Answer on Question #81928, Chemistry / General Chemistry

At 25 degrees celsius, for the 2A (aq) ----> B (aq) + C (aq) reaction, the equilibrium constant is 1.62. If the concentration of B (aq) was 0.373 M and the concentration of C (aq) was 0.509 M, what would be the minimum concentration of A (aq) necessary in order (in mol / L) to make this reaction spontaneous under these conditions?

Solution

Expression for reaction quotient Q for reaction 2A (aq) ----> B (aq) + C (aq) is:

$$Q = \frac{[B][C]}{[A]^2}$$

The reaction is spontaneous when $Q<K_c$, i.e.:

$$\frac{[B][C]}{[A]^2} < K_c$$

$$\frac{0.373 \times 0.509}{c_A^2} < 1.62$$

$$0.117 < c_A^2$$

$$0.342 < c_A$$

So, the reaction is spontaneous when $c_A>0.342$ M. So, the minimum concentration of A is 0.343M.

Answer: 0.343 M