CHEMISTRY ASSESSMENT PLAN 2009 - 2010

March 4, 2009

I. MISSION

The Bachelor of Arts degree in Chemistry is designed to provide students with the background needed for science-related industrial and academic positions, for entry into chemistry graduate programs or professional programs (for example: such as medicine, veterinary medicine, dentistry, optometry) and, coupled with the appropriate education courses, to prepare students to teach high school chemistry. The mission is consistent with the IU Kokomo Mission Statement.

II. PROGRAM GOALS AND STUDENT LEARNING OUTCOMES

Student Learning Outcomes and Components:

Goal I: Knowledge and understanding of the theoretical basis of chemistry.

Outcome 1: Students will be able to connect observations with prior information.

Components:

1. Prediction of chemical reaction products
2. Identification of chemical reaction products

Outcome 2: Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure.

Components:

1. Explanation of physical properties
2. Explanation of chemical properties

Outcome 3: Students will perform quantitative calculations using experimental data.

Components:

1. Selection of an appropriate theoretical relationship/equation for data analysis.
2. Completion of quantitative calculations
3. Explanation of the significance and/or validity of the results.

Goal II: Laboratory Work and Performance

Outcome 1: Students will demonstrate the understanding and ability to carry out laboratory procedures effectively and safely.

Components:

1. Explanation of the purpose of the steps in a laboratory procedure.
2. Use of standard laboratory equipment and instrumentation properly and safely.

Outcome 2: Students will collect, analyze, and draw relevant conclusions from experimental data.

Components:

1. Collection and organization of relevant data.
2. Analyze experimental data appropriately.

3. Interpretation of processed data.
4. Identification of experimental errors.

Outcome 3: Design procedures appropriate to the goal of an investigation.

Components:

1. Selection of a suitable experimental approach.
2. Modification of the approach to optimize the experimental outcome.

Goal III: Application of Quantitative Reasoning Skills and Critical Thinking to Problem Solving

Outcome 1: Students will learn to organize relevant information for analysis.

Components:

1. Identification of critical data elements necessary to understand the problem
2. Identification of applicable theories and/or mathematical relationships

Outcome 2: Students will calculate quantitative values and/or formulate an explanation of observations.

Components:

1. Application of theories to illustrate how observations can be understood
2. Application of equations to determine mathematical values with appropriate significant figures and units

Outcome 3: Students will draw conclusions from quantitative values and/or experimental observations.

Component:

1. Correlation of quantitative results to chemical and/or physical properties of the system.

III. Curriculum Map

[Outcomes] Student will:	C 105 General Chem I	C 106 General Chem II	C 125 Gen Chem Lab I	C 126 Gen Chem Lab II	C 210 Intro Analytical	C 211 Intro Anal. Lab	C 310 Instrumental	C 311 Instrumental Lab	C 341 Organic Lecture I	C 342 Organic Lecture II	C 343 Organic Lab I	C 344 Organic Lab II	C 351 Green Chemistry	C 361 Physical Chem	C 400 Chem Information	C 409 Research	C 430 Inorganic Chem	C 443 Org Spectroscopy	C 483 Biochemistry
Connect observations with prior information	X	X		X		X	X	X	X	X	X	X	X	X				X	
Explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure	X	X	X						X	X		X	X					X	X
Perform quantitative calculations using experimental data	X	X	X	X		X					X	X							
Demonstrate the understanding and ability to carry out laboratory procedures effectively and safely			X	X		X	X	X			X	X	X			X			
Collect, analyze, and draw relevant conclusions from experimental data			X	X		X	X	X				X	X			X		X	
Design procedures appropriate to the goal of an investigation						X	X	X				X	X			X		X	
Organize relevant information for analysis	X	X	X	X	X	X				X	X	X		X		X		X	
Calculate quantitative values and/or formulate an explanation of observations	X	X	X	X	X	X	X			X	X	X	X	X			X		

Draw conclusions from quantitative values and/or experimental observations				X	X	X	X		X	X	X	X	X	X		X		X	
Write effective laboratory reports				X		X		X			X	X				X			
Present written and oral summaries of scientific literature															X	X	X	X	

IV. Assessment of student learning activities planned for 2009-2010

A. Learning outcomes to be assessed:
In 2009-2010, we plan to assess goal I (Knowledge and understanding of the theoretical basis of chemistry – Outcomes 1-3). We are particularly interested in measuring our strengths and weaknesses in helping our students to explain the physical and chemical properties of substances based on an understanding of the theoretical bases and to make the connection between observation and prior information, both in the context of the lecture and laboratory portions of our courses.

B-C. Activities and performance characteristics for each outcome/component to be assessed in 2009-2010.

We will assess these outcomes in the following courses:

	CHEM-C 105	**CHEM-C 106**	**CHEM-C 125/126**	**CHEM-C 211**	**CHEM-C 310/311**	**CHEM-C 341/342**	**CHEM-C 343/344**	**CHEM-C 483**
Outcomes	Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure	Students will perform quantitative calculations using experimental data.	Students will perform quantitative calculations using experimental data	Students will perform quantitative calculations using experimental data	Students will be able to connect observations with prior information	Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure	Students will be able to connect observations with prior information	Students will be able to explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure
Component(s)	Explanation of physical and chemical properties	Selection of an appropriate theoretical relationship/ equation for data analysis	Selection of an appropriate theoretical relationship/ equation for data analysis	Completion of quantitative calculations; Explanation of the significance and/or validity of the results	Identification of chemical reaction products	Explanation of physical and chemical properties	Predication of chemical reaction products	Explanation of physical and chemical properties
Activity(es)	Exam question(s): Use periodic	Exam and quizzes questions that	**Completion of laboratory reports,**	**Completion of laboratory reports,**	Exam and quizzes questions that	Exam questions American Chemical	Exam question(s): Predict the	Exam questions relating to the

	table to explain the properties of elements and compounds, such as electron configuration, ionization energy, and polarity. Use solubility rule to predict the solubility of compounds.	focus on explanation of some phenomena using the kinetic and thermodynamic aspects of chemical reactions.	**including results and analysis of those results; two exams which include performing the types of calculations required in the experiments**	**including results and statistical analysis of those results; Completion of laboratory final examination which includes selecting an appropriate analytical method, processing data, and reporting on results.**	focus on explanation of some phenomena using the kinetic and thermodynamic aspects of chemical reactions.	Society standardized exam (selected questions, such as the ones on the structures and activities on different types of organic compounds)	major products for oxidation, reduction, and substitution reactions	structure and function of the major biological molecules and their interactions
Performance characteristics	Correct/ partially correct/ incorrect	Correct/ partially correct/ incorrect	Correct/ partially correct/ incorrect	Correct/ partially correct/ incorrect	Correct/ partially correct/ incorrect	Correct/ incorrect	Correct/ partially correct/ incorrect	Correct/ partially correct/ incorrect
Benchmark	70% correct	70% correct	70% correct	70% correct	70% correct	70% correct	70% correct	70% correct

In addition to conducting specific assessment of the learning outcomes in the courses as described above, the chemistry faculty members are also interested in an overall learning assessment of the graduating seniors. We propose to start compiling the following data in order to develop a historical profile of the chemistry graduates at IU Kokomo. This may include:

i. Educational Testing Service Major Field Test in Chemistry. *We have never given this examination to our majors, so we do not know whether it will provide an appropriate means of measuring of our students' overall learning.*

ii. Grade Point Average (GPA)
    1. Overall Science/Mathematics GPA
    2. Laboratory Course GPA

iii. Performance on science portions of nationally-normed post-graduate examinations

iv. Student conference presentations and publications

v. Student employment, placement, and graduate school acceptance

D. Benchmark for the performance characteristics (see above table)

Typically the benchmark should be at 70% as in the BIPH and biology plans. However, because of the small number of chemistry majors in most courses, percentages cannot be easily used for one academic year. For example, there may only be 2 or 3 chemistry majors in some classes and yearly aggregate data would not be meaningful. Therefore, we will report raw data on an annual basis and aggregate data as percentages every 2 to 4 years.

V. Ongoing Assessment

Our assessment plan is not complete. We need to establish more specific performance guidelines for many of the outcomes, and examine the assessment instruments we use in pivotal courses to ensure that they demonstrate what it is we want them to demonstrate.

We also need to gain experience using the Educational Testing Service Major Field Test in Chemistry to determine whether or not it is an appropriate instrument for assessing our graduating majors.