CH 223

Sample Quiz #2   Name: ____ Lab Section: _______

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

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1. For the reaction: **$CH_4(g) + 2\ O_2(g) \rightleftharpoons CO_2(g) + 2\ H_2O(g)$, $K_c = 1.15*10^7$** (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 $[CO_2] = [H_2O] = 0.00350$ M, $[O_2] = 3.31*10^{-6}$ M and $[CH_4] = 3.31*10^{-6}$ 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 $2\ CH_4(g) + 4\ O_2(g) \rightleftharpoons 2\ CO_2(g) + 4\ H_2O(g)$ at 430. K?

   What is the value of K_c at 430. K for the reaction: $CO_2(g) + 2\ H_2O(g) \rightleftharpoons CH_4(g) + 2\ O_2(g)$

2. For the reaction: **$Cl_2(g) + Br_2(g) \rightleftharpoons 2\ BrCl(g)$, $K_c = 10.3$** (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: **$RX(s) \rightleftharpoons R(g) + X(g)$, $K_c = 1.11*10^{-7}$** (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 $\mathbf{K_p}$ at 200. K?

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

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1. For the reaction: **$CH_4(g)$ + 2 $O_2(g)$ $\rightleftharpoons$ $CO_2(g)$ + 2 $H_2O(g)$, K_c = 1.15*10^7** (430. K), held within a 2.00 L flask (10 points)

   Write the equilibrium constant expression for K_c. **$K_c = [H_2O]^2[CO_2]/[CH_4][O_2]^2 = 1.15 \times 10^7$**

   Is the reaction at equilibrium if $[CO_2] = [H_2O] = 0.00350$ M, $[O_2] = 3.31*10^{-6}$ M and $[CH_4] = 3.31*10^{-6}$ M? If not, indicate the direction that the reaction must proceed to achieve equilibrium.

   $Q = 1.18 \times 10^9$
   Q > K, will shift left (to reactant side)

   What is the value of the equilibrium constant if the reaction is 2 $CH_4(g)$ + 4 $O_2(g)$ $\rightleftharpoons$ 2 $CO_2(g)$ + 4 $H_2O(g)$ at 430. K?

   $K_{new} = 1.32 \times 10^{14}$

   What is the value of K_c at 430. K for the reaction: $CO_2(g)$ + 2 $H_2O(g)$ $\rightleftharpoons$ $CH_4(g)$ + 2 $O_2(g)$

   $K_{new} = 8.70 \times 10^{-8}$

2. For the reaction: **$Cl_2(g)$ + $Br_2(g)$ $\rightleftharpoons$ 2 BrCl(g), K_c = 10.3** (150 °C) (4 points)

   Is this reaction product-favored or reactant-favored? **product favored (K_c > 1)**

   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?

   $[Cl_2] = [Br_2] = 0.0960$ M
   [BrCl] = 0.308 M

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

   Write the equilibrium constant expression. **$K_c = [R][X] = 1.11 \times 10^{-7}$**

   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.

   $[R] = [X] = 3.33 \times 10^{-4}$ M

   What is the value of **K_p** at 200. K?

   $K_p = 2.99 \times 10^{-5}$