

Name: _____

Chem 2113

Test 2

June 28, 2002

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:

0.0025 M HClO_4

0.0025 M sodium benzoate

0.050 M NaHCO_3 (sodium bicarbonate)

A solution prepared by mixing 27.00 mL of 0.1004 M H_3PO_4 and 40.00 mL of 0.06777 M Na_2HPO_4

0.0250 M KI

2. Consider the titration of 50.0 mL of 0.050M salicylic acid with 0.050M NaOH. Calculate the pH of the solution at the following points along the titration curve:

a) Before any titrant is added;

b) After 25.0 mL of titrant is added;

c) After 40.0 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 sodium phthalate [$\text{Na}_2\text{C}_6\text{H}_4(\text{COO})_2$] 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. The active ingredient in disulfiram, a drug used for the treatment of chronic alcoholism, is tetraethylthiuram disulfide. This drug has a molecular weight of 296.55, and contains four (4) sulfur atoms per molecule. The sulfur in a 0.4329 g sample of disulfiram preparation was oxidized to SO_2 , which was absorbed in H_2O_2 to give H_2SO_4 . The acid was treated with 22.13 mL of 0.03736 M NaOH. Calculate the percentage tetraethylthiuram disulfide in the preparation.

5. A 1.291 sample containing $(\text{NH}_4)_2\text{SO}_4$, NH_4NO_3 , and inert material was diluted to 250.0 mL in a volumetric flask. A 50.00 mL aliquot was then made basic, and the liberated ammonia was distilled into 30.00 mL of 0.08421M HCl. After this reaction was complete, the excess HCl was titrated with 10.17 mL of 0.08802M NaOH. A 25.00 mL aliquot of the sample was then obtained, made basic, and the NO_3^- was reduced to NH_3 with Devarda's alloy. This aliquot was then distilled into 30.00 mL of the standard acid. It required 14.16 mL of the standard base to react with the excess acid from the second distillation. Calculate the percent $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3 present in the sample.

Consider a mixture that may contain NaOH, Na₂CO₃, and NaHCO₃ along with inert material. A 5.000 g sample of this mixture was dissolved in water and diluted to 250.0 mL in a volumetric flask. A 50.00 mL aliquot of this solution was titrated to a *phenolphthalein* endpoint and required 28.31 mL of 0.1092 M HCl. A second, 50.00 mL aliquot, which was titrated to a *bromocresol green* endpoint, required 39.91 mL of the HCl solution to reach the endpoint.

a) Which specie(s) are present? Explain.

b) Calculate the percent of each specie(s) present in the original sample.