CHEM 1212K Reading Day Study Session – Spring 2019

1. When 2.00 mol of SO_2Cl_2 is placed in a 2.00 L flask at 303 K, 56% of the SO_2Cl_2 decomposes to SO_2 and Cl_2:

   $$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$$

   What is the equilibrium constant in terms of molar concentrations, K_c, for this reaction at 303K?

2. The following K_c values were attained at 823 K:

   $$CoO(s) + H_2(g) \longrightarrow Co(s) + H_2O(g) \qquad K_c = 67$$

   $$CoO(s) + CO(g) \longrightarrow Co(s) + CO_2(g) \qquad K_c = 490$$

   Calculate the equilibrium constant for: $H_2(g) + CO_2(g) \longrightarrow CO(g) + H_2O(g)$ at 823K.

3. A 0.084 M solution of phenylacetic acid, $C_6H_5CH_2COOH$, has a pH of 2.68. What is K_a for this acid?

4. Which of the following will act as the strongest base in water?

   Cl^- NO_3^- HSO_4^- ClO^-

5. Hypoiodous acid, HIO, has a pK_a = 10.64 at 25°C. What is the $[OH^-]$ in a 0.250 *M* solution of HIO?

6. What is the pH of 0.045 M solution of $Sr(OH)_2$?

7. $K_{sp} = 1.4 \times 10^{-7}$ for copper(II) iodate, $Cu(IO_3)_2$ in water at 25°C. Estimate the molar solubility of the compound at the same temperature.

8. A buffer contains equal amounts of a weak base and its conjugate acid. It has a pH = 10.84. Out of the following, what is a reasonable value for the pH after the addition of a small amount of base?

   3.16 7.00 10.74 10.94 13.84

9. What is the pH of a 0.265 M solution of ammonium nitrate, NH_4NO_3? The K_b for $NH_3 = 1.76 \times 10^{-5}$.

10. Consider the titration of 30.0 mL of 0.115 M KOH with 0.250 M $HClO_4$. What is the pH after 10.0 mL of $HClO_4$ has been added?

11. Approximately how many moles of NaOH must be added to 1.00 liter of 0.150 M acetic acid to make the pH of the solution 5.240? Assume no change in volume with addition of NaOH. The K_a of acetic acid = 1.8×10^{-5}.

12. Calculate ΔG^o for the following reaction that occurs in a galvanic cell at 25 °C.

    $$Pb^{2+}(aq) + Mg(s) \longrightarrow Pb(s) + Mg^{2+}(aq) \qquad E^o_{cell} = +0.63\ C$$

13. Balance the following reaction in acidic solution.

    $$Mn^{2+}(aq) + NaBiO_3(s) \longrightarrow Bi^3(aq) + Na^+(aq) + MnO_4^-(aq)$$

    What is the coefficient in front of $H^+(aq)$ and which side of the equation is it on in the overall, balanced reaction?

14. Gold can be plated out of a solution containing Au^{3+}. What mass of gold (in grams) can be plated by 5.5 Amp current applied for 10 minutes?

15. A galvanic electrochemical cell was made at 25°C using the redox couples Mn^{2+}/Mn and Sn^{2+}/Sn. What is the cell potential of the electrochemical cell?

16. If the cell potential of a galvanic cell made using the redox couples H^+/H_2 and Zn^{2+}/Zn is 0.55 V at 25°C when the concentration of zinc ions is 1.2 M and the partial pressure of H_2 = 1.0 atm, what is the pH of the cathode solution?

17. If you start with 0.0250 mol of $N_2O_5(g)$ in a volume of 2.0 L, how many minutes will it take for the quantity of $N_2O_5(g)$ to drop to 0.010 mol? Assume a first order rate constant k=.416 min^{-1}

18. Which of the following extrinsic semiconductors would form a p−type semiconductor?

Ge : S Ge : P Si : Al Si : N

19. Which statement is *true*?

A) Co has a greater atomic radius than Rh.
B) Fe has fewer possible oxidation states than Ti.
C) Mn has a greater atomic radius than Sc.
D) Ru and Os have similar atomic radii.
E) The maximum possible oxidation state for V (vanadium) is +3.

20. How many *d* electrons does Co^{3+} possess?

21. What characteristic do isomers of all types share?

A) The number and type of atoms
B) The connectivity of atoms
C) The spatial arrangement of atoms
D) The type of ligands involved
E) The angle at which the ligands are oriented to one another

22. Which compound is an ionization isomer of $[Pt(NH_3)_4SO_4](NO_2)_2$?

A) $[PtCl_4(NH_3)_2](NO_2)_2$
B) $[Pt(NH_3)_4(NO_2)_2]SO_4$
C) $[Pt(NH_3)_4Cl_3](NO_2)_3$
D) $[Pt(NH_3)_4SO_4](NO_2)_4$
E) The chemical formulas for coordination isomers are the same.

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1) 0.71
2) $K_c = 0.14$
3) 5.4×10^{-5}
4) ClO^-
5) 4.2×10^{-9}
6) pH = 12.95
7) 0.0033 mol/L
8) 10.94
9) pH = 4.911
10) pH = 12.376
11) 0.114 mol NaOH
12) −120 kJ
13) 14, left side of the equation
14) 2.2 g
15) +1.04 V
16) pH = 3.51
17) 2.2 min.
18) Si : Al
19) D
20) 6
21) A
22) B