Departmental Assessment Document

For Assessment Committee

Department of Chemistry and Physics

Anderson University

2003

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Assessment Program for the Department of Chemistry and Physics

I. Our graduates will be able to demonstrate knowledge and understanding of the fundamental concepts in their major.

Assessment Tools:

1. The results of student performance on standardized and departmental exams will be used to assess student learning.

    A. Appropriate standardized tests will be given at the end of each class where nationally recognized tests are available. These tests will be used to establish a baseline and to monitor significant deviations.

    B. The performance of our majors on entrance exams for post-graduate programs (e.g., MCAT, MDAT, GRE) will be monitored in order to ascertain their level of achievement in our major areas.

    C. The scores on a department-generated exam given during the student's last semester that assesses understanding of the fundamentals of their subject areas will be monitored. (This exam covers the Learning Objectives for Objective I that are included in Appendix I.)

2. A survey of 2- and 6-year graduates will be distributed to learn their perception of preparedness for their fields and what they identify as the strengths and weaknesses of our program. (See Graduate Survey in Appendix II.)

II. Our graduates will be able to demonstrate a proficiency in laboratory and research skills.

Assessment Tools:

1. The science seminar faculty evaluations will be used to assess the student's proficiency in the areas of data analysis, interpretation, and the conveyance of results through oral and written communication. (See Science Seminar Faculty Evaluation Sheets in Appendix III.)

2. An advance laboratory course will serve as a means to assess a student's proficiency in laboratory and research skills. (See Learning Objective for Objective II in Appendix I and CHEM 4510/4520 Course Syllabi in Appendix IV.)

3. A survey of 2- and 6-year graduates will be distributed to learn their perception of preparedness in the area of laboratory and research skills. (See Graduate Survey in Appendix II.)

III. Our graduates will demonstrate and understand what it means to be Christian and to be a Scientist.

Assessment Tools:

1. Each student will write a paper on the topic, "How my educational experience in science at Anderson University has shaped my understanding of the Christian faith and caused me to reflect upon the implications of faith on my planned career as a scientist." The scores given to each paper by the chemistry and physics faculty will be tabulated and averaged. The average score will be used to monitor changes in student response. (See Evaluation Criteria in Appendix V.)

2. A survey of 2- and 6-year graduates will be distributed to obtain their perception of the role which discussions of Christian faith in their science classes or with their instructors and peers had on their personal and spiritual development. (See Graduate Survey in the Appendix II.)

Appendices Table of Contents

Appendix I

Learning Objectives for Objective I

Matrix for the assessment of chemistry and biochemistry majors by content area and core courses required. The items in the matrix will be used to develop the departmental assessment exam. (**E** for exposure to concept, **D** for detailed coverage; one example given)

Content Area	CHEM 2110	CHEM 2120	CHEM 2210	CHEM 2220	CHEM 3100	CHEM 3110	CHEM 3120
Acid-Base Chemistry	E	E			D		
Inorganic Nomenclature							
Organic Nomenclature							
Conversions							
Stoichiometry							
Redox Reactions							
Electron Configurations							
Periodic Trends							
Molecular Geometries							
Molecular Orbital Theory							
Thermodynamics							
Lewis Structures							
Electronegativity							
Gas Laws							
Solutions							
Intermolecular Forces							
Isotopes							
Atomic Structure							
Nuclear Chemistry							
Reaction Coordinate Diagrams							
Kinetics							
Equilibrium Constants							
Le Châtelier's Principle							
Hybridization							
Nucleophiles/Electrophiles							
Resonance							
Electron "Pushing" and Mechanisms							
Functional Group Identifications							
Carbocations/Carbanions							
Percent Yield Calculations							
Valence and Formal Charges							

Appendix I (continued)

Learning Objectives for Objective II

Matrix for the assessment of chemistry and biochemistry majors by lab or research skills required. The departmental lab skills exam will cover the areas included in this matrix. (**E** for exposure to concept, **D** for detailed coverage; one example given)

Lab or Research Skill	**CHEM 2110**	**CHEM 2120**	**CHEM 2210**	**CHEM 2220**	**CHEM 3100**	**CHEM 3110**	**CHEM 3120**	**CHEM 4510**	**CHEM 4520**	**CHEM 4910**	**CHEM 4920**
Weighing	E	E	E	E	D			D	D	D	
Filtering											
Solution Making											
Pipeting											
Titration											
Melting & Boiling Point Determination											
Distillation (vacuum & simple)											
Chromatography (TLC, column)											
Sublimation											
Extraction											
Separation											
Cleaning											
Safety											
Statistics											
Accurate Measurements											
Calibration											
Standard addition											
Internal standard											
Graphing											
Literature											
Interpretation of results											
Communication (oral & verbal)											
Instrumentation											
IR											
NMR											
UV											
Vis											
AA											
GC-MS											
HPLC											
XRF											
pH meter (ISE)											
Calorimetry											
Modelling											

Appendix II

Graduate Survey

We the faculty of the Chemistry and Physics Department would greatly appreciate it if you could please take a moment out of your busy schedule to complete this brief survey. It is distributed to 2- and 6-year graduates only and your responses will help us assess our efforts in instruction and guidance. *Please note* that if you are no longer working in a science related area, the questions may not be pertinent to you. In that case, please comment on the educational aspects that you feel would be beneficial to us. Thank you!

Name _____ email _____

Employment/current activity: _____

Address: _____

City: _____ State _____ Zip _____ Telephone: _____

(Please feel free to update us on your life at the bottom of this form.)

Understanding of the Fundamental Concepts

Strongly Agree (SA) Agree (A) Neutral (N) Disagree (D) Strongly Disagree (SD)

1. The chemistry/physics courses that I took at AU adequately prepared me for my field of study.
   SA A N D SD

2. The variety of chemistry/physics courses offered at AU allowed me to have adequate exposure to the topics that I encountered in my work after college.
   SA A N D SD

3. The education offered at AU in the chemistry/physics department was comparable to that of my colleagues with a similar degree from other institutions.
   SA A N D SD

General comments on content preparedness:

Laboratory and Research Skills

4. I took an Instrumental Analysis course: ***Yes No***

5. The instrumentation available at AU in the chemistry/physics curriculum were sufficient to gain an adequate background for the work in which I am involved.
   SA A N D SD
   If not, what additional instrumentation should be added?

6. The opportunities to use instrumentation were adequate.

SA ***A*** ***N*** ***D*** ***SD***

7. The foundational ideas of how to conduct research were part of my experience.

SA ***A*** ***N*** ***D*** ***SD***

8. The laboratory techniques that I gained were adequate for my work.

SA ***A*** ***N*** ***D*** ***SD***

If not, what additional techniques should have been taught?

9. The opportunity to present research efforts through communication, oral and written, has aided me in my work after college.

SA ***A*** ***N*** ***D*** ***SD***

General comments on laboratory preparedness:

Christianity and Science

10. The chemistry/physics courses that I took at AU challenged me to see the connection between Christianity and science.

SA ***A*** ***N*** ***D*** ***SD***

11. The chemistry/physics courses that I took at AU caused me to reflect on the integration of faith and my work.

SA ***A*** ***N*** ***D*** ***SD***

12. The faculty in the chemistry/physics department helped me to understand the idea of being a servant in the scientific world.

SA ***A*** ***N*** ***D*** ***SD***

11. The faculty in the chemistry/physics department effectively modeled how to live as Christians in their professional and personal activities.

SA ***A*** ***N*** ***D*** ***SD***

General comments on this section:

Please update us on what's happening in your life.

Appendix III

Science Seminar Faculty Evaluation Sheets for Objective II

SCIENCE SEMINAR EVALUATION FORM

Presenter:_____ Date: _____
Topic:_____ Evaluator:_____

CONTENT AND EFFECTIVENESS (72 points)

1.	Topic was interesting and appropriate for the seminar.	4 3 2 1 0
2.	The opening was interesting and generated audience attention.	4 3 2 1 0
3.	Talk was well-organized and logically developed.	8 6 4 2 0
4.	The introduction clearly demonstrated the relevance of the experiments to the general topic discussed.	4 3 2 1 0
5.	The hypothesis or objective(s) of the experiment(s) presented was (were) clearly stated	8 6 4 2 0
6.	The description of the methods used was adequate to support the experiment(s) discussed.	4 3 2 1 0
7.	The results of the experiment were presented in a concise, coherent, easily understood manner	8 6 4 2 0
8.	The data presented were discussed in relationship to the hypothesis or objectives presented and the overall conclusions reached by the investigators	8 6 4 2 0
9.	The student offered his/her on evaluation of the experimental work presented.	4 3 2 1 0
10.	Speaker's handling of technical information was adequate and accurate.	8 6 4 2 0
11.	Level of the presentation was appropriate for the audience, especially for non-specialists in the field who could understand the main points.	4 3 2 1 0
12.	Effective summary of the main points was given, and appropriate conclusions were drawn.	4 3 2 1 0
13.	Speaker addressed the issues raised by questioners, and questions were answered with confidence.	4 3 2 1 0

MECHANICS (28 points)

1.	Speaker was appropriately dressed.	4 3 2 1 0
2.	Speaker used appropriate tone, loudness, and rate of speech.	4 3 2 1 0
3.	Speaker used correct grammar, pronunciation and enunciation.	4 3 2 1 0
4.	Speaker maintained adequate eye contact with audience and did not rely too frequently on notes nor read presentation.	4 3 2 1 0
5.	Visuals were of professional quality and easy to read.	4 3 2 1 0
6.	Visuals effectively conveyed information and fit into the presentation well.	4 3 2 1 0
7.	Speaker's talk was within the 20 minute limit.	4 3 2 1 0

Total (100 points possible) _____

Appendix IV

CHEM 4510/4520 Course Syllabi for Objective II

Please note that these are last year's syllabi and that next year's will reflect the modifications discussed above.

Anderson University
Department of Chemistry/Physics

CHEM 4510
Advanced Laboratory Practicum I

One Credit Hour
Semester I, 2002-2003
Dr. Dale Bales
Dr. Scott Carr
Dr. Chad Wallace

This course is a review and evaluation of essential laboratory practices. A number of experiences will be shared which involve the maintenance, service, and cost of upkeep for existing lab equipment. In addition, students will participate in open-ended research discussions in order to enhance their skill in doing research. This class will also devote some time to reviewing essential concepts in chemistry and safety in the chemical lab. We will also investigate possible careers in chemistry and the income/benefits of these various careers. There will also be class discussions on what it means to be a Christian chemist.

Text:

"Working Safely with Chemicals," Christine Gorman, editor, 2nd ed., Genium Pub., 1994.
"Safety in Academic Chemistry Laboratories" published by the American Chemical Society, 1995.
Operation Manuals for laboratory instruments.
Various reference materials and chemistry books will be essential.
Books that you have used in previous chemistry classes along with library reference materials will be used.

Grading:

ACS exams (general and organic) – 20%
Maintenance report for instruments – 10%
Lab competency exam – 10%
Safety consultant report - 10%
Chemistry Career paper – 10%
Christian Chemist paper – 10%
Participation grade – 30%

Scale:

A	93-100%	B+	87-89.9%	C+	77-79.9%	D+	67-69.9%
A-	90-29.9%	B	83-86.9%	C	73-76.9%	D	60-66.9%
		B-	80-82.9%	C-	70-72.9%		

The instructor reserves the right to modify this scale as necessary depending on the difficulty of the material.

Schedule of Assignments:

Depending on the development of individual research topics discussions may be held during the semester. Students will be asked to share their research on their Science Seminar topic with the group over the course of the semester. Students should as a minimum plan to present their Seminar talk to the group on the Friday before their presentation.

Sept. 6	Introduction and discussion of class objectives.
Sept. 13	Tour of the instrument lab and develop maintenance report for the instruments.
Sept. 20	Maintenance discussions
Sept 27	Take ACS General Chemistry Exam
Oct. 4	General Chemistry Review
Oct. 11	Lab competency exam
Oct. 18	Chemistry Career Options and expectations
Oct. 25	Lab Safety Introduction
Nov. 1	Lab Safety discussion and presentation of papers
Nov. 8	Take ACS organic chemistry exam
Nov. 15	Organic Chemistry Review
Nov. 22	Christian Chemist discussion
Nov. 29	Thanksgiving Break
Dec. 6	Christian Chemist discussion
Dec. 13	Christian Chemist discussion

Anderson University
Department of Chemistry/Physics

CHEM 4520
Advanced Laboratory Practicum II

One Credit Hour
Semester II, 2002-2003
Dr. Dale Bales
Dr. Scott Carr
Dr. Chad Wallace

This senior level class will attempt to bring together several areas in the student's curriculum. It is the goal of this class that the student will learn to integrate the various classroom materials into a background for doing effective research. Class time will often be used for students to share their current work with other members of the class in order to practice sharing scientific research with others and to also gain suggestions and criticism for improving the project. Students will also be introduced to the scientific literature. Class time will be spent discussing articles chosen by the students from various scientific journals.

Schedule

Session 1 – Introduction

Session 2 – Environmental Science and Technology

Session 3 – Analytical Chemistry Cumulative Exam

Session 4 – Journal of the American Chemical Society

Session 5 – Analytical Chemistry

Session 6 – Organic Letters

Session 7 – Journal of Chemical Education or The Physics Teacher

Session 8 – Journal of Organic Chemistry

Session 9 – Inorganic Chemistry or Organometallics or Physical Chemistry

Session 10 – Chemistry journal from the area you will be going into.

Session 11 – Physical Chemistry Cumulative Exam

Remaining sessions – Chemistry journal from the area you will be going into.

Requirements for Class

For each of the sessions where a certain journal is listed, read a paper from that journal and come prepared to talk to the group about a paper from the last year and to lead a discussion on the topic. Be prepared to turn in a synopsis of the article and the specific reference. You should

choose an article from the past year that you can understand the majority of it and be able to present the material to the class. If you look hard enough, you can find an article that has some interest for you and you can understand some of it. For one of the class sessions, you may substitute an article from a journal that will be more in the area that you are going into instead of the recommended journal for that session.

Your grade for the class will be based upon the completion of the presentations and synopses of articles and the completion of the two exams.
The following must be completed to earn the following grades:

Assignments missed	Grade
0-1	A
2	B
3	C
4	D
5	F

Appendix V

Evaluation Criteria for Objective III

Evaluation Criteria	No Evidence 0	Some Evidence 1	Substantial Evidence 2
Impact	The written paper shows no evidence that our program has impacted the student's faith or understanding of being Christian and being a scientist.	The paper includes an illustration or discussion that implies an impact has been made upon the student's understanding.	Multiple illustrations or ideas are expressed which show that a significant impact has been made on the student's thinking.
Reflection	There is no evidence in the paper of the student being motivated to re-evaluate any previously held ideas.	There is some indication that the student has seriously reflected about at least one issue as a result of ideas that were encountered in a major class.	The student demonstrates in some detail a process that has been stimulated by science classes that have caused serious reflection about faith and values.
Servanthood	There is no evidence of the student's desire to be of service to others.	There is at least mention of the desire to serve others and how studies in the major have shaped this desire.	The student shows considerable desire to be a servant and describes how this desire has been shaped by studies in the major field.