Last Name Key **Chapter 13 Quiz on Chemical Equilibrium**

SHOW YOUR WORK FOR CREDIT / INCLUDE UNITS WHERE APPLICABLE

1) The equilibrium constant is given for two of the reactions below. Determine the value of the missing equilibrium constant. **MY ANSWER IS LETTER** E

$A(g) + B(g) \Leftrightarrow AB(g)$ $K_c = 0.24$

$AB(g) + A(g) \Leftrightarrow A_2B(g)$ $K_c = 3.8$

$2A(g) \Leftrightarrow A_2B(g)$ $K_c = ?$

A) 4.0 B) 0.63 C) 3.6 D) 16 E) 0.91

$K_c = K_{c_1} \times K_{c_2} = 0.24 \times 3.8 = 0.91$

2) In which of the following reactions will $K_c = K_p$? **MY ANSWER IS LETTER** C

A) $N_2O_4(g) \Leftrightarrow 2NO_2(g)$

B) $CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3\,H_2(g)$

C) $H_2(g) + I_2(g) \Leftrightarrow 2\,HI(g)$

D) $CO(g) + 2\,H_2(g) \Leftrightarrow CH_3OH(g)$

E) $N_2(g) + 3\,H_2(g) \Leftrightarrow 2\,NH_3(g)$

3) Determine the value of K_c for the reaction: $N_2(g) + 3\,H_2(g) \Leftrightarrow 2\,NH_3(g)$, given these equilibrium concentrations: $[N_2]_{eq} = 1.5$ M, $[H_2]_{eq} = 1.1$ M, $[NH_3]_{eq} = 0.47$ M.

A) 3.5 B) 0.28 C) 0.11 D) 9.1 E) 0.78

MY ANSWER IS LETTER C

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{.47^2}{1.5 \times 1.1^3} = 0.11$$

4) Determine the value of K_p for the reaction: $2\,CO(g) + O_2(g) \Leftrightarrow 2\,CO_2(g)$ if the equilibrium concentrations are as follows: $P(CO)_{eq} = 6.8 \times 10^{-11}$ atm, $P(O_2)_{eq} = 1.3 \times 10^{-3}$ atm, $P(CO_2)_{eq} = 0.041$ atm.

A) 3.6×10^{-21} B) 2.2×10^{-12} C) 4.6×10^{11} D) 2.8×10^{20} E) 3.6×10^{-15}

MY ANSWER IS LETTER D

$$K_p = \frac{P_{CO_2}^2}{P_{O_2} P_{CO}^2} = \frac{(.041\ atm)^2}{(1.3 \times 10^{-3}\ atm)(6.8 \times 10^{-11})^2} = 2.8 \times 10^{20}$$

Last Name Key **Chapter 13 Quiz on Chemical Equilibrium**

5) Express the equilibrium constant for the reaction **MY ANSWER IS LETTER** E

$2\ CH_3Cl(g) + Cl_2(g) \Leftrightarrow 2\ CH_2Cl_2(g) + H_2(g)$

A) $K = \frac{[CH_2Cl_2][H_2]}{[CH_3Cl][Cl_2]}$ B) $K = \frac{[CH_3Cl]^{1/2}[Cl_2]}{[CH_2Cl_2]^{1/2}[H_2]}$ C) $K = \frac{[CH_3Cl]^2[Cl_2]}{[CH_2Cl_2][H_2]}$

D) $K = \frac{[CH_3Cl][Cl_2]}{[CH_2Cl_2][H_2]}$ E) $K = \frac{[CH_2Cl_2]^2[H_2]}{[CH_3Cl]^2[Cl_2]}$

6) The equilibrium constant is given for one of the reactions below. Determine the value of the missing equilibrium constant. **MY ANSWER IS LETTER** D

$2\ HBr(g) \Leftrightarrow H_2(g) + Br_2(g)$ $K_C = 2.6 \times 10^{-5}$

$H_2(g) + Br_2(g) \Leftrightarrow 2\ HBr(g)$ $K_C = ?$

A) 1.9×10^4 B) 5.3×10^{-5} C) 6.4×10^{-4} D) 3.8×10^4 E) 1.6×10^3

$K_{c_{rev}} = \frac{1}{K_{c_{for}}} = \frac{1}{2.6 \times 10^{-5}} = 38461 = 3.8 \times 10^4$

7) The equilibrium constant is given for one of the reactions below. Determine the value of the missing equilibrium constant. **MY ANSWER IS LETTER** C

$2\ HBr(g) \Leftrightarrow H_2(g) + Br_2(g)$ $K_C = 2.6 \times 10^{-5}$

$HBr(g) \Leftrightarrow 0.5\ H_2(g) + 0.5\ Br_2(g)$ $K_C = ?$

A) 6.8×10^{-10} B) 5.1×10^3 C) 5.1×10^{-3} D) 6.8×10^{10} E) 3.8×10^4

$K_{c_{new}} = (K_{c_{old}})^{1/2} = (2.6 \times 10^{-5})^{1/2} = 5.1 \times 10^{-3}$

8) The reaction $N_2(g) + 3\ H_2(g) \Leftrightarrow 2\ NH_3(g)$ has a K_C value of 61. What is the value of K_P for this reaction at 226.85 C? **MY ANSWER IS LETTER** A

A) 3.6×10^{-2} B) 61 C) 28 D) 15 E) 1.9×10^{-2}

$K_P = K_C(RT)^{\Delta n}$

$\Delta n = 2 - 4 = -2$

$T = 500K = 273.15 + 226.85^\circ C$

$R = .08206\ L\,atm/mol\,K$

$K_P = 61\left(.08206 \frac{L\,atm}{mol\,K} \times 500K\right)^{-2\,mol}$

$K_P = .036 = 3.6 \times 10^{-2}$

Last Name Key Chapter 13 Quiz on Chemical Equilibrium

9) Consider the reaction: $Xe(g) + 2\,F_2(g) \rightarrow XeF_4(g)$. The reaction mixture initially contains 2.24 atm Xe and 4.27 atm F_2. If the equilibrium pressure of Xe is 0.34 atm, by using an ICE table, find the equilibrium concentrations of all reactants and products and use them to find the equilibrium constant (K_p) for the reaction.

A) 0.040 B) 0.12 C) 0.99 D) 8.3 E) 25

MY ANSWER IS LETTER E

	Xe	+ $2F_2$	$\rightarrow$ XeF_4	
I	2.24	4.27	0	atm
C	-1.90	-3.80	+1.90	atm
E	0.34	0.47	1.90	atm

$K_p = \frac{[XeF_4]}{[Xe][F_2]^2}$

$K_p = \frac{1.90}{0.34 \times 0.47^2} = 25$

10) Consider the following reaction: $CH_4(g) + 2\,H_2S(g) \Leftrightarrow CS_2(g) + 4\,H_2(g)$

The reaction mixture initially contains 0.50 M CH_4 and 0.75 M H_2S. If the equilibrium concentration of H_2 is 0.44 M, by using an ICE table, find the equilibrium concentrations of all reactants and products and use them to find the equilibrium constant (K_c) for the reaction.

A) 0.038 B) 0.23 C) 2.9 D) 10. E) 0.34

MY ANSWER IS LETTER A

	CH_4	+ $2H_2S$	$\rightarrow$ CS_2	+ $4H_2$	
I	0.5	0.75	0	0	M
C	-0.11	-0.22	+0.11	+0.44	M
E	0.39	0.53	0.11	0.44	M

$K_c = \frac{0.11 \times 0.44^4}{0.39 \times 0.53^2} = 0.038$

$K_c = \frac{[CS_2][H_2]^4}{[CH_4][H_2S]^2}$