Chemistry
FELO Data for 1d and 1e: FA2024-SP2025

Learning Outcome: FELO 1d. Critical Thinking
Students will be able to examine, critique and synthesize information in order to arrive at reasoned conclusions.

Outcome Measure: This outcome will be measured yearly via direct, summative assessment using CHE 1002 Signature Assignment: "Eggs & Critical Thinking Assessment".

Students are assessed on their ability to:
1. Explain: When presented with a problem / issue, are you able to clearly explain the problem, delivering the relevant information necessary to reflect your understanding of the problem?
2. Investigate: When working with the problem / issue, are you able to select and interpret / evaluate the information and develop an analysis or synthesis?
3. Evaluate: As you work with the problem / issue, are you able to methodically analyze your own assumptions, and the information provided by others, to present an informed position / analysis on the problem / issue?
4. Hypothesize: When asked to form a hypothesis, do you consider the complexities of the issue, acknowledge given facts, and present a perspective for further investigation?
5. Draw Conclusions: Are you able to place evidence and perspective to the problem / issue and your investigation of the situation and present logical consequences / implications / conclusions?

Criteria for Success: At least 70% of the students will score at an average of level 3 or higher on the AACU critical thinking rubric (in each of the 5 categories).

Longitudinal Data:

	3 or higher on the AACU critical thinking rubric				
	Spring 2021	Spring 2022	Spring 2023	Spring 2024	Spring 2025
Number of students	n=17	n = 20	n = 20	n = 20	n = 20
category 1 (Explain)	56%	79%	90%	95%	85%
category 2 (Investigate)	61%	95%	95%	80%	85%
category 3 (Evaluate)	44%	84%	75%	95%	65%
category 4 (Hypothesize)	78%	100%	85%	95%	65%
category 5 (Draw Conclusions)	89%	95%	90%	95%	80%

Conclusions Drawn from Data: The students in CHE 1002 met the criteria for critical thinking in 3 out of 5 categories in the Spring 2025, and fell slightly short of the criteria for two of the categories (evaluate and hypothesize). It is perhaps worth noting that this is the first time that the course was not taught and assessed by Dr. Rouffet, and that the course was twice the size of previous years (48 students instead of 24). Both of these factors may have played a role in the lower scores.

Changes to be Made Based on Data: No changes necessary at this point. A new (to this course) adjunct instructor will teach the course in Spring 2026.

Rubric Used: The following critical thinking value rubric was used.

Criteria	Ratings					Pts
1- Explanation of issues	**4.0 pts** **Capstone** Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	**3.0 pts** **Milestone 3** Issue/problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	**2.0 pts** **Milestone 2** Issue/problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unknown.	**1.0 pts** **Benchmark** Issue/problem to be considered critically is stated without clarification or description.	**0.0 pts** **No Marks**	4.0 pts
2-Evidence/ Investigate	**4.0 pts** **Capstone** Information is taken from source(s) with enough interpretation/evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	**3.0 pts** **Milestone 3** Information is taken from source(s) with enough interpretation/evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	**2.0 pts** **Milestone 2** Information is taken from source(s) with some interpretation/evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.	**1.0 pts** **Benchmark** Information is taken from source(s) without any interpretation/evaluation. Viewpoints of experts are taken as fact, without question.	**0.0 pts** **No Marks**	4.0 pts

3-Influence of context and assumptions/ Evaluate	**4.0 pts** **Capstone** Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	**3.0 pts** **Milestone 3** Identifies own and others' assumptions and several relevant contexts when presenting a position.	**2.0 pts** **Milestone 2** Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	**1.0 pts** **Benchmark** Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.	**0.0 pts** **No Marks**	4.0 pts
4-Student's position (perspective, thesis/hypothesis)/ Hypothesize	**4.0 pts** **Capstone** Specific position (perspective, thesis/hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/hypothesis).	**3.0 pts** **Milestone 3** Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/hypothesis).	**2.0 pts** **Milestone 2** Specific position (perspective, thesis/hypothesis) acknowledges different sides of an issue.	**1.0 pts** **Benchmark** Specific position (perspective, thesis/hypothesis) is stated, but is simplistic and obvious.	**0.0 pts** **No Marks**	4.0 pts

5- Conclusions and related outcomes (implications and consequences)/ Draw conclusions	**4.0 pts** **Capstone** Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	**3.0 pts** **Milestone 3** Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	**2.0 pts** **Milestone 2** Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	**1.0 pts** **Benchmark** Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.	**0.0 pts** **No Marks**	4.0 pts

Learning Outcome: FELO 1e. Quantitative Reasoning
Students will be able to solve problems that are quantitative in nature.

Outcome Measure: Problems on the final exam that are quantitative in nature.
     CHE101 / 1001 Chemistry and Society
     CHE103 / 1003 Introduction to General, Organic, and Biological Chemistry
     CHE152 / 1052 General Chemistry I
     PSC110 Physical Science (chemistry portion)
     PSC111 / 1014 Physical Science for Teachers (chemistry portion)

Criteria for Success: At least 70% of students will score 3 or higher.

Longitudinal Data:

CHE1001 (formerly CHE101)

	Assessment Data for FELO 1e. Quantitative Reasoning									
	Fall 2020	**Spring 2021**	**Fall 2021**	**Spring 2022**	**Fall 2022**	**Spring 2023**	**Fall 2023**	**Spring 2024**	**Fall 2024**	**Spring 2025**
Number of students	n=18	n=19	N/A	n=20	n=20	n=20	n=20	n=20	n=20	n=20
Percentage	77.8%	55.0%	Course not offered	70%	20%	55%	75%	40%	90%	60%

CHE1003 (formerly CHE103)

	Assessment Data for FELO 1e. Quantitative Reasoning									
	Fall 2019	**Spring 2020**	**Fall 2020**	**Spring 2021**	**Fall 2021**	**Spring 2022**	**Fall 2022**	**Spring 2023**	**Fall 2023**	**Fall 2024**
Number of students	n=29	n=20	n=33	n=19	n= 34	N/A	n=31	n=20	n=42	n=38
Percentage	89.7%	90.0	90.9%	47.4%	82.9%	Not assessed	65%	73.7%	85.7%	92.1%

*No assessment data for FELO 1e in CHE103 Spring 2019 and Spring 2022, due to changes made to final exam.

CHE1052 (formerly CHE152)

	Assessment Data for FELO 1e. Quantitative Reasoning								
	Fall 2018	**Fall 2019**	**Fall 2020**	**Fall 2021**	**Fall 2022**	**Fall 2023**	**Spring 2024**	**Fall 2024**	**Spring 2025**
Number of students	n=52	n=48	n=47	n= 45	n=47	n=42	n=17	n= 31	n= 20
Percentage	96.2%	83.0%	76.6%	32.6%	77.8%	71.4%	47.1%	74.2%	30.0%

PSC1014 (formerly PSC110 & PSC111)

	Assessment Data for FELO 1e. Quantitative Reasoning								
	Spring 2017	**Fall 2017**	**Fall 2018**	**Fall 2019**	**Fall 2020**	**Fall 2021**	**Fall 2022**	**Fall 2023**	**Fall 2024**
Number of students	n=18	n=20	n=19	n=20	n=20	n=19	n=20	n= 18	n= 20
Percentage	94.4%	90.0%	63.2%	85.0%	70.0%	78.9%	78.9%	85.7%	85.0%

Conclusions Drawn from Data: FELO 1e (quantitative reasoning) is assessed in 4 of our 5 chemistry FE courses. For General Chemistry I (CHE 1052) our criteria for success was met in the Fall but not in the Spring. We started offering this course in the Spring to support transfer students and students who failed in the Fall and needed to retake it, with this latter group making up the bulk of the course. It is thus unsurprising that many of these students struggle with concepts in the course, including quantitative reasoning.

The criteria for success met for CHE 1003 and PSC 1014 and for Chemistry and Society (CHE 1001) in the Fall semester. However, it was not met for CHE 1001 in the Spring semester. There is no obvious reason for this, except natural variability in the students registering for the course each semester.

Changes to be Made Based on Data: It is likely that CHE 1001 will not be offered after the 202 since it does not have a lab.

Rubric Used: The following scale was used.

	4	**3**	**2**	**1**
% of points earned on quantitative problems	80 – 100%	60 – 79%	40 – 59%	39% or lower