

Be sure to show all work, use the correct number of significant figures, circle final answers and use correct units in all problems.

1. For the reaction: $\text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{g})$, $K_c = 1.15 \times 10^7$ (430. K), held within a 2.00 L flask (10 points)

Write the equilibrium constant expression for K_c .

Is the reaction at equilibrium if $[\text{CO}_2] = [\text{H}_2\text{O}] = 0.00350 \text{ M}$, $[\text{O}_2] = 3.31 \times 10^{-6} \text{ M}$ and $[\text{CH}_4] = 3.31 \times 10^{-6} \text{ M}$? If not, indicate the direction that the reaction must proceed to achieve equilibrium.

What is the value of the equilibrium constant if the reaction is $2 \text{CH}_4(\text{g}) + 4 \text{O}_2(\text{g}) \rightleftharpoons 2 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{g})$ at 430. K?

What is the value of K_c at 430. K for the reaction: $\text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g})$

2. For the reaction: $\text{Cl}_2(\text{g}) + \text{Br}_2(\text{g}) \rightleftharpoons 2 \text{BrCl}(\text{g})$, $K_c = 10.3$ (150 °C) (4 points)

Is this reaction product-favored or reactant-favored?

If 0.500 mol BrCl in a 1.00 L flask is allowed to reach equilibrium, what are the equilibrium concentrations of Cl_2 , Br_2 and BrCl?

3. For the reaction: $\text{RX}(\text{s}) \rightleftharpoons \text{R}(\text{g}) + \text{X}(\text{g})$, $K_c = 1.11 \times 10^{-7}$ (200. K) (6 points)

Write the equilibrium constant expression.

Calculate the equilibrium concentrations of R and X if a solid sample of RX is placed in a closed vessel and decomposes until equilibrium is established.

What is the value of K_p at 200. K?