

B.S./B.A. Sophomore Year Lab

CEM 262 Quantitative Analysis

Description: Quantitative analysis of chemical compounds.

Credit: 3 Credits (2 hours lecture, 1 hour recitation, and 3 hours laboratory per week)

Prerequisite: CEM 162 or LB 172L

Lecture topics:

- Solution descriptions
- Titrimetry including volumetric calculations
- Significant figures; calculation of means and standard deviations; accuracy and precision; random, systematic, and gross errors; sample vs. population; confidence limits; Q test for rejecting outliers
- Chemical equilibrium & activity
- Solution chemistry of acids, bases and salts; equilibrium constants: K_a , K_b , & K_w
- Buffers, Henderson-Hasselbach equation
- Acid-base indicators & titration curves
- Polyfunctional acids and bases
- Solubility product
- Gravimetric analysis
- Equilibrium calculations
- Complexometric titrations & indicators; EDTA equilibria; metal ion indicators
- Electroanalytical chemistry, Nernst equation; oxidation-reduction reactions
- Redox titrations & indicators, iodometric titrations
- Introduction to spectroscopy, absorption and transmittance, Beer's Law, standard additions, external standards
- Calibration curves, linear least squares regression, solving multi-component absorbance of mixtures
- Sensitivity and accuracy of spectroscopic measurements

Experiments:

No formal laboratory reports. Student experiments are graded on accuracy of the result only. Emphasis is on developing good laboratory skills, multitasking, and effective use of a laboratory notebook.

1. Determination of the Purity of a Weak Acid: Potassium Hydrogen Phthalate (KHP)
(titration of impure KHP samples with standardized NaOH using phenolphthalein indicator)
2. Determination of Dissociation Constant and Molecular Weight of a Weak Monoprotic Acid
(titration of unknown acid with standardized NaOH using pH meter to plot the titration curve)
3. Determination of Ca^{2+} Concentration by Oxalate Precipitation
4. Determination of Zinc with EDTA Titration
5. Iodometric Titration of Copper
6. Spectrophotometric Determination of Manganese in a Sample of Steel
7. Simultaneous Determination of Cobalt and Chromium by Multicomponent Spectrophotometry