Day ② : Changing to Equilibrium

PS#8

Period 20

- Return and go over quiz on Le Chatelier's Principle
- Go over Keq worksheet #1 → ICE Tables.
- More Mathematical Examples - Before and after situations

① Example #4 :

$$2\ NOCl\ (g) \rightleftharpoons 2\ NO\ (g) + Cl_2\ (g)$$

Initially 2.00 mol of NOCl was placed in a 1.00 L flask at 462oC and left to reach the equilibrium shown above. When the equilibrium is established, it was found that 0.66 mol of NO were present. Calculate Keq.

Answer #4 :

We can start a table with the initial values given in the question:

Concentrations	2NOCl ⇔	2NO	+	Cl_2
Initial	2.00	0.0		0.0
Change in	–	+	+	
Equilibrium				

NOTES : 1. Because the equilibrium is shifting right, the products will increase and the reactants will decrease, hence the signs - and +.
2. Note the coefficients of the equation are translated into factors in the change in concentration. For example, if we are to make 0.5 mol of Cl_2 we MUST also make 2 times as much NO (from equation).\

Now let's see what other information the question gives us :

It states that we have 0.66 mol of NO at equilibrium. Therefore the $[NO]_{eq}$ must be 0.66 M.

Since we produced 0.66 mol NO, we must have produced 0.33 mol of Cl_2 according to the stoichiometry (for every 2 NO molecules produced, 1 Cl_2 is produced). Since we started with 0 mol Cl_2, the $[Cl_2]_{eq}$ is 0.33 M

Furthermore, stoichiometrically if we produce 2 NO's we must have used 2NOCl's. Similarly, if we produced 0.66 mol NO we must have used up 0.66 mol NOCl. Therefore [NOCl] = 2.00 - 0.66 = 1.34 M

Completing this table we get

Concentrations	2 NOCl	⇔ 2NO	+	Cl_2
Initial	2.00	0.0		0.0
Change in	−0.66	+0.66		+0.33
Equilibrium	1.34	0.66		0.33

2 Example #6 :

$$N_{2\,(g)} + O_{2\,(g)} \Leftrightarrow 2\,NO_{(g)}$$

2.00 mol N_2 and 2.00 mol O_2 are placed in a 2.00 L flask and allowed to come to equilibrium. What is the equilibrium [NO] ? Keq = 4.51×10^{-3}

Answer #6 :

	N2	O2	NO
I	1.00	1.00	0.00
C	-X	-X	+2X
E	1.00-X	1.00-X	2X

$$Keq = \frac{[NO]2}{[N2][O2]} \qquad 4.51 \times 10^{-3} = \frac{(2X)^2}{(1.00-X)(1.00-X)}$$

square root both sides
we get

$$6.72 \times 10^{-2} = \frac{2X}{(1.00-2X)}$$

Algebra :

$$(1.00-2X)(0.0672) = 2X$$
$$0.0672 - 0.0672X = 2X$$
$$0.0672 = 2.0672X$$
$$0.0325 = X$$

Is this what we wanted ?
Go back and look at the table and the question.
We wanted [NO]. According to our table, [NO] = 2X
therefore [NO] = 2(0.0325) = 0.0650 M

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Assignment :

- Read section 19-9 - LOOK at examples
- Keq Worksheet #2 - 1-4