Exam 2 Practice problems

1. Give the direction of the reaction, if K >> 1.

A) The forward reaction is favored.

B) The reverse reaction is favored.

C) Neither direction is favored.

D) If the temperature is raised, then the forward reaction is favored.

E) If the temperature is raised, then the reverse reaction is favored.

1. Express the equilibrium constant for the following reaction.

 PCl5 (g) ⇌ PCl3(g) + Cl2(g)

1. The equilibrium constant is given for one of the reactions below. Determine the value of the missing equilibrium constant.

 2 HD(g) ⇌ H2(g) + D2(g) Kc = 0.28

 2 H2(g) + 2 D2(g) ⇌ 4 HD(g) Kc = ?

1. Determine the value of Kc for the following reaction if the equilibrium concentrations are as follows: [N2]eq = 3.6 M, [O2]eq = 4.1 M, [N2O]eq = 3.3 × 10-18 M.

 2 N2(g) + O2(g) ⇌ 2 N2O(g)

1. Which of the following statements is TRUE?

A) If Q < K, it means the reverse reaction will proceed to form more reactants.

B) If Q > K, it means the forward reaction will proceed to form more products.

C) If Q = K, it means the reaction is at equilibrium.

D) All of the above are true.

E) None of the above are true.

1. Consider the following reaction:

 COCl2(g) ⇌ CO(g) + Cl2(g)

A reaction mixture initially contains 1.6 M COCl2. Determine the equilibrium concentration of CO if Kc for the reaction at this temperature is 8.33 × 10-4.

1. The equilibrium constant, *K*c, for the following reaction is 1.0 × 10-5 at 1500 K.

 N2(g) + O2(g) ↔ 2 NO(g)

If initial concentrations of 0.750 M N2 and 0.750 M O2 are allowed to come to equilibrium, what is the equilibrium concentration of NO?

1. Consider the following reaction at equilibrium. What effect will adding more H2S have on the system?

 2 H2S(g) + 3 O2(g) ⇌ 2 H2O(g) + 2 SO2(g)

A) The reaction will shift to the left.

B) No change will be observed.

C) The equilibrium constant will decrease.

D) The equilibrium constant will increase.

E) The reaction will shift in the direction of products.

1. Which of the following is NOT a conjugate acid-base pair?

A) NH4+/NH3

B) NaCl/Cl–

C) H2SO3/HSO3–

D) C2H3O2–/HC2H3O2

E) All of the above are conjugate acid-base pairs.

1. Which of the following solutions would have the highest pH? Assume that they are all 0.10 M in acid at 25°C. The acid is followed by its Ka value.

A) HF, 3.5 × 10-4

B) HCN, 4.9 × 10-10

C) HNO2, 4.6 × 10-4

D) HCHO2, 1.8 × 10-4

E) HClO2, 1.1 × 10-2

1. What is the concentration of hydroxide ions in pure water at 30.0°C, if Kw at this temperature is 1.47 × 10-14?
2. Calculate the pH of a solution that contains 3.9 x 10-4 M H3O+
3. Determine the [H3O⁺] in a 0.265 M HClO solution.

The Ka of HClO is 2.9 × 10-8

1. Determine the Ka of an acid whose 0.294 M solution has a pH of 2.80.
2. Determine the pH of a 0.188 M NH3 solution at 25°C. The Kb of NH3 is 1.76 × 10-5
3. Which one of the following statements is TRUE?

A) A buffer is an aqueous solution composed of two weak acids.

B) A buffer can absorb an unlimited amount of acid or base.

C) A buffer resists pH change by neutralizing added acids and bases.

D) A buffer does not change pH when strong acid or base is added.

E) None of the above are true.

1. If the pKa of HCHO2 is 3.74 and the pH of an HCHO2/NaCHO2 solution is 3.74, which of the following is TRUE?

A) [HCHO2] > [NaCHO2]

B) [HCHO2] = [NaCHO2]

C) [HCHO2] < [NaCHO2]

D) [HCHO2] < <[NaCHO2]

E) It is not possible to make a buffer of this pH from HCHO2 and NaCHO2.

1. Calculate the pH of a buffer that is 0.158 M HClO and 0.099 M NaClO. The Ka for HClO is 2.9 × 10-8.
2. Calculate the pH of a solution formed by mixing 0.02 M HClO with 0.06 M KClO. The Ka for HClO is 2.9 × 10-8.
3. A 1.00 L buffer solution is 0.250 M in HF and 0.250 M in NaF. Calculate the pH of the solution after the addition of 100.0 mL of 1.00 M HCl. The Ka for HF is 3.5 × 10-4.
4. Which of the following is TRUE?

A) The equivalence point is where the amount of acid equals the amount of base during any acid-base titration.

B) At the equivalence point, the pH is always 7.

C) An indicator is not pH sensitive.

D) A titration curve is a plot of pH vs. the [base]/[acid] ratio.

E) None of the above are true.

1. A 100.0 mL sample of 0.20 M HF is titrated with 0.10 M KOH. Determine the pH of the solution before the addition of any KOH. The Ka of HF is 3.5 x 10-4.
2. A 100.0 mL sample of 0.20 M HF is titrated with 0.10 M KOH. Determine the pH of the solution after the addition of 100.0 mL of KOH. The Ka of HF is 3.5 × 10-4.
3. Determine the molar solubility of PbSO4 in pure water. Ksp (PbSO4) = 1.82 × 10-8.
4. Determine the molar solubility of CaSO4 in a solution containing 0.100 M Na2SO*4*. Ksp (CaSO4) = 2.4 × 10-5
5. A
6. K =

1. 13
2. 2.0 × 10-37
3. 3.7 × 10-2 M
4. 3.7 × 10-2 M
5. 2.4 × 10-3 M
6. E
7. B
8. B
9. 1.21 × 10-7 M
10. 3.41
11. 8.8 × 10-5 M
12. 8.5 × 10-6
13. 11.260
14. C
15. B
16. 7.33
17. 8.01
18. 3.09
19. A
20. 2.08
21. 3.46
22. 1.35 × 10-4 M
23. 2.4 × 10-4 M