



# New Mexico Common Course Assessment Reports Form

Reporting Institution: Central New Mexico Community College

New Mexico Common Core Area: Laboratory Sciences

Competency Number Assessed: (note that *not* all competencies have to be assessed – mark all that apply to this assessment by double-clicking on the check box and choosing the •checked• option)

State Competency 1 <input checked="" type="checkbox"/>	State Competency 2 <input checked="" type="checkbox"/>	State Competency 3 <input checked="" type="checkbox"/>
State Competency 4 <input checked="" type="checkbox"/>	State Competency 5 <input checked="" type="checkbox"/>	State Competency 6 <input type="checkbox"/>

Academic Year of Assessment: 2015-2016

Submission Date: June 2, 2017

Institution Course Number: See crosswalk below

NM Common Core Number: See crosswalk below

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## LABORATORY SCIENCES CROSSWALK

CNM Gen Ed Lab Science	NM State Gen Ed Area III: Laboratory Science
1 Employ critical thinking skills to judge the validity of information from a scientific perspective.	5 Apply scientific thinking to real world problems

2 Apply the scientific method to formulate questions, analyze information/data and draw conclusions.	2 Solve problems scientifically 1 Describe the process of scientific inquiry
3 Properly operate laboratory equipment to collect relevant and quality data.	2 Solve problems scientifically
4 Utilize mathematical techniques to evaluate and solve scientific problems.	2 Solve problems scientifically 4 Apply quantitative analysis to scientific problems
5 Communicate effectively about scientific ideas and topics, in oral and/or written formats.	3 Communicate scientific information
6 Relate science to personal, social or global impact.	5 Apply scientific thinking to real world problems

### Description of Assessment Procedure:

#### *Biology*

Translated via the cross-walk appended to this report, the Biology faculty assessed the following NMHED competencies:

NMHED Competency	Courses
Describe the process of scientific inquiry	BIO 1092, 1492, & 2192
Solve problems scientifically	BIO 1092, 1492, & 2192
Communicate scientific information	BIO 2192
Apply quantitative analysis to scientific problems	BIO 1092, 1492, & 2192
Apply scientific thinking to real world problems	BIO 2192

#### Crosswalk

CNM COURSE #	NMHED#	Description
BIO 1010/1092	BIOL 1113/1111	Biology for Non-Majors/Lab
BIO 1110/1192	ENVS 1113/1111	Environmental Science/Lab
BIO 2110/2192	BIOL 2513/2511	Microbiology/Lab
BIO 2210/2292	BIOL 2413/2411	Human Anatomy & Physiology I/Lab
BIO 2310/2392	BIOL 2423/2421	Human Anatomy & Physiology II/Lab

***Chemistry:***

CHEM 1410 is not part of the degree program and is only being assessed for the Gen Ed outcomes.

CHEM 1410/1492	CHEM 1113/1111	Introduction to Chemistry/Lab
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Earth & Planetary Science:

EPS 1101/1192	GEOL 1113/1111	Introduction to Geology?Lab
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In all sections of EPS1101 (Physical Geology) and EPS1192 (Physical Geology Lab), all students were assessed on CNM's outcome "Utilize mathematical techniques to evaluate and solve scientific problems," which corresponds to NMHED competencies # 2, Solve problems scientifically, and # 4, Apply quantitative analysis to scientific problems. In all sections of EPS 1192, all students were assessed on CNM outcome # 3 as well, "Properly operate laboratory equipment to collect relevant and quality data," which corresponds to NMHED competency 2, Solve problems scientifically. Internal, direct assessments were used in the form of test questions on in-class, mid-term, and final exams.

***Geography:***

GEOG 1101/1192		Physical Geography Lab
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In GEOG 1101, the Geography faculty assessed the CNM Gen Ed outcome "Relate science to personal, social or global impact," which corresponds to NMHED competency # 5, Apply scientific thinking to real world problems. Common exam questions on plate tectonics served as the direct, internal measure for establishment of baseline data.

In GEOG 1192, the Geography faculty assessed the CNM Gen Ed outcome "Utilize mathematical techniques to evaluate and solve scientific problems," which corresponds to NMHED competencies # 2, Solve problems scientifically, and # 4, Apply quantitative analysis to scientific problems. They used internal, direct measures in the form of assignment or quiz questions on calculating map scale to establish baseline data. Two (2) common word-problem measurement questions were given in all sections.

***Natural Science:***

NS 1010		Physical Science for Teachers
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The Natural Science faculty used lab reports and presentations in all NS 1010 courses as internal, direct assessments of three CNM outcomes, 3, 5 & 6, which correspond respectively to NMHED competencies # 2, Solve problems scientifically; # 3, Communicate scientific information; and # 5, Apply scientific thinking to real world problems.

**Physics:**

PHYS 1510/1592	PHYS 1113/1111	Physics I/Lab
PHYS 1610/1692	PHYS 1123/1111	Physics II/Lab
PHYS 1710/1792	PHYS 1213/1211	General Physics I/Lab
PHYS 1810/1892	PHYS 1223/1221	General Physics II/Lab

The Physics faculty assessed the CNM Gen Ed outcome “Utilize mathematical techniques to evaluate and solve scientific problems,” which corresponds to NMHED competencies # 2, Solve problems scientifically, and # 4, Apply quantitative analysis to scientific problems. They used internal, direct measures. The target was an average score of 2 out of 3 points. This would indicate either full points for algebra or half of the algebra points and full points for trigonometry.

**Report of Assessment Data and Results:**

**Biology:**

**GE1** CNM Outcome Corresponding to NMHED Competency 5: Employ critical thinking skills to judge the validity of information from a scientific perspective.

BIO 2192: Do the results of your selective media support your gram stain? Midterm F15=70%; SP16=80%

**GE2** CNM Outcome Corresponding to NMHED Competencies 1 (Describe the process of scientific inquiry) & 2 (Solve problems scientifically): Apply the scientific method to formulate questions, analyze information/data and draw conclusions.

BIO 1092: You decide to compare oxygen consumption in two sets of rats. The first group contains normal rats. In the second group of rats, you surgically remove the thyroid gland of each rat (referred to as thyroidectomy). You measure oxygen consumption for one hour each week during the rats' regular activities. You compare oxygen consumption of both groups to determine if the removal of the thyroid gland has any effect on how much oxygen is consumed. Each rat is 2 years old and consumes 6 grams of food and 15 milliliters (ml) of water each day. Answer the following questions about this experiment:

1A. What is the independent variable? F15=59%; SP16=62%

1B. What is the dependent variable? F15=61%; SP16=60%

1C. What is one controlled variable? F15=65%; SP16=68%

BIO 1092: Suppose both Mom and Dad are able to roll their tongues. Mom is RR and Dad is Rr. What phenotypes are possible among their offspring? F1=61%; SP16=66%

BIO 1492: Interpret DNA fingerprint to determine most likely adult to be parent. F15=95%; S16=93%

BIO 1492: Interpret and solve pedigree chart relating to blood types. F15=58%; S16=73%

BIO 1492: Draw hypothetical graph for enzyme activity at suboptimum pH. F15=72%; SP16=72%

BIO 2192: Based on your Gram stain, formulate a hypothesis about the growth of your organism on MacConkey agar. MIDTERM F15=53%; SP16=66%

**GE3** CNM Outcome Corresponding to NMHED Competency2 (Solve problems scientifically): Properly operate laboratory equipment to collect relevant and quality data.

BIO 1492: Use microscope to identify a state of mitosis in cells F15=85%; SP16=89%

BIO 2192: Gram Stain Technique F15=72% SP16=83%

**GE4** CNM Outcome Corresponding to NMHED Competencies 2 (Solve problems scientifically) & 4 (Apply quantitative analysis to scientific problems): Utilize mathematical techniques to evaluate and solve scientific problems.

BIO 1092: Maria is at Defined Fitness, and she has just finished a 15-minute run on the treadmill. Before she got on the treadmill her heart rate was 77 beats per minute. Now, after 15 minutes of exercise, it is 139 beats per minute. What is the percent change for Maria's heart rate? (Include a plus sign or a minus sign to indicate the direction of the change.) F15=59%; SP16=73%

BIO 1492: Scientific conversion F15=42%; SP16=56%

BIO 1492: Cell size estimation equation Set-up F15=70%; SP16=69%

BIO 1492: Calculation of cell size estimation and convert answer to mm F15=52%; SP16=43%

BIO 2192: Estimate the approximate size of your organism in millimeters F15=56%; SP16=84%

**GE5** CNM Outcome Corresponding to NMHED Competencies 3 (Communicate scientific information): Communicate effectively about scientific ideas and topics, in both oral and written formats.

BIO 2192: Unknown final report discussion (70% minimum score). FINAL EXAM F15=75%; SP16=85%

**GE6** CNM Outcome Corresponding to NMHED Competency 5 (Apply scientific thinking to real world problems): Relate science to personal, social or global impact.

BIO 2192: Unknown final report introduction (70% minimum score) F15=83%; SP16=88%

**Chemistry:**

In CHEM 1410, the students demonstrated 89.7% correct responses.

Cycle Years:	Plan Description:
2011-2017	For Gen. Ed. Outcome #2, the 1410 lecture final was used for assessment rather than the 1492 lab final that we originally planned. However we are considering switching back to the 1492 lab, either the lab practical or lab final to get a more accurate analysis for this Gen Ed outcome.

Student Learning Outcomes:	When Measured:	Where Measured:	How Measured:
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1. Employ critical thinking skills to judge the validity of information from a scientific perspective.	2013 – 2015	CHEM 1410 &/or 1492	Chem 1410 Lecture Final -- direct/internal
2. Apply the scientific method to formulate questions, analyze information/data and draw conclusions.	2015 – 2017	CHEM 1410 &/or 1492	Chem <del>1492 Lab Final</del> – direct/internal The 1410 final was used.
3. Properly operate laboratory equipment to collect relevant and quality data.	Fall 2011-2013	CHEM 1410 &/or 1492	Chem 1492 Lab Practical – direct/internal
4. Utilize mathematical techniques to evaluate and solve scientific problems.	Fall 2011-2013	CHEM 1810 &/or 1892	Chem 1810 ACS Standardized Final Exam – direct/external
5. Communicate effectively about scientific ideas and topics, in both oral and/or written formats.	2013 – 2015	CHEM 1810 &/or 1892	Chem 1892 Lab Report – direct/internal
6. Relate science to personal, social or global impact.	2015-2017	CHEM 1810 &/or 1892	Chem 1892 Lab Final – direct/internal

*Earth & Planetary Science:*

**GEN ED Outcome#1 (for EPS1101): Employ critical thinking skills...**

**xx. If the basalt lava is 25 million years old and the basalt dike is 20 million years old, what is the most accurate age for the fossil in the uppermost shale layer?**

- less (younger) than 20 million years old
- somewhere between 20 and 25 million years old
- older than 25 million years
- very young because it is in the highest layer

**Gen Ed Outcome #2 (for EPS1101): Scientific Method**

**xx. In the following photo, what is the correct sequence of events from oldest to youngest?**

- formation of gneiss through metamorphic processes, faulting, intrusion of magma to form a dike.
- faulting, formation of gneiss through metamorphic process, intrusion of magma to form a dike.
- intrusion of magma to form dike, faulting, formation of gneiss through metamorphic processes.
- formation of gneiss through metamorphic processes, intrusion of magma to form a dike, faulting.

**Gen Ed Outcome #1 for EPS 1192 (see Task #5)**

**Gen Ed Outcome #2 for EPS 1192 (see Task #5)**

**Task #5 – Rubrics for Scoring and Reporting Tools**

Create rubrics for scoring each assessment question and reporting tools that can be used for data collection.

**Gen Ed Outcome #1 – EPS1101**

**Activity:** Instructors will include the multiple choice question below on their **final exam**.

**Scoring and Reporting:** Instructors will determine the percentage of students that correctly/incorrectly answered the question. This

is an all-or-nothing question with no partial credit.

**xx. If the basalt lava is 25 million years old and the basalt dike is 20 million years old, what is the most accurate age for the fossil in the uppermost shale layer?**

- a. less (younger) than 20 million years old
- b. somewhere between 20 and 25 million years old
- c. older than 25 million years
- d. very young because it is in the highest layer

**Gen Ed Outcome #1 – EPS1192**

**Activity:** Instructors will include a relative dating problem on the **final lab exam** that asks students to correctly place a large number of geologic events in the correct order.

**Scoring and Reporting:** Instructors will need to standardize on a specific relative dating problem and how they are going to determine correct or incorrect.

**Gen Ed Outcome #2 – EPS1101**

**Activity:** Instructors will include the multiple choice question below on their **final exam**.

**Scoring and Reporting:** Instructors will determine the percentage of students that correctly/incorrectly answered the question. This is an all-or-nothing question with no partial credit.

**xx. In the following photo, what is the correct sequence of events from oldest to youngest?**

- a. formation of gneiss through metamorphic processes, faulting, intrusion of magma to form a dike.
- b. faulting, formation of gneiss through metamorphic process, intrusion of magma to form a dike.
- c. intrusion of magma to form dike, faulting, formation of gneiss through metamorphic processes.
- d. formation of gneiss through metamorphic processes, intrusion of magma to form a dike, faulting.

**Gen Ed Outcome #2 – EPS1192**

**Activity:** As part of the **midterm exam**, EPS1192 instructors will have students try to correctly identify a sample of calcite.

**Geography:**

GEOG 1101:

**Assessment Findings:**

- 1) If you travel away from a midocean ridge you will find \_\_\_\_\_.
- A) increasingly older rocks
  - B) increasingly younger rocks
  - C) the seafloor is drifting opposite to your direction of motion
  - D) more and more earthquakes
  - E) little evidence of paleomagnetic reversals of the poles

2014-2015 Average Fall and Spring: 75%

2015-2016 Average Fall and Spring: 84%

F) 2) Research since the 1970s has identified the cause of plate tectonics to be \_\_\_\_\_.

- A) diastrophism
- B) convection
- C) sun spots
- D) warping
- E) uniformitarianism

2014-2015 Average Fall and Spring: 76%

2015-2016 Average Fall and Spring: 85%

3) The Himalayas were formed by crumpling of plate edges in a \_\_\_\_\_ zone.

- A) transcurrent
- B) divergent
- C) convergent
- D) rift
- E) basalt

2014-2015 Average Fall and Spring: 84%

2015-2016 Average Fall and Spring: 87%

## Geology 1192

### Assessment Results/Findings:

1. Which of the following is not considered part of the scientific method?

- A. Observation
- \*B. Formation of a Theory
- C. Gathering Data
- D. Formation of a Hypothesis

2015-2016 Average: 80%



2. Which of the following best describes a theory in science?

- A. A theory is just an educated guess and is easily discounted.
- B. A theory does not have to be changed if new evidence is discovered that contradicts it.
- \*C. A theory has some sort of explanatory function that takes into account existing tested data.
- D. A theory and a hypothesis are the same thing in science.

2015-2016 Average: 79%

3. Why would you use a sling psychrometer?

- A. To measure the specific humidity in the air.
- B. To measure the absolute humidity in the air.
- C. To only measure the temperature of the air.
- \*D. To measure the relative humidity of the air.

2015-2016 Average: 84%

4. Which of the following temperatures on a sling psychrometer correlate with air temperature?

- \*A. The dry bulb temp.
- B. The wet bulb temp.

2015-2016 Average: 79%

Average was taken of all classes in both Fall and Spring, and these values were averaged again.

Analysis and Interpretation of Assessment Results/Findings:

Students scored above average on all questions. However there is definitely room for improvement in both standards, especially in teaching the scientific method and the use of a sling psychrometer.

## *Natural Science:*

Assessment Findings:
Outcome 5-69.6% mastery, Outcome 6-73.1% mastery

### **Analysis and Interpretation/Reflection on Results or Trends:**

#### *Biology:*

Students achieved the 70% success mark for all assessments related to outcomes GE1, GE3, GE5 and GE6.

#### **Apply the scientific method to formulate questions, analyze information/data and draw conclusions.**

This outcome is being assessed with several tools across all 3 course (BIO 1092, BIO 1492, and BIO 2192). Students surpassed the 70% success mark for most of the assessment tools. The exceptions were identification different variables associated with a scientific experiment and analysis of genetic cross data with BIO 1092, and formulation of hypothesis with BIO 2192.

The performance of students with the hypothesis question in BIO 2192 was unusual, as students usually are very successful with this question. One factor could be the number of new faculty that started teaching BIO 2192 last year, as performance improved substantially during Spring 2016. Although students did not achieve the 70% goal for the genetic cross assessment, there was a substantial improvement over last year. This is probably related to restructuring of the question to take emphasis away from differentiating genotype and phenotype, and focusing rather on their success with the genetic cross problem.

#### **Utilize mathematical techniques to evaluate and solve scientific problems.**

Math calculations and scientific conversions continue to be a challenge for students in all 3 courses (BIO 1092, BIO 1492, and BIO 2192), but there were some substantial improvements over last year. Student success with calculating percent change of heart rate in BIO 1092 increased from approximately 40% during 2014-2015, to 67% during 2015-2016. Students achieved 73% success on this assessment question in Spring 2016. This most likely reflects a change in the assessment tool that provided the formula for the students so they were being assessed specifically on their ability to successfully perform the calculation. Students in BIO 1492 achieved the 70% success goal for the first time with their set-up of the cell size estimate equation. However, still struggled with performing the calculations. Although BIO 2192 students were below the 70% success goal for cell size estimate calculations during Fall 2016, there was a substantial increase to 84% success during Spring 2016. This may also be related to new faculty becoming more comfortable with teaching BIO 2192.

#### *Chemistry:*

CHEM 1410 – This is the first time this Gen. Ed. Outcome #2 was assessed for this class. There were no predetermined expectations. This will be a benchmark for future assessment of Gen. Ed. Outcome #2.

#### *Earth & Planetary Science:*

The percentage of correct responses across all sections of EPS 1192 on the question meant to assess CNM outcome # 3 was 71.7. The percentage of correct responses across all sections of EPS 1101 and 1192 on the questions meant to assess CNM outcome #4 was 70. This was first year data that can now be used to help determine future expectations.

***Geography:***

GEOG 1101: Students did substantially better on Post-Tests for questions 1 & 2. Students did worse on question 3 when comparing pre/post for question 3 alone; however, more students got question 3 correct on both pre & post-tests, overall. They also did better overall (by 10%) on question 3 compared to the first 2 questions, on the post test. Reasoning for this contradiction: only 56% of student population took the pre-test compared to post-test (187 vs 333 students). The different sample sizes obviously skewed the results.

GEOG 1192: Across all sections, students seemed to continue having the most problems with Question 2, which asked them to calculate slope. Question 3, which uses the data gathered from section 2, also posed some challenges, but overall students scored higher on this question (the higher scores are probably a result of a student being able to visually answer the question as well after looking at the map).

***Natural Science:***

<b>Analysis and Interpretation of Assessment Findings:</b>
For outcome 5 69.6% of students scored 80% or better on this outcome.
For outcome 6 73.1% of students scored 80% or better on this outcome.

***Physics:***

<b>Analysis and Interpretation of Assessment Findings:</b>
Last year's data implied our general education students were competent in utilizing mathematical techniques to evaluate and solve scientific problems. Just over 68% of the students earned full points on the algebra portion and 84% did so on the trigonometry portion. Sixty-two percent earned full points on both.

**Plan for Improving the Assessment Process and/or Student Learning:**

***Biology:***

One major change for the upcoming year is removing several of the upper level courses from the General Education matrix. These courses will include BIO1610/1692, BIO 2110/2192, BIO 2410/2492, and BIO 2510/2592. Removal of BIO 2192 will have the biggest impact on assessment since it provided assessment for many of the General Education outcomes. However, development of assessment tools in other more appropriate General Education courses will replace the loss of BIO 2192.

The development of new tools and incorporation of additional courses in the assessment plan will be delayed until the HED provides their finalized changes to the General Education core.

Action plans related to current assessment tools that are not meeting the 70% target are the following:

**GE4 Utilize mathematical techniques to evaluate and solve scientific problems.**

BIO 1492: The Biology faculty voted to allow the use of calculators on exams. Calculators had been restricted in the past. Allowing the use of calculators and continued assessment of student equation set-up will provide assessment of student skills with and without technology.

***Earth & Planetary Science:***

In year three, faculty will assess outcomes #1 and #2, analyze Year 1 & 2 results, re-plan and make changes, and do it again. It is recommended that CNM fund Geology tutors at all CNM campuses offering EPS 1101 and/or EPS1192.

***Geography:***

GEOG: 1101: Emphasize concepts of convection and seafloor spreading when discussing plate-tectonics. Online students scored higher on question 2 in Molly's online classes, compared to most face-to-face classes across the department. This could be the result of a written assignment (concentrated on the topic of convection as it relates to plate-tectonics) that is required in the online classes and not for the face-to-face classes.

GEOG 1192: More attention should be focused in the lab on not only how to calculate slope from a map, but what this means in real landscape.

***Physics:***

The current curriculum appears to be doing a good job of helping students achieve this particular learning objective. No drastic changes to curriculum or pedagogy are indicated.