2017 Assessment Plan- Chemistry

I. Mission of the Major:

The major in chemistry provides students the opportunity and the guidance to build a foundation in the chemical sciences. Students engage in active learning as they apply the scientific method towards understanding chemistry. Students **think critically and reason wisely** when evaluating data and issues related to chemistry in society. Students from this program are equipped with the tools needed to **understand new technologies**, **communicate effectively about science and scientific issues**, and **form collaborations to tackle a variety of projects**. Ultimately, upon leaving the department students are prepared for graduate school, for a variety of careers, and for becoming lifelong learners.

II. Chemistry Program Goals:

This program:

1. Provides students the opportunity and the guidance to learn the fundamental principles and technology needed to be successful in the chemical sciences.
2. Challenges students to think critically, quantitatively, and reason wisely in evaluating data and working through problem sets. Students should be able to apply these skills to issues arising in the world around them, including ethical conflicts surrounding particular scientific theories, technologies, or applications.
3. Train students to communicate scientific work in a clear, coherent manner in both written and oral form.
4. Engages students in practicing the process of science – planning, executing, evaluating, self-reflection, collaborating and communicating. It also involves helping students understand the importance of diversity in the practice of science through collaborative learning where different perspectives are valued and evaluated.

Alignment of Chemistry Goals with the Wells College's Student Goals:

	Chemistry Program Goals			
	1	**2**	**3**	**4**
Content 1	X			
Content 2	X			
Content 3			X	X
Skills 1		X	X	
Skills 2		X		
Skills 3			X	
Skills 4		X		X
Skills 5				X
Skills 6				X

III. & IV. Learning Objectives and Measurable Learning Outcomes

1. **Program Goal**: *Provides students the opportunity and the guidance to learn the fundamental principles and technology needed to be successful in the chemical sciences.*
   a. **Learning Objective**: Upon completion of the program students will possess a working knowledge of major principles in the chemical sciences.
      - **Measurable Learning Outcome**: In class quizzes and exams are used to measure the mastery of concepts and principles taught in lecture and lab.
      - **Measurable Learning Outcome**: take-home exams and projects will test a students' mastery of information and will demonstrate if a student can build upon acquired knowledge independently.

b. **Learning Objective**: Students will be able to utilize a variety of instrumentation and technology used in the chemical sciences.

- **Measurable Learning Outcome**: Students learn how to use technology (instrumentation and software) needed in the chemical sciences. To assess if the use of the instrument has been mastered, students are asked to hand in post-lab questions and lab reports that are dependent on their understanding of the technology.
- **Measurable Learning Outcome**: These technologies are also continually used throughout the semester with the expectation the student can use the equipment independently.

2. **Program Goal**: *Challenges students to think critically, reason wisely, and quantitatively in evaluating data and to apply that skill to issues arising in the world around them, including ethical conflicts surrounding particular scientific theories, technologies, or applications.*

a. **Learning Objective**: Students will be able to think critically, quantitatively, and reason wisely about data collected in lab and problem sets worked through for class.

- **Measurable Learning Outcome**: Students participate in inquiry-based lab activities and independent projects. Lab write-ups from these activities are used to monitor whether students can efficiently analyze the data collected in lab.
- **Measurable Learning Outcome**: Problem sets and case studies are used in classes to measure how well students can apply their reasoning and critical thinking skills outside of lab.

b. **Learning Objective**: Students will apply critical thinking and reasoning skills to current issues arising in the world around them, including ethical conflicts surrounding particular scientific theories, technologies, or applications.

- **Measurable Learning Outcome**: Case studies and paper discussions are used to bring relevant real world topics into the classroom. This outcome is usually assessed through the completion of reflection pieces, question sets or discussion sessions.

3. **Program Goal**: *Train students to communicate scientific work in a clear, coherent manner in both written and oral form.*

a. **Learning Objective**: Students are able to *write* about scientific work in a clear, coherent manner.

- **Measurable Learning Outcome**: Lab reports are used to assess whether a student can write and describe their own scientific work obtained from experiments conducted in the lab.
- **Measurable Learning Outcome**: Students are also asked to summarize the work carried out in a specific field of chemistry by other scientists. These involve students writing literature reviews and a research propositional.

b. **Learning Objective**: Students are able to *speak* about scientific work clearly and coherently.

- **Measurable Learning Outcome**: Students present their results or research to their peers. This requires them to not only think critically about their data but also figure out a way to efficiently convey their results.
- **Measurable Learning Outcome**: Throughout a variety of courses (Inorganic, Instrumental, Bioinorganic, Biochemistry, Biochemical Pathways, and the Senior Seminar) students are also asked to read, digest and present work from the primary literature.
- **Measurable Learning Outcome**: In addition to formal class presentation students are encouraged to talk about chemistry in a more informal setting (such as small group or class discussions). This is measured using group assignments and projects.

4. **Program Goal**: *Engages students in practicing the process of science – planning, executing, evaluating, collaborating and communicating. It also involves helping students understand the importance of diversity in the practice of science through collaborative learning where different perspectives are valued and evaluated.*

a. **Learning Objective**: Students are effective in practicing the process of science – planning, executing, and evaluating.

- **Measurable Learning Outcome**: In many chemistry lab courses students are required to keep a lab notebook. This exercise requires students to come up with a purpose of the experiment, draw out the protocol, collect data, analyze results and draw conclusions.
- **Measurable Learning Outcome**: Once skills have been mastered students are asked to carry out independent or research projects. Success of these projects requires them to not only know the material but also stay organized independent of the instructor. Successfully completing an independent project involves independently designing the experiment, setting up and running the experiment, followed by writing up the results or presenting findings to the class.

b. **Learning Objective**: Students will appreciate the importance of *diversity* in the practice of science through collaborative learning where different perspectives are valued and evaluated.

- **Measurable Learning Outcome**: Students work in groups, allowing them to appreciate the different perspectives needed to complete scientific problem set or laboratory exercises.
- **Measurable Learning Outcome**: Students are asked to provide constructive peer evaluation on class presentations and papers.

V. Means of Assessment of Outcomes:

Goal	Objective		How outcome is measured	Measurement Tool	Success Criteria	Data Location
1	a	Has a working knowledge of the concepts and principles presented in class	Exam	Answer Key	70% of students to score at or above C level.	Faculty files.
	b	Becomes proficient in technology used in class and/or lab	Group Post-lab Assignment	Answer Key	70% of students to score at or above C level.	Faculty files.
2	a	Can think critically, reason wisely, and quantitatively about data collected in lab and class problem sets.	Group Post-lab Assignment	Answer Key	70% of students to score at or above C level.	Faculty files.
	b	Can apply critical thinking and reasoning skills to current issues arising in the world around them, including ethical conflicts surrounding particular scientific theories, technologies, or applications.	Group Post-lab Assignment	Answer Key	70% of students to score at or above C level.	Faculty files.
3	a	Is able to write about scientific work in a clear, coherent manner.	Paper	Paper Rubric	70% of students to score at or above C level.	Faculty files.
	b	Is able to *speak* about scientific work in a clear and coherent manner.	Presentations	Presentation Rubric	70% of students to score at or above C level.	Faculty files.
4	a	Can efficiently organize exercises designed by the instructor and can keep a lab notebook to be used for data analysis and lab reports	Lab Notebook	Lab Notebook Practical	70% of students to score at or above C level.	Faculty files.
	b	Appreciates the importance of diversity in the practice of science through collaborative learning where different perspectives are valued and evaluated.	Group Post-lab Assignment	Answer Key	70% of students to score at or above C level.	Faculty files.

VI. Utilizing Assessment Data

Student work will be collected throughout the academic year by the faculty member teaching the respective courses. Each faculty member will evaluate whether the students learned what was expected, based on each assignment. Percentages of how well the student answered/ completed the activity will be calculated, and students will be considered proficient if 70% or more of the students demonstrated a passing grade on the assessed activity. Throughout the year the chemistry faculty will assess the progress in each of their classes and make adjustments to meet the learning needs of the students.