Answer on Question#51004 – Chemistry – Other

PCl3(g)+Cl2(g)<---->PCl5(g) Kc=20 @ 240 C

If a 1.0 L container contains 0.25 mol of PCl5 at 240 C, how many moles of it dissociate to form PCl3 and Cl2?

Solution:

aA = bB + cC; Kc = $[B]^b[C]^c/[A]^a$;

Kc – the equilibrium constant (the concentration quotient);

[ ] – the molar concentration (mol/L);

C = n/V;

C – molar concentration (mol/L); n – mole (mol); V – volume (L);

Reaction: PCl5(g) = PCl3(g) + Cl2(g);

According to the equilibrium: n(PCl5):n(PCl3):n(Cl2) = 1:1:1;

C(PCl5) = n(PCl5)/V; C(PCl5) = 0.25 mol/L;

Initial concentration PCl5 = 0.25 M; Kc = 20;

x – n(PCl5) – that dissociated; (0.25 – x) – n (equilibrium);

V – constant; $n(PCl3) = n(Cl2) = n(PCl5)_{dis} = x$;

$$Kc = \frac{C(PCl3) * C(Cl2)}{C(PCl5)_{eq}} = \frac{(n(PCl3)/V) * (n(Cl2)/V)}{n(PCl5)_{eq}/V} = \frac{n(PCl3) * n(Cl2)}{n(PCl5)_{eq}};$$

$Kc = x^2/(0.25 - x)$;

$x^2/(0.25 - x) = 20$;

$x^2 + 20x - 5 = 0$;

x = 0.25;

$n(PCl5)_{dis} = 0.25$ mol

Answer: 0.25 mol.