Answer on the question #59190, Chemistry / Physical Chemistry

Question:

if 2 moles each of A and B were allowed to come to equilibrium at 300k for the reaction A+B---C+D , deltaG=460cal .The equlibrium concentration ratio of C to A will be

Solution:

Let's find the value of equilibrium constant:

$$\Delta G = -RTlnK$$

$$K = \exp\left(-\frac{\Delta G}{RT}\right) = 0.455$$

By definition, equilibrium constant for our reaction is:

$$K = \frac{[A][B]}{[C][D]}$$

If we assume that the equilibrium concentration of C and D is x, then:

$$K = \frac{(2-x)^2}{x^2}$$

$$\sqrt{K} = \pm\frac{2-x}{x}$$

You can check that if we take negative variant of the equation, we get x value more than 2 that is physically impossible.

$$0.674 = \frac{2-x}{x}$$

$$x = 0.837\ mol$$

And finally ratio of equilibrium concentrations for C and A:

$$\frac{[C]}{[A]} = \frac{x}{(2-x)} = \frac{0.837}{(1.123)} = 0.72$$

Answer: 0.72