-3.5 ea

CHM 152/54 QUIZ 3 25 PTS FALL 04 NAME: Key

1. The equilibrium constant, K_c, for the reaction

$$\frac{1}{2}N_2O_4(g) \rightleftharpoons NO_2(g)$$

is 3.3 at 100°C. The value for the equilibrium constant will be changed if

1. concentrations are given in atmospheres instead of moles per liter.
2. the temperature is changed to 200°C.
3. the equation above is doubled.

[A] 2 and 3 only [B] 1 and 2 only [C] 1 only (D) 1, 2, and 3 [E] 2 only

Explanation: 1. There is a change in moles of gas
2. K_c is temp. dependent.
3. $K_c = \frac{[NO_2]}{[N_2O_4]^{\frac{1}{2}}}$ but doubled would be $K_c = \frac{[NO_2]^2}{[N_2O_4]}$

2. Which of the following statements is true in a reaction system at equilibrium?

1. The number of collisions per unit time between reactants is equal to the number of collisions per unit time between products.
2. Reactants are reacting to form products at the same rate as products are reacting to form reactants.
3. The product of the concentrations of the products divided by the product of the concentrations of the reactants is always a constant.

[A] 1 only (B) 2 only [C] 1, 2, and 3 [D] 3 only [E] 1 and 2 only

3. The equilibrium constant at 1300 K for the reaction $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$ is 1.6×10^5. The value of K for the reverse reaction is

[A] 6.3×10^{-5}. [B] -1.6×10^5. [C] 1.6×10^{-5}. [D] 1.6×10^5. (E) 6.3×10^{-6}

reverse Rxn: $2HBr(g) \rightleftharpoons H_2(g) + Br_2(g)$

$K_c = \frac{[H_2][Br_2]}{[HBr]^2}$ as written above $K_c = \frac{[HBr]^2}{[H_2][Br_2]}$

there is a reciprocal relationship so $\frac{1}{1.6 \times 10^{-5}} = 6.25 \times 10^{-6}$

more on back

Key

4. For which of the following values of the equilibrium constant does the reaction mixture consist mainly of reactants?

[A] 10^0 [B] 10^3 [C] 10^{-3} [D] 10^{-5} [E] 10^5

the "ratio" is $\frac{[\text{Products}]^{\text{coeff.}}}{[\text{Reactants}]^{\text{coeff}}}$ → small #

5. Carbon disulfide and chlorine react according to the following equation:

$$CS_2(g) + 3Cl_2(g) \rightleftharpoons S_2Cl_2(g) + CCl_4(g)$$

I 1.00 3.00 0 0

When 1.00 mol of CS_2 and 3.00 mol of Cl_2 are placed in a 2.00-L container and allowed to come to equilibrium, the mixture is found to contain 0.250 mol of CCl_4. What is the amount of Cl_2 at equilibrium?

[A] 0.25 mol [B] 2.25 mol [C] 0.50 mol [D] 2.75 mol [E] 0.75 mol

C $-x$ $-3x$ x x

E $1.00-x$ $3.00-3x$ x x

$x = 0.250$ mol so $3.00 - 3(0.250) = 2.25$

6. Which expression correctly describes the equilibrium constant for the following reaction?

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$$

[A] $K_c = \frac{[H_2O][NO]}{[NH_3][O_2]}$ [B] $K_c = \frac{4[NH_3]+5[O_2]}{6[H_2O]+4[NO]}$ [C] $K_c = \frac{[H_2O]^6+[NO]^4}{[NH_3]^4[O_2]^5}$

[D] $K_c = \frac{6[H_2O]+4[NO]}{4[NH_3]+5[O_2]}$ [E] $K_c = \frac{[NH_3]^4+[O_2]^5}{[H_2O]^6[NO]^4}$

* none since [C] mistakenly had a + sign

7. If K = 0.145 for $A_2 + 2B \rightleftharpoons 2AB$, then for $4AB \rightleftharpoons 2A_2 + 4B$, K would equal

[A] 2.63. [B] 6.90. [C] –0.145. [D] 0.145. [E] 47.6.

$K_{c_1} = \frac{[AB]^2}{[A_2][B]^2} = 0.145$ $K_{c_2} = \frac{[A_2]^2[B]^4}{[AB]^4}$

$\therefore K_{c_2} = \left(\frac{1}{K_{c_1}}\right)^2 = \left(\frac{1}{0.145}\right)^2 = 47.6$