



Lead City University, Ibadan
Faculty of Sciences
Department of Biochemistry

COURSE PARTICULARS

Course Title: Analytical Chemistry
Course code: CHM 411
No. of Units: 2
Status: Compulsory

LECTURER DETAILS

Name: Mrs. Oni O.S.
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Area of Specialization: Analytical/Industrial chemistry

Name: Dr. S. Alayande
Qualifications:
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COURSE DESCRIPTION

- Theory of Errors
- Sampling and Sample Pre-treatment
- pH Methods of analysis
- Conducto-metric methods
- GC-MS Method of analysis
- Radio-chemical Method of analysis
- Chromatography

COURSE OBJECTIVES

- To explore topics such as experimental design
- To have an understanding of sampling
- To learn how to interpret experimental results.

ASSESMENT

Class Attendance	5marks
Test(s) and Assignments	25marks
Final Examination	70marks

LECTURE PLAN

Week	Topic
1 st	Introduction to Analytical chemistry and course content
2 nd	Theory of Errors
3 rd -4 th	Introduction to sampling and sample pre-treatment
5 th	pH Methods of analysis
6 th -7 th	Chemical methods of analysis- Conducto-metric method
8 th -9 th	Chemical methods of analysis - GC-MS method
10 th	Chemical methods of analysis - Radio-chemical Method of analysis
11 th -12 th	Chromatography

READING LIST

1. Holler, J. F and Grouch S. Fundamentals of Analytical Chemistry 9th edition (2013).
 - a. Skoog and West.
2. Christian G, Analytical Chemistry 6th edition (2004) Wiley International edition.

TUTORIAL QUESTIONS

1. The accuracy of a spectrophotometer can be evaluated by preparing a solution of 60.06-ppm $K_2Cr_2O_7$ in 0.0050 M H_2SO_4 and measuring its absorbance at a wavelength of 350 nm using a cell with a pathlength of 1.00 cm. The absorbance should be 0.640. What is the molar absorptivity of $K_2Cr_2O_7$ at this wavelength?
 - a. What are the limits to Beer and Lamberts Law.
2. An analysis to determine the concentration of Cu in an industrial plating bath uses a procedure for which Zn interferent. When a sample containing 128.6 ppm Cu is carried through a separation to remove Zn, the concentration of Cu remaining is 127.2 ppm. When a solution of Zn is carried through the separation, a concentration of 4.3 ppm remains. Calculate the
 - a. recoveries for Cu and Zn
 - b. the separation factor
3. The concentration ratio of Cu to Zn in the plating bath is 7:1. Analysis of the standard solutions containing only Cu or Zn give the following standard equations.
$$S_{Cu} = 1250 \times \text{ppm Cu}$$
$$S_{Zn} = 2310 \times \text{ppm Zn}$$
 - a. What error is expected if no attempt is made to remove Zn before analyzing for Cu?
 - b. What is the error if the separation is carried out?
4. What is the difference between fluorescence and phosphorescence?
 - b. By how many kilojoules per mole is the energy of increased when it absorbs ultraviolet radiation with a wavelength of 147 nm?
 - c. How much is the energy of increased when it absorbs infrared radiation with a wavenumber of 2300 cm^{-1} ?
5. Pure hexane has negligible ultraviolet absorbance above a wavelength of 200 nm. A solution prepared by dissolving 25.8 mg of benzene in hexane and

diluting to 250.0 mL had an absorption peak at 256 nm and an absorbance of 0.266 in a 1.000-cm cell. Find the molar absorptivity of benzene at this wavelength.

- b. Explain the difference between transmittance, absorbance, and molar absorptivity. Which one is proportional to concentration?

6. Draw and explain a flow scheme of the fluorescence Spectrometer.

- b. A sample of hexane contaminated with benzene had an absorbance of 0.070 at 256 nm in a cuvet with a 5.000-cm pathlength. Find the concentration of benzene in mg/L.

7. What is the main advantage of fluorescence over other absorption measurements?

- b. State the principles underlying the following spectroscopic methods.

- Refractometry
- Polarimetry
- NMR

8. A 3.96×10^{-4} M solution of compound A exhibited an absorbance of 0.624 at 238 nm in a 1.000-cm cuvet; a blank solution containing only solvent had an absorbance of 0.029 at the same wavelength. Find the molar absorptivity of compound A.

- b. What is the difference between luminescence and chemiluminescence?

9. What is the difference between a fluorescence excitation spectrum and a fluorescence emission spectrum? Which one resembles an absorption spectrum?

- b. A 5.00×10^{-4} M solution of an analyte is placed in a sample cell that has a pathlength of 1.00 cm. When measured at a wavelength of 490 nm, the absorbance of the solution is found to be 0.338. What is the analyte's molar absorptivity at this wavelength?

10. The transmittance of a solution is found to be 85.0% when measured in a cell whose pathlength is 1.00 cm. What is the percent transmittance if the pathlength is increased to 10 cm.

- b. What is an absorption spectrum?
- c. The IR spectrum is split into regions. What are these regions and what part do they play in the reading of the spectrum?