CHEM 1212K Reading Day Study Session - Fall 2018

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:
$$SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$$
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:
$$CoO(s) + H_2(g) \rightleftharpoons Co(s) + H_2O(g) \quad K_c = 67$$
$$CoO(s) + CO(g) \rightleftharpoons Co(s) + CO_2(g) \quad K_c = 490$$
Calculate the equilibrium constant for: $H_2(g) + CO_2(g) \rightleftharpoons CO(g) + H_2O(g)$ at $823K$.

3. Calculate the Gibbs free energy of reaction, $\Delta G_{r\times n}$, that occurs in a closed vessel with constant volume, temperature and total pressure for the reaction:
$$2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$$
when the partial pressures of the substances are as follows: $P_{H2S} = 0.445$ bar; $P_{H2} = 0.112$ bar; $P_{S2} = 0.055$ bar. The value of $K = 2.4 \times 10^{-4}$ at $1073K$.

4. A 0.084 M solution of phenylacetic acid, $C_6H_5CH_2COOH$, has a pH of 2.68. What is the acid dissociation constant for this acid?

5. Which of the following will act as the strongest base in water?
$$Cl^- \quad NO_3^- \quad HSO_4^- \quad ClO^-$$

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

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

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

9. 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?
$$3.16 \quad 7.00 \quad 10.74 \quad 10.94 \quad 13.84$$

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

11. 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?

12. 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. The K_a of acetic acid $= 1.8 \times 10^{-5}$.

13. Calculate $\Delta G^\circ_{r\times n}$ in kJ for the following reaction occuring in a galvanic cell at $25°C$.
$$Pb^{2+}(aq) + Mg(s) \rightarrow Pb(s) + Mg^{2+}(aq) \quad E^\circ_{cell} = +0.63V$$

14. Balance the following reaction in acidic solution.

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

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

15. Gold can be plated out of a solution containing Au^{3+}. What mass of gold (in grams) can be plated by a 10.0-min. flow of a 5.5 Amp current?

16. 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?

17. 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?

18. 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?

19. Which of the following extrinsic semiconductors would form a $p-$type semiconductor?

$$Ge : S \quad Ge : P \quad Si : Al \quad Si : N$$

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1. 0.71
2. $K_c = 0.14$
3. 24 kJ/mol
4. 5.4×10^{-5}
5. ClO^-
6. 4.2×10^{-9}
7. $pH = 12.95$
8. 0.0033 mol/L
9. 10.94
10. $pH = 4.911$
11. $pH = 12.376$
12. 0.114 mol $NaOH$
13. -120 kJ
14. 14, left side of the equation.
15. 2.2 g
16. $+1.04$ V
17. $pH = 3.51$
18. 2.2 min.
19. $Si : Al$