SUPeR Chemistry
CH 223 Practice Exam

This exam has been designed to help you practice working multiple choice problems over the topics presented in chapters 17 and 18 of the Silberberg text. The actual exams for each section of CH 223 will be different and you should not assume that this practice exam is representative of those exams.

To get the most benefit from this practice exam, treat it like a real exam. Do not start it until you feel prepared. Allow 50 minutes to complete the exam and use no materials except a calculator and periodic table.

The exam answer key will be posted on the bulletin board across the hall from room 127 Klamath.

1. In which of the following does the reaction go farthest to completion?

   A) $K_c = 10^5$

   B) $K_c = 10^{-5}$

   C) $K_c = 1000$

   D) $K_c = 100$

   E) $K_c = 1$

2. For the reaction $2H_2S(g) \leftrightarrows 2H_2(g) + S_2(g)$, $K_c = 4500$ at a particular temperature. What will happen when 0.010 mole of H_2S, 1.0 mol of H_2 and 1.5 mol of S_2 are added to a 1.0 L container at that temperature?

   A) Nothing, the system is at equilibrium.

   B) More H_2S will be formed.

   C) More H_2 will be formed than S_2.

   D) More S_2 will be formed that H_2.

3. For the reaction system $N_2(g) + 3H_2(g) \leftrightarrows 2NH_3(g)$, $\Delta H = -92$ kJ. To shift the equilibrium and increase the yield of ammonia, we should

   1. increase the temperature
   2. decrease the temperature
   3. increase the pressure by decreasing the volume.
   4. decrease the pressure by increasing the volume.

   A) 1 only

   B) 2 only

   C) 1 and 3 only

   D) 2 and 3 only

   E) 1 and 4 only

4. A 1.00 L vessel initially contains 0.777 mol of SO_3 at 1100K. What is the value of K_c at this temperature if 0.520 mol of SO_3 remains at equilibrium?

$$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$$

A) 0.0315 B) 0.0637 C) 0.129 D) 31.7 E) 7.75

5. Consider the following equilibrium reaction:

$$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$$

with $K = 1.6 \times 10^{-5}$. 1.00 mole of pure NOCl and 1.00 mol of pure Cl_2 are placed in a 1.00 L container. What is the equilibrium concentration of NO(g)?

A) 1.0 M B) 1.6×10^{-5}M C) 0.50 M D) 6.2×10^{-4}M E) 4×10^{-3}M

6. A mixture of 0.60 mol $Cl_{2(g)}$ and 0.40 mol $F_{2(g)}$ was allowed to come to equilibrium in a 1000–mL flask. If $2x$ represents the molar concentration of $ClF_{(g)}$ at equilibrium, which expression represents the equilibrium constant?

$$Cl_{2(g)} + F_{2(g)} \rightleftharpoons 2ClF_{(g)}$$

(A) $\dfrac{x^2}{(0.60-x)\cdot(0.40-x)}$

(B) $\dfrac{(2x)^2}{(0.60-x)\cdot(0.40-x)}$

(C) $\dfrac{2x}{(0.60-x)\cdot(0.40-x)}$

(D) $\dfrac{2x^2}{(0.60-x)\cdot(0.40-x)}$

7. Use the reactions

(1) $H_2(g) + O_2(g) \leftrightarrows H_2O_2(g)$ $K_p = 2.3 \times 10^6$ at 600 K

(2) $2H_2(g) + O_2(g) \leftrightarrows 2H_2O(g)$ $K_p = 1.8 \times 10^{37}$ at 600 K

to find K_p for

(3) $H_2O(g) + 1/2\ O_2(g) \leftrightarrows H_2O_2(g)$ at 600 K

A) 4.4×10^{43}

B) 9.8×10^{24}

C) 1.2×10^{-4}

D) 5.4×10^{-13}

E) 2.6×10^{-31}

8. If K = 0.145 for $A_2 + 2B \leftrightarrows 2AB$, then for $AB \leftrightarrows B + 1/2\ A_2$, K would equal

A) 0.145

B) -0.145

C) 0.381

D) 2.63

E) 6.90

9. Exactly 1.0 mol of N_2O_4 is placed in an empty 1.0 L container and is allowed to reach equilibrium described by the equation

$$N_2O_4(g) \leftrightarrows 2NO_2(g)$$

If at equilibrium the N_2O_4 is 20% dissociated, what is the value of the equilibrium constant for the reaction under these conditions?

A) 0.05

B) 0.2

C) 0.5

D) 20

E) 400

10. The best description of an aqueous solution of a strong acid is:

A) 5% ionization, pH > 7

B) 5% ionization, pH < 7

C) 100% ionization, pH > 7

D) 100% ionization, pH < 7

11. The pH of 3.6×10^{-5} M HNO_3 is

A) 5.2

B) 4.4

C) 4.7

12. Which solution is the most basic?

A) pOH = 5.2

B) $[OH^-] = 2.5 \times 10^{-6}$ M

C) pH = 8.6

13. A 0.10 M solution of an acid HA has $[H_3O^+] = 10^{-5}$. What is K_a for the acid?

A) 10^{-10}

B) 10^{-5}

C) 10^{-9}

14. Which statement is FALSE?

A) a Lewis base donates electrons

B) $HOClO_3$ is a stronger oxyacid than $HOClO_2$

C) OH^- is the conjugate base of H_3O^+

15. If methyl amine CH_3NH_2 has $K_b = 4.4 \times 10^{-4}$ then K_a for $CH_3NH_3^+$ is:

A) 2.3×10^{-11}

B) 3.8×10^{-9}

C) 4.4×10^{-10}

16. Which statement is FALSE?

A) 0.5 M H_2SO_3 ($K_{a1} = 10^{-2}$; $K_{a2} = 10^{-7}$) has $[H_2SO_3] > [HSO_3^-] > [SO_3^{2-}]$

B) Ag^+ in the reaction $Ag^+ + 2\ NH_3 \rightarrow Ag(NH_3)_2^+$ is a Bronsted-Lowry acid

C) pure water at 25°C has $[H_3O^+] = 1.0 \times 10^{-7}$ M

Ionization constants for Questions 17-20

HNO_2 : $K_a = 7.1 \times 10^{-4}$, NH_3 : $K_b = 1.8 \times 10^{-5}$

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17. The pH of 0.440 M HNO_2 is

A) 3.51

B) 1.75

C) 4.38

D) 2.49

18. The degree of ionization in 0.010 M NH_3 is

A) 1.8%

B) 0.9%

C) 3.7%

D) 4.2%

19. The pH of 0.25 M $NaNO_2$ is

A) 8.1

B) 8.2

C) 8.3

D) 8.4

20. At pH = 6.15 the quotient $[NO_2^-] / [HNO_2]$ in a solution containing HNO_2 is:

A) 10^4

B) 10^3

C) 10^2

D) 10

21. Calculate the pH of a 0.05 M solution of the diprotic acid, H_2A, which has $K_{a1} = 7.9 \times 10^{-5}$ and $K_{a2} = 1.6 \times 10^{-12}$.

A) 1.3

B) 2.7

C) 3.1

D) 5.4

E) 6.5