

# **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  $2\text{H}_2\text{S}(\text{g}) \rightleftharpoons 2\text{H}_2(\text{g}) + \text{S}_2(\text{g})$ ,  $K_c = 4500$  at a particular temperature. What will happen when 0.010 mole of  $\text{H}_2\text{S}$ , 1.0 mol of  $\text{H}_2$  and 1.5 mol of  $\text{S}_2$  are added to a 1.0 L container at that temperature?
- A) Nothing, the system is at equilibrium.
  - B) More  $\text{H}_2\text{S}$  will be formed.
  - C) More  $\text{H}_2$  will be formed than  $\text{S}_2$ .
  - D) More  $\text{S}_2$  will be formed than  $\text{H}_2$ .
3. For the reaction system  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ ,  $\Delta H = -92 \text{ kJ}$ . 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  $\text{SO}_3$  at 1100K. What is the value of  $K_c$  at this temperature if 0.520 mol of  $\text{SO}_3$  remains at equilibrium?



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

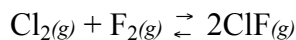
5. Consider the following equilibrium reaction:



with  $K = 1.6 \times 10^{-5}$ . 1.00 mole of pure  $\text{NOCl}$  and 1.00 mol of pure  $\text{Cl}_2$  are placed in a 1.00 L container. What is the equilibrium concentration of  $\text{NO}(\text{g})$ ?

- A) 1.0 M      B)  $1.6 \times 10^{-5}\text{M}$       C) 0.50 M      D)  $6.2 \times 10^{-4}\text{M}$       E)  $4 \times 10^{-3}\text{M}$

6. A mixture of 0.60 mol  $\text{Cl}_2(\text{g})$  and 0.40 mol  $\text{F}_2(\text{g})$  was allowed to come to equilibrium in a 1000-mL flask. If  $2x$  represents the molar concentration of  $\text{ClF}(\text{g})$  at equilibrium, which expression represents the equilibrium constant?



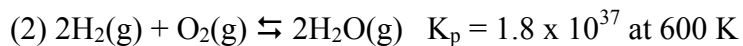
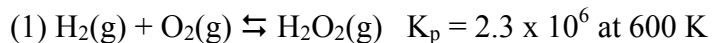
(A)  $\frac{x^2}{(0.60 - x) \cdot (0.40 - x)}$

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

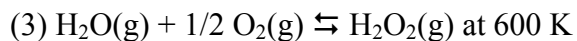
(C)  $\frac{2x}{(0.60 - x) \cdot (0.40 - x)}$

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

7. Use the reactions



to find  $K_p$  for



A)  $4.4 \times 10^{43}$

B)  $9.8 \times 10^{24}$

C)  $1.2 \times 10^{-4}$

D)  $5.4 \times 10^{-13}$

E)  $2.6 \times 10^{-31}$

8. If  $K = 0.145$  for  $\text{A}_2 + 2\text{B} \rightleftharpoons 2\text{AB}$ , then for  $\text{AB} \rightleftharpoons \text{B} + 1/2 \text{A}_2$ ,  $K$  would equal

A) 0.145

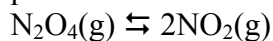
B) -0.145

C) 0.381

D) 2.63

E) 6.90

9. Exactly 1.0 mol of  $\text{N}_2\text{O}_4$  is placed in an empty 1.0 L container and is allowed to reach equilibrium described by the equation



If at equilibrium the  $\text{N}_2\text{O}_4$  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,  $\text{pH} > 7$
- B) 5% ionization,  $\text{pH} < 7$
- C) 100% ionization,  $\text{pH} > 7$
- D) 100% ionization,  $\text{pH} < 7$

11. The pH of  $3.6 \times 10^{-5} \text{ M HNO}_3$  is

- A) 5.2
- B) 4.4
- C) 4.7

12. Which solution is the most basic?

- A)  $\text{pOH} = 5.2$
- B)  $[\text{OH}^-] = 2.5 \times 10^{-6} \text{ M}$
- C)  $\text{pH} = 8.6$

13. A 0.10 M solution of an acid HA has  $[\text{H}_3\text{O}^+] = 10^{-5}$ . 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)  $\text{HOClO}_3$  is a stronger oxyacid than  $\text{HOClO}_2$
- C)  $\text{OH}^-$  is the conjugate base of  $\text{H}_3\text{O}^+$

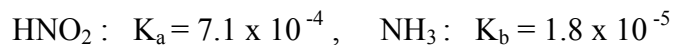
15. If methyl amine  $\text{CH}_3\text{NH}_2$  has  $K_b = 4.4 \times 10^{-4}$  then  $K_a$  for  $\text{CH}_3\text{NH}_3^+$  is:

- A)  $2.3 \times 10^{-11}$
- B)  $3.8 \times 10^{-9}$
- C)  $4.4 \times 10^{-10}$

16. Which statement is FALSE?

- A)  $0.5 \text{ M H}_2\text{SO}_3$  ( $K_{a1} = 10^{-2}$ ;  $K_{a2} = 10^{-7}$ ) has  $[\text{H}_2\text{SO}_3] > [\text{HSO}_3^-] > [\text{SO}_3^{2-}]$
- B)  $\text{Ag}^+$  in the reaction  $\text{Ag}^+ + 2 \text{NH}_3 \rightarrow \text{Ag}(\text{NH}_3)_2^+$  is a Bronsted-Lowry acid
- C) pure water at  $25^\circ\text{C}$  has  $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ M}$

**Ionization constants for Questions 17-20**



17. The pH of  $0.440 \text{ M HNO}_2$  is

- A) 3.51
- B) 1.75
- C) 4.38
- D) 2.49

18. The degree of ionization in  $0.010 \text{ M NH}_3$  is

- A) 1.8%
- B) 0.9%
- C) 3.7%
- D) 4.2%

19. The pH of 0.25 M  $\text{NaNO}_2$  is

- A) 8.1
- B) 8.2
- C) 8.3
- D) 8.4

20. At  $\text{pH} = 6.15$  the quotient  $[\text{NO}_2^-] / [\text{HNO}_2]$  in a solution containing  $\text{HNO}_2$  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,  $\text{H}_2\text{A}$ , which has

$$K_{a1} = 7.9 \times 10^{-5} \text{ and } K_{a2} = 1.6 \times 10^{-12}.$$

- A) 1.3
- B) 2.7
- C) 3.1
- D) 5.4
- E) 6.5