Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 131-Human Anatomy and Physiology- (Lecture/Lab Combination)	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.91+/-0.02 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target for this SLO was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 96.5% to 100%. These results indicate that BIOL 131 students are assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to human anatomy and physiology. We attribute this level of attainment to several factors: (1) this is a high-stakes course were students must earn a "C" or higher to move into their academic programs, so those who take the assessment exert effort to earn the points associated with the assessment, (2) by the end of the

semester, students who are performing poorly in the course have withdrawn or cease attending class so they did not participate in the assessment, (3) the course is rigorous so that those who persist have started learning how to test and to learn by the end of the semester.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 5 +/- 0 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99% to 100%. The basic concepts and principles assessed by the items on the instrument for this SLO were major course themes that were stressed every class period and lab. Fundamental understanding of these concepts was necessary to progress in the course.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	97.8% (223 out of 228). The mean score was 4.37+/-0.05 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met with 223 of 228 students (97.8%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 65.8% to 99.6%. Although the goals set for this SLO were met, these were the lowest individual item scores across the assessment with scores on individual items of 65.8 and 79.8%. These items were higher ono Bloom's scale requiring students to apply the knowledge that they have learned which could explain the lower scores. As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.			

Colonnade Learning Outcome 4	
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues.

	For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.			
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*			
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.		**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.98+/-0.01 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met with 228 of 228 students (100%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99.1% to 100%. We were pleased to see that our students were able to successfully transfer their knowledge to a broader perspective. Note, however, that this class is highly focused on preparing healthcare professionals and the content revolves around understanding this perspective.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Ogden College of Science and Engineering	*Physics and Astronomy*
Astronomy 108	
Michael Carini	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Coloannde Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	Each section will include 10 common multiple choice questions on the final exam.		
Criteria for Student Success	Students will score 70% or better on 70% of the questions asked.		
Program Success Target for this Measurement	The goal is to have at least 70% of the students in all sections achieve a score of 70% or better.	**Percent of Program Achieving Target**	59
Methods	10 common multiple choice questions are asked on the final exam in each section of the course offered. The percent of correct answers per question are reported to the department chair.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

33 students were assessed in AY 22/23. The success target was not met. The individual exam questions will be analyzed to identify which concepts are commonly not explained correctly and the curriculum will be adjusted to work on the student understanding of and ability to explain these concepts. This assessment will continue next semester. Note that the instructor is having difficulty accessing the Fall 2022 data. This sheet will be updated if and when that data is recovered.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 114: General Biology Lab	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☐ Taught 100% face to face
☐ Taught 100% online
☒ Mix of online and face to face
☒ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	Face-to-face sections: 75.8% (182 out of 240). The mean score was 3.20+/-0.06 out of 5. Online sections: 88.3% (53 out of 60). The mean score was 3.62 +/- 0.11 out of 5. Online dual credit sections: 100.0% (3 out of 3). The mean score was 4.00 +/- 0.00 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 240 in face-to-face sections, n = 60 in online sections, n = 3 in online dual credit sections).		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)
The attainment target was met by students in face-to-face sections. 182 of 240 students (75.8%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 18.8% to 90.8%. The attainment target was also met by students in online sections. 53 of 60 students (88.3%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 20.0% to 90.0%. The attainment target was also met by students in online dual credit sections. 3 of 3 students (100.0%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 33.3% to 100.0%. The small sample size limits the statistical power of these findings. These results indicate that BIOL 114 students in all sections across all delivery modes and student demographics are doing well at assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to biology. The levels of attainment are comparable among face-to-face, online, and online dual credit subgroups. We evaluate this level of attainment within the context of several factors: (1) the student population in BIOL 114 is diverse, consisting entirely of students with majors other than biology (most outside the sciences altogether), (2) the strong majority of students who take BIOL 114 are first-year students, (3) BIOL 114 is an optional laboratory experience coupled with BIOL 113 lecture, and (4) as a non-majors course, the BIOL 114 curriculum is heavily focused on giving non-science students the opportunity to see and experience how different fields of biology apply the science process to ask and answer questions in their specific areas. It is also important to note that the BIOL 114 curriculum was completely revamped in 2022-23 to incorporate an inquiry-based approach, and this new curriculum was launched across all sections in Fall 2022. We are pleased to see that our strong focus on SLO1 was reflected in the level of student attainment. We are of the opinion that SLO1 and SLO4 are the most important for our non-majors audience, as these build overall scientific literacy and the ability to make connections between science and the societal issues. As this was the first year of administration of this instrument (as well as the new curriculum), we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion	**Percent of Program Achieving**	Face-to-face sections: 36.7% (88

	level of attainment.	**Target**	out of 240). The mean score was 2.15+/-0.08 out of 5. Online sections: 53.3% (32 out of 60). The mean score was 2.62 +/- 0.15 out of 5. Online dual credit sections: 66.7% (2 out of 3). The mean score was 2.67 +/- 0.89 out of 5.

Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 240 in face-to-face sections, n = 60 in online sections, n = 3 in online dual credit sections).

Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.	☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met by students in face-to-face sections. 182 of 240 students (75.8%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 18.8% to 90.8%. Student performance on this SLO was below expectations, as the mean number of correct responses out of 5 items was 2.15 +/- 0.08, within Milestone 2 level of performance.

The attainment target was also not met by students in online sections. 32 of 60 students (53.3%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 43.3% to 65.0%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.62 +/- 0.06, above the midpoint between Milestone 2 and 3 level of performance.

The attainment target was also not met by students in online dual credit sections. 2 of 3 students (66.7%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 33.3% to 66.7%. The small sample size limits the statistical power of these findings.

These results indicate that BIOL 114 students are doing moderately well at assimilating the knowledge of basic concepts and principles related to laboratory/experiential aspects of biology. The levels of attainment are higher in online and online dual credit subgroups than in the face-to-face subgroup, which indicates that alternate delivery modes and student demographics are at least comparable in performance to traditional sections.

We evaluate this level of attainment within the context of several factors: (1) the student population in BIOL 114 is diverse, consisting entirely of students with majors other than biology (most outside the sciences altogether), (2) the strong majority of students who take BIOL 114 are first-year students, (3) BIOL 114 is an optional laboratory experience coupled with BIOL 113 lecture, and (4) as a non-majors course, the BIOL 114 curriculum is heavily focused on giving non-science students the opportunity to see and experience how different fields of biology apply the science process to ask and answer questions in their specific areas. It is also important to note that the BIOL 114 curriculum was completely revamped in 2022-23 to incorporate an inquiry-based approach, and this new curriculum was launched across all sections in Fall 2022.

The data on this SLO suggest that we may want to work in the laboratory setting to draw stronger connections between inquiry-based activities and the underlying concepts they are designed to explore. While the foundations are built into the laboratory materials and activities, students may be concentrating more on what they are doing in the lab and consequently may not be connecting that back to the foundational concepts. This is something we will address in introductory lab lectures and interactions with student teams.

As this was the first year of administration of this instrument (as well as the new curriculum), we do not feel any curricular changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3				
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.			
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*			
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	Face-to-face sections: 39.2% (94 out of 240). The mean score was 2.22+/-0.07 out of 5. Online sections: 58.3% (35 out 60). The mean score was 2.70 +/- 0.15 out of 5. Online dual credit sections: 100.0% (3 out of 3). The mean score was 4.00 +/ 0.00 out of 5.	
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 240 in face-to-face sections, n = 60 in online sections, n = 3 in online dual credit sections).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
The attainment target was not met by students in face-to-face sections. 182 of 240 students (75.8%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 18.8% to 90.8%. Student performance on this SLO was below expectations, as the mean number of correct responses out of 5 items was 2.22 +/- 0.07, within Milestone 2 level of performance. The attainment target was also not met by students in online sections. 35 of 60 students (58.3%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 21.7% to 88.3%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.70 +/- 0.15, above the midpoint between Milestone 2 and 3 level of performance.				

The attainment target was also met by students in online dual credit sections. 3 of 3 students (100.0%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 0.03% to 100.0%. The small sample size limits the statistical power of these findings.

These results indicate that BIOL 114 students are doing moderately well at assimilating the skills necessary to apply scientific principles and make predictions related to laboratory/experiential aspects of biology. The levels of attainment are higher in online and online dual credit subgroups than in the face-to-face subgroup, which indicates that alternate delivery modes and student demographics are at least comparable in performance to traditional sections.

We evaluate this level of attainment within the context of several factors: (1) the student population in BIOL 114 is diverse, consisting entirely of students with majors other than biology (most outside the sciences altogether), (2) the strong majority of students who take BIOL 114 are first-year students, (3) BIOL 114 is an optional laboratory experience coupled with BIOL 113 lecture, and (4) as a non-majors course, the BIOL 114 curriculum is heavily focused on giving non-science students the opportunity to see and experience how different fields of biology apply the science process to ask and answer questions in their specific areas. It is also important to note that the BIOL 114 curriculum was completely revamped in 2022-23 to incorporate an inquiry-based approach, and this new curriculum was launched across all sections in Fall 2022.

The data on this SLO suggest that we may want to work in the laboratory setting to draw stronger connections between inquiry-based activities and the skills they are developing in the process. While skill-building is built into the laboratory materials and activities, students may be concentrating more on what they are doing in the lab and consequently may not be generalizing these skills to other settings and contexts. This is something we will address in introductory lab lectures and interactions with student teams.

As this was the first year of administration of this instrument (as well as the new curriculum), we do not feel any curricular changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4			
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	Face-to-face sections: 89.6% (215 out of 240). The mean score was 3.60+/-0.06 out of 5. Online sections: 93.3% (56 out of 60). The mean score was 3.90 +/0.12 out of 5.

			Online dual credit sections: 100.0% (3 out of 3). The mean score was 4.00 +/- 0.00 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 240 in face-to-face sections, n 60 in online sections, n = 3 in online dual credit sections).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met by students in face-to-face sections. 182 of 240 these students (75.8%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 18.8% to 90.8%.

The attainment target was also met by students in online sections. 56 of 60 these students (93.3%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 33.3% to 96.7%.

The attainment target was also met by students in online dual credit sections. 3 of 3 students (100.0%) sections attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 33.3% to 100.0%. The small sample size limits the statistical power of these findings.

These results indicate that BIOL 114 students across all delivery modes and student demographics are doing quite well at assimilating the perspectives regarding the personal and public relevance of laboratory/experiential aspects of biology. The levels of attainment are comparable among face-to-face, online, and online dual credit subgroups.

We evaluate this level of attainment within the context of several factors: (1) the student population in BIOL 114 is diverse, consisting entirely of students with majors other than biology (most outside the sciences altogether), (2) the strong majority of students who take BIOL 114 are first-year students, (3) BIOL 114 is an optional laboratory experience coupled with BIOL 113 lecture, and (4) as a non-majors course, the BIOL 114 curriculum is heavily focused on giving non-science students the opportunity to see and experience how different fields of biology apply the science process to ask and answer questions in their specific areas. It is also important to note that the BIOL 114 curriculum was completely revamped in 2022-23 to incorporate an inquiry-based approach, and this new curriculum was launched across all sections in Fall 2022.

We are pleased to see that our strong focus on SLO4 was reflected in the level of student attainment. We are of the opinion that SLO1 and SLO4 are the most important for our non-majors audience, as these build overall scientific literacy and the ability to make connections between science and the societal issues.

As this was the first year of administration of this instrument (as well as the new curriculum), we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 120/121: Biological Concepts: Cells, Metabolism, and Genetics with Lab	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	56.9% (182 out of 320). The mean score was 2.72+/-0.06 out of 5.

Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.

Based on your results, highlight whether the program met the goal Student Learning Outcome 1.	☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 182 of 320 students (56.9%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 27.8% to 91.6%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.72 +/- 0.06, above the midpoint between Milestone 2 and 3 level of performance. These results indicate that BIOL 120/121 students are doing moderately well at assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such

as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

The observation that criterion-level attainment was lower on this SLO vs. SLO2-SLO4 may reflect the fact that students are still learning to put the course content within the broader context of the science process; this incorporates a higher-level Bloom's taxonomy construct than simply learning the elements of the science process and/or other basic concepts, principles, and skills. To address SLO1, BIOL 120/121 employs a strong inquiry-based framework in the laboratory component which builds this conceptual framework at a foundational level and in so doing exposes students to an approach to learning and doing biology that they have not typically experienced in high school. As such, we exepct performance on this SLO to lag behind that of the other SLOs, which emphasize more direct learning of course content. The fact that the differences were much less in BIOL 120/121 (5-13 ppts) than in BIOL 122/123 (20+ ppts) we believe reflects the more diverse and less-experienced student demographic.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonanade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	61.3% (196 out of 320). The mean score was 2.83+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was not met. 196 of 320 students (61.3%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 9.7% to 75.6%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was			

2.83 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing moderately well at assimilating the knowledge of basic concepts and principles related to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	62.2% (199 out of 320). The mean score was 2.83+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was not met. 199 of 320 students (62.2%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 12.8% to 82.8%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.83 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing fairly well at assimilating the skills necessary to apply scientific principles and make predictions related to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.			

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4			
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	69.4% (222 out of 320). The mean score was 2.91+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 222 of 320 students (69.4%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 23.8% to 82.8%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.91 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing fairly well at assimilating the perspectives regarding the personal and public relevance of the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

We are pleased to see that the % of students attaining the criterion level of attainment on this SLO was higher than that for any of the other SLOs. Linking course content to broader societal issues is a challenge and likely new experience for beginning students. It is reassuring to see that this key emphasis of the Colonnade Program is being developed in BIOL 120/121.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 120/121: Biological Concepts: Cells, Metabolism, and Genetics with Lab	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	56.9% (182 out of 320). The mean score was 2.72+/-0.06 out of 5.

Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.

Based on your results, highlight whether the program met the goal Student Learning Outcome 1.	☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 182 of 320 students (56.9%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 27.8% to 91.6%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.72 +/- 0.06, above the midpoint between Milestone 2 and 3 level of performance. These results indicate that BIOL 120/121 students are doing moderately well at assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such

as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

The observation that criterion-level attainment was lower on this SLO vs. SLO2-SLO4 may reflect the fact that students are still learning to put the course content within the broader context of the science process; this incorporates a higher-level Bloom's taxonomy construct than simply learning the elements of the science process and/or other basic concepts, principles, and skills. To address SLO1, BIOL 120/121 employs a strong inquiry-based framework in the laboratory component which builds this conceptual framework at a foundational level and in so doing exposes students to an approach to learning and doing biology that they have not typically experienced in high school. As such, we exepct performance on this SLO to lag behind that of the other SLOs, which emphasize more direct learning of course content. The fact that the differences were much less in BIOL 120/121 (5-13 ppts) than in BIOL 122/123 (20+ ppts) we believe reflects the more diverse and less-experienced student demographic.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonanade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	61.3% (196 out of 320). The mean score was 2.83+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was not met. 196 of 320 students (61.3%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 9.7% to 75.6%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was			

2.83 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing moderately well at assimilating the knowledge of basic concepts and principles related to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	62.2% (199 out of 320). The mean score was 2.83+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 320). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was not met. 199 of 320 students (62.2%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 12.8% to 82.8%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.83 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing fairly well at assimilating the skills necessary to apply scientific principles and make predictions related to the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.			

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4			
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	69.4% (222 out of 320). The mean score was 2.91+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of each semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 222 of 320 students (69.4%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 23.8% to 82.8%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.91 +/- 0.06, approaching Milestone 3 level of performance. These results indicate that BIOL 120/121 students are doing fairly well at assimilating the perspectives regarding the personal and public relevance of the cellular organization, metabolism, and genetics of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 120/121 is diverse, including biology majors as well as majors in other disciplines (such as agriculture) that require the course, (2) BIOL 120/121 is typically taken by students during their 1st semester, before BIOL 122-123, and (3) the course content is more micro-level than the content in BIOL 122/123 and so may be less approachable to students. As such, we expect performance in BIOL 120/121 to generally be lower than in BIOL 122/123, which the data indicate it was.

We are pleased to see that the % of students attaining the criterion level of attainment on this SLO was higher than that for any of the other SLOs. Linking course content to broader societal issues is a challenge and likely new experience for beginning students. It is reassuring to see that this key emphasis of the Colonnade Program is being developed in BIOL 120/121.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 122/123: Biological Concepts: Evolution, Diversity, & Ecology with Lab	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	60.6% (149 out of 246). The mean score was 2.87+/-0.08 out of 5.

Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.

Based on your results, highlight whether the program met the goal Student Learning Outcome 1.	☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 149 of 246 students (60.6%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 38.2% to 75.2%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.87 +/- 0.08, which approached the Milestone 3 level of performance. These results indicate that BIOL 122/123 students are doing fairly well at assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to the evolution, diversity, and ecology of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester,

after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

The 20+ ppt difference in criterion-level attainment on this SLO vs. SLO2-SLO4 may reflect the fact that students are still learning to put the course content within the broader context of the science process; this incorporates a higher-level Bloom's taxonomy construct than simply learning the elements of the science process and/or other basic concepts, principles, and skills. To address SLO1, BIOL 122/123 employs a strong inquiry-based framework in the laboratory component which builds this conceptual framework at a foundational level and in so doing exposes students to an approach to learning and doing biology that they have not typically experienced in high school. As such, we exepct performance on this SLO to lag behind that of the other SLOs, which emphasize more direct learning of course content.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonanade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	88.6% (218 out of 246). The mean score was 3.82+/-0.07 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met. 218 of 246 students (88.6%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 60.6% to 92.3%. These results indicate that BIOL 122/123 students are assimilating the knowledge of basic concepts and principles related to evolution, diversity, and ecology of organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL			

122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	83.3% (205 out of 246). The mean score was 3.58+/-0.07 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 205 of 246 students (83.3%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 55.3% to 89.4%. These results indicate that BIOL 122/123 students are assimilating the skills necessary to apply scientific principles and make predictions related to evolution, diversity, and ecology or organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4			
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	89.0% (219 out of 246). The mean score was 3.67+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 219 of 246 students (89.0%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 55.3% to 89.4%. These results indicate that BIOL 122/123 students are assimilating the perspectives regarding the personal and public relevance of the evolution, diversity, and ecology or organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 131-Human Anatomy and Physiology- (Lecture/Lab Combination)	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.91+/-0.02 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target for this SLO was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 96.5% to 100%. These results indicate that BIOL 131 students are assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to human anatomy and physiology. We attribute this level of attainment to several factors: (1) this is a high-stakes course were students must earn a "C" or higher to move into their academic programs, so those who take the assessment exert effort to earn the points associated with the assessment, (2) by the end of the

semester, students who are performing poorly in the course have withdrawn or cease attending class so they did not participate in the assessment, (3) the course is rigorous so that those who persist have started learning how to test and to learn by the end of the semester.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 5 +/- 0 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99% to 100%. The basic concepts and principles assessed by the items on the instrument for this SLO were major course themes that were stressed every class period and lab. Fundamental understanding of these concepts was necessary to progress in the course.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	97.8% (223 out of 228). The mean score was 4.37+/-0.05 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met with 223 of 228 students (97.8%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 65.8% to 99.6%. Although the goals set for this SLO were met, these were the lowest individual item scores across the assessment with scores on individual items of 65.8 and 79.8%. These items were higher ono Bloom's scale requiring students to apply the knowledge that they have learned which could explain the lower scores. As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.			

Colonnade Learning Outcome 4	
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues.

	For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.			
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*			
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.		**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.98+/-0.01 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met with 228 of 228 students (100%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99.1% to 100%. We were pleased to see that our students were able to successfully transfer their knowledge to a broader perspective. Note, however, that this class is highly focused on preparing healthcare professionals and the content revolves around understanding this perspective.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 131-Human Anatomy and Physiology- (Lecture/Lab Combination)	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.91+/-0.02 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target for this SLO was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 96.5% to 100%. These results indicate that BIOL 131 students are assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to human anatomy and physiology. We attribute this level of attainment to several factors: (1) this is a high-stakes course were students must earn a "C" or higher to move into their academic programs, so those who take the assessment exert effort to earn the points associated with the assessment, (2) by the end of the

semester, students who are performing poorly in the course have withdrawn or cease attending class so they did not participate in the assessment, (3) the course is rigorous so that those who persist have started learning how to test and to learn by the end of the semester.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 5 +/- 0 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 228 of 228 students (100%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99% to 100%. The basic concepts and principles assessed by the items on the instrument for this SLO were major course themes that were stressed every class period and lab. Fundamental understanding of these concepts was necessary to progress in the course.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	97.8% (223 out of 228). The mean score was 4.37+/-0.05 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met with 223 of 228 students (97.8%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 65.8% to 99.6%. Although the goals set for this SLO were met, these were the lowest individual item scores across the assessment with scores on individual items of 65.8 and 79.8%. These items were higher ono Bloom's scale requiring students to apply the knowledge that they have learned which could explain the lower scores. As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.			

Colonnade Learning Outcome 4	
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues.

	For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.			
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*			
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.		**Percent of Program Achieving Target**	100% (228 out of 228). The mean score was 4.98+/-0.01 out of 5.
Methods	The instrument was delivered electronically via Blackboard (Learning Management System) at the end of the semester. It was constructed from questions procured from McGraw Hill's Connect library that is associated with the e-text used in the course. Some questions were modified to directly address the SLO. All enrolled students across all sections were included in the sample, however, not all students participated. The resulting sample size for analysis included those students who responded to all items on the survey (n = 228). Because BIOL 131 and BIOL 131 Lab are co-requisite courses, they were combined into a single assessment.			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met with 228 of 228 students (100%) attaining the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 99.1% to 100%. We were pleased to see that our students were able to successfully transfer their knowledge to a broader perspective. Note, however, that this class is highly focused on preparing healthcare professionals and the content revolves around understanding this perspective.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 207: General Microbiology	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	96.5% (83 out of 86). The mean score was 3.93+/-0.09 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the Spring 2023 semester. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 136).		

Based on your results, highlight whether the program met the goal Student Learning Outcome 1.	☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 83 of 86 students (96.5%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 44.2% to 100.0%. These results indicate that BIOL 207 students are assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to general microbiology. We attribute this high level of attainment to several factors: (1) BIOL 207 is taught as service courses for the School of Nursing and Allied Health, so nearly all students enrolled are pre-nursing or pre-dental hygiene who are motivated to perform well in the class, and (2) the course content is highly focused, and aligned with students' professional interests.

During AY 2022-23, BIOL 207 was transitioning from a course taken by most students during their 2nd semester at WKU to one that will more often be taken by 1st-semester students. As such, we expect there may be some decrease in levels of attainment in future years, and this is something we will monitor. However, as this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	96.5% (83 out of 86). The mean score was 4.24+/-0.08 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the Spring 2023 semester. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 136).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met. 83 of 86 students (96.5%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 46.5% to 96.5%. These results indicate that BIOL 207 students are assimilating the knowledge of basic concepts and principles related to general microbiology. We attribute this high level of attainment to several factors: (1) BIOL 207 is taught as service courses for the School of Nursing and Allied Health, so nearly all students enrolled are pre-nursing or pre-dental hygiene who are motivated to perform well in the class, and (2) the course content is highly focused, and aligned with students' professional interests. During AY 2022-23, BIOL 207 was transitioning from a course taken by most students during their 2nd semester at WKU to one that will more often be taken by 1st-semester students. As such, we expect there may be some decrease in levels of attainment in future years, and this is something we will monitor. However, as this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.			

Colonnade Learning Outcome 3	
Colonnade Learning	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.

Outcome			
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	91.9% (79 out of 86). The mean score was 3.87+/-0.09 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the Spring 2023 semester. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 136).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 79 of 86 students (91.9%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 52.3% to 97.7%. These results indicate that BIOL 207 students are assimilating the skills necessary to apply scientific principles and make predictions related to general microbiology. We attribute this high level of attainment to several factors: (1) BIOL 207 is taught as service courses for the School of Nursing and Allied Health, so nearly all students enrolled are pre-nursing or pre-dental hygiene who are motivated to perform well in the class, and (2) the course content is highly focused, and aligned with students' professional interests.

During AY 2022-23, BIOL 207 was transitioning from a course taken by most students during their 2nd semester at WKU to one that will more often be taken by 1st-semester students. As such, we expect there may be some decrease in levels of attainment in future years, and this is something we will monitor. However, as this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4

Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3

	level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.			
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*			
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	82.6% (71 out of 86). The mean score was 4.01+/-0.10 out of 5.	
Methods	The instrument was delivered electronically via Qualtrics at the end of the Spring 2023 semester. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 136).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 71 of 86 students (82.6%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 45.3% to 98.8%. These results indicate that BIOL 207 students are assimilating the perspectives regarding the personal and public relevance of general microbiology. We attribute this high level of attainment to several factors: (1) BIOL 207 is taught as service courses for the School of Nursing and Allied Health, so nearly all students enrolled are pre-nursing or pre-dental hygiene who are motivated to perform well in the class, and (2) the course content is highly focused, and aligned with students' professional interests.

During AY 2022-23, BIOL 207 was transitioning from a course taken by most students during their 2nd semester at WKU to one that will more often be taken by 1st-semester students. As such, we expect there may be some decrease in levels of attainment in future years, and this is something we will monitor. However, as this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment CHEM 101 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students should correctly answer question 1 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question correctly on the assessment.	**Percent of Program Achieving Target**	55%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 75 students completed the 6 question assessment. Statistics: median = 3.0, mean = 3.2, SD = 1.3		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The students successfully met the criteria by identifying the first step in the scientific method. The assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.		
Criteria for Student Success	Students should correctly answer question 5 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	79%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 75 students completed the 6 question assessment. Statistics: median = 3.0, mean = 3.2, SD = 1.3		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students correctly identified a basic type of reaction (oxidation). Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.		
Criteria for Student Success	Students will correctly answer question 2 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	48%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 75 students completed the 6 question assessment. Statistics: median = 3.0, mean = 3.2, SD = 1.3		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students were just below the threshold on this topic; we had an abrupt change in modality in the second half of the semester which may have impacted their understanding of this topic. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised			

to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students should correctly answer question 6 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	76%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 75 students completed the 6 question assessment. Statistics: median = 3.0, mean = 3.2, SD = 1.3		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students were able to correctly apply their understanding of chromatography to a real-world problem. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

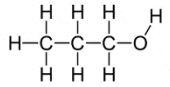
Colonnade Assessment
CHEM 101
Academic year 22/23

1. The first step in the scientific method involves ...
    a. forming a hypothesis
    b. making observations
    c. performing experiments
    d. predicting results

2. The molecular shape (geometry) of CO_2 is ...
    a. linear
    b. tetrahedral
    c. bent
    d. trigonal planar

3. Which molecule is most likely to have hydrogen bonding as the primary intermolecular force of attraction?
    a. methane, CH_4
    b. water, H_2O
    c. sulfur dioxide, SO_2
    d. diethyl ether, CH_3COCH_3

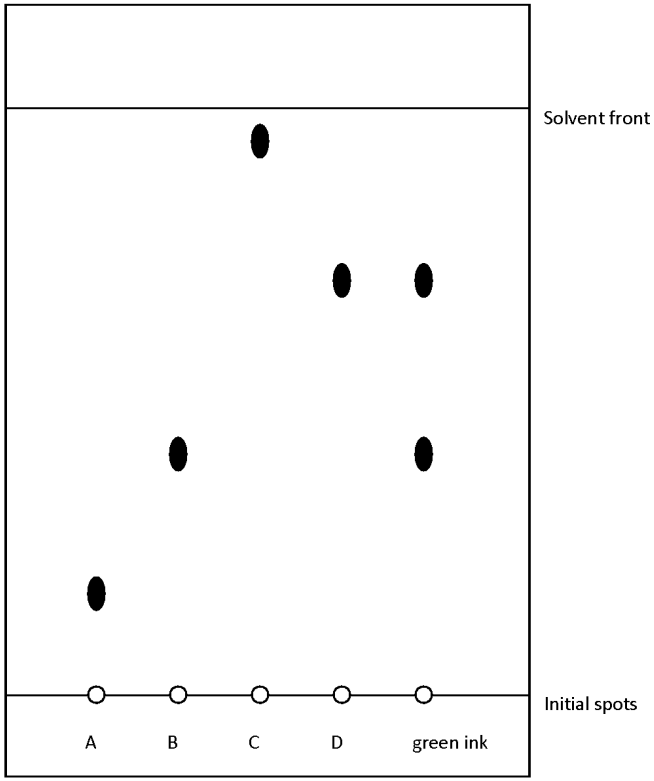
4. According to IUPAC rules the following molecule would be correctly named as what type of compound?



    a. Alcohol
    b. Aldehyde
    c. Carboxylic Acid
    d. Ketone

5. Rusting of iron can be represented in the equation below. What type of reaction is this?
$4Fe(s) + 2O_2(g) \rightarrow 2Fe_2O_3(s)$
    a. acid-base
    b. oxidation-reduction (redox)
    c. decomposition
    d. displacement

6. Based on the chromatogram below, which components (A, B, C, D) are in the green ink?
    a. B only
    b. B and D
    c. C and D
    d. D only



Colonnade EXPLORATIONS Assessment CHEM 105 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 1 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	72%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified key features of the scientific method. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.			
Criteria for Student Success	Students will correctly answer question 5 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	26%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students did not correctly calculate the amounts; this may be due to a lengthy calculation included on an assessment for few if any points. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments, including this one, required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Learning Outcome 3				
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.			
Criteria for Student Success	Students will correctly answer question 7 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	34%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students did not correctly predict the formula of the oxide; this question may be relying on assumptions that are not as well covered in CHEM 105 as in majors-level courses. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments				

required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			
Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students will correctly answer question 6 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	47%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Student success on this question was just below the threshold. Given then complexity of the question and calculations, this question may not be appropriate for a nonmajors course when few if any points in the course are at stake. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			

Colonnade Assessment
CHEM 105 / 116 / 120
Academic year 22/23

1. Which statements about the scientific method are true:
   I. A hypothesis follows from the experiment performed
   II. The hypothesis must be proven correct in order to gain information
   III. An experiment should be designed such that it answers a specific question

   A. All are true
   B. I and III only
   C. III only
   D. II and III only
   E. None are true

2. A short verbal or mathematical statement which has been tested under many conditions and explains a fundamental relationship or regularity of nature is a(n):

   A. Scientific Law
   B. Hypothesis
   C. Theory
   D. Experiment

3. Choose the correct name for the compound indicated by the formula: $MnSO_4 \cdot 7H_2O$

   A. Magnesium sulfite heptahydrate
   B. Magnesium(II) sulfate pentahydrate
   C. Manganese sulfite pentahydrate
   D. Manganese(II) sulfate heptahydrate
   E. Manganese sulfate heptahydrate

4. How many grams of hydrogen are found in 7.4×10^{24} formula units of $Mg(OH)_2$?
   (Avogadro's number = $6.02 \times 10^{23}\ mol^{-1}$)

   A. 25 g
   B. 49 g
   C. 50 g
   D. 2.5 g
   E. 12 g

5. How many grams of sodium iodide are required to react completely with 35.5 grams of chlorine?

$$2\ NaI + Cl_2 \rightarrow I_2 + 2\ NaCl$$

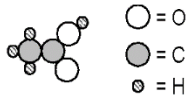
A. 1.50 g
B. 37.5 g
C. 150. g
D. 74.9 g
E. 33.6 g

6. A 27.0-L sample of nitrogen at 7.85 atm and 27.0°C is simultaneously expanded to 63.4 L and heated to 35.0°C. What is the new pressure of the gas?

A) 4.33 atm
B) 168 atm
C) 3.43 atm
D) 212 atm
E) 3.26 atm

7. An unknown element, X, forms an oxide that has the formula X_2O. Which of the following would be most likely to be X?

A. N
B. Cl
C. K
D. C
E. Mg

8. The empirical formula for the molecule:  is ...

A. CHO
B. CH_2O
C. $C_2H_4O_2$
D. CH_3COOH
E. none of the above.

Colonnade EXPLORATIONS Assessment CHEM 105 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 1 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	72%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified key features of the scientific method. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.			
Criteria for Student Success	Students will correctly answer question 5 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	26%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students did not correctly calculate the amounts; this may be due to a lengthy calculation included on an assessment for few if any points. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments, including this one, required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Learning Outcome 3				
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.			
Criteria for Student Success	Students will correctly answer question 7 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	34%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students did not correctly predict the formula of the oxide; this question may be relying on assumptions that are not as well covered in CHEM 105 as in majors-level courses. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments				

required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			
Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students will correctly answer question 6 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	47%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 47 students completed the 8 question assessment. Statistics: median = 4.0, mean = 3.7, SD = 1.5		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Student success on this question was just below the threshold. Given then complexity of the question and calculations, this question may not be appropriate for a nonmajors course when few if any points in the course are at stake. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			

Colonnade Assessment
CHEM 105 / 116 / 120
Academic year 22/23

1. Which statements about the scientific method are true:
   I. A hypothesis follows from the experiment performed
   II. The hypothesis must be proven correct in order to gain information
   III. An experiment should be designed such that it answers a specific question

   A. All are true
   B. I and III only
   C. III only
   D. II and III only
   E. None are true

2. A short verbal or mathematical statement which has been tested under many conditions and explains a fundamental relationship or regularity of nature is a(n):

   A. Scientific Law
   B. Hypothesis
   C. Theory
   D. Experiment

3. Choose the correct name for the compound indicated by the formula: $MnSO_4 \cdot 7H_2O$

   A. Magnesium sulfite heptahydrate
   B. Magnesium(II) sulfate pentahydrate
   C. Manganese sulfite pentahydrate
   D. Manganese(II) sulfate heptahydrate
   E. Manganese sulfate heptahydrate

4. How many grams of hydrogen are found in 7.4×10^{24} formula units of $Mg(OH)_2$?
   (Avogadro's number = $6.02 \times 10^{23}\ mol^{-1}$)

   A. 25 g
   B. 49 g
   C. 50 g
   D. 2.5 g
   E. 12 g

5. How many grams of sodium iodide are required to react completely with 35.5 grams of chlorine?

$$2\ NaI + Cl_2 \rightarrow I_2 + 2\ NaCl$$

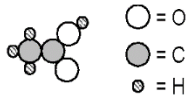
A. 1.50 g
B. 37.5 g
C. 150. g
D. 74.9 g
E. 33.6 g

6. A 27.0-L sample of nitrogen at 7.85 atm and 27.0°C is simultaneously expanded to 63.4 L and heated to 35.0°C. What is the new pressure of the gas?

A) 4.33 atm
B) 168 atm
C) 3.43 atm
D) 212 atm
E) 3.26 atm

7. An unknown element, X, forms an oxide that has the formula X_2O. Which of the following would be most likely to be X?

A. N
B. Cl
C. K
D. C
E. Mg

8. The empirical formula for the molecule:  is ...

A. CHO
B. CH_2O
C. $C_2H_4O_2$
D. CH_3COOH
E. none of the above.

Colonnade EXPLORATIONS Assessment 2022-2023	
Oden College of Science & Engineering	*Department of Biology*
BIOL 122/123: Biological Concepts: Evolution, Diversity, & Ecology with Lab	
Doug McElroy and Kerrie McDaniel, Assessment Coordinators	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	Students will demonstrate an understanding of the methods of science inquiry.
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*

Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	60.6% (149 out of 246). The mean score was 2.87+/-0.08 out of 5.

Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.

Based on your results, highlight whether the program met the goal Student Learning Outcome 1.	☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was not met. 149 of 246 students (60.6%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 38.2% to 75.2%. Despite not meeting the attainment target, student performance on this SLO was solid, as the mean number of correct responses out of 5 items was 2.87 +/- 0.08, which approached the Milestone 3 level of performance. These results indicate that BIOL 122/123 students are doing fairly well at assimilating the necessary knowledge, skills, and perspectives regarding the science process and its application to the evolution, diversity, and ecology of organisms. We attribute this level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester,

after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

The 20+ ppt difference in criterion-level attainment on this SLO vs. SLO2-SLO4 may reflect the fact that students are still learning to put the course content within the broader context of the science process; this incorporates a higher-level Bloom's taxonomy construct than simply learning the elements of the science process and/or other basic concepts, principles, and skills. To address SLO1, BIOL 122/123 employs a strong inquiry-based framework in the laboratory component which builds this conceptual framework at a foundational level and in so doing exposes students to an approach to learning and doing biology that they have not typically experienced in high school. As such, we exepct performance on this SLO to lag behind that of the other SLOs, which emphasize more direct learning of course content.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 2			
Colonanade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	88.6% (218 out of 246). The mean score was 3.82+/-0.07 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
The attainment target was met. 218 of 246 students (88.6%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 60.6% to 92.3%. These results indicate that BIOL 122/123 students are assimilating the knowledge of basic concepts and principles related to evolution, diversity, and ecology of organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL			

122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 3			
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	83.3% (205 out of 246). The mean score was 3.58+/-0.07 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 205 of 246 students (83.3%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 55.3% to 89.4%. These results indicate that BIOL 122/123 students are assimilating the skills necessary to apply scientific principles and make predictions related to evolution, diversity, and ecology or organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade Learning Outcome 4			
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	A 20-question, multiple choice assessment given at the end of the semester or term. The instrument is comprised of 5 questions aligned with each of the 4 SLOs. For SLO1, these questions consist of 2 knowledge-, 2 skills-, and 1 perspectives-focused question(s) related to the science process. For SLO2, all 5 questions address knowledge of key concepts in the subject area. For SLO3, all 5 questions address skills in applying the scientific process. For SLO4, all 5 questions address perspectives of the relationship between the subject area and broader societal issues. For each SLO, 0 correct answers out of 5 items are mapped to Benchmark 1 level of attainment on the Explorations NS rubric; 1-2 correct responses out of 5 are mapped to Milestone 2 level of attainment on the rubric, and 3-4 correct responses out of 5 are mapped to Milestone 3 level of attainment on the rubric. 5 correct responses out of 5 are mapped to the Capstone 4 level of attainment on the Explorations NS rubric.		
Criteria for Student Success	*1.A score of 3 or higher (out of 5) on the corresponding rubric element, corresponding to Milestone 3 or higher level of achievement.*		
Program Success Target for this Measurement	At least 75% of students will reach the criterion level of attainment.	**Percent of Program Achieving Target**	89.0% (219 out of 246). The mean score was 3.67+/-0.06 out of 5.
Methods	The instrument was delivered electronically via Qualtrics at the end of the semester/term. All enrolled students across all sections were included in the sample. The resulting sample size for analysis included those students who responded to all items on the survey (n = 246). Because BIOL 120 and BIOL 121 are co-requisite courses, they were combined into a single assessment.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The attainment target was met. 219 of 246 students (89.0%) attained the criterion score or higher. Item analysis indicated the % correct responses for each of the 5 items ranged from 55.3% to 89.4%. These results indicate that BIOL 122/123 students are assimilating the perspectives regarding the personal and public relevance of the evolution, diversity, and ecology or organisms. We attribute this strong level of attainment to several factors: (1) the student population in BIOL 122/123 consists primarily of biology majors, (2) BIOL 122/123 is typically taken by students during their 2nd semester, after BIOL 120-121, and (3) the course content is more macro-level than the content in BIOL 120/121 and so may be more approachable to students. As such, we expect performance in BIOL 122/123 to generally be higher than in BIOL 120/121, which the data indicate it was.

As this was the first year of administration of this instrument, we do not feel any changes are warranted at this time – we need additional years of data to draw any firm conclusions.

Colonnade EXPLORATIONS Assessment CHEM 106 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 4 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	44%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 59 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.1, SD = 1.3		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students scored below the threshold for this assessment question. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.			
Criteria for Student Success	Students will correctly answer question 2 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	66%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 59 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.1, SD = 1.3			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students were able to correctly balance an equation. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Learning Outcome 3				
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.			
Criteria for Student Success	Students will correctly answer question 7 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	53%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 59 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.1, SD = 1.3			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students were just above the threshold on this assessment question, which required application of VSEPR theory to predict a structure. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical				

manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students will correctly answer question 8 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	92%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 59 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.1, SD = 1.3		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified the appropriate glassware to achieve the correct level or precision in the measurement. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Assessment
CHEM 106 / 121
Academic year 22/23

1. Which is the appropriate eye wear when a splash hazard is present in the laboratory?

   a. glasses with side shields
   b. goggles with full surround contact
   c. full face shield
   d. all of the above

2. Balance the equation. The smallest whole-number coefficient in front of O_2 is ...
   $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

   a. 2
   b. 3
   c. 4
   d. 5

3. The correct name for Cl_2O_7 is ...

   a. chlorine oxide
   b. chlorine(VII) heptoxide
   c. dichlorine(VII) oxide
   d. dichlorine heptoxide

4. The first step in the scientific method involves ...

   a. forming a hypothesis
   b. making observations
   c. performing experiments
   d. predicting results

5. The correct name for Cu_2O is ...

   a. copper(I) oxide
   b. copper(II) oxide
   c. copper oxide
   d. copper dioxide

6. A fire extinguisher has a pressure of 10.0 atm at a 25° C. What is the pressure, in atm, in the fire extinguisher when the temperature is 75° C?

a. 20.0 atm
b. 12.0 atm
c. 32.0 atm
d. 21.0 atm

7. The molecular shape (geometry) of PH_3 is ...

a. trigonal pyramidal
b. tetrahedral
c. bent
d. trigonal planar

8. Which would you use to measure a precise amount of liquid?

a. 

b. 

c. 

d. 

Colonnade EXPLORATIONS Assessment CHEM 109 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 5 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	49%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 49 students completed the 5 question assessment. Statistics: median = 3.0, mean = 2.4, SD = 0.9		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Student success on this question was just below the threshold. This academic year, the sudden loss of one of our instructors greatly impacted our ability to do an assessment of one section, and thus results are incomplete. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2				
Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.			
Criteria for Student Success	Students will successfully answer question 1 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	92%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 49 students completed the 5 question assessment. Statistics: median = 3.0, mean = 2.4, SD = 0.9			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students correctly identified the charge of the electron. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Learning Outcome 3				
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.			
Criteria for Student Success	Students will correctly answer question 2 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	72%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 49 students completed the 5 question assessment. Statistics: median = 3.0, mean = 2.4, SD = 0.9			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students correctly applied the concept of valence electrons to answer the question. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery				

of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				
Colonnade Learning Outcome 4				
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.			
Criteria for Student Success	Students will correctly answer question 3 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	18%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 49 students completed the 5 question assessment. Statistics: median = 3.0, mean = 2.4, SD = 0.9			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.			☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students did not correctly answer the assessment question. This academic year, the sudden loss of one of our instructors greatly impacted our ability to do an assessment of one section, and thus results are incomplete. In the assessed section, there may not have been an expectation that students would memorize the conversion of pounds to kilograms, which would have been necessary to complete the calculation. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Assessment
CHEM 109
Academic year 22/23

1. Which subatomic particle has a negative charge?

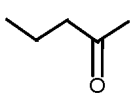
   A. Proton
   B. Neutron
   C. Electron
   D. Isotope

2. How many valence electrons are in one atom of phosphorus?

   A. 2
   B. 3
   C. 5
   D. 7

3. What volume of medication is required for a 150 pound patient who needs 0.250 mg drug per kg of body weight? The medication is in a solution with a concentration of 5.0 mg/mL.

   A. 3.4 mL
   B. 7.5 mL
   C. 9.8 mL
   D. 16.5 mL

4. According to IUPAC rules the following molecule would be correctly named as what type of  compound?

A. Alcohol
B. Aldehyde
C. Carboxylic Acid
D. Ketone

5. The first step in the scientific method involves _____.

A. forming a hypothesis
B. making observations
C. performing an experiment
D. predicting the result of an experiment

Colonnade EXPLORATIONS Assessment CHEM 116 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 1 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	48%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 27 students completed the 8 question assessment. Statistics: median = 4.0, mean = 4.0, SD = 1.7		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☐ **Met**	☒ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students were very near the threshold for success on this assessment to identify key portions of the scientific method. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.		
Criteria for Student Success	Students will correctly answer question 5 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	59%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 27 students completed the 8 question assessment. Statistics: median = 4.0, mean = 4.0, SD = 1.7		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students correctly calculated the amounts of materials based on principles that are emphasized in this course. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.		
Criteria for Student Success	Students will correctly answer question 7 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	41%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 27 students completed the 8 question assessment. Statistics: median = 4.0, mean = 4.0, SD = 1.7		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☐ **Met**	☒ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students did not accurately predict the formula of the oxide; this particular question was related to a topic that is not emphasized strongly in this course. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students			

as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				
Colonnade Learning Outcome 4				
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.			
Criteria for Student Success	Students will correctly answer question 6 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	59%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 27 students completed the 8 question assessment. Statistics: median = 4.0, mean = 4.0, SD = 1.7			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students were able to correctly use the gas laws to understand the effects of temperature and pressure on gases. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Assessment
CHEM 105 / 116 / 120
Academic year 22/23

1. Which statements about the scientific method are true:
   I. A hypothesis follows from the experiment performed
   II. The hypothesis must be proven correct in order to gain information
   III. An experiment should be designed such that it answers a specific question

   A. All are true
   B. I and III only
   C. III only
   D. II and III only
   E. None are true

2. A short verbal or mathematical statement which has been tested under many conditions and explains a fundamental relationship or regularity of nature is a(n):

   A. Scientific Law
   B. Hypothesis
   C. Theory
   D. Experiment

3. Choose the correct name for the compound indicated by the formula: $MnSO_4 \cdot 7H_2O$

   A. Magnesium sulfite heptahydrate
   B. Magnesium(II) sulfate pentahydrate
   C. Manganese sulfite pentahydrate
   D. Manganese(II) sulfate heptahydrate
   E. Manganese sulfate heptahydrate

4. How many grams of hydrogen are found in 7.4×10^{24} formula units of $Mg(OH)_2$?
   (Avogadro's number = $6.02 \times 10^{23}\ mol^{-1}$)

   A. 25 g
   B. 49 g
   C. 50 g
   D. 2.5 g
   E. 12 g

5. How many grams of sodium iodide are required to react completely with 35.5 grams of chlorine?

$$2\ NaI + Cl_2 \rightarrow I_2 + 2\ NaCl$$

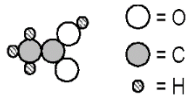
A. 1.50 g
B. 37.5 g
C. 150. g
D. 74.9 g
E. 33.6 g

6. A 27.0-L sample of nitrogen at 7.85 atm and 27.0°C is simultaneously expanded to 63.4 L and heated to 35.0°C. What is the new pressure of the gas?

A) 4.33 atm
B) 168 atm
C) 3.43 atm
D) 212 atm
E) 3.26 atm

7. An unknown element, X, forms an oxide that has the formula X_2O. Which of the following would be most likely to be X?

A. N
B. Cl
C. K
D. C
E. Mg

8. The empirical formula for the molecule:  is ...

A. CHO
B. CH_2O
C. $C_2H_4O_2$
D. CH_3COOH
E. none of the above.

Colonnade EXPLORATIONS Assessment CHEM 120 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 1 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	76%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 199 students completed the 8 question assessment. Statistics: median = 5.0, mean = 4.7, SD = 1.6		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified key features of the scientific method. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.			
Criteria for Student Success	Students will correctly answer question 5 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	65%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 199 students completed the 8 question assessment. Statistics: median = 5.0, mean = 4.7, SD = 1.6			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students correctly calculated the correct amounts using stoichiometry principles. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.				

Colonnade Learning Outcome 3				
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.			
Criteria for Student Success	Students will correctly answer question 7 of the assessment.			
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	50%	
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 199 students completed the 8 question assessment. Statistics: median = 5.0, mean = 4.7, SD = 1.6			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
Students just met the threshold for this assessment; the question is somewhat confusing because it is not clear that the oxide is an ionic one, so this will be clarified. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required				

mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 4

Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students will correctly answer question 6 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	71%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 199 students completed the 8 question assessment. Statistics: median = 5.0, mean = 4.7, SD = 1.6		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students successfully used the gas laws to calculate the effects of temperature, pressure, and volume of a gas. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Assessment
CHEM 105 / 116 / 120
Academic year 22/23

1. Which statements about the scientific method are true:
   I. A hypothesis follows from the experiment performed
   II. The hypothesis must be proven correct in order to gain information
   III. An experiment should be designed such that it answers a specific question

   A. All are true
   B. I and III only
   C. III only
   D. II and III only
   E. None are true

2. A short verbal or mathematical statement which has been tested under many conditions and explains a fundamental relationship or regularity of nature is a(n):

   A. Scientific Law
   B. Hypothesis
   C. Theory
   D. Experiment

3. Choose the correct name for the compound indicated by the formula: $MnSO_4 \cdot 7H_2O$

   A. Magnesium sulfite heptahydrate
   B. Magnesium(II) sulfate pentahydrate
   C. Manganese sulfite pentahydrate
   D. Manganese(II) sulfate heptahydrate
   E. Manganese sulfate heptahydrate

4. How many grams of hydrogen are found in 7.4×10^{24} formula units of $Mg(OH)_2$?
   (Avogadro's number = $6.02 \times 10^{23}\ mol^{-1}$)

   A. 25 g
   B. 49 g
   C. 50 g
   D. 2.5 g
   E. 12 g

5. How many grams of sodium iodide are required to react completely with 35.5 grams of chlorine?

$$2\ NaI + Cl_2 \rightarrow I_2 + 2\ NaCl$$

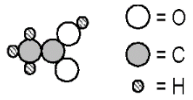
A. 1.50 g
B. 37.5 g
C. 150. g
D. 74.9 g
E. 33.6 g

6. A 27.0-L sample of nitrogen at 7.85 atm and 27.0°C is simultaneously expanded to 63.4 L and heated to 35.0°C. What is the new pressure of the gas?

A) 4.33 atm
B) 168 atm
C) 3.43 atm
D) 212 atm
E) 3.26 atm

7. An unknown element, X, forms an oxide that has the formula X_2O. Which of the following would be most likely to be X?

A. N
B. Cl
C. K
D. C
E. Mg

8. The empirical formula for the molecule:  is ...

A. CHO
B. CH_2O
C. $C_2H_4O_2$
D. CH_3COOH
E. none of the above.

Colonnade EXPLORATIONS Assessment CHEM 121 2022-2023	
Ogden College of Science and Engineering	Chemistry
Chemistry 623	
Kevin Williams	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Coloannde Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' understanding of the scientific method.		
Criteria for Student Success	Students will correctly answer question 4 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	58%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 133 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.5, SD = 1.7		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified the first step of the scientific method. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to use basic concepts and principles in chemistry.		
Criteria for Student Success	Students will correctly answer question 2 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	72%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 133 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.5, SD = 1.7		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students correctly balanced the chemical equation. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to interpret and make predictions.		
Criteria for Student Success	Students will correctly answer question 7 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	58%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 133 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.5, SD = 1.7		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Students were just above the threshold on this assessment question, which required application of VSEPR theory to predict a structure. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the			

scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	Student performance on the assessment instrument directly measures students' ability to apply chemical principles to issues of personal or public importance.		
Criteria for Student Success	Students will correctly answer question 8 of the assessment.		
Program Success Target for this Measurement	50% of students will answer the question(s) correctly on the assessment.	**Percent of Program Achieving Target**	98%
Methods	Students were administered the assessment during the final exam period. All students were asked to complete the assessment. 133 students completed the 8 question assessment. Statistics: median = 5.0, mean = 5.5, SD = 1.7		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Students correctly identified the appropriate glassware to achieve the correct level or precision in the measurement. Assessment will be revised to include two measurement instruments probing students understanding of the the methods of science inquiry. Having multiple measurement instruments will allow the Department to gain a deeper insight into students' understanding of the material. Review of measurement instruments revealed that some instruments required mathematical manipulation beyond the scope of the course and were testing mastery of multiple topics within a single question. Measurement instruments will be revised to better reflect the level of mathematical manipulation expected in the course. Measurement instruments will be revised to ensure each instrument is measuring single topic mastery by the students as opposed to multiple topic mastery. Additionally the Department will explore the use of a pre-/post-assessment format to better gauge changes in students' understanding of topics.

Colonnade Assessment
CHEM 106 / 121
Academic year 22/23

1. Which is the appropriate eye wear when a splash hazard is present in the laboratory?

   a. glasses with side shields
   b. goggles with full surround contact
   c. full face shield
   d. all of the above

2. Balance the equation. The smallest whole-number coefficient in front of O_2 is ...
   $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

   a. 2
   b. 3
   c. 4
   d. 5

3. The correct name for Cl_2O_7 is ...

   a. chlorine oxide
   b. chlorine(VII) heptoxide
   c. dichlorine(VII) oxide
   d. dichlorine heptoxide

4. The first step in the scientific method involves ...

   a. forming a hypothesis
   b. making observations
   c. performing experiments
   d. predicting results

5. The correct name for Cu_2O is ...

   a. copper(I) oxide
   b. copper(II) oxide
   c. copper oxide
   d. copper dioxide

6. A fire extinguisher has a pressure of 10.0 atm at a 25° C. What is the pressure, in atm, in the fire extinguisher when the temperature is 75° C?

a. 20.0 atm
b. 12.0 atm
c. 32.0 atm
d. 21.0 atm

7. The molecular shape (geometry) of PH_3 is ...

a. trigonal pyramidal
b. tetrahedral
c. bent
d. trigonal planar

8. Which would you use to measure a precise amount of liquid?

a. 

b. 

c. 

d. 

Colonnade EXPLORATIONS Assessment GEOG/GEOL 103 (Our Dynamic Planet) 2022-2023	
Ogden College of Science and Engineering	*Earth, Environmental, and Atmospheric Sciences*
Environmental, Sustainability, and Geographic Studies (5009); Geological Sciences (5008)	
Margaret Gripshover; Christopher Groves	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☐ Taught 100% face to face
☐ Taught 100% online
☒ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Colonnade Learning Outcome	Demonstrate an understanding of the methods of science inquiry		
Measurement Instrument 1	The pre- and post-test assessment tools consist of a number of questions related to learning objectives gathered from a Geoscience Concept Inventory (Libarkin and Anderson 2005) relating to the atmosphere, hydrosphere, and lithosphere. The questions in the GCI have been validated using item analysis techniques from both classical test theory and item response theory (Libarkin and Anderson 2005). The assessment contains 20 questions (see appendix).		
Criteria for Student Success	The goal of the pre- and post-assessment is to demonstrate student learning related to a variety to topics within the course. Questions are divided amongst the four Colonnade Learning Outcomes as follows: CLO 1: 1, 2, 12, 13 CLO 2: 3, 6, 8, 9, 10, 11, 14, 17 CLO 3: 4, 5, 6, 19 CLO 4: 15, 16, 18, 20 Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Course Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning demonstrated in 100% of questions related to this CLO with an average increase of 21.4% from pre- to post-assessment.
Methods	Out of a total 396 students that took GEOG/GEOL 103 in AY 2022-23, a total of 169 (43%) successfully completed both the pre- and post-assesments without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre) / pre) * 100). Students completed the pre-assessment during the first week of the semester, and the post-assessment in the final week of the semester. A sample of 100 (N=100) students was used to assess success.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
We intend to further refine the assessment metric this coming academic year. The assessment last underwent revision in 2014, and could be improved to more accurately reflect the areas of emphasis within the course, taking advantage of more current literature, case studies, and areas of interest to students. Because student learning is occurring with respect to this CLO, we will not make adjustments to the corresponding curricula. We hope to encourage a larger percentage of students to participate in this process.			

Colonnade Learning Outcome 2			
Colonnade Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	The pre- and post-test assessment tools consist of a number of questions related to learning objectives gathered from a Geoscience Concept Inventory (Libarkin and Anderson 2005) relating to the atmosphere, hydrosphere, and lithosphere. The questions in the GCI have been validated using item analysis techniques from both classical test theory and item response theory (Libarkin and Anderson 2005). The assessment contains 20 questions (see appendix).		
Criteria for Student Success	The goal of the pre- and post-assessment is to demonstrate student learning related to a variety to topics within the course. Questions are divided amongst the four Colonnade Learning Outcomes as follows: CLO 1: 1, 2, 12, 13 CLO 2: 3, 6, 8, 9, 10, 11, 14, 17 CLO 3: 4, 5, 6, 19 CLO 4: 15, 16, 18, 20 Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning demonstrated in 100% of questions related to this CLO with an average increase of 44.5% from pre- to post-assessment.
Methods	Out of a total 396 students that took GEOG/GEOL 103 in AY 2022-23, a total of 169 (43%) successfully completed both the pre- and post-assesments without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre) / pre) * 100). Students completed the pre-assessment during the first week of the semester, and the post-assessment in the final week of the semester. A sample of 100 (N=100) students was used to assess success.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
We intend to further refine the assessment metric this coming academic year. The assessment last underwent revision in 2014, and could be improved to more accurately reflect the areas of emphasis within the course, taking advantage of more current literature, case studies, and areas of interest to students. Because student learning is occurring with respect to this CLO, we will not make adjustments to the corresponding curricula. We hope to encourage a larger percentage of students to participate in this process.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	The pre- and post-test assessment tools consist of a number of questions related to learning objectives gathered from a Geoscience Concept Inventory (Libarkin and Anderson 2005) relating to the atmosphere, hydrosphere, and lithosphere. The questions in the GCI have been validated using item analysis techniques from both classical test theory and item response theory (Libarkin and Anderson 2005). The assessment contains 20 questions (see appendix).		
Criteria for Student Success	The goal of the pre- and post-assessment is to demonstrate student learning related to a variety to topics within the course. Questions are divided amongst the four Colonnade Learning Outcomes as follows: CLO 1: 1, 2, 12, 13 CLO 2: 3, 6, 8, 9, 10, 11, 14, 17 CLO 3: 4, 5, 6, 19 CLO 4: 15, 16, 18, 20 Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning demonstrated in 100% of questions related to this CLO with an average increase of 51.5% from pre- to post-assessment.
Methods	Out of a total 396 students that took GEOG/GEOL 103 in AY 2022-23, a total of 169 (43%) successfully completed both the pre- and post-assesments without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre) / pre) * 100). Students completed the pre-assessment during the first week of the semester, and the post-assessment in the final week of the semester. A sample of 100 (N=100) students was used to assess success.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
We intend to further refine the assessment metric this coming academic year. The assessment last underwent revision in 2014, and could be improved to more accurately reflect the areas of emphasis within the course, taking advantage of more current literature, case studies, and areas of interest to students. Because student learning is occurring with respect to this CLO, we will not make adjustments to the corresponding curricula. We hope to encourage a larger percentage of students to participate in this process.			

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.		
Measurement Instrument 1	The pre- and post-test assessment tools consist of a number of questions related to learning objectives gathered from a Geoscience Concept Inventory (Libarkin and Anderson 2005) relating to the atmosphere, hydrosphere, and lithosphere. The questions in the GCI have been validated using item analysis techniques from both classical test theory and item response theory (Libarkin and Anderson 2005). The assessment contains 20 questions (see appendix).		
Criteria for Student Success	The goal of the pre- and post-assessment is to demonstrate student learning related to a variety to topics within the course. Questions are divided amongst the four Colonnade Learning Outcomes as follows: CLO 1: 1, 2, 12, 13 CLO 2: 3, 6, 8, 9, 10, 11, 14, 17 CLO 3: 4, 5, 6, 19 CLO 4: 15, 16, 18, 20 Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning demonstrated in 100% of questions related to this CLO with an average increase of 101.6% from pre- to post-assessment.
Methods	Out of a total 396 students that took GEOG/GEOL 103 in AY 2022-23, a total of 169 (43%) successfully completed both the pre- and post-assesments without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre) / pre) * 100). Students completed the pre-assessment during the first week of the semester, and the post-assessment in the final week of the semester. A sample of 100 (N=100) students was used to assess success.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
We intend to further refine the assessment metric this coming academic year. The assessment last underwent revision in 2014, and could be improved to more accurately reflect the areas of emphasis within the course, taking advantage of more current literature, case studies, and areas of interest to students. Because student learning is occurring with respect to this CLO, we will not make adjustments to the corresponding curricula. We hope to encourage a larger percentage of students to participate in this process.			

Appendix
Pre/Post Assessment: GEOG/GEOL 103
Colonnade Assessment Questions

1. Using the "Scientific Method," a natural observation or a research question is translated into:
    a. The data collection.
    b. The methodology.
    c. The analysis.
    d. The hypothesis.
    e. The conclusion.

2. Science is:
    a. A process of repeating many times and making observations.
    b. A model that attempts to explain why the law is true.
    c. A summary of the experiments.
    d. An initial best guess concerning nature.
    e. The investigation and explanation of natural phenomena.

3. Which type of heat transfer is most associated with solar energy reaching the Earth?
    a. Advection
    b. Conduction
    c. Convection
    d. Frontal
    e. Radiation

4. From June 21st to September 22nd:
    a. The length of daylight is getting shorter in the mid-latitudes of the Northern Hemisphere.
    b. The length of daylight is getting longer in the mid-latitudes of the Northern Hemisphere.
    c. The southern hemisphere is experiencing its summer.
    d. The South Pole receives 24 hours of daylight.
    e. The northern hemisphere is experiencing its winter.

5. In which of the following ways does air move in a high-pressure center in the Northern Hemisphere?
    a. Converging counterclockwise
    b. Converging clockwise
    c. Diverging counterclockwise
    d. Diverging clockwise
    e. Air does not move in a pressure center

6. Carbon dioxide and other greenhouse gases absorb longwave radiation as they are emitted into the atmosphere in the lower parts of this layer of the atmosphere.
    a. Troposphere
    b. Mesosphere
    c. Exosphere
    d. Stratosphere
    e. Thermosphere

7. Which of the following is least likely if global climate change continues?
    a. A general lowering of mean sea level.
    b. Expansion of the limits and ranges of insects carrying tropical diseases into higher latitudes.
    c. More intense rainfall and more serious droughts in semi-arid regions.
    d. A rise in temperatures in most polar regions.
    e. Flooding in low elevation coastal areas.

8. Warm fronts typically:
    a. Move more quickly than cold fronts.
    b. Are the same as occluded fronts.
    c. Have a gentler slope than cold fronts.
    d. Never cause precipitation.
    e. Are indicated on weather maps as lines with (blue) triangles.

9. The two weather elements used most often as indicators of climate are:
    a. Pressure and precipitation.
    b. Wind and pressure.
    c. Precipitation and temperature.
    d. Temperature and cloud cover.
    e. Storms and aridity.

10. Which type of fault is typically associated with convergent boundaries?
    a. Normal fault
    b. Transform fault
    c. Neutral fault
    d. Reverse fault
    e. Picture fault

11. Which of the following rock types forms from molten material?
    a. Sedimentary rocks
    b. Detrital rocks
    c. Igneous rocks
    d. Metamorphic rocks
    e. Schistose rocks

12. The rock cycle tells us that:
    a. Rocks can only form from preexisting rocks.
    b. All major rock types can form from any of the other major rock types.
    c. Once a rock forms it cannot be changed.
    d. Rocks begin as large pieces and are slowly altered to smaller and smaller pieces.
    e. Minerals are composed of one or more types of rock.

13. Earthquakes:
    a. Are roughly evenly distributed over Earth's surface.
    b. Can be predicted with between 90% and 95% accuracy globally.
    c. Are most frequently found along plate boundaries.
    d. Never occur on islands.
    e. Occur about twice as frequently compared to pre-industrial times.

14. Which of the following is **NOT** a landform or feature associated with glacial processes?
    a. Moraines.
    b. Kettle lakes.
    c. Till.
    d. Ice caps.
    e. Cross-bedding.

15. You are visiting a cemetery located on a hillside. You observe that the oldest tombstones are all tilted in the downslope direction of the hill. Which of the following best explains this geologic process?
    a. Creep
    b. Normal faulting
    c. Volcanic uplift
    d. Downslope tsunami generation
    e. Lacustrine overturning

16. London, England and Calgary, Canada are both located at approximately 51°N latitude. What is the dominant reason for the much milder climate experienced in London?
    a. Calgary is at lower altitude than London.
    b. The Gulf Stream brings warmth to the North Atlantic Ocean.
    c. London is more densely populated than Calgary.
    d. London is located on a volcanic hotspot.
    e. Calgary is cooled by the trade winds.

17. About how old is the oldest oceanic crust?
    a. 4.4 billion years old.
    b. 3.0 billion years old.
    c. 250 million years old.
    d. 1 million years old
    e. Less than 10,000 years old.

18. Deep soils are characteristic of tropical regions, whereas thin rocky soils are characteristic of high latitudes. What is the best geologic explanation for this observation?
    a. Agriculture has removed the soils at high latitudes
    b. Physical weathering rates are higher at high latitudes, removing soil faster than it can form.
    c. Rock types from which deep soils can develop are only found near the equator.
    d. Physical weathering does not occur in the tropics.
    e. Chemical weathering rates are much higher in the tropics than high latitudes.

19. You are in a boat and concerned about shallow water in a meandering river. When entering a curve where should you aim your boat to find the deepest water?
    a. Mid-channel
    b. Along the inside of the curve
    c. It doesn't matter, as long as you remain a meter or two from either bank
    d. On the outside of the curve, close to the cut bank
    e. Can’t be determined from this information.

20. Rainwater seeps down through the cracks in the limestone, reacts with the rock, and dissolves the rock. What gas in the soil acidifies the rainwater?
    a. Carbon Monoxide
    b. Nitrogen
    c. Sulfates
    d. Carbon Dioxide
    e. Water Vapor

Colonnade EXPLORATIONS Assessment – GEOG 280 2022-2023	
Ogden College of Science and Engineering	*Dept of Earth, Environmental, and Atmospheric Sciences*
Environmental, Sustainability, and Geographic Studies (5009)	
Dr. Pat Kambesis, Dr. Margaret Gripshover, and Dr. Leslie North	

Please select the option(s) that best describe all sections of this course (you may select more than one):

☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1

Colonnade Learning Outcome	**Demonstrate an understanding of the methods of science inquiry**
Measurement Instrument 1	A pre- and post-assessment consisting of 13 questions is utilized as a direct measurement of student learning. Student learning can be quantified by comparing the pre-assessment results with the post-assessment results. The questions on the pre- and post-assessment consist of questions related to the learning objectives, and were drawn from the Geoscience Concept Inventory and the Victorian Curriculum and Assessment Environmental Science Database (Libarkin and Anderson, 2005; Victorian Curriculum and Assessment Authority, 2013). See the appendix at the end of the form for all of the assessment questions.
Criteria for Student Success	The following questions align with Colonnade learning outcome 1: - Question 9: Briefly describe two water quality concerns an environmental scientist might study. - Question 10:Compare and contrast the pros and cons of one form of fossil fuel (nonrenewable) energy and one form of renewable energy. The pre-assessment is completed within the first 2 weeks of the semester and the post-assessment is completed during the last week of class. Student learning is demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.

Program Success Target for this Measurement	At least 70% of the questions related to the Colonnade Learning Outcome (CLO) will demonstrate student learning.	**Percent of Program Achieving Target**	100% - Student learning was demonstrated in both questions related to this CLO with an average 20.6% increase from pre- to post-assessment.
Methods	Five out of seven sections of GEOG 280 produced usable pre-and post-assessment data that were utilized to calculate the statistical percentages for overall correct answers as well as for the percent change in correct answers from pre- to post-assessment. An increase in the number of students that answered the questions correctly on the post-assessment compared to the pre-assessment is used to demonstrate student learning.		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

The target was achieved, so no immediate action has been put in place. However, the professors who teach GEOG 280 work to improve the course every semester and share successes when new approaches are tried regarding the course material.

Colonnade Learning Outcome 2

Coloannde Learning Outcome	**Explain basic concepts and principles in one or more of the sciences**
Measurement Instrument 1	A pre- and post-assessment consisting of 13 questions is utilized as a direct measurement of student learning Student learning can be quantified by comparing the pre-assessment results with the post-assessment results. The questions on the pre- and post-assessment consiss of questions related to the learning objectives, and were drawn from the Geoscience Concept Inventory and the Victorian Curriculum and Assessment Environmental Science Database (Libarkin and Anderson, 2005; Victorian Curriculum and Assessment Authority, 2013). See appendix at the end of the form for all of the assessment questions. **NOTE: If you use the same artifact for all SLOs, use the same instrument for each.**
Criteria for Student Success	The following assessment questions align with Collonade learning outcome 2: - Question 1: Define environmental science - Question 2: Identify renewable resources - Question 3: Identify 2 nonrenewable resources - Question 4: Define biodiversity - Question 8: Name any three categories of waste studied by environmental scientists The pre-assessment is completed in the first 2 weeks of class and the post assessment is completed in the last week of class. An increase in the percentage of students who answer the question correctly on the post assessment is used to demonstrate student learning.

Program Success Target for this Measurement	At least 70% of the questions related to the Colonnade Learning Outcome (CLO) will demonstrate student learning.	**Percent of Program Achieving Target**	100% - Student learning was demonstrated in all questions related to this CLO with an average of 15% increase from pre- to post-assessment.
Methods	Five out of seven sections of GEOG 280 produced usable pre-and post-assessment data that were utilized to calculate the statistical percentages for overall correct answers as well as for the percent change in correct answers from pre- to post-assessment. An increase in the number of students that answered the questions correctly on the post-assessment compared to the pre-assessment is used to demonstrate student learning.		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

Overall, each of the questions showed an increase in student learning. However, one question had a much larger increase than others. Question 8 had the highest increase in correct answers (30.3%) and question 1 had the lowest increase (3.5%). This could be due to the concept of environmental science being introduced at the beginning of the semester and waste management being discussed toward the end of the semester. An approach to increasing the score would be to discuss the holistic approach of environmental science and how it applies to concepts covered in the second half of the class.

<table>
<tr><th colspan="5">Colonnade Learning Outcome 3</th></tr>
<tr><td>Coloannde Learning Outcome</td><td colspan="4">Apply scientific principles to interpret and make predictions in one or more sciences</td></tr>
<tr><td>Measurement Instrument 1</td><td colspan="4">A pre and post assessment consisting of 13 questions is utilized as a direct measurement of student learning. Student learning can be quantified by comparing the pre-assessment results with the post-assessment results. The questions on the pre- and post-assessment consiss of questions related to the learning objectives, and were drawn from the Geoscience Concept Inventory and the Victorian Curriculum and Assessment Environmental Science Database (Libarkin and Anderson, 2005; Victorian Curriculum and Assessment Authority, 2013). See appendix at the end of the form for all of the assessment questions.</td></tr>
<tr><td>Criteria for Student Success</td><td colspan="4">The following questions align with Colonnade learning outcome 3:
Question 7-The United States is a developed country, and Bangladesh is a developing country. Of these two, which country would rank higher for: life expectancy, population growth rate, energy use, pollution rate, resource consumption rate?
Question 11-Name two differences between mechanized farming and organic farming
The pre-assessment is completed within the first 2 weeks of the semester and the post-assessment is completed during the last week of class. Student learning is demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.</td></tr>
<tr><td colspan="2">Program Success Target for this Measurement</td><td>At least 70% of the questions related to the Colonnade Learning Outcome (CLO) wil demonstrate student learning.</td><td>Percent of Program Achieving Target</td><td>100% - Both questions had an increase in learning between the pre- and post-assessments, with an average increase of 13.03%.</td></tr>
<tr><td>Methods</td><td colspan="4">Five out of seven sections of GEOG 280 produced usable pre-and post-assessment data that were utilized to calculate the statistical percentages for overall correct answers as well as for the percent change in correct answers from pre- to post-assessment. An increase in the number of students that answered the questions correctly on the post-assessment compared to the pre-assessment is used to demonstrate student learning.</td></tr>
<tr><td colspan="3">Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.</td><td>☒ Met</td><td>☐ Not Met</td></tr>
<tr><td colspan="5">Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)</td></tr>
<tr><td colspan="5">The overall results show a positive increase in responses between the pre- and post-assessments. The results for this Colonnade learning outcome varied from class to class. Overall, the question about differences in types of farming had the highest increase in correct answers. Question 7 was graded in 5 parts, and of those 5 parts, the part the students scored lowest on was the camparison of pollution rates between Bangladesh and the United States. Pollution is covered in every unit of the course: introductory, unit, biodiversity, human development, agriculture, water, waste management, energy, atmosphere and air pollution, and in the climate unit. Discussing the pollution impacts of both more developed and less developed countres around the world in various units should increase the scores on part d of question 7.</td></tr>
</table>

<table>
<tr><th colspan="5">Colonnade Learning Outcome 4</th></tr>
<tr><td>Coloannde Learning Outcome</td><td colspan="4">Explain how scientific principles relate to issues of personal and/or public importance</td></tr>
<tr><td>Measurement Instrument 1</td><td colspan="4">A pre and post assessment consisting of 13 questions is utilized as a direct measurement of student learning. Student learning can be quantified by comparing the pre-assessment results with the post-assessment results. The questions on the pre- and post-assessment consist of questions related to the learning objectives, and were drawn from the Geoscience Concept Inventory and the Victorian Curriculum and Assessment Environmental Science Database (Libarkin and Anderson, 2005; Victorian Curriculum and Assessment Authority, 2013). See appendix at the end of the form for all of the assessment questions.</td></tr>
<tr><td>Criteria for Student Success</td><td colspan="4">The following questions from the assessment align with Colonnade learning outcome 4:
- Question 5 - Define the “Tragedy of the Commons”
- Question 6 - What is the difference between climate change and global warming?
- Question 12 – Describe 3 of th greatest environmental degradations/depletions facing the world today.
- Question 13 – Describe 3 of the human activities that have the greatest environmental impact in the world today.
The pre-assessment is completed within the first 2 weeks of the semester and the post-assessment is completed during the last week of class. Student learning is demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.</td></tr>
<tr><td colspan="2">Program Success Target for this Measurement</td><td>At least 70% of the questions related to the Colonnade Learning Outcome (CLO) wil demonstrate student learning.</td><td>Percent of Program Achieving Target</td><td>100% - Each of the 4 questions had an increase in the percent of students that answered correctly with an average of 21.9% increase.</td></tr>
<tr><td>Methods</td><td colspan="4">Five out of seven sections of GEOG 280 produced usable pre-and post-assessment data that were utilized to calculate the statistical percentages for overall correct answers as well as for the percent change in correct answers from pre- to post-assessment. An increase in the number of students that answered the questions correctly on the post-assessment compared to the pre-assessment is used to demonstrate student learning.</td></tr>
<tr><td colspan="3">Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.</td><td>☒ Met</td><td>☐ Not Met</td></tr>
<tr><td colspan="5"><u>Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)</u></td></tr>
<tr><td colspan="5">Target goal achieved with the largest increase in change from pre- to post-assessment out of all of the Colonnade learning outcomes. There is no plan to change curriculum to increase the percentage. However, faculty members who teach the course share course materials and provide feedback to each other when they find a new approach to a learning outcome that works in their class(es).</td></tr>
</table>

Pre & Post Assessment:
Introduction to Environmental Science and Sustainability

1. Define environmental science.

2. Identify two **renewable** resources: 1. _____

2. _____

3. Identify two **nonrenewable** resources: 1. _____

2. _____

4. Define biodiversity.

5. Define the 'Tragedy of the Commons.'

6. What is the difference between climate change and global warming?

7. The United States is a developed country, and Bangladesh is a developing country. Of these two, which country would rank **HIGHER** for…

	United States	Bangladesh
a. Life Expectancy:	☐	☐
b. Population Growth Rate:	☐	☐
c. Energy Use:	☐	☐
d. Pollution Rate:	☐	☐
e. Resource Consumption Rate:	☐	☐

8. Name any three categories of waste studied by environmental scientists.

9. Briefly describe two water quality concerns an environmental scientist might study.

10. Compare and contrast the pros and cons of one form of fossil fuel (nonrenewable) energy and one form of renewable energy.

11. Name two differences between mechanized farming and organic farming.

12. Describe three of the greatest environmental **degradations/depletions** facing the world today.

13. Describe three of the **human activities** that have the greatest **environmental impact** in the world today.

Colonnade EXPLORATIONS Assessment 2022-2023	
Ogden College of Science and Engineering	*Earth, Environmental, and Atmospheric Sciences*
Geological Sciences (5008)	
Dr. M. Royhan Gani, Dr. Chris Groves	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Colonnade Learning Outcome	Students will demonstrate the ability to demonstrate an understanding of the methods of scientific inquiry.		
Measurement Instrument 1	Direct measurement: At the end of the semester, students take a comprehensive assessment test consisting of multiple-choice questions, which are aligned with the student learning outcomes (SLOs) of the course (GEOL 114). In this test, there are two questions related to CLO 1. This assessment test is NOT part of the course grading.		
Criteria for Student Success	A student should be able to answer correctly both questions (100%) related to CLO 1.		
Program Success Target for this Measurement	75% of students will score 100% in the CLO 1 part of the test.	**Percent of Program Achieving Target**	100% of students achieved the target.
Methods	All students who completed the test during AY23 were assessed (N = 14).		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)

As the Learning Outcome 1 was met, we intend to keep the assessment structure the same. However, we will put an effort to increase the sample population (N) in the next academic year. To maintain a meaningful and effective assessment practice, we will continue to monitor students' success in the course and adjust the assessment accordingly.

Colonnade Learning Outcome 2				
Colonnade Learning Outcome	Students will demonstrate the ability to explain basic concepts and principles in one or more of the sciences.			
Measurement Instrument 1	Direct measurement: At the end of the semester, students take a comprehensive assessment test consisting of multiple-choice questions, which are aligned with the student learning outcomes (SLOs) of the course. In this test, there are two questions related to CLO 2. This assessment test is NOT part of the course grading.			
Criteria for Student Success	A student should be able to answer correctly at least one of the two questions (50%) related to CLO 2.			
Program Success Target for this Measurement	75% of students will score 50% in the CLO 2 part of the test.	**Percent of Program Achieving Target**	79% of students achieved the target.	
Methods	All students who completed the test during AY23 were assessed (N = 14).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
As the Learning Outcome 2 was met, we intend to keep the assessment structure the same. However, we will put an effort to increase the sample population (N) in the next academic year. To maintain a meaningful and effective assessment practice, we will continue to monitor students' success in the course and adjust the assessment accordingly.				

Colonnade Learning Outcome 3				
Colonnade Learning Outcome	Students will demonstrate the ability to apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Direct measurement: At the end of the semester, students take a comprehensive assessment test consisting of multiple-choice questions, which are aligned with the student learning outcomes (SLOs) of the course. In this test, there are two questions related to CLO 3. This assessment test is NOT part of the course grading.			
Criteria for Student Success	A student should be able to answer correctly both questions (100%) related to CLO 3.			
Program Success Target for this Measurement	75% of students will score 100% in the CLO 3 part of the test.	**Percent of Program Achieving Target**	79% of students achieved the target.	
Methods	All students who completed the test during AY23 were assessed (N = 14).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
As the Learning Outcome 3 was met, we intend to keep the assessment structure the same. However, we will put an effort to increase the sample population (N) in the next academic year. To maintain a meaningful and effective assessment practice, we will continue to monitor students' success in the course and adjust the assessment accordingly.				

Colonnade Learning Outcome 4				
Colonnade Learning Outcome	Students will demonstrate the ability to explain how scientific principles relate to issues of personal and/or public importance.			
Measurement Instrument 1	Direct measurement: At the end of the semester, students take a comprehensive assessment test consisting of multiple-choice questions, which are aligned with the student learning outcomes (SLOs) of the course. In this test, there are two questions related to CLO 4. This assessment test is NOT part of the course grading.			
Criteria for Student Success	A student should be able to answer correctly both questions (100%) related to CLO 4.			
Program Success Target for this Measurement	75% of students will score 100% in the CLO 4 part of the test.	**Percent of Program Achieving Target**	100% of students achieved the target.	
Methods	All students who completed the test during AY23 were assessed (N = 14).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
As the Learning Outcome 4 was met, we intend to keep the assessment structure the same. However, we will put an effort to increase the sample population (N) in the next academic year. To maintain a meaningful and effective assessment practice, we will continue to monitor students' success in the course and adjust the assessment accordingly.				

Questions to assess CLOs (Colonnade Learnging Outcomes)

GEOL 114: Earth's Past & Future Lab

Note: There are a total of 8 assessment questions (two from each of the four CLOs).

CLO 1: Demonstrate an understanding of the methods of science inquiry.

1. Study of fossils helps us:
   a. correlate rocks between two locations.
   b. understand how life evolved on earth.
   c. determine geologic times.
   d. all of the above.
   e. none of the above.

2. After analyzing the dinosaur footprints below, it was determined that the carnivore T-rex (pictured at the top right) was chasing the herbivore Stegosaur (pictured at the bottom right).

   a. true
   b. false

CLO 2: Explain basic concepts and principles in one or more of the sciences.

3. Which of the following principles are used to determine relative ages of geological events?
   a. superposition.
   b. uniformitarianism.

c. catastrophism.
d. continental drifting.
e. none of the above.

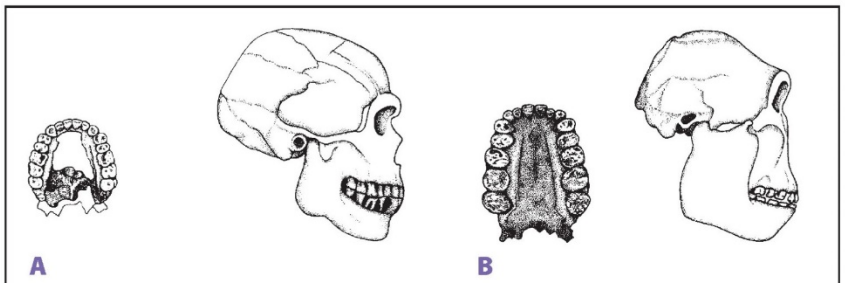
4. Deep incision of the Grand Canyon is linked to:
a. the formation of the Sierra Nevada Mountains.
b. the formation of the Uinta Lake.
c. the uplift of the Colorado Plateau.
d. the subsidence of the Colorado Plateau.
e. excessive human kayaking and rafting.

CLO 3: Apply scientific principles to interpret and make predictions in one or more of the sciences.

5. Identify the taxon of the fossil sample shown below:

a. Molluska
b. Brachiopoda
c. Trilobita
d. Echinoida

6. Examine the image below. The jaw associated with each skull is located to its left. Comparing to modern humans, early hominins had:



a. smaller teeth.
b. larger brain.
c. greater number of teeth.
d. larger jaw.

CLO 4: Explain how scientific principles relate to issues of personal and/or public importance.

7. Melting of ice sheet on land because of the global warming can cause sea-level rise:
a. true.
b. false.

8. Although physical appearances of modern humans are greatly varied, all of us are originated in:
a. North America
b. Asia
c. Africa
d. Europe
e. Australia

Colonnade EXPLORATIONS Assessment 2022-2023	
Ogden College of Science and Engineering	*Earth, Environmental, and Atmospheric Sciences*
Meteorology (578)	
Dr. Gregory Goodrich	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Colonnade Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 41% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students (18%) successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.

Colonnade Learning Outcome 2			
Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 29% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 27% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 80% of the questions related to this CLO with an average increase of 17% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in nearly all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

FUNDAMENTALS IN METEOROLOGY

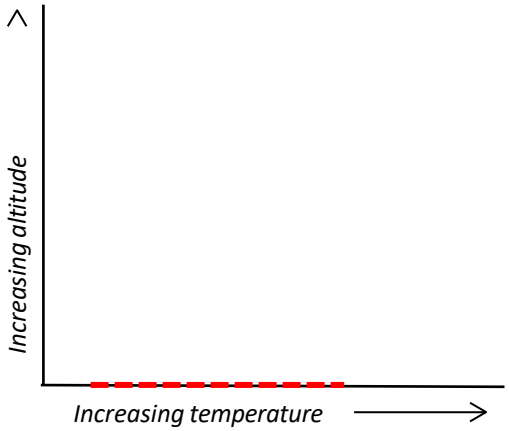
INVENTORY

Version 1.6

1. Inside of a cumulus cloud, the air temperature is measured to be 5°C. The dew point temperature was also measured at the same location. What is the *most likely* value of the dew point temperature?
    a. -5°C
    b. 0°C
    c. 5°C
    d. 10°C

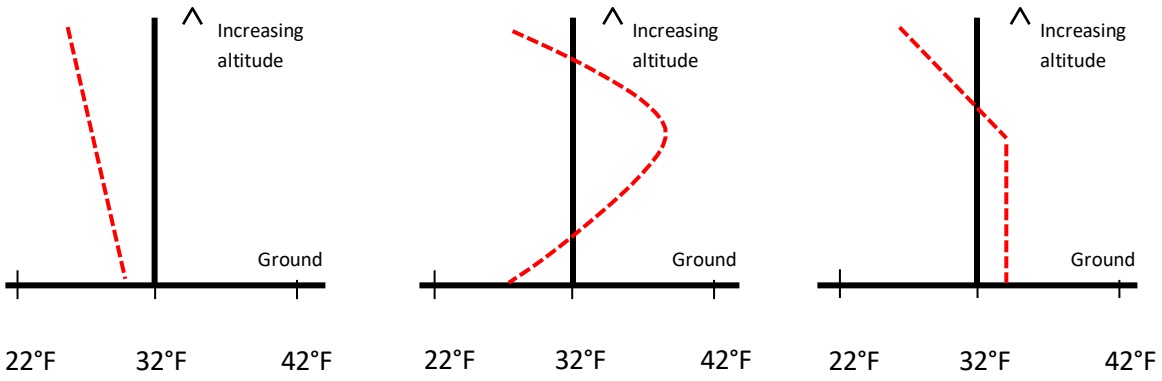
2. The global wind pattern is *primarily* caused by:
    a. The uneven distribution of precipitation
    b. The uneven distribution of surface temperature
    c. The uneven distribution of cloud cover
    d. The uneven distribution of land masses

3. If the environmental temperature increased with height (see figure below), what would happen to a small bubble of air (otherwise known as a parcel) if it was lifted upward some distance from the surface and then let go? Assume the bubble has the same temperature as the environment at the surface and cools at a constant rate as it rises.



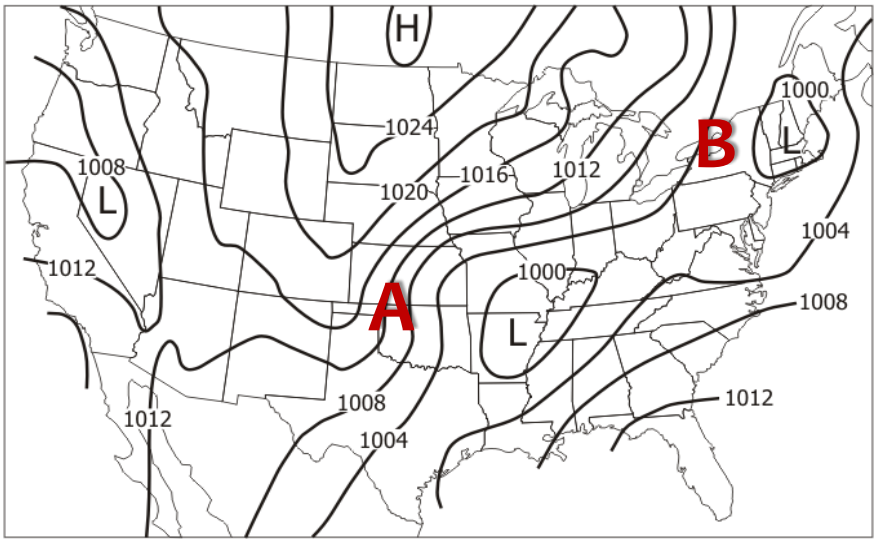
    a. The parcel would continue to rise on its own
    b. The parcel would stay at the same altitude
    c. The parcel would sink back to the surface
    d. The parcel would oscillate up and down for a while

4. What are the expected precipitation types at the surface for the following temperature profiles? (left to right)



a. Snow, sleet, freezing rain
b. Sleet, snow, freezing rain
c. Snow, freezing rain, sleet
d. Sleet, freezing rain, snow

5. Examine the map below of sea-level pressure. Location A, west of an area of low pressure, is observed to have *stronger* surface winds than location B, also west of a separate area of low pressure. Why are stronger winds observed at location A compared to location B?



a. Location A is east of the Rocky Mountains, so gravity helps accelerate the wind.
b. Location B is closer to a center of low pressure, where wind speeds are lower.
c. The higher latitude of location B means a stronger Coriolis effect will slow the wind down.
d. Sea-level pressure is changing more rapidly with horizontal distance near location A.

6. Eureka, California and New York City, New York, shown on the map below, are both coastal cities and at approximately the same latitude. Why does New York City experience a greater annual range of temperatures?

   a. Eureka is closer to a mountain range, so they receive more precipitation, reducing temperature variations.
   b. A warm ocean current runs along the coast of California, which moderates their temperature.
   c. In New York City, the wind usually comes from the west, blowing over land which heats up and cools down faster than the ocean, causing large temperature changes.
   d. New York City experiences more low pressure systems than Eureka, which bring with them more extreme temperatures, resulting in a larger annual temperature range.

7. Given the following forecast for Oklahoma City, Oklahoma in late spring, what type of weather boundary is expected to pass through later?

   "Warm and humid today, with southerly winds and increasing cloudiness with a chance of thunderstorms in the afternoon. Towards evening, continued warm, drier, with gusty westerly winds."

   a. Cold front
   b. Warm front
   c. Occluded front
   d. Dryline

8. Which of the following environments would be *most likely* to produce a tornado?
    a. **Hot and humid** at the surface, strong winds that are the *same speed and direction* with height in the lower atmosphere.
    b. **Hot and dry** at the surface, winds that *increase in speed and change direction* with height in the lower atmosphere.
    c. **Hot and humid** at the surface, winds that *increase in speed and change direction* with height in the lower atmosphere.
    d. **Hot and dry** at the surface, strong winds that are the *same speed and direction* with height in the lower atmosphere.

9. Which of the following is common to both cold fronts and warm fronts?
    a. Light to calm winds at the surface
    b. Lifting of warm air over cold air
    c. Divergence of surface winds
    d. Steady surface pressure

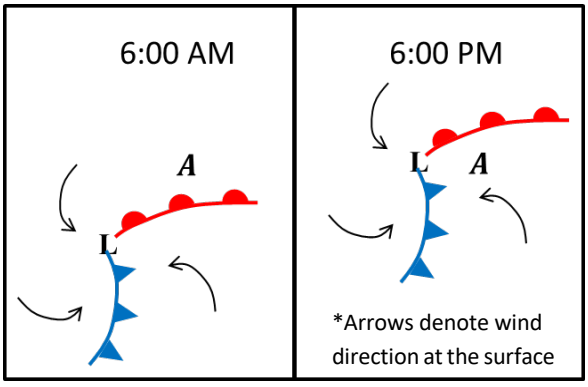
10. Which of the following processes *increases* the stability of the atmosphere?
    a. Increasingly cold air aloft
    b. Increasingly warm air aloft
    c. Radiational cooling from cloud tops
    d. Intense solar heating near Earth's surface

11. Rank the three locations shown below from the largest annual temperature range to the smallest.

    a. Seattle, Washington D.C., Minneapolis
    b. Washington D.C., Minneapolis, Seattle
    c. Minneapolis, Washington D.C., Seattle
    d. Washington D.C., Seattle, Minneapolis

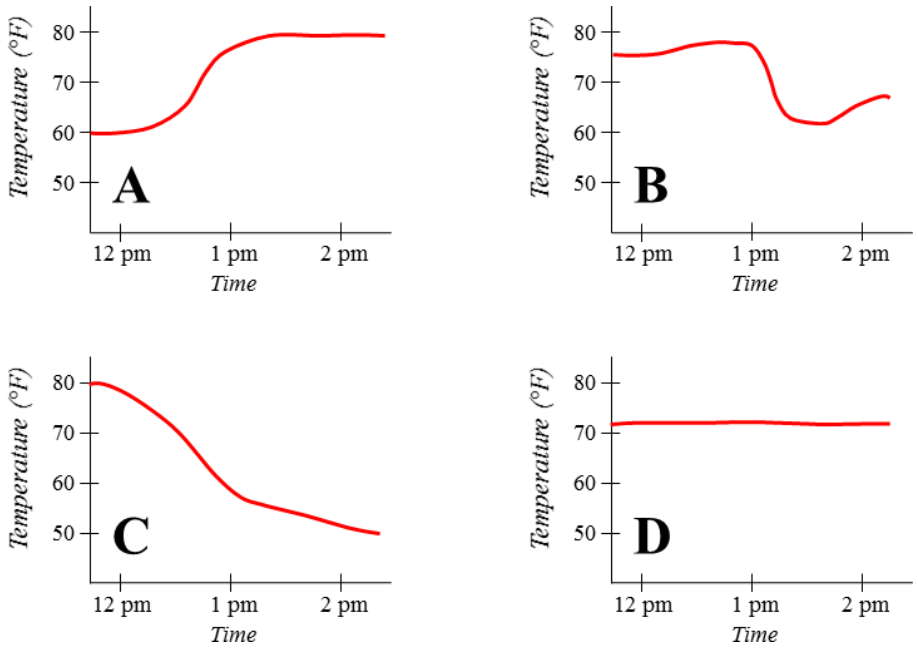
12. When dealing with cloud droplet growth in warm clouds (i.e., all liquid water, with small cloud droplets growing into large rain drops), which of the following would most favor *rapid* cloud droplet growth?
    a. Uniform cloud droplet sizes, so that the droplets all fall at the same speed
    b. Very few initial cloud droplets, so that more water vapor can be condensed upon a given cloud droplet
    c. A wide range of initial cloud droplet sizes, so that the cloud droplets are falling at different speeds
    d. Lots of initial cloud droplets, so that water vapor can be condensed on all cloud droplets and each is able to grow

13. Which of the following best describes the weather that would have been experienced at point (A) during the 12 hour period shown?
    a. Warm, humid and clear skies transitioning to cold, dry, and clear skies
    b. Warm, humid and clear skies, transitioning to cold, humid and rainy
    c. Cold, humid, and rainy transitioning to warm, humid, and clear skies
    d. Cold, dry, and clear skies transitioning to warm, dry, and clear skies

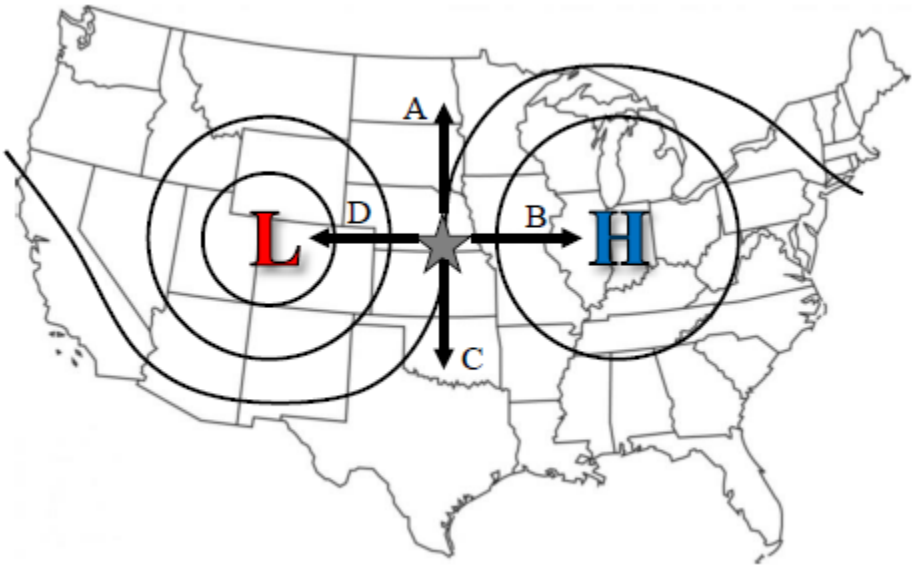


14. Around noon on a sunny, warm spring day, you notice a thunderstorm form to your west. By 1 pm it is directly overhead, bringing with it heavy rain and lightning. By 2 pm it has moved east of your location and dissipated, and the sky is now mostly sunny. If you checked the local temperature observations over that 2 hour period, which of the following temperature trends would you most likely see?

a. A
b. B
c. C
d. D



15. The surface pressure map shown below displays isobars (lines of equal pressure, in solid black). Assuming a smooth surface, which of the following *most likely* represents the wind vector at the starred location?

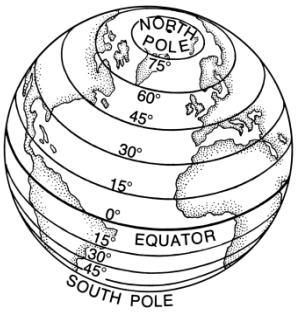


a. A
b. B
c. C
d. D

16. Earth's largest desert climates are located near 30° latitude north and south. What is the primary reason for this observation?
    a. Large scale areas of low pressure near 30° latitude are associated with warm, dry weather
    b. Most of the surface area near 30° latitude is land, not ocean, so there is a lack of water leading to presence of deserts
    c. The high sun angle, particularly during the summer season, results in hot and dry conditions
    d. Surface winds tend to diverge near 30° latitude, resulting in large scale sinking motion

17. Which of the following bests explains why Florida frequently experiences a sea breeze and accompanying thunderstorms during the day in the summer?
    a. Florida's proximity to the ocean means that there is plenty of moisture and energy to promote the development of the sea breeze and fuel the thunderstorms.
    b. Florida's peninsula of land heats up much faster than the ocean during the day, resulting in the formation of the sea breeze that lifts air to create thunderstorms.
    c. Florida's low vertical wind shear environment helps develop and sustain the sea breeze, and is also favorable for thunderstorm development.
    d. The Gulf Stream ocean current nearby helps to converge and lift air, creating the sea breeze and promoting thunderstorm development.

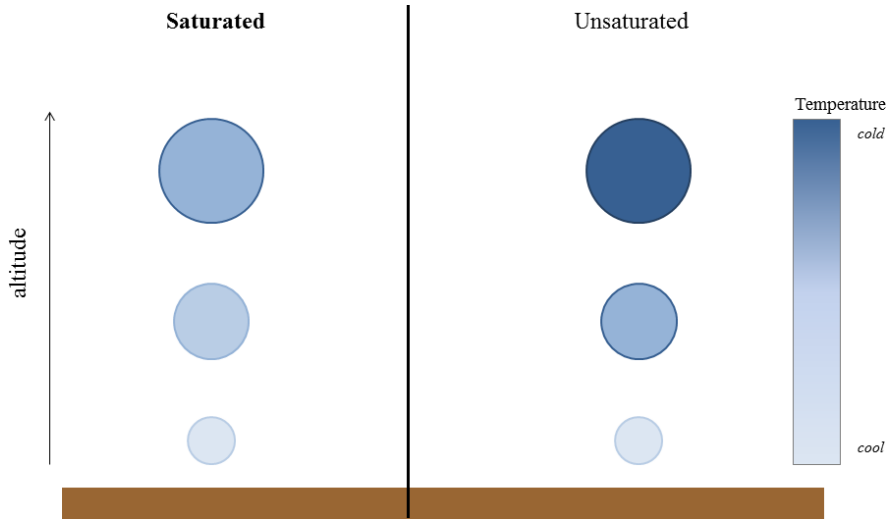
18. Winds are deflected from their original trajectory due to the Coriolis force. Which of the following situations would experience the greatest deflection?
    a. A fast wind at a high latitude such as 60° N.
    b. A fast wind at a low latitude such as 15° N.
    c. A slow wind at a high latitude such as 60° N.
    d. A slow wind at a low latitude such as 15° N.



19. At local noon at a given location, which of the following conditions would generally lead to the warmest observed temperature?
    a. Clear skies, on the windward (upwind) side of a lake
    b. Clear skies, with fresh snow on the ground
    c. Clear skies, just minutes after a rainstorm
    d. Clear skies, located at 500 m above sea level

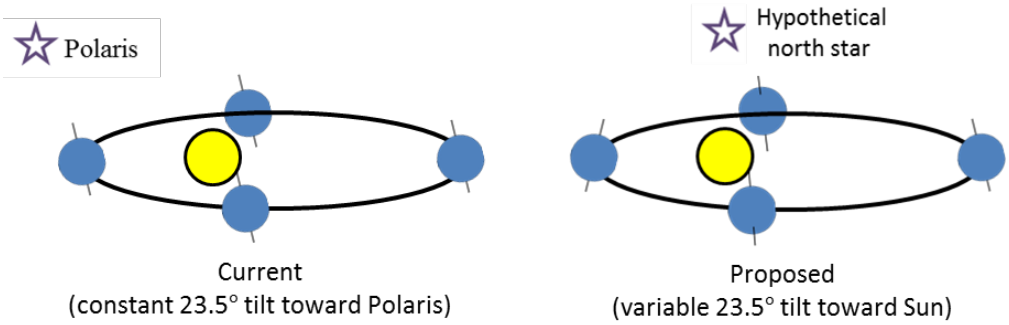
20. Based on the basic laws of radiation, which of the following is the most accurate comparison of radiation emitted from the Sun versus the Earth?
    a. The Sun emits radiation at a longer wavelength than the Earth
    b. The Earth emits more radiation than the Sun
    c. Earth's emitted radiation peaks in the infrared portion of the electromagnetic spectrum, while most of the Sun's radiation peaks in the visible range
    d. The Sun is twice as hot as the Earth, and emits twice as much radiation

21. When a bubble of air (known as a parcel) is lifted, it cools and expands in size. We observe that saturated parcels cool more slowly as they rise than unsaturated parcels. At a given altitude, why is the saturated parcel warmer than the unsaturated parcel?



    a. A saturated parcel is heavier than an unsaturated parcel, so it takes more energy (by lifting to a higher altitude) for it to get as cold as an unsaturated parcel
    b. Warm air holds more water vapor than cold air, so a saturated parcel is naturally warmer
    c. The saturated parcel is able to condense water vapor as it rises, which releases heat and offsets some of the cooling, resulting in a warmer temperature
    d. Saturated air is like a large body of water takes a long time to heat up or cool down, thus it takes a longer time (i.e., a higher altitude) to be as cold as an unsaturated parcel

22. Currently, the Earth's axis is tilted 23.5° off the vertical, such that it points toward Polaris (the "north star") throughout the year, as shown in the figure on the left below. This tilt produces seasonal variations in temperature. What would happen to seasonal changes in temperature if instead the tilt changed throughout the year, so that the North Pole always pointed 23.5° toward a hypothetical north star directly above the Sun?



a. There would be no change, since the Earth is still following the same orbit around the Sun
b. There would still be the same seasons, but winter and summer would be more extreme
c. There would be perpetual winter in the Northern Hemisphere
d. There would be perpetual summer in the Northern Hemisphere

23. Which of the following best describes differences in *climate* between two locations?
    a. Yesterday, Rapid City, South Dakota was warmer than Savannah, Georgia.
    b. On average, Astoria, Oregon receives 67 inches of rain per year while Yuma, Arizona only receives 3 inches per year.
    a. Last winter was the warmest on record in California, but colder than average in New York.
    b. During the summer of 2012 parts of the central United States experienced an extreme drought while parts of the northeast and northwest observed above-normal precipitation.

24. A thunderstorm is more likely to be intense and long-lived if there is a large change in the wind speed and/or direction with height, called vertical wind shear. Why is this true?
    a. An increase in wind speed, and change in direction with height pushes rain and hail away from the storm's updraft, allowing for a continuous supply of warm, moist air.
    b. A large increase in wind speed with height causes low-level air to converge and rise, strengthening the thunderstorm.
    c. The change in wind direction with height drives the cold air that forms beneath the thunderstorm (known as outflow) away, leaving only warm, moist air.
    d. The change in wind direction and increase in wind speed with height allows for more warmth and moisture to be brought into the storm from different areas

Colonnade EXPLORATIONS Assessment 2022-2023	
Ogden College of Science and Engineering	*Earth, Environmental, and Atmospheric Sciences*
Meteorology (578)	
Dr. Gregory Goodrich	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☒ Taught 100% face to face
☐ Taught 100% online
☐ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Colonnade Learning Outcome	Demonstrate an understanding of the methods of science inquiry.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 41% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students (18%) successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**

Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.

Colonnade Learning Outcome 2			
Coloannde Learning Outcome	Explain basic concepts and principles in one or more of the sciences.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 29% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

Colonnade Learning Outcome 3			
Coloannde Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 100% of the questions related to this CLO with an average increase of 27% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

Colonnade Learning Outcome 4			
Coloannde Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance		
Measurement Instrument 1	A 24 question pre- and post-assessment: The Fundamentals in Meteorology Inventory Casey E. Davenport & Adam J. French (2019), The Fundamentals in Meteorology Inventory: Validation of a tool assessing basic meteorological conceptual understanding, *Journal of Geoscience Education*, DOI: 10.1080/10899995.2019.1629193		
Criteria for Student Success	A 24 question pre- and post-assessment (see appendix) based on the Fundamentals in Meteorology Inventory from Davenport and French (2019) will be given to each student taking METR 121. The goal of the pre- and post-assessment is to demonstrate student learning in several topical areas related to an introductory meteorology class. The 24 questions are divided amongst the four Colonnade Learning Outcomes as follows CLO 1) Demonstrate an understanding of the methods of science inquiry (2, 6, 17, 18, 20) CLO 2) Explain basic concepts and principles in one or more of the sciences (1, 4, 5, 9, 10, 12, 15, 21, 24) CLO 3) Apply scientific principles to interpret and make predictions in one or more of the sciences (3, 7, 13, 14, 19) CLO 4) Explain how scientific principles relate to issues of personal and/or public importance (8, 11, 16, 22, 23) Student learning will be demonstrated by an increase in the percentage of questions answered correctly from pre- to post-assessment.		
Program Success Target for this Measurement	At least 80% of the questions related to this CLO will demonstrate student learning.	**Percent of Program Achieving Target**	Student learning was demonstrated in 80% of the questions related to this CLO with an average increase of 17% from pre- to post-assessment.
Methods	Out of a total of 391 students that took METR 121 in AY 2022-23 a total of 71 students successfully completed both the pre- and post-assessment without leaving any questions blank. Student learning was determined for each question by comparing the number of correct answers for each question in the pre- and post-assessments. If more students answered correctly for a given question in the post-assessment than the pre-assessment, student learning was determined to have occurred. The percentage increase was determined by ((post – pre)/pre *100).		
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
Since student learning was observed in nearly all questions related to this CLO we will not make any adjustments to the curricula for METR 121. Going forward we hope to encourage a larger percentage of students in METR 121 to participate in the pre- and post-assessment process.			

FUNDAMENTALS IN METEOROLOGY

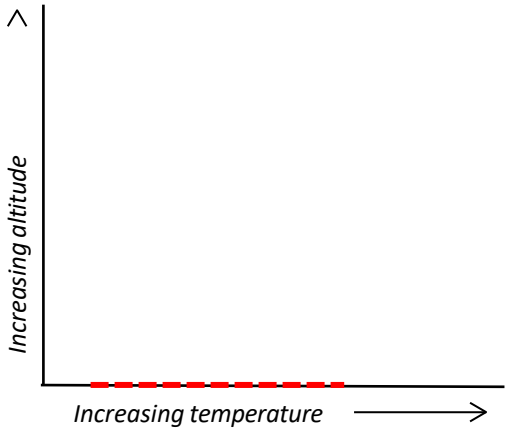
INVENTORY

Version 1.6

1. Inside of a cumulus cloud, the air temperature is measured to be 5°C. The dew point temperature was also measured at the same location. What is the *most likely* value of the dew point temperature?
    a. -5°C
    b. 0°C
    c. 5°C
    d. 10°C

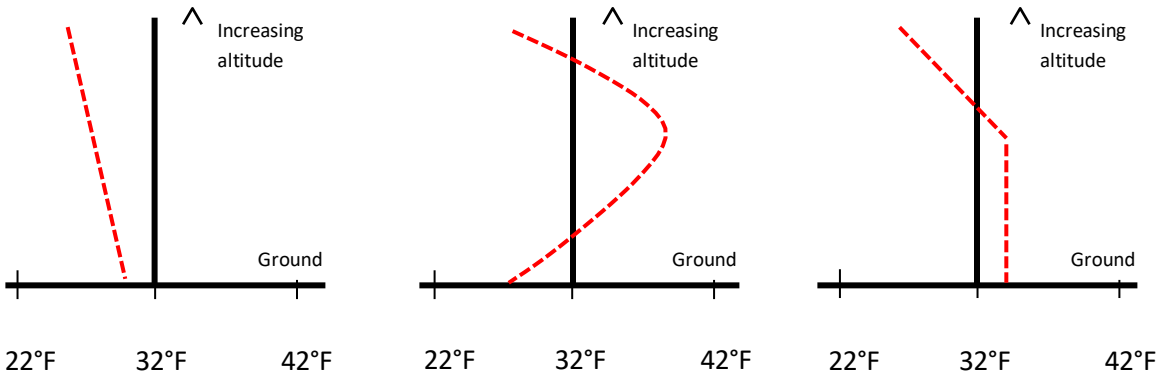
2. The global wind pattern is *primarily* caused by:
    a. The uneven distribution of precipitation
    b. The uneven distribution of surface temperature
    c. The uneven distribution of cloud cover
    d. The uneven distribution of land masses

3. If the environmental temperature increased with height (see figure below), what would happen to a small bubble of air (otherwise known as a parcel) if it was lifted upward some distance from the surface and then let go? Assume the bubble has the same temperature as the environment at the surface and cools at a constant rate as it rises.



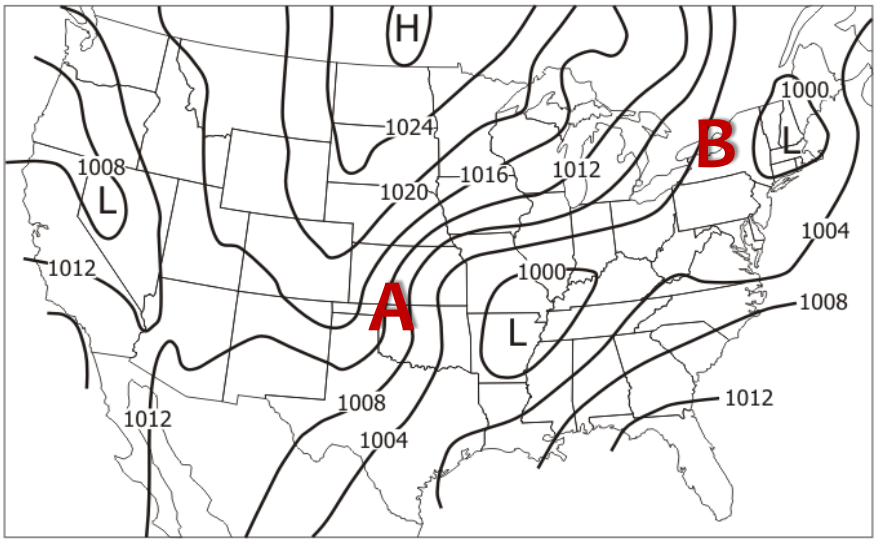
    a. The parcel would continue to rise on its own
    b. The parcel would stay at the same altitude
    c. The parcel would sink back to the surface
    d. The parcel would oscillate up and down for a while

4. What are the expected precipitation types at the surface for the following temperature profiles? (left to right)



a. Snow, sleet, freezing rain
b. Sleet, snow, freezing rain
c. Snow, freezing rain, sleet
d. Sleet, freezing rain, snow

5. Examine the map below of sea-level pressure. Location A, west of an area of low pressure, is observed to have *stronger* surface winds than location B, also west of a separate area of low pressure. Why are stronger winds observed at location A compared to location B?



a. Location A is east of the Rocky Mountains, so gravity helps accelerate the wind.
b. Location B is closer to a center of low pressure, where wind speeds are lower.
c. The higher latitude of location B means a stronger Coriolis effect will slow the wind down.
d. Sea-level pressure is changing more rapidly with horizontal distance near location A.

6. Eureka, California and New York City, New York, shown on the map below, are both coastal cities and at approximately the same latitude. Why does New York City experience a greater annual range of temperatures?

   a. Eureka is closer to a mountain range, so they receive more precipitation, reducing temperature variations.
   b. A warm ocean current runs along the coast of California, which moderates their temperature.
   c. In New York City, the wind usually comes from the west, blowing over land which heats up and cools down faster than the ocean, causing large temperature changes.
   d. New York City experiences more low pressure systems than Eureka, which bring with them more extreme temperatures, resulting in a larger annual temperature range.

7. Given the following forecast for Oklahoma City, Oklahoma in late spring, what type of weather boundary is expected to pass through later?

   "Warm and humid today, with southerly winds and increasing cloudiness with a chance of thunderstorms in the afternoon. Towards evening, continued warm, drier, with gusty westerly winds."

   a. Cold front
   b. Warm front
   c. Occluded front
   d. Dryline

8. Which of the following environments would be *most likely* to produce a tornado?
    a. **Hot and humid** at the surface, strong winds that are the *same speed and direction* with height in the lower atmosphere.
    b. **Hot and dry** at the surface, winds that *increase in speed and change direction* with height in the lower atmosphere.
    c. **Hot and humid** at the surface, winds that *increase in speed and change direction* with height in the lower atmosphere.
    d. **Hot and dry** at the surface, strong winds that are the *same speed and direction* with height in the lower atmosphere.

9. Which of the following is common to both cold fronts and warm fronts?
    a. Light to calm winds at the surface
    b. Lifting of warm air over cold air
    c. Divergence of surface winds
    d. Steady surface pressure

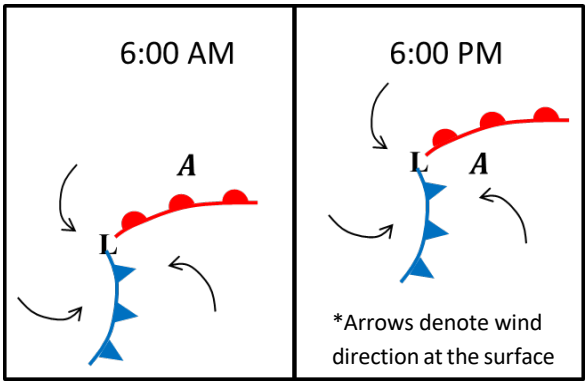
10. Which of the following processes *increases* the stability of the atmosphere?
    a. Increasingly cold air aloft
    b. Increasingly warm air aloft
    c. Radiational cooling from cloud tops
    d. Intense solar heating near Earth's surface

11. Rank the three locations shown below from the largest annual temperature range to the smallest.

    a. Seattle, Washington D.C., Minneapolis
    b. Washington D.C., Minneapolis, Seattle
    c. Minneapolis, Washington D.C., Seattle
    d. Washington D.C., Seattle, Minneapolis

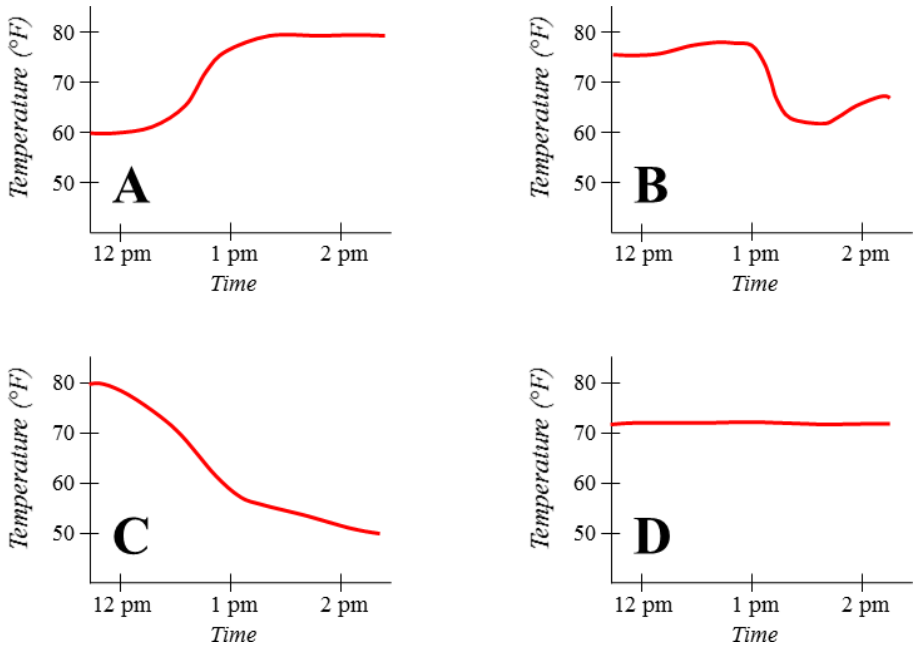
12. When dealing with cloud droplet growth in warm clouds (i.e., all liquid water, with small cloud droplets growing into large rain drops), which of the following would most favor *rapid* cloud droplet growth?
    a. Uniform cloud droplet sizes, so that the droplets all fall at the same speed
    b. Very few initial cloud droplets, so that more water vapor can be condensed upon a given cloud droplet
    c. A wide range of initial cloud droplet sizes, so that the cloud droplets are falling at different speeds
    d. Lots of initial cloud droplets, so that water vapor can be condensed on all cloud droplets and each is able to grow

13. Which of the following best describes the weather that would have been experienced at point (A) during the 12 hour period shown?
    a. Warm, humid and clear skies transitioning to cold, dry, and clear skies
    b. Warm, humid and clear skies, transitioning to cold, humid and rainy
    c. Cold, humid, and rainy transitioning to warm, humid, and clear skies
    d. Cold, dry, and clear skies transitioning to warm, dry, and clear skies

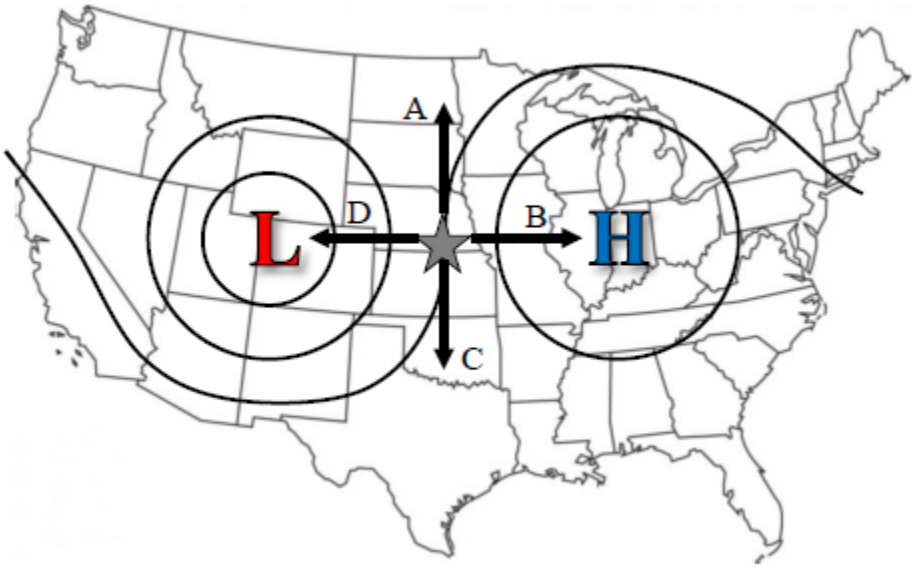


14. Around noon on a sunny, warm spring day, you notice a thunderstorm form to your west. By 1 pm it is directly overhead, bringing with it heavy rain and lightning. By 2 pm it has moved east of your location and dissipated, and the sky is now mostly sunny. If you checked the local temperature observations over that 2 hour period, which of the following temperature trends would you most likely see?

a. A
b. B
c. C
d. D



15. The surface pressure map shown below displays isobars (lines of equal pressure, in solid black). Assuming a smooth surface, which of the following *most likely* represents the wind vector at the starred location?

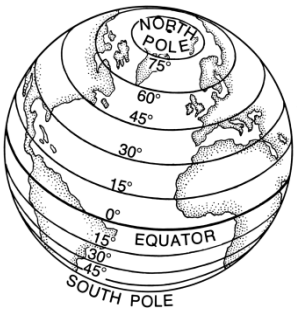


a. A
b. B
c. C
d. D

16. Earth's largest desert climates are located near 30° latitude north and south. What is the primary reason for this observation?
    a. Large scale areas of low pressure near 30° latitude are associated with warm, dry weather
    b. Most of the surface area near 30° latitude is land, not ocean, so there is a lack of water leading to presence of deserts
    c. The high sun angle, particularly during the summer season, results in hot and dry conditions
    d. Surface winds tend to diverge near 30° latitude, resulting in large scale sinking motion

17. Which of the following bests explains why Florida frequently experiences a sea breeze and accompanying thunderstorms during the day in the summer?
    a. Florida's proximity to the ocean means that there is plenty of moisture and energy to promote the development of the sea breeze and fuel the thunderstorms.
    b. Florida's peninsula of land heats up much faster than the ocean during the day, resulting in the formation of the sea breeze that lifts air to create thunderstorms.
    c. Florida's low vertical wind shear environment helps develop and sustain the sea breeze, and is also favorable for thunderstorm development.
    d. The Gulf Stream ocean current nearby helps to converge and lift air, creating the sea breeze and promoting thunderstorm development.

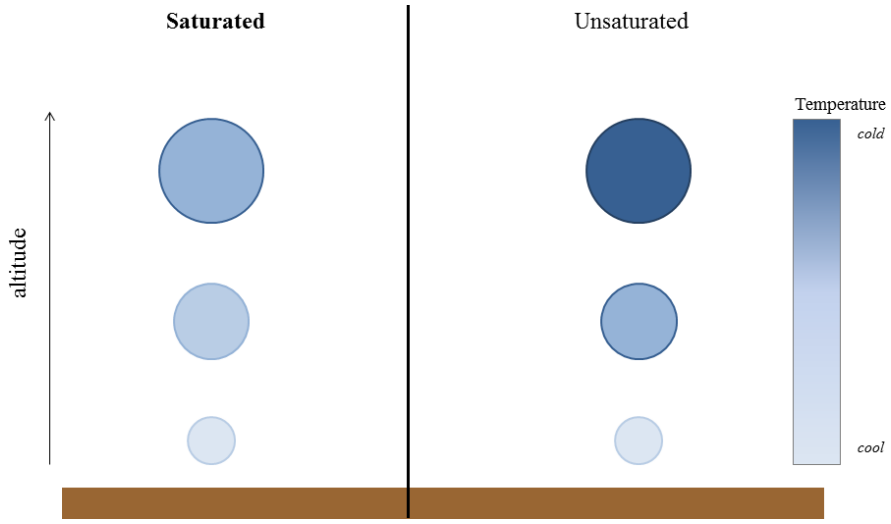
18. Winds are deflected from their original trajectory due to the Coriolis force. Which of the following situations would experience the greatest deflection?
    a. A fast wind at a high latitude such as 60° N.
    b. A fast wind at a low latitude such as 15° N.
    c. A slow wind at a high latitude such as 60° N.
    d. A slow wind at a low latitude such as 15° N.



19. At local noon at a given location, which of the following conditions would generally lead to the warmest observed temperature?
    a. Clear skies, on the windward (upwind) side of a lake
    b. Clear skies, with fresh snow on the ground
    c. Clear skies, just minutes after a rainstorm
    d. Clear skies, located at 500 m above sea level

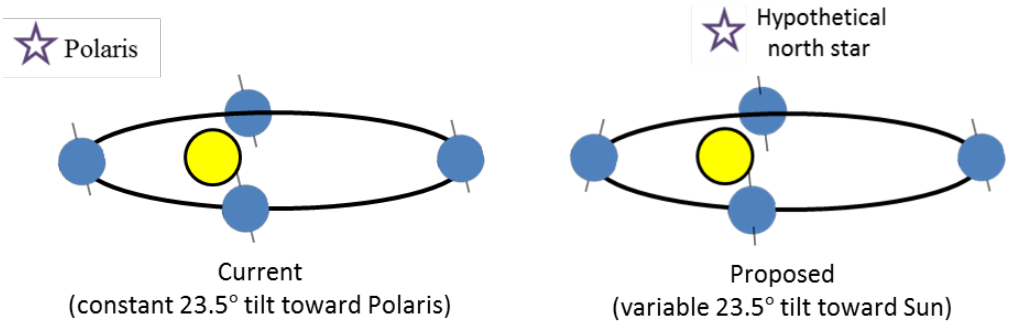
20. Based on the basic laws of radiation, which of the following is the most accurate comparison of radiation emitted from the Sun versus the Earth?
    a. The Sun emits radiation at a longer wavelength than the Earth
    b. The Earth emits more radiation than the Sun
    c. Earth's emitted radiation peaks in the infrared portion of the electromagnetic spectrum, while most of the Sun's radiation peaks in the visible range
    d. The Sun is twice as hot as the Earth, and emits twice as much radiation

21. When a bubble of air (known as a parcel) is lifted, it cools and expands in size. We observe that saturated parcels cool more slowly as they rise than unsaturated parcels. At a given altitude, why is the saturated parcel warmer than the unsaturated parcel?



    a. A saturated parcel is heavier than an unsaturated parcel, so it takes more energy (by lifting to a higher altitude) for it to get as cold as an unsaturated parcel
    b. Warm air holds more water vapor than cold air, so a saturated parcel is naturally warmer
    c. The saturated parcel is able to condense water vapor as it rises, which releases heat and offsets some of the cooling, resulting in a warmer temperature
    d. Saturated air is like a large body of water takes a long time to heat up or cool down, thus it takes a longer time (i.e., a higher altitude) to be as cold as an unsaturated parcel

22. Currently, the Earth's axis is tilted 23.5° off the vertical, such that it points toward Polaris (the "north star") throughout the year, as shown in the figure on the left below. This tilt produces seasonal variations in temperature. What would happen to seasonal changes in temperature if instead the tilt changed throughout the year, so that the North Pole always pointed 23.5° toward a hypothetical north star directly above the Sun?



a. There would be no change, since the Earth is still following the same orbit around the Sun
b. There would still be the same seasons, but winter and summer would be more extreme
c. There would be perpetual winter in the Northern Hemisphere
d. There would be perpetual summer in the Northern Hemisphere

23. Which of the following best describes differences in *climate* between two locations?
    a. Yesterday, Rapid City, South Dakota was warmer than Savannah, Georgia.
    b. On average, Astoria, Oregon receives 67 inches of rain per year while Yuma, Arizona only receives 3 inches per year.
    a. Last winter was the warmest on record in California, but colder than average in New York.
    b. During the summer of 2012 parts of the central United States experienced an extreme drought while parts of the northeast and northwest observed above-normal precipitation.

24. A thunderstorm is more likely to be intense and long-lived if there is a large change in the wind speed and/or direction with height, called vertical wind shear. Why is this true?
    a. An increase in wind speed, and change in direction with height pushes rain and hail away from the storm's updraft, allowing for a continuous supply of warm, moist air.
    b. A large increase in wind speed with height causes low-level air to converge and rise, strengthening the thunderstorm.
    c. The change in wind direction with height drives the cold air that forms beneath the thunderstorm (known as outflow) away, leaving only warm, moist air.
    d. The change in wind direction and increase in wind speed with height allows for more warmth and moisture to be brought into the storm from different areas

Colonnade EXPLORATIONS Assessment 2022-2023	
Ogden College of Science and Engineering	*Earth, Environmental, and Atmospheric Sciences*
Geological Sciences (5008)	
Dr. Nahid Gani, Dr. Chris Groves	

Please select the option(s) that best describe all sections of this course (you may select more than one):
☐ Taught 100% face to face
☐ Taught 100% online
☒ Mix of online and face to face
☐ Includes dual credit

Colonnade Learning Outcome 1			
Colonnade Learning Outcome	Demonstrate and understand the methods of science inquiry.		
Measurement Instrument 1	Direct Measurement: Lab #1 (EDDIE Environmental data-driven inquiry and exploration) was used for CLO 1. In this lab, students collected, analyzed, and interpreted environmental data. This lab-related assessment allowed students to understand the methods of science inquiry by answering the following two questions: Q1- What is the general pattern of C efflux (amount of carbon exchange between Earth's carbon reservoir; in this case soil respiration pattern that you see in your chart) throughout the year? Q2- Now that you are familiar with the chart and have a good idea of the soil respiration or C efflux variations, what do you hypothesize are the main drivers or controls of C efflux variation?		
Criteria for Student Success	A student should be able to answer both questions correctly (100%) related to CLO 1.		
Program Success Target for this Measurement	75% of students will score 100% in the CLO 1 assessment.	**Percent of Program Achieving Target**	91% of students achieved the target.
Methods	All students who completed Lab #1 during AY23 were assessed (N =119).		
Based on your results, highlight whether the program met the goal Student Learning Outcome 1.		☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)			
We intend to keep the assessment structure the same because the learning outcome was met. To maintain a meaningful assessment practice, we will continue to monitor students' success and adjust the assessment practice accordingly.			

Colonnade Learning Outcome 2	
Colonnade Learning Outcome	Explain basic concepts and principles in one or more of the sciences.

Measurement Instrument 1	Direct Measurement: Students were provided case study #1 on the current global warming issues related to the ice mass and sea-level change. They particularly studied Greenland, which is one of the two largest ice sheets in the world today, and participated in a group discussion in the class. This case study assessment was used to measure students' understanding of scientific principles relating to global issues by using the following two questions: Q3- How much has the temperature changed between 1950 and 2014? (You can find it either from your scatter plot or from the Excel column). Q4- What phenomenon explains the matching patterns of average global temperature and atmospheric CO2? (Think about some of your thoughts from this course, for example, causes of climate change). Explain your answer briefly.			
Criteria for Student Success	A student should be able to answer both questions correctly (100%) related to CLO 2.			
Program Success Target for this Measurement	75% of students will score 100% in the CLO 2 assessment.	**Percent of Program Achieving Target**	80% of students achieved the target.	
Methods	All students who completed Case Study # 1 during AY23 were assessed (N =117).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
We intend to keep the assessment structure the same because the learning outcome was met. To maintain a meaningful assessment practice, we will continue to monitor students' success and adjust the assessment practice accordingly.				

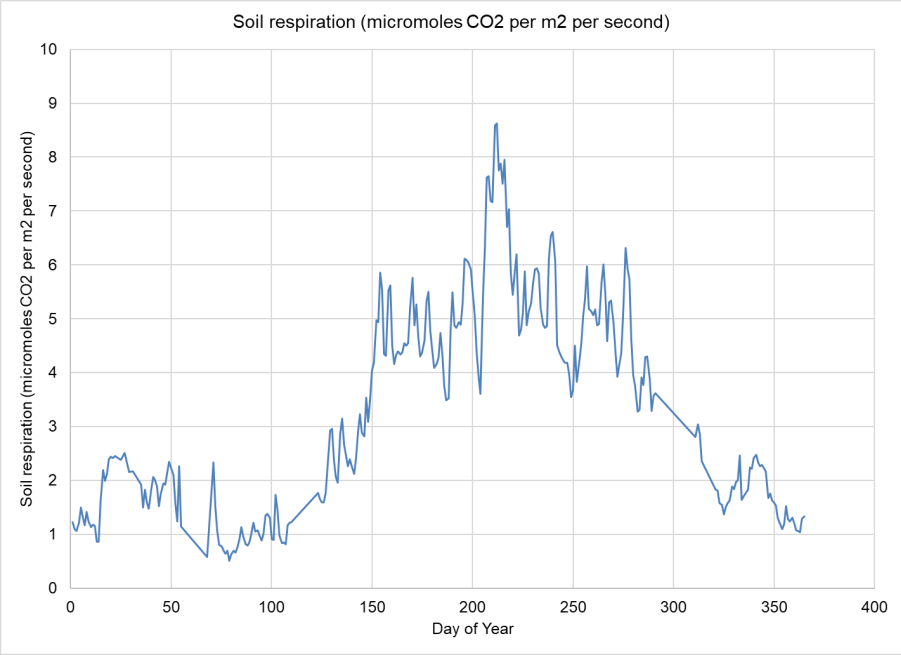
Colonnade Learning Outcome 3				
Colonnade Learning Outcome	Apply scientific principles to interpret and make predictions in one or more of the sciences.			
Measurement Instrument 1	Direct Measurement: Students were provided case study #2 article on monitoring volcanoes and communicating risks. They studied different volcanoes (e.g., Mt. St. Helen, Hawaii, and Yellowstone) to understand eruption and assess societal risk. They participated in a discussion in the class and then took a quiz on predicting risks for the local communities and providing alert levels. This case study assessment was used to measure students' ability to apply scientific principles to interpret and make predictions by using the following two questions: Q5- Why were the citizens of Heimaey, Iceland, successful in stopping the lava flow that threatened their harbor? Q6- Ash fall eruptions create several environmental hazards. Click all that apply. Click on the volcano in the following picture that shows the highest VEI (Volcanic Explosivity Index).			
Criteria for Student Success	A student should be able to answer both questions correctly (100%) related to CLO 3.			
Program Success Target for this Measurement	75% of students will score 100% in the CLO 3 assessment.	**Percent of Program Achieving Target**	84% of students achieved the target.	
Methods	All students who completed Case Study # 2 during AY23 were assessed (N =117).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
We intend to keep the assessment structure the same because the learning outcome was met. To maintain a meaningful assessment practice, we will continue to monitor students' success and adjust the assessment practice accordingly.				

Colonnade Learning Outcome 4				
Colonnade Learning Outcome	Explain how scientific principles relate to issues of personal and/or public importance.			
Measurement Instrument 1	Direct Measurement: Students were provided case study #3 on the MARPOL (Marine Pollution) Convention. They participated in a group discussion in class on the significance and implementation of the MARPOL Convention in preventing coastal pollution that can affect marine ecosystems and humans living in coastal areas. This case study assessment was used to measure students' ability to relate scientific principles to issues of public importance like marine pollution by using the following two questions: Q7- The agreement designed to reduce unintentional and accidental releases of pollution in the world ocean is known as _____. Q8- The following image shows _____ in the water body.			
Criteria for Student Success	A student should be able to answer both questions correctly (100%) related to CLO 4.			
Program Success Target for this Measurement	75% of students will score 100% in the CLO 4 assessment.	**Percent of Program Achieving Target**	78% of students achieved the target.	
Methods	All students who completed Case Study # 3 during AY23 were assessed (N =117).			
Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.			☒ **Met**	☐ **Not Met**
Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn't, and plan going forward)				
We intend to keep the assessment structure the same because the learning outcome was met. To maintain a meaningful assessment practice, we will continue to monitor students' success and adjust the assessment practice accordingly.				

Colonnade Learning Outcome 1: Demonstrate and understand the methods of science inquiry

Q1-SLO 1:
What is the general pattern of C efflux (amount of carbon exchange between Earth's carbon reservoir; in this case soil respiration pattern that you see in your chart) throughout the year?

1. generally, lower at the start and end of the year and higher in the middle of the year
2. generally higher at the start and end of the year and lower in the middle of the year
3. no pattern can be identified.
4. same throughout the year



*Students are required to generate this chart from soil respiration data in Excel spreadsheet.

Q2-SLO 1:
Now that you are familiar with the chart and have a good idea of the soil respiration or C efflux variations, what do you hypothesize are the main drivers or controls of C efflux variation?

1. seasonal variation
2. rock type
3. temperature
4. waste product

Colonnade Learning Outcome 2: Explain basic concepts and principles in one or more of the sciences.

Q3-SLO 2
How much has the temperature changed between 1950 and 2014? (You can find it either from your scatter plot or from the Excel column).

Q4-SLO 2

Question 13: What phenomenon explains the matching patterns of average global temperature and atmospheric CO_2? (Think about some of your thoughts from this course, for example, causes of climate change). Explain your answer briefly.

Colonnade Learning Outcome 3: Apply scientific principles to interpret and make predictions in one or more of the sciences.

Q5-SLO 3

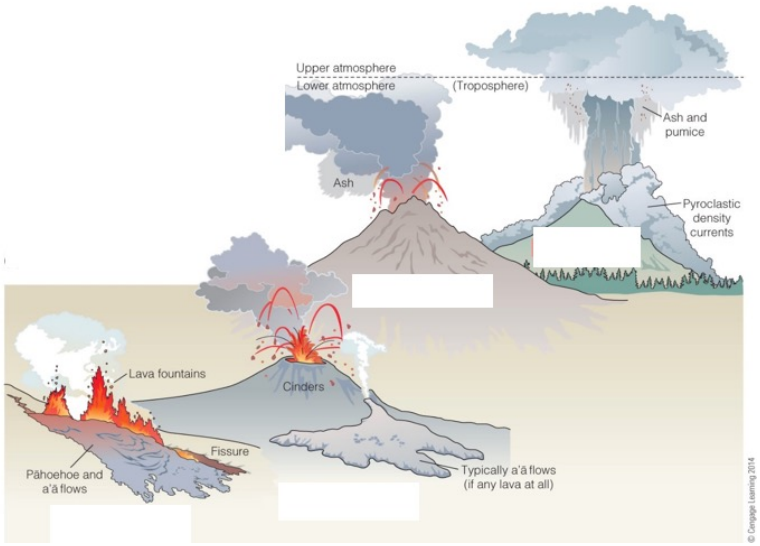
Why were the citizens of Heimaey, Iceland, successful in stopping the lava flow that threatened their harbor?

1. no lava flow occurred
2. a giant sea wall was constructed to stop the lava flows
3. the Icelandic air force bombed the lava flows
4. they used hydraulic chilling to chill the lava flow

Q6-SLO 3
Ash fall eruptions create several environmental hazards. Click all that apply.

1. vegetation loss
2. health hazard
3. air traffic hazard
4. structural damage to building

Click on the volcano in the following picture that shows the highest VEI (Volcanic Explosivity Index).



Colonnade Learning Outcome 4: Explain how scientific principles relate to issues of personal and/or public importance.

Q7-SLO4

The agreement designed to reduce unintentional and accidental releases of pollution in the world ocean is known as_____.

1. MARPOL Convention
2. VAAC
3. Great Pacific Garbage Patch
4. Seismic Safety Commission

Q8-SLO4

The following image shows _____ in the water body.

1. volcanic eruption
2. sea cliff erosion
3. Question 2 - Correct Answer3
4. Dead zone
5. air traffic