1. Explain the effect that the following errors would have on the normality of a solution of NaOH being standardized against pure KHP. Would the error cause the normality to be high or low, or would it have no effect? (a) The buret containing NaOH is read too quickly, not allowing sufficient time for drainage. (b) The initial reading of the NaOH buret is recorded as 1.10 when it is actually 0.90 ml. (c) The weight of KHP is recorded as 0.7862 when it is actually 0.7682 g. (d) The sample is dissolved in 50 ml of water although the directions called for 100 ml. (12 %)

2. The sulfate ion in a solution is to be precipitated by the addition of lead (II) ion. The solution also contains small amounts of NO_3^-, Cl^-, and ClO_4^- ions. (a) Which ion is most likely to be co-precipitated ? Why? (b) How could you minimize this co-precipitation? (8 %)

3. A chemist wishes to prepare 100 ml of a solution of pH 1.40 from solutions of HCl, pH 0.40, and NaOH, pH 13.70. How many ml of each solution should be mixed to give the desired solution? Assume that the volumes are additive. (10 %)

4. A sample of pure $NaHCO_3$ weighing 1.008 g is dissolved in water, and 0.3200 g of pure NaOH is added to the solution. The solution is then diluted to 250.0 ml in a volumetric flask and a 50.00-ml aliquot is titrated with 0.100 M HCl using phenolphthalein indicator. (a) How many ml of titrant are required? (b) How many additional ml would be required to reach the methyl orange end point? (20 %)

5. Convert each of the following decimal numbers to its binary equivalent. (a) 24 (b) 79 (c) 136 (d) 581 (8 %)

6. Why do quantitative and qualitative analysis often require different monochromator slit width? (8 %)

7. In a hydrogen/oxygen flame, an atomic absorption peak for iron was found to decrease in the presence of large concentrations of sulfate ion. (a) Suggest an explanation for this observation. (b) Suggest three possible methods for overcoming the potential interference of sulfate in a quantitative determination of iron. (12 %)

8. Draw a schematic diagram for a double-beam spectrophotometer with beams separated in space. (10 %)

9. How do the mass spectra for electron-impact, field ionization, and chemical ionization sources differ from one another? (12 %)