Chemistry 122 Exam Review

1. A 38.8g piece of metal alloy absorbs 181J as its temperature increases from 25.0oC to 36.0oC. What is the alloy’s specific heat? (0.424J/g•oC)
2. If the temperature of 34.4g of ethanol increases from 25.0oC to 78.8oC, how much heat has been absorbed by the ethanol? (C = 2.44J/g•oC). (4.52 x 103J)
3. A 124g sample of ethanol at an initial temperature of 30.0oC absorbs 1560J of heat. What is the final temperature of the ethanol? (35.2oC)
4. Calculate the heat required to melt 25.7g of solid methanol at its melting point (∆Hfus = 3.22kJ/mol). (2.58kJ)
5. What mass of methane (CH4) must be burned in order to liberate 12 880kJ of heat (∆Hcomb = -891kJ/mol)? (232g)
6. Use equations (a) and (b) to determine ∆H for the following reaction:

2CO(g) + 2NO(g) → 2CO2(g) + N2(g) ∆H = (-385.4kJ)

1. 2CO(g) + O2(g) → 2CO2(g) ∆H = -566.0kJ
2. N2(g) + O2(g) → 2NO(g) ∆H = -180.6kJ
3. Write the rate law for the reaction aA → bB if the reaction is third order in A. [B] is not part of the rate law. (Rate = [A]3
4. Given the experimental data below, use the method of initial rates to determine the rate law for the reaction aA + bB → products.

|  |  |  |  |
| --- | --- | --- | --- |
| Trial | Initial [A] mol/L | Initial [B] mol/l | Initial Rate mol/L•s |
| 1 | 0.100 | 0.100 | 2.00 x 10-3 |
| 2 | 0.200 | 0.100 | 2.00 x 10-3 |
| 3 | 0.200 | 0.200 | 4.00 x 10-3 |

(Rate = k[A]0[B]1)

1. The following reaction is second order in Fe(OH)2+ and the rate constant at 298K is 4.5 x 102 (L/mol•s).

2Fe(OH)2+ → Fe2(OH)24+

Calculate the instantaneous rate when the concentration of Fe(OH)2+ is 0.040mol/L. (7.2 x 10-1mol/L•s

1. Write the equilibrium constant expression for the following:

CH4(g) + 2H2S(g) ↔ CS2(g) + 4H2(g)

(Keq = [CS2(g)][H2(g)]4/[CH4(g)][H2S]2

1. Solid iron reacts with chlorine gas to form solid iron(III) chloride. Write the balanced equation and the equilibrium constant expression for the reaction. (2Fe(s) + 3Cl2(g) → 2FeCl3(s); Keq = [FeCl3(s)]2/[Fe(s)]2[Cl2(g)]3
2. The reaction COCl2(g) ↔ CO(g) + Cl2(g) reaches equilibrium at 900K. Keq = 8.2 x 10-2. If the equilibrium concentrations of CO and Cl2 are 0.150mol/L, what is the equilibrium concentration of COCl2? (0.27mol/L)
3. Explain how decreasing the volume of the reaction vessel affects each equilibrium.
4. 2SO2(g) + O2(g) ↔ 2SO3(g) b. H2(g) + Cl2(g) ↔ 2HCl(g)
5. The equilibrium shifts to the right; b. The stress has no effect on the equilibrium)
6. If Keq for the following equilibrium is 0.110 at a particular temperature, [I2] = 0.0330, and [Cl2] = 0.220, what is the equilibrium concentration of ICl?

2ICl(g) ↔ I2(g) + Cl2(g)

([ICl] = 0.257mol/L)

1. The Ksp of lead carbonate (PbCO3) is 7.40 x 10-14 at 298K. What is the solubility of lead carbonate in g/mol? (7.27 x 10-5g/mol)
2. Calculate the solubility of Ag3PO4 (Ksp = 2.6 x 10-18). (1.8 x 10-5mol/L)
3. Will a precipitate form when equal volumes of 0.020mol/L Ca(NO3)2 and 0.0064mol/L NaF solutions are mixed at 298K? At 298K, Ksp for CaF2 = 3.5 x 10-11. (yes, a precipitate will form, Qsp = 1.0 x 10-7)
4. Calculate the molar solubility of lead(II) fluoride in a 0.20mol/L Pb(NO3)2 solution. (4.1 x 10-4 mol/L)