Solutions to Review Problems for Exam 2

1) a) When the piston is pushed downwards, I_2 is forced into solution and the amount of starch that is bound to I_2 increases.

   b) If starch is added to the solution, then more I_2 gets bound to the starch. This lowers the amount of $I_{2(aq)}$ and the amount of $I_{2(g)}$ therefore decreases.

2) a) Addition of NaCl pushes the reaction to the right (towards products).
   b) Addition of $Co(H_2O)_6^{+2}$ pushes the reaction to the right.
   c) they will both be equal

3) They will dissolve more rapidly at great depths.

4) a) choice (b), the number of moles of PCl_5 will decrease.
   b) choice (a), an increase in the number of moles of PCl_5.

5) choice (a) the number of moles of NOCl will have decreased.

6) 300ml of NaOH are needed.

7) pH = 11

8) HNO_2 ($Ka=4.6x10^{-4}$) is a weaker acid than HF ($Ka=6.6x10^{-4}$), so in a fight for protons, it will win. (NO_2 will tend to steal protons from HF.) The reaction:
    $HF + NO_2^- <--> HNO_2 + F^-$
has a K>1. More specifically, K= $6.6x10^{-4}/4.6x10^{-4} = 1.4$

9) a) pH=2.1 (b) pH = 8.3 (c) pH=3.6
  (d) pH = 3.34 before addition of acid or base; on addition of acid it drops to pH=3.16; on addition of the base it rises to pH=3.51.
  (e) $[NO_2^-] = 0.65M$, $[HNO_2] = 0.35M$.

10) HCN is the weakest acid of the three, so it's conjugate base (CN^-) will be the strongest base ($K_b=K_w/K_a$). Therefore NaCN will have the highest (most basic) pH.

11) a) pH = 4.3 (b) pH = 8.6 (c) pH = 11.1 (d) pH = 13.5

12) a) pH=4.3 (b) pH= 7.5 (c) pH = 10.1 (d) pH = 12.5

13) a) pH=pKa in the middle of the buffer region, so the dotted line has the higher pKa.
  b) It takes 50ml to reach the equivalence point, so the concentration of the base must be twice that of the acid, or 0.2M.

14) 1/100

15) ($[F^-]/[HF]$) > ($[CN^-]/[HCN]$), since HCN is a weaker acid

16) [Ac-] increases, since the solution becomes more basic.