

c) If 0.100 M of H2 is allowed to react with 0.200 M of I2 in a reaction vessel at 700 K, what are the concentrations of H2, I2, and Hl at equilibrium given that Kc is 57.0?

Answer:

The reaction occurs: $H_2 + I_2 \rightarrow 2HI$

The equilibrium equation for the reaction: $K_c = \mu_3^2 / \mu_1 \times \mu_2$, where μ_1 – equilibrium concentration of H_2, μ_2 – equilibrium concentration of I_2, μ_3 – equilibrium concentration of HI.

If **y** mol/l of H_2 reacts then $\mu_1 = 0.1\ M - y$, $\mu_2 = 0.2\ M - y$, $\mu_3 = 2y$.

Thus, $K_c = 57 = 4y^2/((0.1-y)(0.2-y))$,

$57 \times (0.02 - 0.1y - 0.2y + y^2) = 4y^2$

$1.14 - 17.1y + 57y^2 = 4y^2$

$53y^2 - 17.1y + 1.14 = 0$

y = 0.093 ; 0.228. Only the first value has a physical sense. Therefore this is used for the further calculations:

H_2: $\mu_1 = 0.1 - 0.093\ M = 0.007\ M = 0.007$ mol/l

I_2: $\mu_2 = 0.2 - 0.093\ M = 0.107\ M = 0.107$ mol/l

HI: $\mu_3 = 0.186\ M = 0.186$ mol/l

Comment: 1 mol in 10 L equals 0.100 M. So answers a) and c) are identical.