1. Meaning of a Rate Law.



Assume that the decomposition of CH2Cl2,

CH2Cl2(g) → C(s) + 2 HCl(g) is third order, with a rate constant of 0.20 M-2/s What is the instantaneous rate of disappearance of CH2Cl2 when its concentration is 0.50 M ?

2. Kinetics and stoichiometry.

In the reaction 2 C4H10 + 13 O2 → 8 CO2 + 10 H2O

If the rate of appearance of H2O is 8.0 x 10-3 M/s, what is the rate of disappearance of C4H10?

3. Rate constant and half life. If at a given temperature, the half life of XeF4 in the reaction XeF4 → Xe + 2 F2  is 10.0 minutes, what is the rate constant, in min-1 ?

4. Initial Rates Problems.

A + B + C → D.

Initial concentrations (M) Initial rate of disappearance of A

[A] [B] [C] ( in M/sec)

4.0 4.0 4.0 2.0 x 10-2

8.0 4.0 4.0 1.6 x 10-1

4.0 8.0 4.0 2.0 x 10-2

4.0 4.0 2.0 1.0 x 10-2

Find a) the total reaction order.

b) The rate expression.

c) The value of the rate constant, (including units)

d) The initial rate when all 3 reactants are 8.0 molar.

Le Chatelier…

5. In the EXOTHERMIC reaction,

C2H4(g) + Br2 (g) → C2H4Br2(g) , what change in conditions would DECREASE the value of the equilibrium constant?

6. “Type 3 equilibrium calculation”

Cu2+(aq) + 4 NH3(aq)  ⇌ Cu(NH3)42+aq)

The initial molarities are 4.00 M Cu2+ and 12.0 M NH3

At equilibrium, the [Cu(NH3)2] is found to be 2.75 M.

a) Find the Keq for the reaction, based on that data.

b) The NH3 in this reaction is A) Lewis acid B) Lewis Base

C) Bronsted acid D) Bronsted base

7. Mechanism.Suppose the reaction C2H4 + Br2 →C2H4Br2 Occurred via 3 elementary steps.

1. Br2 → 2 Br

2. Br + C2H4 → C2H4Br

3. C2H4Br + Br → C2H4Br2

a) what is the rate law if the FIRST step is rate determining?

b) What is the rate law if the THIRD step is rate determining?

8. N2(g) + 3 H2(g) ⇌ 2 NH3(g)

Without adding or subtracting any components, AND without changing the value of the Kp, what could you do to increase the the amount of NH3 at equilibrium ?

9. Identify the conjugate acid, and the conjugate base, of HCO3-

10. Find the pH of… a) 0.0080 M HBr b) An ammonia solution with an [OH-] of 3.5 x 10-4  c) a 2.0 M solution of a monoprotic acid that has a Ka of 4.0 x 10-6

11. If a 0.40 molar solution of a monoprotic acid has a pH of 3.00, what is the Ka of the acid?

12. The molar mass of NaF is 42. If 4.2 grams of NaF are added to 100 mL. of 2.00 molar HF, what is the resulting [H+] ? The Ka of HF is 6.4 x 10-4

13. acidic, basic, or neutral? A) ZnI2  B) KNO3  C) BaF2

I. Ksp. CaF2 has a Ksp of 4.0 x 10-11

a) Find the concentration of each ion in saturated CaF2

b) If sufficient NaF is added to the solution to make the [F-] 0.040 M, what is the new molarity of the Ca2+ ?

c) Will a precipitate form when 200. mL of 1.0 x 10-3 M CaCl2

is mixed with 300. mL of 1.0 x 10-3 M KF ? (show work!)

II. Kinetics – integrated rate law.

Suppose that at a certain temperature, the decomposition of SO2 gas to S(g) and O2(g) is first order.

If an initial pressure of SO2 ( assuming constant T and V) goes from 4.00 atm. to 1.00 atm. in 25.0 seconds, how long would it take to go from 0.400 atm to 0.300 atm. ?

What is the half life of the reaction, under the given conditions?

III. Titration. 50.0 mL of 2.0 molar HNO2 are tested, and found to have a pH of 1.52. A) Find the Ka of HNO2 .

B) The acid is titrated with 4.0 molar NaOH. What is the [H+] after the addition of 10.0 mL of the NaOH ?

C) In a titration of 0.200 M HCl with 0.100 M KOH, what is the pH after the addition of 50.0 mL of the 0.100 M KOH to 20.0 mL of the 0.200 M HCl?