

In-class portion (1-2):Pledge:

When you have completed this portion of the exam, please consider the following:

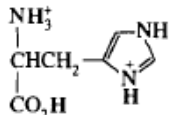
I affirm that I have neither committed nor witnessed a violation of academic integrity in the completion of this portion of the exam.

Signed _____

Answer the following on separate sheets of paper. All work must be shown for full credit.

- (30 pts) You want to make 500.0 mL of a 0.350 M buffer at pH 6.20. You choose hydroxylamine as the system for your buffer. (See the table below.)
 - If you start with solid hydroxylamine (FW = 33.03 g/mol) and solid hydroxylamine hydrochloride (FW = 69.49 g/mol), and then dilute to 500.0 mL, what masses of each solid will you need?
 - If you start with solid hydroxylamine hydrochloride and 1.00 M NaOH, what mass of solid will you need and what volume of NaOH can you expect to add?
 - Calculate the pH of the resulting solution if 10.00 mL of 0.125 M KOH were added to 100.0 mL of your buffer solution.
- (50 pts) A 3.50-g sample of histidine dihydrochloride (FW = 228.08 g/mol) in water and diluting to a final volume of 50.00 mL. The resulting solution is then titrated with 0.500 M NaOH. Calculate the pH of the titration at each of the following points:
 - initial
 - each equivalence point
 - 10.00 mL before each equivalence point
 - 20.00 mL after the last equivalence point

Use the provided graph paper to make a well-labeled sketch of the resulting titration curve. Be sure to show the proper shape of the entire curve.

Name	Structure	pK_a	K_a
Hydroxylamine	$\text{HO}\overset{+}{\text{N}}\text{H}_3$	5.96 (NH) (13.74) (OH)	1.10×10^{-6} 1.8×10^{-14}
Histidine		1.6 (CO ₂ H) 5.97 (NH) 9.28 (NH ₃)	3×10^{-2} 1.07×10^{-6} 5.2×10^{-10}

Name _____

Take-home portion (3-4), due Tuesday (4/22) at noon:

Pledge:

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Signed _____

This portion of the exam is open-book. Use any reference material available to you. Where applicable, let a spreadsheet do as much work for you as possible, then turn in a hard copy of the spreadsheet. I ask only that you do not consult with another person regarding any of the following questions, and that you do not use material from anyone who has taken this class in a previous semester.

3. (14 pts) A 30.00-mL sample of 0.2569 M ethanolamine (2-aminoethanol) is titrated with 0.1563 M HCl.
 - a) Use the spreadsheet method to generate a well-labeled theoretical titration curve for this titration.
 - b) What would be a good indicator to use for this titration, and what color change would signify the end point?

4. (16 pts) Chromel is an alloy composed of nickel, iron, and chromium. A 0.7176-g sample of the alloy was dissolved in HNO₃ and diluted to 250.0 mL in a volumetric flask. A 50.00-mL aliquot of this sample, treated with pyrophosphate to mask the Fe and Cr, required 26.14 mL of 0.05831 M EDTA to reach the end point. A second 50.00-mL aliquot was treated with hexamethylenetetramine to mask the Cr. Titrating with 0.05831 M EDTA required 35.43 mL to reach the end point. Finally, a third 50.00-mL aliquot was treated with 50.00 mL of 0.05831 M EDTA, and back-titrated to the end point with 6.21 mL of 0.06316 M Cu²⁺. Report the weight percents of Ni, Fe, and Cr in the alloy.