Fall 1995-96
Time = 2 hours

Fri. February 2, 1996
Professor Ayssar Nahlé

Chemistry 206

Quantitative Analysis

Final

Student's name: .....
Family First name

I.D. no.: ..... - .....

Section no.: 1 2 3 4
(Circle)

Grade

I	/ 20
II	/ 14
III	/ 18
IV	/ 12
V	/ 16
VI	/ 20
Total:	/ 100

Good Luck

I. A) Use the Q test to test the following results using the 90% confidence level. **Show your calculation and circle the rejected values.**

6.02; 7.28; 7.32; 7.02; 7.92; 7.12; 7.32; 7.22

B) Estimate the absolute and the relative standard deviations (Sy) and $(\frac{Sy}{y})$ respectively in the results of the accompanying calculations (the numbers in parentheses are absolute standard deviations for the numbers they follow). Round the result to the appropriate number of significant figures. (Fill in the blank).

a) $$y = \frac{Log[3.221(\pm 0.005)]^3 + 12.07(\pm 0.04)}{10.3214(\pm 0.0003) \times \sqrt{1.496(\pm 0.002)}} = 1.076817167...(\pm ??)$$

S_y = ...

$\frac{Sy}{y}$ = ...

y = ... ± .....

b) $$y = \frac{[21.7(\pm 0.1) + 16.932(\pm 0.004)] \times 0.796(\pm 0.003)}{\sqrt[3]{27.916(\pm 0.05)}} = 10.136994...(\pm ??)$$

S_y = ...

$\frac{Sy}{y}$ = ...

y = ... ± .....

II. Phosphorus in urine can be determined by treating with molybdenum(VI) and then reducing the phosphomolybdo complex with aminonaphtholsulfonic acid to give the characteristic molybdenum blue color. This absorbs at 690 nm. A patient excreted 1270 mL urine in 24 hours, and the pH of the urine was 6.5. A 1.00 mL aliquot of the urine was treated with molybdate reagent and aminonaphtholsulfonic acid and was diluted to a volume of 50.0 mL. A series of phosphate standards was similarly treated. The absorbance of the solutions at 690 nm, measured against a blank, were as follows:

Solution	Absorbance
1.00 ppm P	0.205
2.00 ppm P	0.410
3.00 ppm P	0.615
4.00 ppm P	0.820
Urine sample	0.625

a) Calculate the number of grams phosphorus excreted per day.

.....

b) Calculate the phosphate concentration in the urine as millimoles per liter.

.....

c) Calculate the ratio of HPO_4^{2-} to $H_2PO_4^-$ in the sample.

HPO_4^{2-} : $H_2PO_4^-$ = ...

III. If the potential of a calcium-selective electrode is +0.0443 V in a 0.0200 M $CaCl_2$ solution, what will the potential be in a 0.200 M $CaCl_2$ solution? **(Use activities)**

Potential = ... V

IV. Chloride in a brine solution is determined by the Volhard method. A 10.00 mL aliquot of the solution is treated with 15.00 mL of standard 0.1182 M silver nitrate solution. The excess silver is treated with standard 0.101 M potassium thiocyanate solution, requiring 2.38 mL to reach the red $Fe(SCN)^{2+}$ end point. Calculate the concentration of chloride in the brine solution, in g/L.

Concentration of chloride in the brine = ...

V. In a solution, ferric ions are reduced to ferrous ions by metallic iron (Fe). If $[Fe^{2+}]=0.100$ M at the equilibrium state, what is the Fe^{3+} ion concentration in equilibrium with Fe^{2+} ions and the metallic Fe?

$[Fe^{3+}]$ = ...

VI. **a)** Construct the titration curve, **emf** of cell (with a silver electrode (cathode) and a saturated calomel electrode) as a function of the volume of titrant, in the titration of 50.00 mL of 0.0500 M NaCl solution with standard 0.1000 M silver nitrate solution.
(Fill in the table below the silver ion concentration and the calculated cell potential corresponding to the volumes of silver nitrate listed)

$AgNO_3$, mL	$[Ag^+]$	E_{cell}, V
0.00	.....	.....
1.00	.....	.....
5.00	.....	.....
10.00	.....	.....
15.00	.....	.....
20.00	.....	.....
22.50	.....	.....
24.90	.....	.....
25.00	.....	.....
25.10	.....	.....
25.50	.....	.....
27.50	.....	.....

b) PLot the titration curve (E_{cell} versus V_{AgNO_3}) on the provided graph paper.