

Name: _____

CHEM 2113

Test 2

March 2, 2001

Questions are worth 25 points each. OMIT ONE QUESTION by clearly writing OMIT in the space provided for your work. If you fail to mark OMIT on a question I will omit the last question of the test. Show your work and circle your answers for full credit.

1. Calculate the pH of the following solutions:

a) 0.045 M benzoic acid

b) 0.027 M hydrazine

c) 0.20 M potassium hydrogen phthalate

d) 0.025 M sodium cyanide

e) 2.0×10^{-7} M perchloric acid

2. Consider the titration of 50.0 mL of 0.10 M formic acid with 0.10 M NaOH. Calculate the pH of the solution at the following points along the titration curve:

a) Before any titrant is added;

b) After 15.0 mL of titrant is added;

c) After 25.0 mL of titrant is added;

d) After 50.0 mL of titrant is added;

e) After 60.0 mL of titrant is added.

3. Consider the titration of 25.0 mL of 0.10 M ethylene diamine with 0.10 M HCl. Calculate the pH of the solution at the following points along the titration curve:

a) Before any titrant is added;

b) After 12.5 mL of titrant is added;

c) After 25.0 mL of titrant is added;

d) After 37.5 mL of titrant is added;

e) After 50.0 mL of titrant is added.

4. One of the major pollutants in coal is sulfur - as sulfur when burned will react with water to form acid rain. All major consumers of coal for industrial purposes must therefore have a method to remove sulfur from the effluent gases. Your corporation is considering the purchase of coal from a new mine located in Wyoming, but the sulfur content is questionable. The scrubbers at your factory can handle coal with a sulfur content of up to 750 ppm. A sample of coal was sent to you, and you choose to determine the sulfur content by combustion analysis. A 10.00 g sample of the coal was burned, and the effluent was bubbled through a 3% solution of hydrogen peroxide to convert the effluent to sulfuric acid. This sample was then titrated with NaOH, which required 45.17 mL of the 0.01087 M NaOH to reach the endpoint. Write the reaction for the sulfuric acid with NaOH, and calculate the ppm sulfur in the sample, and make a recommendation as to the feasibility of this purchase.

5. Consider a mixture that may contain NaOH (39.997), Na₂CO₃ (105.989) and NaHCO₃ (84.007). A 6.125 g sample of an unknown was dissolved and diluted to 250.0 mL. A 100.0 mL aliquot of this solution was titrated to a phenolphthalein endpoint, which required 32.15 mL of 0.1012 M HCl. A 50.00 mL aliquot was titrated to a bromocresolgreen endpoint with 47.22 mL of the 0.1012 M HCl. Determine the identity of the active component(s), and calculate the percentage of each present in the original mixture.