STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

COURSE OUTLINE

CHEM 121 – General, Organic, and Biochemistry Laboratory

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SCHOOL OF SCIENCE, HEALTH & PROFESSIONAL STUDIES
SCIENCE DEPARTMENT
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CHEM 121– General, Organic, and Biochemistry Laboratory

A. **TITLE:** General, Organic, and Biochemistry Laboratory

B. **COURSE NUMBER: CHEM 121**
SHORT TITLE: General, Organic, and Biochemistry Laboratory

C. **CREDIT HOURS:** 1 credit hours

D. **WRITING INTENSIVE COURSE (OPTIONAL):** N/A

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Fall/Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
Three hours laboratory per week .

H. **CATALOGUE DESCRIPTION:**
The laboratory component of CHEM 120 (General, Organic, and Biochemistry). The course includes experiments in measurement principles, thermodynamics, kinetics, gravimetric analysis, physical behavior of gases, spectroscopy, radiochemistry, solutions, organic chemistry separation techniques and organic chemical synthesis. This course must be taken with CHEM 120 or after CHEM 120 has been successfully completed.

I. **PRE-REQUISITES/CO-COURSES:**
Prerequisites:
High School Regents chemistry(65 grade minimum) or Introduction to Chemistry (CHEM 101) and High School Algebra or Intermediate Algebra (MATH 106)
Co-requisites/ prerequisites:
CHEM 120 (General, Organic, and Biochemistry)

J. **GOALS (STUDENT LEARNING OUTCOMES):**

Course Student Learning Outcomes	Institutional Student Learning Outcomes
Know the safety requirements and procedures of the General, Organic and Biochemistry laboratory	Professional Competence
Report data and results to the correct precision of measurement devices or instruments used in the laboratory exercises.	Professional Competence Communication
Construct and interpolate graphs using graphics software	Professional Competence Communication Critical Thinking
Perform all required operations using appropriate experimental technique leading to the successful completion of the laboratory experiments	Professional Competence Critical Thinking

K. **TEXTS:** Laboratory Exercises for General, Organic, and Biochemistry, Brian Washburn, SUNY Canton Spring 2008 edition (used for CHEM 102)

L. REFERENCES: N/A

M. EQUIPMENT: N/A

N. GRADING METHOD: (P/F, A-F, etc.) (A-F)

O. MEASUREMENT CRITERIA/METHODS:

Chemical Safety Examination
Laboratory Reports
Organic Chemistry Laboratory Practicum Examination

P. DETAILED TOPICAL OUTLINE:

I. Laboratory Safety
   - A. Location and use of laboratory safety equipment
   - B. Safety procedures and routes of egress
   - C. National Fire Prevention Association (NFPA) chemical safety coding system

II. Scientific Method, Accuracy, and Precision
   - A. Scientific Method
   - B. Accuracy and precision
   - C. Operation of an analytical balance
   - D. Exercise in the evaluation of US Mint possible changes to the penny

III. Measurement and Density
   - A. Technique for measuring with analog devices
   - B. Use of a caliper
   - C. Measurement of the dimensions of a solid object
   - D. Measurement of liquid volumes using devices of different precision
   - E. Determination of the density of an unknown metal
   - F. Determination of an average and average deviation for the density data
   - G. Determination of a percentage error

IV. Heat Transfer
   - A. Operation of data logger
   - B. Determination of the heat capacity of a calorimeter
   - C. Determination of the specific heat of a metal using calorimetric techniques
   - D. Determination of an average and standard deviation for a data set

V. Water of Hydration
   - A. Operation of a Bunsen burner
   - B. Gravimetric technique
   - C. Determination of the number of waters of hydration contained in two hydrates

VI. Determination of the Energy of Activation for a Chemical Reaction
   - A. Use of a burette and Eppendorf pipette
   - B. Collection of temperature and time data
   - C. Graphing of Log time vs. 1/Temperature
   - D. Linear Fit regression analysis to determine the slope of a line
   - E. Calculation of the energy of activation from the slope of a line

VII. Determination of the Value of Absolute Zero and the Atomic Mass of Mg
   - A. Construction of the pressure/temperature apparatus
   - B. Accurate recording of a pressure gauge
   - C. Construction of the graph needed to evaluate the value of absolute zero

D. Techniques associated with the operation of a eudiometer tube
E. Accurate recording of gas volume and mass of Mg metal used
F. Determination of the atomic mass of Mg
G. Determination of an average and average deviation for a data set
H. Determination of a percentage error for the atomic mass of Mg

VIII. Solution Preparation and Spectroscopy
A. Preparation of a solution from pure solute and pure solvent
B. Preparation of solutions by dilution techniques
C. Preparation of a UV/Vis spectrometer for the analysis of a solution
D. Operation of a UV/Vis spectrometer to obtain absorbance values for a number of solutions
E. Construction of "standard curves" using graphing software.
F. Interpolation of concentration values using "standard curves" and absorbance values of unknown solutions

IX. Radioactivity
A. Operation of a Geiger-Mueller tube
B. Determination of background radiation levels
C. Determination of Beqerruels for a alpha, beta, and gamma radiation source
D. Determination of the effect of distance on radiation intensity
E. Determination of the effect of lead and aluminum in shielding radiation from a gamma radiation source

X. Acids and Bases
A. Titration techniques
B. Determination of the Normality of a unknown HCl solution by titration with standardized NaOH using phenolphthalein as the acid/base indicator
C. Operation of a pH meter
D. Titration of a strong acid and a weak acid with standardized NaOH using a pH meter
E. Construction of pH vs. ml. of NaOH graphs for the above titrations using graphing software
F. Determination of the Equivalence Point for the above graphs

XI. Recrystallization of an Impure Organic Solid
A. The recrystallization process
B. The recrystallization solvent required characteristics
C. Recrystallization techniques
D. Separation of salicylic acid from sugar, sand, and sawdust

XII. Extraction of an Organic Acid from Water
A. Extraction Principles
B. Extraction mathematics
C. Extraction techniques
D. Titration techniques
E. Determination of the $K_{(Distribution)}$ for propanoic acid in a water/ 1-heptanol extraction
F. Evaluation of the efficacy of multiple vs. single extractions

XIII. Distillation Techniques and Gas Chromatography
A. Simple distillation
B. Fractional distillation
C. Construction of the apparatus for fractional distillation
D. Fractional distillation of an acetone/ 1-butanol mixture
E. Principles of gas chromatography

F. Recording of gas chromatograms for fractions obtained during the fractional distillation of an acetone/ 1-butanol mixture

XIV. Dehydration of 2-Methyl-2-butanol
- A. Dehydration of 2-Methyl-2- butanol including Saitzev's Rule
- B. Determination of the percentage yield of a chemical reaction
- C. Apparatus and procedures for the dehydration
- D. Determination of the percentage yield
- E. Gas chromatogram interpretation to substantiate the validity of Saitzev's Rule

XV. Esterification of 3-Methyl-1-butanol
- A. Esterification of 3-Methyl-1-butanol
- B. Apparatus and procedures for the esterification
- C. Determination of the percentage yield`