

CHEMISTRY
Core Competencies FA2024-SP2025

Core Competency: Critical Thinking

Students will be able to examine, critique and synthesize information in order to arrive at reasoned conclusions.

Outcome Measure:

Results & Discussion score of their final Biochemistry Lab report

Criteria for Success (how do you judge if the students have met your standards):

80% of the students will score above 80% in the Results & Discussion section of their Biochemistry final lab report.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	<i>Percentage of Students Marginal or Proficient</i>								
	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Number of students	n=25	n=17	n=20	n=35	n=26	n=28	n= 25	N/A	n= 11
^a ETS Proficiency Profile Level 2 Reading, or ^b Percent scoring above 80% on their Results & Discussion Section	96.0% ^a	88.2% ^a	95.0% ^a	74.3% ^a	73.1% ^a	89.3% ^a	92% ^a	Not assessed	90.9% ^b

Conclusions Drawn from Data:

This is our first time using the students' final lab report in biochemistry to assess Critical Thinking. In particular, we chose to use their Results & Discussion score, because this is where they are evaluating their experimental data to arrive at reasoned conclusions. This year the students easily met the criteria for success.

Changes to be Made Based on Data:

We have not made any changes thus far. We will collect data and see whether our new outcome measure and criteria for success are providing useful information.

Rubric Used

Attached

Results and Discussion – 35 points

This time we are combining results and discussion. Journals do this sometimes and given you will spend time justifying your selection of mutation, it seems easier to combine them for this report. Here are your potential subheadings as you walk me through everything.

- Site Directed Mutagenesis
 - **FIGURE:** Zoomed in region of the beta-gal active site with your mutation included (if you did not include this in your introduction – if you did, then you don't need to have it here again)
 - Provide some measurements if necessary, highlight the residue you changed, discuss its proximity to the OTHER active site residue
 - What was your reasoning in selecting the mutation you selected?
 - This is really important – we spent practically a lab period figuring out what mutation to make so spend some time talking about this.
 - What did you expect to learn from this mutation? What did you think would happen?
- Activity analysis
 - **FIGURE:** graph of your WT and mutant activity plotted together on the same graph
 - Explain the assay itself – what does the information on the graph mean in terms of beta-gal function.
 - Describe what the Figures are telling us in the text of your results/discussion
 - Are the results in your activity Figure expected or are these results surprising?
 - What does this specifically tell you (or begin to tell you) about Beta-gal active site mechanism
- Functional relevance of your results in the broader research community
 - Read the paper published in Cells in 2022 (this is available in the assignment description).
 - Include a short paragraph explaining how this study relates to your project or how your project could be modified to provide additional information to this type of study.
- Future Directions: Where would you go from here?
 - Propose one additional mutation to learn more detail or go more in depth as a way of enhancing what your mutation told you,
 - What would you propose and why?

CHEMISTRY Core Competencies

Core Competency: Written

Students will be able to effectively express ideas and information to others through written communication.

Outcome Measure:

Introduction score of their final Biochemistry Lab report

Criteria for Success (how do you judge if the students have met your standards):

80% of the students will score above 80% in the Introduction section of their Biochemistry final lab report.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	Percentage of Students Marginal or Proficient								
	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Number of students	n=25	n=17	n=20	n=35	n=26	n=28	n= 25	N/A	n= 11
^a ETS Proficiency Profile Level 2 Writing, or ^b Percent scoring above 80% on their Introduction Section	88.9% ^a	82.4% ^a	90.0% ^a	74.3% ^a	80.8% ^a	75.0% ^a	64% ^a	Not assessed	100% ^b

Conclusions Drawn from Data:

This is our first time using the students' final lab report in biochemistry to assess Writing. In particular, we chose to use their Introduction score, because students have multiple opportunities to revise and improve their writing in this section, and the ultimate product is graded entirely on the effectiveness of their prose. As shown above, all the students have met the criteria for success.

Changes to be Made Based on Data:

We have not made any changes thus far. We will collect data and see whether our new outcome measure and criteria for success are providing useful information.

Rubric Used

Attached

CHE/BIO4050L Introduction Requirements Fall 2024

Beta-Galactosidase Report Introduction Rubric (available on Canvas)

Description of Biological Relevance: Thorough explanation of the background of why it is interesting to study beta-gal, health implications, etc. **5 points**

Active Site Mechanism: Based on the mechanism summary assignment, this should be a thorough and accurate explanation of the mechanism happening at the active site. **3 points**

Introduction of the specific mutation: Explain the mutation and the aspect of the mechanism that this project seeks to learn. **3 points**

Figures are referenced in the text: Any figure is specifically referenced by its number in the text. **2 points**

Figure labels: Figures should be labeled in numerical order based on the order in the paper and the labels should be underneath the figure itself. **2 points**

Figure captions: Each figure should have a 1 – 2 sentence caption describing what the reader is seeing in the figure **3 points**

References: There should be at least 3 references at the end of the manuscript, each used at least once in the text. **2 points**

CHEMISTRY Core Competencies

Core Competency: Quantitative Reasoning

Students will be able to solve problems that are quantitative in nature.

Outcome Measure:

Score on their final Bomb Calorimetry report in Physical Chemistry.

Criteria for Success (how do you judge if the students have met your standards):

80% of the students will score above 80/100 on their report.

Aligned with DQP Learning Areas (circle one or more but not all five):

1. Specialized Knowledge
2. Broad Integrative Knowledge
3. Intellectual Skills/Core Competencies
4. Applied and Collaborative Learning, and
5. Civic and Global Learning

Longitudinal Data:

	<i>Percentage of Students Marginal or Proficient</i>								
	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Number of students	n=25	n=17	n=20	n=35	n=26	n=28	n= 25	N/A	n=10
^a ETS Proficiency Profile Level 2 Math, or ^b Percent scoring above 80 on their bomb calorimetry report	100.0% ^a	94.1% ^a	95.0% ^a	94.3% ^a	88.5% ^a	100.0% ^a	96.0% ^a	Not assessed	100.0% ^b

Conclusions Drawn from Data:

This is our first time using the students' Bomb Calorimetry Lab Report in Physical Chemistry. We chose this because it is a single assignment that features many of the chemistry-relevant quantitative skills in which students need to demonstrate proficiency (including plotting data in Excel, performing multiple linear regressions, unit conversions and algebraic rearrangements of thermodynamics equations, stoichiometry, and error analysis.) We can see that most students met or exceeded the criterion for success that we chose.

Changes to be Made Based on Data:

We have not made any changes thus far. We will collect data and see whether our new outcome measure and criteria for success are providing useful information.

Rubric Used

Attached

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3025L-Report1-SP25

Criteria	Ratings			Pts
Title	2 pts Title present and descriptive	1 pts Title insufficiently descriptive For example, simply repeating the title from the handout	0 pts No Marks	2 pts
Methods: No unnecessary results	3 pts Full Marks	0 pts No Marks		3 pts
Methods: Paragraphs	3 pts Full Marks	0 pts No Marks		3 pts
Method: Narrative Past tense Indicative mood	3 pts Full Marks	0 pts No Marks		3 pts
Method: Reproducible detail	3 pts Full Marks	0 pts No Marks		3 pts
Method: No excessive/unncessary detail	3 pts Full Marks	0 pts No Marks		3 pts
Method: All noteworthy hazards	3 pts Full Marks	0 pts No Marks		3 pts
Method: No common/obvious hazards	3 pts Full Marks	0 pts No Marks		3 pts
R&D: All tables/figures appear near first mention	3 pts Full Marks	0 pts No Marks		3 pts
R&D: All tables/figures cross-referenced in text	3 pts Full Marks	0 pts No Marks		3 pts

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3025L-Report1-SP25

Criteria	Ratings		Pts
R&D: All tables/figures have correct caption placement Above for tables, below for figures	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All tables/figures have descriptive captions More descriptive than basic titles	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All tables/figures are numbered correctly Tables should be numbered separately from figures	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All tables/figures have no excessive blank space	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All graphs have titles	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All graphs have axes labeled, with units	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All graphs have correct y vs. x orientation y should be the dependent variable, x should be the independent variable	2 pts Full Marks	0 pts No Marks	2 pts
R&D: All tables/figures are fully legible	3 pts Full Marks	0 pts No Marks	3 pts
R&D: Paragraphs	3 pts Full Marks	0 pts No Marks	3 pts
R&D: No excess data Data beyond what's required in the instructions is okay IF and ONLY IF it	3 pts Full Marks	0 pts No Marks	3 pts

<https://canvas.pointloma.edu/courses/77455/rubrics/302260>

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3025L-Report1-SP25

Criteria	Ratings		Pts
meaningfully contributes to your narrative.			
Result: Temp vs. time plot	2 pts Full Marks	0 pts No Marks	2 pts
Result: Calorimeter constant	2 pts Full Marks	0 pts No Marks	2 pts
Result: Experimental $\Delta H_{r,m}$ (naphthalene) in kJ/mol	2 pts Full Marks	0 pts No Marks	2 pts
Result: Computational $\Delta H_{r,m}$ (naphthalene) in kJ/mol	2 pts Full Marks	0 pts No Marks	2 pts
Result: $\Delta H_{r,m}$ (naphthalene), both values compared to lit	2 pts Full Marks	0 pts No Marks	2 pts
Result: Experimental ΔH_f (naphthalene) in kJ/mol	2 pts Full Marks	0 pts No Marks	2 pts
Result: ΔH_f (naphthalene) compared to lit	2 pts Full Marks	0 pts No Marks	2 pts
Result: $\Delta H_{r,m}$ (foodstuff) in kcal/g	2 pts Full Marks	0 pts No Marks	2 pts
Result: $\Delta H_{r,m}$ (foodstuff) comparison to label	2 pts Full Marks	0 pts No Marks	2 pts
Error: Parr manual error sources	3 pts Full Marks	0 pts No Marks	3 pts
Error: Pressure changes	3 pts Full Marks	0 pts No Marks	3 pts
Error: Compare $\Delta H_{r,m}$ vs. ΔH_f	3 pts Full Marks	0 pts No Marks	3 pts

<https://canvas.pointloma.edu/courses/77455/rubrics/302260>

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3025L-Report1-SP25

Criteria	Ratings		Pts
Error: Additional errors considered Vague statements such as "human error", "error is always a possibility", and similar sentiments will get negative credit.	3 pts Full Marks	0 pts No Marks	3 pts
Error: Integrated into discussion	3 pts Full Marks	0 pts No Marks	3 pts
References: All references ACS style	2 pts Full Marks	0 pts No Marks	2 pts
References: Superscript numbers In-text citations should be superscript numbers in order of citation	2 pts Full Marks	0 pts No Marks	2 pts
References: Literature values All lit values should be from reliable scholarly sources	2 pts Full Marks	0 pts No Marks	2 pts
References: Procedure The methods section should cite the lab handout	2 pts Full Marks	0 pts No Marks	2 pts
References: Nothing left uncited Anything that did not originate with the student or their group should have a citation.	2 pts Full Marks	0 pts No Marks	2 pts
Reflection Any thoughtful response gets full credit	5 pts Full Marks	0 pts No Marks	5 pts
Total Points: 100			

CHEMISTRY
Core Competencies

Core Competency: Oral Communication

Students will develop oral communication skills.

Outcome Measure: Chemistry Research Study Presentation in Chemistry Seminar (CHE4095).

Criteria for Success: At least 80% of students will have an average score of 3 or higher.

Longitudinal Data:

	2017	2018	2019	2020	2021	2022	2023	2024	2025
	n=18	n=13	n=11	n=18	n=14	n=15	n=18	n=17	n=13
% students with average score of 3.0 or higher in Chemistry Research Study Presentation	100%	100%	100%	100%	92.9%	93.3%	88.9%	100%	100%

Conclusions Drawn from Data: The criteria for success were met in all years 2015 – 2025, therefore we conclude that students are successful in oral communication. We believe this can be attributed to several factors including an increased number of oral presentations required in upper division courses and students' involvement in our summer research where they present their project to each other on a weekly basis.

Changes to be Made Based on Data: No changes are necessary.

Rubric Used: See below.

CHEMISTRY Core Competencies

Core Competency: Information Literacy

Students will develop information literacy skills.

Outcome Measure: Chemistry Research Study Presentation in Chemistry Seminar (CHE4095)

Criteria for Success (if applicable): At least 80% of students will have an average score of 3 or higher.

Longitudinal Data:

	2017	2018	2019	2020	2021	2022	2023	2024	2025
	n=18	n=13	n=11	n=18	n=14	n=15	n=18	n=17	n=13
<i>% Students with average score of 3.0 or higher in Chemistry Research Study Presentation</i>	100%	84.6%	100%	94.4%	100%	100%	94.4%	100%	100%

Conclusions Drawn from Data: The criteria for success were met in all years 2015 – 2025, therefore, we conclude that students are successful in information literacy.

Changes to be Made Based on Data No changes are necessary as our students clearly learn to develop skills over their 4 years at PLNU.

Rubric Used: See below.

CHE 4095 rubrics (**Oral Communication** and **Information Literacy**)

	Outstanding	High satisfactory	Low satisfactory	unsatisfactory
Command of background material	- Clearly knows material and key facts by memory - Expands on PPT slides - Content and language appropriate for audience	- Clearly knows key facts with a few memory slips - Some expansion on PPT slides - Partial audience adaptation of content	- Read some information; knows some facts from memory - No expansion on PPT slide content - little audience adaptation of content	- Read sentence from slides - Dependent on notes - Lack audience adaptation of content
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.

Use Information Effectively to Accomplish a specific purpose	Communicates, organizes and synthesizes information from sources to fully achieve a specific purpose, with clarity and depth	Communicates, organizes and synthesizes information from sources. Intended purpose is achieved.	Communicates and organizes information from sources. The information is not yet synthesized, so the intended purpose is not fully achieved.	Communicates information from sources. The information is fragmented and/or used inappropriately (misquoted, taken out of context, or incorrectly paraphrased, etc.), so the intended purpose is not achieved.
Determine the Extent of Information	Effectively defines the scope of the research question or thesis. Effectively determines key concepts. Types of information (sources) selected directly relate to concepts or answer research question.	Defines the scope of the research question or thesis completely. Can determine key concepts. Types of information (sources) selected relate to concepts or answer research question.	Defines the scope of the research question or thesis incompletely (parts are missing, remains too broad or too narrow, etc.). Can determine key concepts. Types of information (sources) selected partially relate to concepts or answer research question.	Has difficulty defining the scope of the research question or thesis. Has difficulty determining key concepts. Types of information (sources) selected do not relate to concepts or answer research question.