Chemistry 1B Semester Homework Assignment
Kotz and Treichel, **FIFTH** edition.

- Quizzes and exams are based on lecture notes / class discussion, problems given through worksheets and problems given through textbook assignments.
- My philosophy about the homework is that you do as much as you need to do in order to understand the concepts and math problems thoroughly. You may ask me to review any of your homework assignments during "official" office hours, or any time after class, but I will not collect the homework assignments.
- My quizzes and exams test both problem solving ability (math problems) and comprehension (answering verbal questions), which includes an understanding of what each variable in a formula means, as well as an understanding of what happens physically between the atoms/molecules in a particular experiment or situation. Keep this in mind when working on your homework problems.
- You will be responsible for doing the homework that corresponds to the information we discuss in class. So review your notes to determine how far you should be going in the problems for each chapter. Also check the website for the quiz and test information.
- Remember there are no graphing calculators on quizzes or exams.

Chapter 23
Don't worry about learning names, dates, scientists and experiments unless we discuss them explicitly in class. In general, I will not be testing you on historical facts. The problems assigned below are fair game, so pay attention to those with verbal answers.

Problems: Please go to the library and compare the Ch.23 problems in your book with those in the 6^{th} edition, and figure out which problems to do, or simply photocopy the problems from the 6^{th} edition and work on them.

Chapter 15
Problems: 1, 4, 7-9, 12-15 (typo: there is no problem #11.)
16-66 even. (before doing , read notes below)
Notes: After problem 20, include the following.
1. Using the rate equation "Rate = $k[A]^2[B]$ ", define the order of the reaction with respect to A, B and the overall order of the rate equation.
2. Problem 24 has a typo: in the table, $[H_2]$ should be $[O_2]$.

Also include problems 78, 82, 86, 87, 88, 90, 92, 97.

Chapter 16
Review the Equilibrium worksheet we did in lab.
Problems 8, 12, (16-30) even, 36, 38, 40, 44, [45 Ans. $K_2 = 1 / K_1^2$], 52, 54,
[55 Ans. $P_{total} = 1.21$ atm],
[57 Ans. $[NH_3] = 0.67$ M, $[N_2] = 0.57$ M, $[H_2] = 1.7$ M, $P_t = 180$ atm]
[65 Ans. a) the flask containing $(H_3N)B(CH_3)_3$ will have the largest partial pressure of $B(CH_3)_3$. b) $P(B(CH_3)_3) = P(NH_3) = 2.1$ atm and $P((H_3N)B(CH_3)_3) = 1.0$ atm, $P_t = 5.2$ atm, and 69% dissociation.]

Chapter 16 (section 6)
Problems: 1 [Ans. a) the reaction produces acetate ion, the conj. base of acetic acid. The solution is weakly basic. pH is >7] 32, 34, 47 [Ans. a) $CH_3CO_2H + HPO_4^{2-}$ (double arrow) $CH_3CO_2^- + H_2PO_4^-$; b) CH_3CO_2H is a stronger acid than $H_2PO_4^-$ so the equilibrium will lie to the right.] , 49 [Ans. a)Lewis base, b) Lewis acid c) Lewis base due to lone pair of electrons on N], 50.

Answer to 1: $H_2O > HCN > H_3O^+$ and $CN^- > OH^-$
Answer to 2: Mixing the NaOH and acetic acid solution gives 60 mL of 0.075M sodium acetate. This solution is weakly basic and contains: $H_2O > Na^+$ and $CH_3COO^- > OH^-$ and $CH_3COOH > H_3O^+$

Chapter 17
Problems: You should be able to do any of the even numbered problems from 10 – 98. Also, 87, 102, 104, 106. OMIT problems 94, 100, 108.
Also these two problems.
1. You prepare a 0.10 M solution of HCN. What molecules and ions exist in solution? List them in order of decreasing concentration. (answers below Ch.16 section 6)
2. You mix 30.0 mL of 0.15 M NaOH with 30.0 mL 0.15 acetic acid. What molecules and ions exist in solution? List them in order of decreasing concentration. (answers below Ch.16 section 6)

Chapter 18
Problems: 18-40 even, [44 and 46: match the pH at the equivalence point so that it comes within the middle of the pH range of an indicator], 52-70 even, [72 consider the hydrolysis reaction of each ion and Le Chatelier's principle], 74-94 even, 98, 100, [104 this is a combination of 2 equilibria: figure out the 2 reactions and the K constants for each and figure out the K constant for the two reactions (review ch. 16 section 5)], 110.

Chapter 19
Problems: 4, 6 Ans. a) True, b) False, whether an exothermic process is spontaneous also depends on the entropy c) False, reactions with +enthalpy and + entropy are spontaneous at higher temperatures d) True.
8 Ans. a) exothermic and an increase number of gas molecules from reactant to product so predict an increase in change in entropy for both system and surroundings and so universe.
b) Exothermic rxn so $\Delta H° < O$ Combined with a positive change in entropy, $\Delta G° < 0$.
c) The value of Kp is expected to be much greater than 1, and because $\Delta S°$ is positive, the value of Kp will be even larger at high temperatures.
11. Ans In solid NaCl the particles are fixed in a solid lattice. When the solid is dissolved, the sodium and chloride ions are dispersed throughout the solution.

Problems: 12 and 14 – explain your choice), 16, 18, 20 (write the equation for the formation process), 22-46 even, 48, 50,
51 Ans. a) $\Delta H° = -352.88$ kJ, $\Delta S° = 21.31$ J/K, $\Delta G° = -359.23$ kJ.

53 Ans. a) endothermic and reactant-favored. Predicted results: $\Delta H°>0$, $\Delta S°surr < 0$, $\Delta S°univ < 0$, $\Delta G°sys> 0$. $\Delta S°sys > 0$ because 1 mole of gas and 2 mol of liquid is produced from 2 mol solid. Calculated results: $\Delta H°= 181.66$ kJ, $\Delta S°sys = 216.53$ J/K, $\Delta G°sys= 117$ kJ. b) $Kp = 3.1 \times 10^{-21}$ Reaction is reactant favored.

Problems: 54 (explain prediction), 58, 60, 62, 64, 68 (explain prediction),
71 Ans. $\Delta H° = 126.03$ kJ, $\Delta S° = 78.2$ J/K , $\Delta G° = 103$ kJ. The reaction is not predicted to be spontaneous under standard conditions.
73. Ans. $\Delta G° = 6.98$ kJ/mol.
76, 78, 80, 84, 89 Ans. $\Delta G°$ form [HI(g) = -10.9 kJ/mol] , 92.

Chapter 20
Problems: 2, (12-17, all –answers below), 18-60 even, 62, 64, 65 Ans. a) E°(anode) must be more negative than -0.90 V, so Cr (-0.91 V) would be appropriate, for example, on the other side, E°(cathode) must be more positive than 2.5 V, so F (2.87 V) would be appropriate, for example. b) E°(anode) must be greater than 0.30 V, so Cu (0.337 V) would be appropriate, for example, on the other side, E°(cathode) must be more positive than 1.3 V, so Cl (1.36 V) would be appropriate, for example.
Problems (con't): 66, 68, 70, 71 [Ans. 8.1×10^5 g Al], 72, 75 [Ans. $\Delta G° = -562$ kJ], 77 [Ans. 8.2×10^5 g Na, 1.3×10^6 g Cl_2, 6700 kW-h], 79 [Ans. 2 mol e^-/mol of Ru, so Ru^{+2}, $Ru(NO_3)_2$], 81 [Ans. 8.9×10^7 g Cl_2], 83 [Ans. 0.054 g Au], 85 [Ans. see below], 92, 94.

13. a) $H_2O_2(aq) \rightarrow O_2(g) + 2H^+(aq) + 2\ e^-$ oxid.
b) $H_2C_2O_4(aq) + 2CO_2(g) + 2\ H^+(aq) + 2\ e^-$ oxid
c) $NO_3^-(aq) + 4\ H^+(aq) + 3\ e^- \rightarrow NO(g) + 2H_2O(l)$ red
d) $MnO_4^-(aq) + 2\ H_2O(l) + 3\ e^- \rightarrow MnO_2(s) + 4\ OH^-(aq)$ red

15. a) $Sn(s) + 2H^+(aq) \rightarrow Sn^{2+}(aq) + H_2(g)$
b) $Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6\ Fe^{2+}(aq) \rightarrow 2\ Cr^{3+}(aq) + 7\ H_2O(l) + 6\ Fe^{3+}(aq)$
c) $MnO_2(s) + 4\ H^+(aq) + 2\ Cl^-(aq) \rightarrow Mn^{2+}(aq) + 2\ H_2O(l) + Cl_2(g)$
d) $H_2CO(aq) + H_2O(l) + 2\ Ag^+(aq) \rightarrow HCO_2H(aq) + 2\ H^+(aq) + 2\ Ag(s)$

17. a) $3\ Fe(OH)_3(s) + Cr(s) \rightarrow 3\ Fe(OH)_2(s) + Cr(OH)_3(s)$
b) $NiO_2(s) + 2\ H_2O(l) + Zn(s) \rightarrow Ni(OH)_2(s) + Zn(OH)_2(s)$
c) $3\ Fe(OH)_2(s) + CrO_4^{2-}(aq) + 4\ H_2O(l) \rightarrow 3\ Fe(OH)_3(s) + Cr(OH)_4^-(aq) + OH^-(aq)$
d) $N_2H_4(aq) + 2\ Ag_2O(s) \rightarrow N_2(g) + 2\ H_2O(l) + 4\ Ag(s)$

85. a) $2\ Ag^+(aq) + C_6H_5CHO(aq) + H_2O(l) \rightarrow C_6H_5CO_2H(aq) + 2\ H^+(aq) + 2\ Ag(s)$
b) $3\ CH_3CH_2OH(aq) + 2\ Cr_2O_7^{2-}(aq) + 16\ H^+(aq) \rightarrow 3\ CH_3CO_2H(aq) + 4\ Cr^{3+}(aq) + 11\ H_2O(l)$

Chapter 22 Note: * problems have answers just before Ch. 20 HW begins.
Problems: 16, 18, 22, 24, 26, 34, *35, 36, *37, 38, 42, 44, 46, 50, *53, 54, 56, *57, 58, 62, 66, 68, 70, *71, 74.

*35 [Ans. a) possible, cis/trans b) possible fac/mer c) possible fac/mer d) not possible]
*37 [Ans. 2 isomers have one set of trans ligands, chiral isomers are have only cis isomers]
*53 [Ans. a) no b) yes c) no]
*57 [Ans. a) +3 b)6 c) octahedral d) 1 unpaired electron e) paramagnetic f) 3 isomers
*71 [Ans. a) absorbs orange light, transmits blue light b) 640 is a low energy visible wavelength, so it will have a relatively small Δ, so high spin complex expected. c) Co^{3+} has 6 valence electrons, so in high spin, 4 unpaired electrons so paramagnetic.