AP Chemistry

Name _____
Period ___ Date ___/___/___

13 • Gaseous Equilibrium

PRACTICE TEST

1. Consider the reaction system,
   $CoO(s) + H_2(g) \rightleftharpoons Co(s) + H_2O(g)$.
   The equilibrium constant expression is
   a) $\frac{[CoO][H_2]}{[Co][H_2O]}$
   b) $\frac{[Co][H_2O]}{[CoO][H_2]}$
   c) $\frac{[Co][H_2O]}{[H_2]}$
   d) $\frac{[H_2]}{[H_2O]}$
   e) $\frac{[H_2O]}{[H_2]}$

2. Given the equilibrium,
   $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, if this equilibrium is established by beginning with equal number of moles of SO_2 and O_2 in a 1.0 Liter bulb, then the following ***must*** be true at equilibrium:
   a) $[SO_2] = [SO_3]$
   b) $2[SO_2] = 2[SO_3]$
   c) $[SO_2] = [O_2]$
   d) $[SO_2] < [O_2]$
   e) $[SO_2] > [O_2]$

Questions 3 & 4 refer to the following:
At a given temperature, 0.300 mole NO, 0.200 mol Cl_2 and 0.500 mol ClNO were placed in a 25.0 Liter container. The following equilibrium is established: $2ClNO(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

3. At equilibrium, 0.600 mol of ClNO was present. The number of ***moles*** of Cl_2 present at equilibrium is
   a) 0.050
   b) 0.100
   c) 0.150
   d) 0.200
   e) 0.250

4. The equilibrium constant, Kc, is:
   a) 4.45×10^{-4}
   b) 6.67×10^{-4}
   c) 0.111
   d) 0.167
   e) 1500

5. At 985°C, the equilibrium constant for the reaction,
   $H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g)$
   is 1.63. What is the equilibrium constant for the reverse reaction?
   a) 1.63
   b) 0.815
   c) 2.66
   d) 0.613
   e) 1.00

6. What is the relationship between K_p and K_c for the reaction, $2ICl(g) \rightleftharpoons I_2(g) + Cl_2(g)$?
   a) $K_p = K_c(RT)^{-1}$
   b) $K_p = K_c(RT)$
   c) $K_p = K_c(RT)^2$
   d) $K_p = K_c$
   e) $K_p = K_c(2RT)$

7. For the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$, K_p at 25°C is 7.3, when all partial pressures are expressed in atmospheres. What is K_c for this reaction? [$R = 0.0821\ L \cdot atm \cdot mol^{-1} \cdot K^{-1}$]
   a) 4270
   b) 0.0119
   c) 0.291
   d) 179
   e) 2.06

8. 0.200 mol NO is placed in a one liter flask at 2273 K. After equilibrium is attained, 0.0863 mol N_2 and 0.0863 mol O_2 are present. What is K_c for this reaction?

$$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$$

a) 9.92
b) 3.15
c) 0.0372
d) 39.7
e) 0.576

9. $N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$

At 25°C, 0.11 mole of N_2O_4 reacts to form 0.10 mol of N_2O_4 and 0.02 mole of NO_2. At 90°C, 0.11 mole of N_2O_4 forms 0.050 mole of N_2O_4 and 0.12 mole of NO_2. From these data we can conclude

a) N_2O_4 molecules react by a second order rate law.
b) N_2O_4 molecules react by a first order rate law.
c) the reaction is exothermic.
d) N_2O_4 molecules react faster at 25°C than at 90°C.
e) the equilibrium constant for the reaction above increases with an increase in temperature.

10. For the equilibrium system

$$H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$$
$$\Delta H = -42\ kJ/mol$$

K_c equals 0.62 at 1260 K. If 0.10 mole each of H_2O, CO, H_2 and CO_2 (each at 1260 K) were placed in a 1.0-Liter flask at 1260 K, when the system came to equilibrium…

	The temperature would	The mass of CO would
a)	decrease	increase
b)	decrease	decrease
c)	remain constant	increase
d)	increase	decrease
e)	increase	increase

11. For the reaction system,

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + heat$$

the conditions that would favor maximum conversion of the reactants to products would be

a) high temperature and high pressure
b) high temperature, pressure unimportant
c) high temperature and low pressure
d) low temperature and high pressure
e) low temperature and low pressure

12. Solid HgO, liquid Hg, and gaseous O_2 are placed in a glass bulb and are allowed to reach equilibrium at a given temperature.

$$2HgO(s) \rightleftharpoons 2Hg(l) + O_2(g) \quad \Delta H = +43.4\ kcal$$

The mass of HgO in the bulb could be increased by

a) adding more Hg.
b) removing some O_2.
c) reducing the volume of the bulb.
d) increasing the temperature.
e) removing some Hg.

Answers:

1.	E
2.	D
3.	C
4.	B
5.	D
6.	D
7.	D
8.	A
9.	E
10.	A
11.	D
12.	C

Answers: 1E 2D 3C 4B 5D 6D 7D 8A 9E 10A 11D 12C