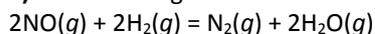


A mixture of 0.10 mol of NO, 0.050 mol of H₂ and 0.10 mol H₂O is placed in 1.0 L vessel at 300K. At equilibrium, [NO]=0.062 M. a) Calculate the equilibrium concentrations of H₂, N₂ and H₂O. b) Calculate K_c.

Solution:

a) The following reaction occurs in vessel:



Create a table containing concentration data of each substance before the reaction, during the reaction and after:

	NO	H ₂	N ₂	H ₂ O
before	0.10	0.050	-	0.1
change in reaction				
after	0.062			

Difference between initial and eventual concentrations of NO is its change in reaction 0.10 – 0.062 = 0.038.

Due to the reaction equation the same quantity of H₂ reacts 0.038.

	NO	H ₂	N ₂	H ₂ O
before	0.10	0.050	-	0.1
change in reaction	0.038	0.038		
after	0.062			

Difference between initial concentration of H₂ and its change in reaction is eventual concentration of H₂ 0.05 – 0.038 = 0.012.

	NO	H ₂	N ₂	H ₂ O
before	0.10	0.050	-	0.1
change in reaction	0.038	0.038		
after	0.062	0.012		

Due to the reaction equation, the quantity of N₂ produced in reaction is two times less than the reaction quantity of NO or H₂ 0.038/2 = 0.019. And the same quantity is after the reaction, as N₂ was not present in initial mixture.

	NO	H ₂	N ₂	H ₂ O
before	0.10	0.050	-	0.1
change in reaction	0.038	0.038	0.019	
after	0.062	0.012	0.019	

The quantity of water produced in reaction is the same as reaction concentration of H₂ or NO. The concentration of H₂O after the reaction is sum of before and the quantity produced in the reaction:

	NO	H ₂	N ₂	H ₂ O
before	0.10	0.050	-	0.1
change in reaction	0.038	0.038	0.019	0.038
after	0.062	0.012	0.019	0.138

The equilibrium concentrations are the same as concentrations after the reaction, so

Answer: [H₂] = 0.012 mol/L, [N₂] = 0.019 mol/L, [H₂O] = 0.138 mol/L.

$$\text{b) } K_c = \frac{[\text{N}_2] \cdot [\text{H}_2\text{O}]^2}{[\text{NO}]^2 \cdot [\text{H}_2]^2} = \frac{0.019 \cdot 0.138^2}{0.062^2 \cdot 0.012^2} = 653.62 \text{ L/mol}$$

Answer: K_c = 653.62 L/mol.