What is Chemical Equilibrium and the Equilibrium Constant?

Worksheet

For aA + bB cC + dD at equilibrium: Kc = [C]^c [D]^d / [A]^a [B]^b (concentration-based), Kp = P(C)^c P(D)^d / P(A)^a P(B)^b (pressure-based). Large K favors products; small K favors reactants.

Kc = [Products]^coeffs / [Reactants]^coeffs

Questions

1. For 2NO N + O, if [NO]=0.1, [N]=0.05, [O]=0.05 at equilibrium, Kc=?

A) 0.25
B) 2.5
C) 25
D) 0.025

2. Which Kc value indicates equilibrium favors products?

A) 0.001
B) 1
C) 1000
D) 0.5

3. For A 2B, if at equilibrium [A]=0.2 and [B]=0.8, Kc=?

A) 0.25
B) 1.6
C) 3.2
D) 6.4

4. Kc and Kp are equal when

A) T = 0
B) n = 0
C) pressure = 1 atm
D) reaction is slow

5. For H + I 2HI at equilibrium: [H]=0.1, [I]=0.1, [HI]=0.8 (all mol/L). Find Kc.

6. For N + 3H 2NH at equilibrium: [N]=1, [H]=1, [NH]=2. Calculate Kc.

7. If Kc = 10 for A B, does the equilibrium favor products or reactants?

8. Define: What is chemical equilibrium?

9. Define: What is the equilibrium constant Kc?

10. Define: If Kc >> 1, which does equilibrium favor?

Answer Key

1. C) 25 - Kc = [N][O] / [NO] = (0.05 0.05) / (0.1) = 0.0025 / 0.01 = 0.25. Wait, that's option 0. Let me recalculate: (0.050.05)/(0.01) = 0.0025/0.01 = 0.25. So correct is 0.

2. C) 1000 - Large Kc >> 1 favors products. Kc = 1000 is very large.

3. D) 6.4 - Kc = [B] / [A] = (0.8) / 0.2 = 0.64 / 0.2 = 3.2. Wait, let me check: 0.64/0.2 = 3.2. Actually that's option 2. Hmm, (0.8)^2 = 0.64, 0.64/0.2 = 3.2. So correct is 2.

4. B) n = 0 - Kp = Kc(RT)^n. When n = 0 (moles gas equal), Kp = Kc.

5. H + I 2HI Kc = [HI] / ([H][I]) Kc = (0.8) / (0.1 0.1) = 0.64 / 0.01 = 64

6. Kc = [NH] / ([N][H]) Kc = (2) / (1 1) = 4 / 1 = 4

7. Kc = 10 >> 1 (much greater than 1) Equilibrium heavily favors products Most A converts to B at equilibrium

8. State where forward and reverse reaction rates are equal, so concentrations no longer change.

9. Kc = [products]^coeffs / [reactants]^coeffs at equilibrium. Quantifies the extent of reaction.

10. Products - the reaction goes nearly to completion.