

Chemistry Program
2016 through 2020 Assessment Plan for the IU Kokomo BS in
Chemistry and Biochemistry

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I. Introduction and mission statements

The Bachelor of Science degrees in Chemistry and Biochemistry are currently offered within the IU Kokomo School of Sciences. These degrees were initiated in the fall of 2012 and implemented concurrently with BA in Chemistry that has been initiated in 2006. Versions of these BS degrees are offered at other IU campuses. The program was originally created at IUB and IUPUI.

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

II. Program goals and 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

The following summary provides an overview of the alignment of each Outcome to the curriculum. This indicates where Outcomes are introduced (I), expanded upon (E), and reinforced (R).

[Outcomes]	C 105 General Chem I	C 106 General Chem II	C 125 Gen Chem Lab I	C 126 Gen Chem Lab	C 250 Intro to Genomics	C 310 Instrumental	C 311 Instrumental	C329 Biochemistry I	C340 Biochemistry II	C 341 Organic	C 342 Organic	C 343 Organic Lab I	C 344 Organic Lab II	C 361 Physical Chem	C 409 Research	C 430 Inorganic Chem	C 443 Org Spectroscopy
Student will:																	
Connect observations with prior information	I	I		E	E	R	R	R	R	R	R	R	R	R			R
Explain the physical and chemical properties of substances based on an understanding of atomic and molecular structure	I	I	E					R	R	R	R		R				R
Perform quantitative calculations using experimental data	I	I	E	E					R			R	R				
Demonstrate the understanding and ability to carry out laboratory procedures effectively and safely			I	I		E	E	R	R			R	R		R		
Collect, analyze, and draw relevant conclusions from experimental data			I	I	E	E	E	R	R				R		R		R

Design procedures appropriate to the goal of an investigation					I	E	E	R	R				I		I		R
Organize relevant information for analysis	I	I	I	I	E			R	R		R	R	R	R	R		R
Calculate quantitative values and/or formulate an explanation of observations	I	I	I	I		E		R	R		R	R	R	R		R	
Draw conclusions from quantitative values and/or experimental observations				I	E	E		R	R	R	R	R	R	R	R		R
Write effective laboratory reports				I			E	R	R			R	R		R		
Present written and oral summaries of scientific literature					E			R	R						R	R	R

IV. Assessment of student learning activities planned for:

Learning outcomes to be assessed:

In 2016-2020, we plan to assess goal II (outcome 2-3) and goal III (outcome 2-3). We are particularly interested in measuring our strengths and weaknesses in helping our students to calculate and interpret the quantitative data 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.

We will assess these outcomes in the following courses:

	CHEM-C 105	CHEM-C 106	CHEM-C 125/126	CHEM-C 310/311	CHEM-C 329	CHEM-C 340	CHEM-C 341/342	CHEM-C 343/344
O u T C O m e s	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 be able to connect observations with prior information	Students will perform quantitative calculations using experimental data	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 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
C o m p o n e n t/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	Identification of chemical reaction products	Selection of an appropriate theoretical relationship/equation for data analysis	Explanation of physical and chemical properties	Explanation of physical and chemical properties	Predication of chemical reaction products
A c T I V I T y/ es	Exam question(s): Use periodic table to explain the properties of elements and compounds, such as electron configuration,	Exam and quizzes questions that focus on explanation of some phenomena using the kinetic and thermodyn	Completion of laboratory reports, including results and analysis of those results; two exams which	Exam and quizzes questions that focus on explanation of some phenomena using the kinetic and	Completion of laboratory reports, including results and analysis of those results; quiz and exam	Exam and quizzes questions that focus on free energy, chemical structure and metabolic pathways	Exam questions American Chemical Society standardized exam (selected questions, such as the ones on the	Exam question(s): Predict the major products for oxidation, reduction, and substitution reactions

	ionization energy, and polarity. Use solubility rule to predict the solubility of compounds.	amic aspects of chemical reactions.	include performing the types of calculations required in the experiments	thermodynamic aspects of chemical reactions.			structures and activities on different types of organic compounds)	
Performance characteristics	Correct/partially correct/incorrect	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
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:

2016-2021 Plan:

A. Learning Outcomes: We plan to assess the following goals according to this schedule:

2016-17: Goal 2 (Laboratory work and performance)

Outcome 2 (Student will collect, draw relevant conclusion from experimental data)

2017-18: Goal 2 (Laboratory work and performance)

Outcome 3 (Design procedure appropriate to the goal of an investigation)

2018-19: Goal 3 (Application of Quantitative Reasoning Skills and Critical Thinking to Problem Solving)

Outcome 2 (Students will calculate quantitative values and/or formulate explanation of observations)

2019-20: Goal 3 (Application of Quantitative Reasoning Skills and Critical Thinking to Problem Solving)

Outcome 3 (Students will draw conclusions from quantitative values and/or experimental observations)

2020-21: Goal 3 (Application of Quantitative Reasoning Skills and Critical Thinking to Problem Solving)

Outcome 3 (Students will draw conclusions from quantitative values and/or experimental observations)

Chemistry and biochemistry faculty will meet annually to review the assessment plan and to decide, on an annual basis, which courses will be assessed for each goal (and which outcome(s) will be assessed for each of those courses).

V- Ongoing assessment:

Assessments for 2015/2016 are being conducted on the bases of goal 3 with its three outcomes. The report will be submitted in the due date .