1. A 0.8040 g sample of an iron ore is dissolved in acid. The iron is then reduced to Fe^{+2} and titrated with 47.22 mL of 0.02242 M $KMnO_4$ solution. Calculate the results of this analysis in terms of (a) % Fe (55.847 g/mol) and (b) % Fe_3O_4 (231.54 g/mol). The reaction of the analyte with the reagent is described by the following equation: (10 分)

$$MnO_4^- + 5\,Fe^{2+} + 8\,H^+ \rightarrow Mn^{2+} + 5\,Fe^{3+} + 4\,H_2O$$

2. (1) Calculate the pH of a solution that is 0.200 M in NH_3 and 0.300 M in NH_4Cl. Dissociation constant of NH^{4+} is $K_a = 5.70 \times 10^{-10}$. (15 分)
(2) Calculate the pH change that takes place when a 100 mL portion of (a) 0.0500 M NaOH and (b) 0.0500 M HCl is added to 400 mL of the buffer solution that was described in (1). (15 分)

3. Calculate the dissociation constant for the weak acid HP if the cell
SCE || HP(0.010 M), NaP(0.040 M) | Pt, H_2 (1.00 atm)
develops a potential of –0.591 V. (15 分)

4. (1) Explain "Standard-Addition Method". (10 分)
(2) A 2.00 mL urine specimen was treated with reagent to generate a colored adduct with phosphate, and the sample was then diluted to 100 mL. Exactly 5.00 mL of a phosphate solution containing 0.0300 mg phosphate/mL were added to a second 2.00 mL sample, which was treated in the same way as the original sample. The absorbance of the first sample was 0.428; that of the second was 0.538. Calculate the milligrams of phosphate per millimeter of the specimen. (5 分)

5. The following data are for a liquid chromatographic column:
Length of packing: 25 cm, Flow rate: 0.5 mL/min, V_M: 1.4 mL, V_S: 0.16 mL.
A chromatogram of a mixture of species A, B, and C provided the following data:

	Retention Time, min	Width of Peak Base (W), min
Nonretained	3.1	--
A	5.4	0.41
B	13.3	1.07
C	14.1	1.16

Calculate (a) number of plates from each peak, (b) the plate height for the column, (c) the capacity factor and partition coefficient for A, B, and C, (d) the resolution and the selectivity factor for B and C, (e) the length of column necessary to separate B and C with a resolution of 1.8. (30 分)