

CHEM 213
Chemical Analysis
Exam 1

1 _____ (of 20)

2 _____ (of 10)

3 _____ (of 4)

4 _____ (of 10)

5 _____ (of 6)

Σ _____ (of 50)

%

Name: _____
(please print)

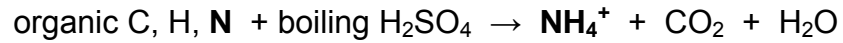
1. Quinine may be determined by measuring the fluorescence intensity in 1 M H_2SO_4 solution. Standard solutions of quinine gave the following fluorescence values.

concentration of quinine x ($\mu\text{g mL}^{-1}$)	0.00	0.10	0.20	0.30	0.40
Fluorescence intensity y (arb. units)	0.00	5.20	9.90	15.30	19.10

- a. Calculate by the least squares method the equation of the best straight line for the calibration curve. Report your result in the form $y = [m(\pm s_m)]x + [b(\pm s_b)]$. (15 points)

- b. An unknown quinine sample gave a fluorescence intensity of 10.20. Calculate the number of quinine in $\mu\text{g/mL}$ in the unknown and estimate its uncertainty. (5 points)

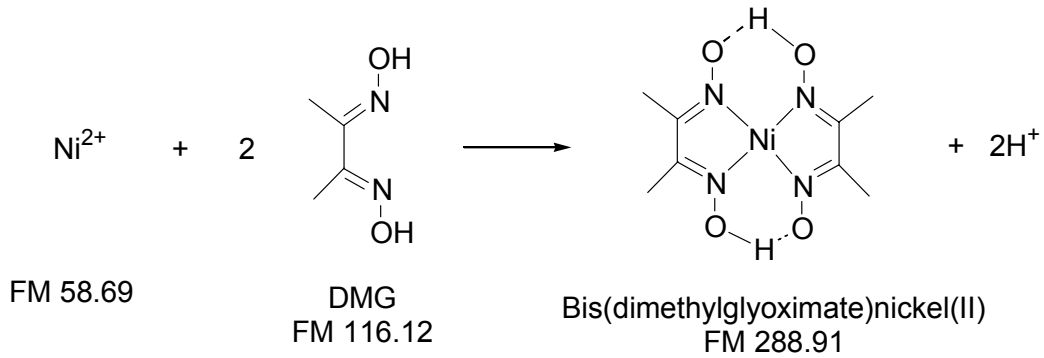
2. In a Kjeldahl nitrogen analysis, nitrogen in substances such as protein, milk, cereal, and flour is determined.



A typical protein contains 16.2 wt% nitrogen. A 0.500-mL aliquot of protein solution was digested, and the liberated NH_3 was distilled into 10.00 mL of 0.02140 M HCl. The unreacted HCl required 3.26 mL of 0.0198 M NaOH for complete titration. Find the concentration of protein (mg protein/mL) in the original sample. (10 points)

3. Analysis of a sample of iron ore gave the following percentage values for the iron content: 7.08, 7.21, 7.12, 7.09, 7.16, 7.14, 7.07, 7.14, 7.18, 7.11. Calculate the a) mean, b) standard deviation and c) coefficient of variation for the values. (4 points)

4. To measure the nickel content in steel, the alloy is dissolved in 12 M HCl and neutralized in the presence of citrate ion, which maintains iron in solution. The slightly basic solution is warmed, and dimethylglyoxime (DMG) is added to precipitate the red DMG-nickel complex quantitatively. The product is filtered, washed with cold water, and dried at 110 °C.



If the nickel content is known to be near 3 wt % and you wish to analyze 1.0 g of the steel, what volume of 1.0 wt% alcoholic DMG solution should be used to give a 50% excess of DMG for the analysis? Assume that the density of the alcohol solution is 0.79 g/mL. (10 points)

5. Traces of toxic, man-made hexachlorohexanes in North Sea sediments were extracted by a known process and by two new procedures, and measured by chromatography.

Method	Concentration found (pg/g)	Standard deviation (pg/g)	Number of replications
Conventional	34.4	3.6	6
Method A	42.9	1.2	6
Method B	51.1	4.6	6

- a. Is the standard deviation for procedure B significantly different from that of the conventional procedure? ($F_{\text{table}} = 5.05$) (3 points)

- b. Is the mean concentration found by procedure B significantly different from that of the conventional procedure? ($t_{\text{table}} = 2.365$) (3 points)