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 Creative Project 2  
 Practice Exam

- 1) Lex Luthor has discovered a way to make a more powerful form of Kryptonite by mixing green kryptonite with pink kryptonite at 500 K.

	Ion Size	Ionic Strength	Charge	Concentration
Green Kryptonite	1020 pm	.1	0	.25M
Pink Kryptonite	1075 pm	.1	+1	.5
Chartreuse Kryptonite	1100 pm	.1	-1	.45

- a. Using the information in table 1, calculate the activity coefficient for Green Kryptonite, Pink Kryptonite, and Chartreuse Kryptonite.
  - b. Using your answers from part a, find K for this reaction.
- 2) The Green Arrow is trying to develop a new kind of trick arrow, one that will spray acid on his enemies. The 1L solution has a molarity of .25 M HNO<sub>2</sub>.
- $$\text{HNO}_2 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{NO}_2^- \quad K_a = 7.1 \times 10^{-4}$$
- $$\text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^- \quad K_w = 1 \times 10^{-14}$$
- a. What is the charge balance of this reaction?
  - b. What is the mass balance of this equation?
  - c. Ignoring activity coefficients, write the equilibrium expressions needed for this problem
  - d. Solve for the concentrations of HNO<sub>2</sub>, H<sup>+</sup>, NO<sub>2</sub><sup>-</sup>, and OH<sup>-</sup>. For simplicities sake, assume that [H]<sup>>></sup>[OH] since we have an acid. Therefore, you can ignore the [OH<sup>-</sup>] when solving the monster of an equation.
- 3) Krona is a scientist from Oa, whose work focuses on energy and entropy in the universe. He was studying the reaction between Inerton and Fluorine. The K of this reaction is .10 at 298 K
- a. Find ΔG<sup>0</sup> (reminder, R=8.314 J/(K\*mol))
  - b. ΔH<sup>0</sup>=500 J/mol. Find ΔS<sup>0</sup>.
  - c. Is this reaction exothermic or endothermic?
- 4) Barry Allen (aka The Flash) is working in the lab, working with the newly discovered chartreuse kryptonite. He's found that if an aqueous solution containing 1 M chartreuse kryptonite has a pH of 11.3 or greater, the kryptonite does not affect Kryptonians. What is the K<sub>b</sub> for chartreuse kryptonite? Remember that  $K_b = x^2 / (F-x)$
- chartreuse kryptonite + H<sub>2</sub>O → OH<sup>-</sup> + weaker kryptonite*

- 5) While Batman was drugged by Scarecrow's hallucinogen, Lucius Fox had to come up with an antidote. Fox needed to use a buffer system to make sure that the antidote was not too acidic or basic for human tolerance. He used 4.35 g of [BH<sup>+</sup>] (FM 156.41) and 8.00g of [B] (FM 220.67). If the pK<sub>a</sub> is 13.32 what is the pH?

Is this antidote reasonable? Why or Why not?

- 6) Poison Ivy was trying to create stronger plants and was experimenting with the idea of adding metal to them. She came across a situation that required her to do a titration. At a point in the titration after the equivalence point she needed to know the concentration of the 0.080 M EDTA in the solution after 15ml of EDTA was added. The initial volume of the metal was 38ml and the total volume at the equivalence point was 51ml.
- 7) Superman had found out about Lex Luther's new creations of chartreuse kryptonite and got to work on a counter attack. Barry Allen had told him about the pH, and so superman decided to carry around a bottle of a basic solution to cancel the effects of the kryptonite. He wanted to carry around the smallest possible amount of liquid, but have enough to be effective. If the safe pH was 11.3 or higher how much solution should superman carry around? (see previous problems for information. The initial concentration of HA is .030 and the initial volume of HA is 75ml)
- 8) Ray Palmer a.k.a. the Atom was tinkering with his shrink ray in an attempt to figure out why it worked on him and came across a situation that required a diprotic buffer system. However he got carried away with his experiment and forgot to write down the grams of one of his substances[P<sup>2-</sup>]. He knows it has a formula mass is 197.01, and he knows there was 6.01g of the other substance [HP<sup>-</sup>] with a formula mass of 210.60. He tests the pH and finds it to be 4.77. If he looks up the pK<sub>2</sub> value and finds it to be 4.51 how many grams of the [P<sup>2-</sup>] did Dr. Palmer have to begin with?

1D. K<sub>b</sub> is known as the base \_\_\_\_ constant.  
*Hydrolysis*

1A. The material balance is another name for the \_\_\_\_ because it is a statement of the conservation of matter.

2D. If  $\Delta H$  is negative, then the reaction is \_\_\_\_

3D. Activity is the concentration of a species multiplied by its \_\_\_\_.

2A. \_\_\_\_ acids or bases can donate or accept more than one proton.

3A. The addition of one substance to another until a complete reaction has occurred is called \_\_\_\_.

4D. EDTA likes to bond to \_\_\_\_ ions.

4A. A \_\_\_\_ solution resists change to pH when acids or bases are added.

*What do you do with a dead chemist?*

You \_\_\_\_\_

A B C D E F

