

Chem 201—Quantitative Analysis
Exam #2
12 November 2009

Name _____

1. (5 points) For the technique of flame atomic absorption spectrometry, increasing the temperature of the flame will:
 - A. increase signal; improve detection limits
 - B. increase signal; worsen detection limits
 - C. decrease signal; improve detection limits
 - D. decrease signal; worsen detection limits
 - E. have no effect on signal or detection limits

2. (5 points) For the technique of flame emission spectrometry, increasing the temperature of the flame will:
 - A. increase signal; improve detection limits
 - B. increase signal; worsen detection limits
 - C. decrease signal; improve detection limits
 - D. decrease signal; worsen detection limits
 - E. have no effect on signal or detection limits

3. (5 points) A buffer solution is made by mixing 0.135 M acetic acid with 0.207 M sodium acetate. The acid constant for acetic acid is $K_a = 1.75 \times 10^{-5}$. The pH of the resulting buffer solution is:
 - A. pH = 4.57
 - B. pH = 4.33
 - C. pH = 5.18
 - D. pH = 4.94

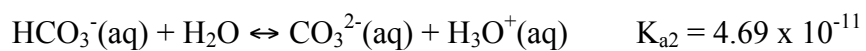
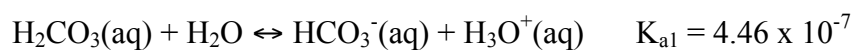
4. (5 points) The role of an auxiliary complexing ligand, L, when performing an EDTA titration is to:
 - A. bind the metal ion as a complex ion in solution to prevent precipitation as a metal hydroxide.
 - B. bind the metal ion as a precipitate, $ML_n(s)$, to prevent interference by hydroxide ion.
 - C. improve the sharpness of the EDTA titration curve endpoint.
 - D. act as an indicator for the titration.

5. (30 points) A mixture of X and Y was analyzed using UV/vis absorption spectroscopy at four different wavelengths to determine the concentrations of the two unknowns. The pathlength of the cell was 1.00 cm. The following data were obtained:

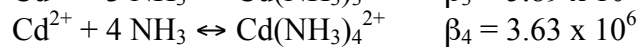
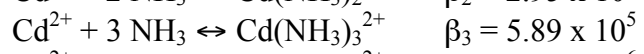
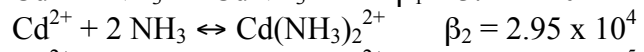
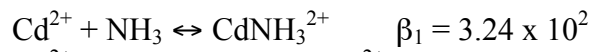
$A_{\text{tot}}(327 \text{ nm}) = 0.1304$	$\epsilon_X(327 \text{ nm}) = 517 \text{ M}^{-1}\text{cm}^{-1}$	$\epsilon_Y(327 \text{ nm}) = 279 \text{ M}^{-1}\text{cm}^{-1}$
$A_{\text{tot}}(403 \text{ nm}) = 0.0695$	$\epsilon_X(403 \text{ nm}) = 85.0 \text{ M}^{-1}\text{cm}^{-1}$	$\epsilon_Y(403 \text{ nm}) = 738 \text{ M}^{-1}\text{cm}^{-1}$
$A_{\text{tot}}(478 \text{ nm}) = 0.1386$	$\epsilon_X(478 \text{ nm}) = 246 \text{ M}^{-1}\text{cm}^{-1}$	$\epsilon_Y(478 \text{ nm}) = 1236 \text{ M}^{-1}\text{cm}^{-1}$
$A_{\text{tot}}(551 \text{ nm}) = 0.2289$	$\epsilon_X(551 \text{ nm}) = 928 \text{ M}^{-1}\text{cm}^{-1}$	$\epsilon_Y(551 \text{ nm}) = 426 \text{ M}^{-1}\text{cm}^{-1}$

Determine the concentrations of [X] and [Y].

6. (25 points) 50.00 mL of 0.150 M carbonic acid, H_2CO_3 , is titrated with 0.250 M NaOH. Determine the pH at the first and second endpoints of the titration.



7. (25 points) 50.0 mL of a 0.00200 M Cd^{2+} solution is titrated with 0.00400 M EDTA in the presence of 0.0750 M NH_3 buffered at $\text{pH} = 9.00$. Determine pCd^{2+} when 28.5 mL of EDTA solution have been added.



$$\alpha_{\text{Cd}^{2+}} = 1.80 \times 10^{-3}$$

$$\alpha_{\text{Y}^{4-}} = 0.041$$