Program Report for the Preparation of Science Teachers
National Science Teachers Association (NSTA)
2012 Standards - Option A

NCATE approved the 2012 NSTA Standards in 2012. Beginning in Fall 2014, programs submitting reports must use the 2012 standards.

COVER SHEET

1. **Institution Name**
2. **State**
3. **Date submitted**

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2018

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1. **Report Preparer's Information:**

Name of Preparer:

Phone: Ext.

**(** **)** **-**

E-mail:

1. **CAEP Coordinators’ Information:**

|  |  |
| --- | --- |
| Name:Phone: **(** **)** **-** E-mail:  | Name:Phone: **(** **)** **-** E-mail:  |

**MAT Science - Biology, Chemistry, and Physics**

1. **Name of Institution’s Program**

M.A.T. in Secondary Science – Secondary Biology M.A.T.

M.A.T. in Secondary Science – Secondary Chemistry, M.A.T.

M.A.T. in Secondary Science – Secondary Physics, M.A.T.

1. **CAEP Category**

Science Education-Biology; Science Education-Chemistry; Science Education-Physics

1. **Grade levels for which candidates are being prepared(1)**

6-12

 ***(1)*** *e.g, K-6, 7-9, 7-12, K-12*

1. **Program Type**





1. **Degree or award level**

****

****

****

1. **Is this program offered at more than one site?
**
2. **If your answer is "yes" to above question, list the sites at which the program is offered**
3. **Title of the state license for which candidates are prepared**

Secondary Science (Grades 6-12) Biology

Secondary Science (Grades 6-12) Chemistry

Secondary Science (Grades 6-12) Physics

1. **State Licensure data requirement on program completers disaggregated by specialty area with sub-area scores:**

CAEP requires programs to provide completer performance data on state licensure examinations for completers who take the examination for the content field, if the state has a licensure testing requirement. Test information and data must be reported in Section IV. Does your state require such a test?

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SECTION I – CONTEXT

* 1. **Descriptions of any state or institutional policies that may influence the application of NSTA standards.**

The <state commission> approves all educator preparation programs and issues all educator licenses for teaching in the state. As such, Educator Preparation Programs (EPP) in <this state> undergo a program approval and review process. To facilitate this approval and review process, the <state commission> establishes a set of program standards that are adopted from the national SPAs as appropriate. Hence, the <state commission) adopted the NSTA SPA standards for secondary Biology, Chemistry, and Physics programs. As part of the teacher preparation program review process, teacher preparation institutions in our state submit candidate assessments, scoring guides, performance data, and other preparation program documents responding to professional standards for <state commission> review. Information from the preparation program review process is used to address the elements of content knowledge, professional and pedagogical knowledge and skills, pedagogical content knowledge, and student learning.

For individuals who have earned an undergraduate degree in biology, chemistry, physics or related disciplines, but lack background in education and who are seeking initial certification at the Master’s level, the x department at x University offers the Master’s of Arts in Teaching (MAT) degree in collaboration with the relevant university departments. The MAT programs are approved by the <state commission> and are nationally recognized by the National Science Teachers Association (NSTA) (Spring, 2011).

The MAT in Secondary Science is offered through a collaboration between the Department of x in the x and the Department of x, the Department of x, and the Department of x in the College of x. Housed in the the program’s professional education, inclusive education and instructional technology courses are taught by faculty in the EPP. Faculty from the science departments teach the science content and methods courses, as well as supervise two field experiences.

The MAT in Secondary Science is designed to be completed within three semesters for well-qualified, full-time candidates who are seeking accelerated paths into teaching; however the option to spread course work out over two years is also available. The MAT in Secondary Science leads to initial (T- 5) certification in one of three teaching fields: biology (grades 6-12); chemistry (grades 6-12); or physics (grades 6-12). The program of study for each teacher education candidate is customized to ensure that through either previous coursework or during the MAT Science program, each NSTA Content Standard is fully addressed. As demonstrated in the MAT Science program’s Content Analysis Form, the curriculum in the plan is well-aligned with NSTA Standards. There are no institutional or state policies that adversely affect the application of the NSTA standards in the MAT Science program.

* 1. **Description of the field and clinical experiences required for the program, including the number of hours for early field experiences and the number of hours/weeks for student teaching or internships. Describe setting of student teaching (i.e., student teaching occurs in a science classroom).**

Teacher candidates in the Secondary Science MAT program are typically admitted in the Spring semester, and begin their coursework during the summer term. Coursework continues during the subsequent fall and spring semesters, in conjunction with a Yearlong Clinical Experience I (YCE I) during the Fall semester and Yearlong Clinical Experience II (YCE II) during the Spring semester. Candidates are placed in a public high school science classroom with a collaborating teacher with an academic background and teaching assignment aligned with the MAT Science candidate’s licensure area (biology, chemistry, or physics). Candidates work in the same science classroom with the same mentor for both YCE I and YCE II. For experience in middle grades classrooms for the 6-12 secondary science certification, candidates complete a 2-week middle school science teaching experience mid-year, at the end of YCE I in either 7th grade (life science for biology candidates) or 8th grade (physical science for chemistry and physics candidates).

YCE I (BED 6450, CHED 6450, PHED 6450) is the first semester of an intensive and extensive co-teaching yearlong clinical experience in Biology, Chemistry, or Physics Education. Under the guidance of a collaborating teacher and university supervisor, and working in a diverse environment that includes students with exceptionalities and English learners, candidates practice professional competencies that impact student achievement. This experience includes regularly scheduled professional seminars.

**Course:** BED/CHED/PHED 6650: Yearlong Clinical Experience I

**Grade level of placement**: 6-8 or 9-12 (candidate choice)

**Placement secured by**: CEPP

**Required field hours**: 300

**Distribution of hours**: 20 hours per week from pre-planning to week 12 of semester; full day on Mondays; 4 hours Tuesday – Thursday; 0 hours on Friday. Weeks 13 and 14 full time in a secondary placement that is in another grade level. For instance, if the candidate is placed in HS for YCE, the candidate will need a two week full-time MS placement (or vice versa).

**Supervisor responsibilities**: 1 initial orientation meeting with collaborating teacher and teacher candidate and 3 observations using CAPS. Other responsibilities listed on supervisor job description document.

**Collaborating teacher responsibilities**: Co-teaching (PD from CEPP); collaborate with candidate; make four official observations; conference with candidate in collaboration with supervisor.

**Learning Outcomes**: *InTASC Standards*: Learner Development; Learning differences; Learning environments; Content knowledge; Application of Content; Assessment; Planning for instruction; Instructional strategies; Professional learning and ethical practice; Leadership and collaboration

**Course:** BED/CHED/PHED 6660: Yearlong Clinical Experience II

**Grade level of placement**: 6-8 or 9-12 (candidate choice, but same as YCE I for yearlong)

**Placement secured by**: CEPP

**Required field hours**: 375

**Distribution of hours**: Weeks 1-4, 20 hours per day/Monday –Thursday; Weeks 5-9, 40 hours per week (full time/five day a week); Weeks 10-16, 20 hours per week.

**Supervisor responsibilities**: 4 observations using CAPS. Other responsibilities listed on supervisor job description document.

**Collaborating teacher responsibilities**: Co-teaching; collaborate with candidate; make four official observations; conference with candidate in collaboration with supervisor.

**Learning Outcomes**: *InTASC Standards*: Learner Development; Learning differences; Learning environments; Content knowledge; Application of Content; Assessment; Planning for instruction; Instructional strategies; Professional learning and ethical practice; Leadership and collaboration

**Course:** BED/CHED/PHED 6650: Woodrow Wilson Fellows Yearlong Clinical Experience I

**Grade level of placement**: 9-12 in a high-needs school

**Placement secured by**: CEPP with WWF program coordinator and MOU districts

**Required field hours**: greater than 560.

**Distribution of hours**: Pre-planning – Week 14: Monday – Thursday 8 hours/day; Weeks 13 and 14 full time in a middle grades placement.

**Supervisor responsibilities**: 1 initial orientation meeting with collaborating teacher and teacher candidate and 3 observations using CAPS. Other responsibilities listed on supervisor job description document.

**Collaborating teacher responsibilities**: Co-teaching (PD from CEPP); collaborate with candidate; make four official observations; conference with candidate in collaboration with supervisor.

**Learning Outcomes**: *InTASC Standards*: Learner Development; Learning differences; Learning environments; Content knowledge; Application of Content; Assessment; Planning for instruction; Instructional strategies; Professional learning and ethical practice; Leadership and collaboration

**Course:** BED/CHED/PHED 6660: Woodrow Wilson Fellows Yearlong Clinical Experience II

**Grade level of placement**: 9-12 in a high needs school

**Placement secured by**: CEPP with WWF program coordinator and MOU districts

 **Required field hours**: 520

**Distribution of hours**: Weeks 1-4 and 10-13, Monday – Thursday 8 hours/day; Weeks 5-9, full time Monday – Friday.

**Supervisor responsibilities**: Four observations using CAPS. Other responsibilities listed on supervisor job description document.

**Collaborating teacher responsibilities**: Co-teaching; collaborate with candidate; make four official observations; conference with candidate in collaboration with supervisor.

**Learning Outcomes**: *InTASC Standards*: Learner Development; Learning differences; Learning environments; Content knowledge; Application of Content; Assessment; Planning for instruction; Instructional strategies; Professional learning and ethical practice; Leadership and collaboration

* 1. **A program of study that outlines the courses and experiences required for candidates to complete the program. The program of study must include course titles and numbers.** (This information may be provided as an attachment from the college catalog or as a student advisement sheet.) **Include forms showing requirements for science content courses for post degree or master’s programs. Syllabi and course descriptions are not generally necessary. Please include directions for each level of candidate (e.g., undergraduate advising sheet and post degree or graduate advising sheet.) A course of study for post baccalaureate or master's programs should include required science content.**

Programs of study for MAT Biology, Chemistry, and Physics are included as attachments.

* 1. **This system will not permit you to include tables or graphics in text fields. Therefore any tables or charts must be attached as files here. The title of the file should clearly indicate the content of the file. Word documents, pdf files, and other commonly used file formats are acceptable.**
	2. **Candidate Information**

Directions: Provide three years of data on candidates enrolled in the program and completing the program, beginning with the most recent academic year for which numbers have been tabulated. Report the data separately for the levels/tracks (e.g., baccalaureate, post-baccalaureate, alternate routes, master's, doctorate) being addressed in this report. Data must also be reported separately for programs offered at multiple sites. Update academic years (column 1) as appropriate for your data span. Create additional tables as necessary.

|  |
| --- |
| **Program: M.A.T. in Secondary Science – Biology** |
|  |
| **Academic Year** | **# of Candidates** **Enrolled in the Program** | **# of Program Completers(2)** |
| 2016-2017 | 7 | 6 |
| 2015-2016 | 7 | 7 |
| 2014-2015 | 4 | 4 |

|  |
| --- |
| **Program: M.A.T. in Secondary Science – Chemistry** |
|  |
| **Academic Year** | **# of Candidates** **Enrolled in the Program** | **# of Program Completers(2)** |
| 2016-2017 | 1 | 1 |
| 2015-2016 | 3 | 3 |
| 2014-2015 | 8 | 8 |

|  |
| --- |
| **Program: M.A.T. in Secondary Science – Physics** |
|  |
| **Academic Year** | **# of Candidates** **Enrolled in the Program** | **# of Program Completers(2)** |
| 2016-2017 | 2 | 2 |
| 2015-2016 | 2 | 2 |
| 2014-2015 | 3 | 3 |

***(2)*** *CAEP uses the Title II definition for program completers. Program completers are persons who have met all the requirements of a state-approved teacher preparation program. Program completers include all those who are documented as having met such requirements. Documentation may take the form of a degree, institutional certificate, program credential, transcript, or other written proof of having met the program's requirements.*

* 1. **Faculty Information**

Note: We are only including a few representative faculty in this section. We will include these details for all faculty teaching in the program when we submit the SPA report in March.

Directions: Complete the following information for each faculty member responsible for professional coursework, clinical supervision, or administration in this program. (Please refer to the footnotes for clarification)

|  |  |
| --- | --- |
| **Faculty Member Name***(250 character limit)* |  |
| **Highest Degree, Field, &****University(3)** *(250 character limit)* |  |
| **Assignment: Indicate the role of the faculty member(4)** *(250 character limit)* |  |
| **Faculty Rank(5)** *(250 character limit)* |  |
| **Tenure Track**  | [ ]   |
| **Scholarship(6), Leadership in Professional Associations, and Service(7): List up to 3 major contributions in the past 3 years(8)** *(1000 character limit)* |  |
| **Teaching or other professional experience in****P-12 schools(9)***(1000 character limit)* |  |

|  |  |
| --- | --- |
| **Faculty Member Name***(250 character limit)* |  |
| **Highest Degree, Field, &****University(3)** *(250 character limit)* |  |
| **Assignment: Indicate the role of the faculty member(4)** *(250 character limit)* |  |
| **Faculty Rank(5)** *(250 character limit)* |  |
| **Tenure Track**  | [ ]   |
| **Scholarship(6), Leadership in Professional Associations, and Service(7): List up to 3 major contributions in the past 3 years(8)** *(1000 character limit)* |  |
| **Teaching or other professional experience in****P-12 schools(9)***(1000 character limit)* |  |

In this section, list the 6-8 assessments that are being submitted as evidence for meeting the NSTA standards. All programs must provide all six assessments. If your state does not require a state licensure test in the content area, you must substitute an assessment that documents candidate attainment of content knowledge in #1 below. For each assessment, indicate the type or form of the assessment and when it is administered in the program.

SECTION II - LIST OF ASSESSMENTS

1. Please provide following assessment information (Response limited to 250 characters each field)

|  |  |  |  |
| --- | --- | --- | --- |
| Type and Number of Assessment | Name of Assessment(10) | Type of Form of Assessment(11) | When the assessment is administered(12) |
| Assessment #1: Content Knowledge – Licensure Tests (required) | GACE Content Exams in Biology, Chemistry, or Physics | State licensure test | Admission to program |
| Assessment #2: Content Knowledge – an assessment of general content knowledge in discipline to be taught, GPA and Content Analysis Form (required) | NSTA Content Analysis Form  | GPA/Transcript analysis | Admission to program |
| Assessment #3: Pedagogical and Professional Knowledge and Skills – Planning instruction and assessment (required) | Unit Plan with Analysis of Planning and Teaching | Unit Plans (Biology, Chemistry, and Physics) |  BED/CHED/PHED 6422 |
| Assessment #4: Pedagogical and Professional Knowledge and Skills – Student Teaching Assessment with Legal/Safety/Ethical Issues (required) | Candidate Assessment on Performance Standards (CAPS)Observation Form with Safety Addendum  | Student teaching evaluation  | BED/CHED/PHED 6650 BED/CHED/PHED 6660 |
| Assessment #5: Effects on student learning (required) | edTPA | Required assessment for state licensure |  BED/CHED/PHED 6623 |
| Assessment #6: Pedagogical and Professional Knowledge and Skills (required) | Professional Knowledge and Skills Reflection | Reflection |  BED/CHED/PHED 6623 |
| Assessment #7: (*optional*) |  |  |  |
| Assessment #8: (*optional*) |  |  |  |

1. *Identify assessment by title used in the program; refer to Section IV for further information on appropriate assessment to include.*
2. *Identify the type of assessment (e.g., essay, case study, project, comprehensive exam, reflection, state licensure test, portfolio).*
3. *Indicate the point in the program when the assessment is administered (e.g., admission to the program, admission to student teaching/internship, required courses [specify course title and numbers], or completion of the program).*

For each NSTA Standard on the chart below, identify the assessment(s) in Section II that address the standard. One assessment may apply to multiple NSTA standards.

SECTION III - RELATIONSHIP OF ASSESSMENT TO STANDARDS

**1.**  **NSTA Standard 1**
Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assessments:  | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***1a)** Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.**1b)** Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.**1c)** Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students. |[x] [x] [ ] [ ] [ ] [ ] [ ] [ ]

**2.** **NSTA** **Standard 2**
Effective teachers of science understand how students learn and develop scientific knowledge. Preservice teachers use scientific inquiry to develop this knowledge for all students.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Assessments: | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***2a)**Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.**2b)**Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate. **2c)**Design instruction and assessment strategies that confront and address naïve concepts/preconceptions. |[ ] [ ] [x] [ ] [ ] [ ] [ ] [ ]

**3.**  **NSTA Standard 3**
Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources--including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assessments:  | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***3a)**Use a variety of strategies that demonstrate the candidates’ knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings and applicable instruments and/or technology- to allow access so that all students learn. These strategies are inclusive and motivating for all students.**3b)**Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.**3c)**Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.**3d)**Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area. |[ ] [ ] [x] [ ] [ ] [ ] [ ] [ ]

**4.**  **NSTA Standard 4**
Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Assessments: | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***4a)**Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.**4b)**Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.**4c)**Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms. |[ ] [ ] [ ] [x] [ ] [ ] [ ] [ ]

**5.**  **NSTA Standard 5**
Effective teachers of science provide evidence to show that P-12 students’ understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Assessments: | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***5a)**Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.**5b)**Provide data to show that P-12 students are able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.**5c)**Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner. |[ ] [ ] [ ] [ ] [x] [ ] [ ] [ ]

**6.**  **NSTA Standard 6**
Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Assessments: | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
| *Preservice teachers will:***6a)**Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.**6b)**Engage in professional development opportunities such as conferences, research opportunities, or projects within their community. |[ ] [ ] [ ] [ ] [ ] [x] [ ] [ ]

DIRECTIONS: The 6-8 key assessments listed in Section II must be documented and discussed in Section IV. Taken as a whole, the assessments must demonstrate candidate mastery of the SPA standards. The key assessments and data reported should be required of all candidates. Assessments, scoring guides/rubric and data charts should be aligned with the SPA standards. This means that the concepts in the SPA standards should be apparent in the assessments and in the scoring guides to the same depth, breadth, and specificity as in the SPA standards. Data tables should also be aligned to the SPA standards. The data should be presented as they are collected. For example, if a rubric collects data on 10 elements [each relating to specific SPA standard(s)], then the data chart should report the data on each of the elements and NSTA standards.

In the description of each assessment below, the SPA has identified potential assessments that would be appropriate. Assessments have been organized into the following three areas to be aligned with the elements in CAEP Standard 1:

SECTION IV - EVIDENCE FOR MEETING STANDARDS

* **Content knowledge** (Assessments 1 and 2)
* **Pedagogical and professional knowledge, skills and dispositions** (Assessments 3, 4, and 6)
* **Focus on student learning** (Assessment 5)

Note that in some disciplines, content knowledge may include or be inextricable from professional knowledge. If this is the case, assessments that combine content and professional knowledge may be considered "content knowledge" assessments for the purpose of this report.

***For each assessment, the SPA Assessment Summary Lead should prepare one document that includes the following items:***

1. ***A two-page narrative that includes the following:***
	1. A brief description of the assessment and its use in the program (one sentence may be sufficient);
	2. A description of how this assessment specifically aligns with the standards it is cited for in Section III. Cite SPA standards by number, title, and/or standard wording.
	3. A brief analysis of the data findings;
	4. An interpretation of how that data provides evidence for meeting standards, indicating the specific SPA standards by number, title, and/or standard wording;

**AND**

1. ***Assessment Documentation***
	1. The assessment tool itself or a rich description of the assessment (often the directions given to candidates);
	2. The scoring guide/rubric for the assessment; and
	3. Charts that provide candidate data derived from the assessment.

***The responses for e, f, and g (above) should be limited to the equivalent of five text pages each, however in some cases assessment instruments or scoring guides/rubrics may go beyond five pages.***

**Note:** As much as possible, combine all of the files for one assessment into a single file. *That is, create one file for Assessment #4 that includes the two-page narrative (items a – d above), the assessment itself (item e above), the scoring guide (item f above, and the data chart (item g above)*. Each attachment should be no larger than 2 MB. Do not include candidate work or syllabi. There is a limit of 20 attachments for the entire report so it is crucial that you combine files as much as possible.

1. **CONTENT KNOWLEDGE:** Data from licensure tests of content knowledge in science education. If your state does not require licensure tests in the content area, data from another assessment must be presented to document candidate attainment of content knowledge. The NSTA standard that must be addressed by this assessment includes, but is not limited to, Standard 1a.

***Provide assessment information as outlined in the directions for Section IV.***

* + 1. The names of all licensure tests or professional examinations required by the state for content and pedagogical or professional knowledge**15**.
		2. Description of the alignment between licensure test data and applicable NSTA standards. However, if the test is a science content Praxis II test, the alignment is not required (e.g., Praxis II 20235: Biology Content).
		3. Aggregated pass rates for each year over the past 3 years, including the most recent academic year. Data must be presented on all completers, even if there were fewer than 10 test takers during a single year. Eighty percent of program completers**16** who have taken the **content** test must pass the applicable state licensure test if the state has such a test. Data should be in aggregate form (not scores for each candidate) and disaggregated by licensure area (biology, chemistry, middle school, etc) and by program (undergraduate, post degree, masters of teaching).
		4. The mean and range of sub-scores for the most recent academic year.
		Data should be in aggregate form (not scores for each candidate) and disaggregated by licensure area (biology, chemistry, middle school, etc) and by program (undergraduate, post degree, masters of teaching).
1. *For example, Praxis II Biology: Content Knowledge.*
2. *CAEP uses the Title II definition for program completers. Program completers are persons who have met all the requirements of a state-approved teacher preparation program. Program completers include all those who are documented as having met such requirements. Documentation may take the form of a degree, institutional certificate, program credential, transcript, or other written proof of having met the program’s requirements.*
3. **CONTENT KNOWLEDGE:** An assessment that demonstrates candidate knowledge of the conceptual science to be taught and related fields. An assessment that demonstrates that candidates are well prepared in the breadth of knowledge needed to teach in their fields of licensure. The NSTA standard that must be addressed by this assessment includes, but is not limited to, Standard 1.

Assessments could include content grade point averages and minimum grade requirements, portfolio requirements, or comprehensive examinations suitable for preparing teachers of a curriculum based on the content recommendations in the 2012 NSTA Standards 1a-b.

**NOTE:** In addition to the above all programs must submit the appropriate NSTA Content Analysis Form. These are available at the following URL: http://caepnet.org/accreditation/caep-accreditation/spa-standards-and-report-forms/nsta. Download the appropriate form, fill it out, and attach it here. ***Provide assessment information as outlined in the directions for Section IV.***

1. **PEDAGOGICAL AND PROFESSIONAL KNOWLEDGE AND SKILLS:** An assessment that demonstrates candidates can plan effective classroom-based instruction, and design assessments, consistent with goals of the National Science Education Standards. NSTA standards that must be addressed by this assessment include, but are not limited to, Standard 1.

A minimum indicator should include performance in the design of at least one major demonstration teaching unit (not a single lesson plan) aligned with goals as reflected in breadth of 2012 NSTA Standards 1c, 2a-c, and 3a-d (with lesson plans and varied assessments). ***Provide assessment information as outlined in the directions for Section IV.***
2. **PEDAGOGICAL AND PROFESSIONAL KNOWLEDGE AND SKILLS:** Assessment that demonstrates candidates' knowledge and skills are applied effectively in practice. NSTA standards that must be addressed by this assessment include, but are not limited to, Standard 4. The assessment instrument used in student teaching and the internship should be submitted.

An indicator could include performances on a subset of items from a student teaching observation form with each area of safety addressed explicitly: 4a- Chemical use and storage, 4b – Safety procedures, 4c –Use and care of animals.

An indicator could include performance in an internship that is evaluated using an observation form filled out by the cooperating teacher and supervisor. ***Provide assessment information as outlined in the directions for Section IV.***
3. **EFFECTS ON STUDENT LEARNING: An assessment that demonstrates candidate effects on student learning** using evidence collected from the instruction and assessment of students; the nature of science; the practice of inquiry (including student engagement in inquiry). NSTA standard that must be addressed by this assessment include, but is not limited to, Standard 5.

A minimum indicator should include an assessment of candidate work aligned with NSTA Standard 5. Work samples may include pre and post test data with analysis and reflections. ***Provide assessment information as outlined in the directions for Section IV.***
4. **PEDAGOGICAL AND PROFESSIONAL KNOWLEDGE AND SKILLS:** An assessment that demonstrates candidates are prepared to be active members in their profession. The NSTA standard addressed by this assessment includes, but is not limited to, Standard 6.  ***Provide assessment information as outlined in the directions for Section IV.***
5. **Additional assessment that addresses NSTA standards.
*Provide assessment information as outlined in the directions for Section IV.***
6. **Additional assessment that addresses NSTA standards.
*Provide assessment information as outlined in the directions for Section IV.***

**Use of Assessment Results to Improve MAT Science Program for Biology, Chemistry, and Physics:** The College of Education (COE) supports a process of continuous, intentional, evidence-based assessment of P-12 teacher development throughout the Educator Preparation Program (EPP). Data are routinely submitted by program faculty to the COE assessment faculty and are summarized by program, assessment and licensure area in Chalk and Wire®. Candidate performance data inform program evaluation and improvement via an annual data review process. Program evaluation mirrors that of CAEP with on-site and off-site reviews conducted by faculty and administrative representatives across the EPP and at other institutions. The data analysis and reflection on program design brought about by the writing of this report positions us to set new goals for our use of diverse sources of data as the basis for ongoing improvement of the program.

SECTION V - USE OF ASSESSMENT RESULTS TO IMPROVE PROGRAM

**Goals for Improving Program and Candidate Performance Based on Analysis of Candidate Data**

**Content Knowledge (CK)** All beginning science teachers, regardless of GPA, must take the science knowledge developed at the university and reconstruct it into forms that will allow them to teach effectively, such that adolescents with diverse needs, talents and interests can learn and achieve in science. As science teacher educators, most of our efforts relating to candidates' content knowledge are focused on helping candidates apply, adapt and extend their science content knowledge to the demands of teaching adolescents. Thus, we find two related components of content knowledge consistently demand our attention as we help preservice science teachers develop professionally. First is the development of pedagogical content knowledge, initially from the candidates' major discipline. Next is the candidates' ability to do science, applying the processes of scientific inquiry both as a university student and middle/high school science teacher. During school-based experiences, we must help the candidate build upon their prior knowledge of doing science to help them design instructional experiences that allow their middle and high school students to conduct scientific inquiries characterized by careful observation, inductive and deductive reasoning, experimentation, and application of mathematics in problem solving.

In prior years, we were able to offer discipline-specific pedagogical instruction for each of the three MAT Science licensure areas. However, fiscal constraints have impacted that ability. Currently, the second of three pedagogical methods courses for MAT science candidates is discipline specific. That is BED 6622 is for MAT Biology candidates, taught by a science education faculty member with biology expertise and high school teaching experience. CHED/PHED 6622 is team-taught by a chemistry education faculty member and an adjunct faculty who is a local high school physics teacher. This structure allows our candidates to discuss and practice teaching methods and apply state and national curriculum standards by first relating these to the science discipline of their greatest expertise. Currently, MAT Biology and MAT Chemistry field experience supervisors have degrees in the licensure area of the candidate they are supervising. Unfortunately, we no longer have physics education faculty and there are no plans to hire in this area.

**CK Goal 1:** Moving forward, program faculty agree on the goal to sustain the Life Science and Physical Science licensure-specific pedagogical instruction and supervision, ideally via team-teaching (BED/CHED faculty) and licensure-specific supervision, or at the very least, by instructors/supervisors differentiating for all licensure areas with input from partner-school faculty with expertise in the other licensure areas. Performance relative to this goal must be measured via candidate feedback on course/faculty impact on their learning, and key elements of NSTA Standards (e.g., 1c, 2c, 3b, 5b).

**CK Goal 2:** A second goal related to science content knowledge is specific to MAT Physics. Our NSTA Content Analysis Form (CAF) indicates that for MAT Biology, Chemistry, and Physics, the alignment of required undergraduate courses relative to CAF competency topics is 89%, 85%, and 78% respectively. This and the fact that GACE Physics Exam data indicate that while MAT Physics candidates, on average, scored 11 points higher than the State Average on the GACE Physics exam, there were several subareas of the exam where MAT Physics candidates scored below the state average. Thus, our Content Knowledge Goal #2 for MAT Science is to monitor candidate performance on all subareas of each licensure exam and address lower performing areas, as much as possible, in discipline-specific pedagogical coursework and mentoring during field-based supervision. This may sound unrealistic, so a tangible action step relates to each MAT candidates’ self-assessment of content knowledge weaknesses. At the start of their programs, MAT Biology, Chemistry and Physics candidates will be required to analyze the twelve subareas of their GACE Content Exam Results, and these areas of improvement will be a required element in their first and final draft of Assessment 6, Professional Knowledge and Skills Narrative.

**Professional Knowledge and Skill (PrKS):** MAT science candidates typically have no problem stepping into the teaching role. They readily form a professional identity and most do so in an exemplary manner without support or accountability beyond what is typically required. MAT science candidates are all meeting or exceeding NSTA Standard 6. Input from candidates, and analysis of candidate Assessment 6 data has led us to recognize the limited scope and overly prescribed nature of Assessment 6 as presented in this report. Candidates write the first draft of their Professional Knowledge and Skills Reflection early in the fall semester, then revise to complete their professionalism narrative toward the end of the spring semester. Past versions of the Assessment 6 description implied that candidates need only do one professional development activity for Standard 6a, and one for Standard 6b to complete this assessment. Assessment 6 seemed perfunctory and was not informing candidate learning and program improvement. Thus, our **PrKS Goal** is to revise Assessment 6 to increase relevance to candidates, greater impact on candidate learning and enhanced program design. MAT Biology is piloting a new version of Assessment 6 during the 2017-2018 academic year.

As an identity-development piece, candidates write about the key life events that have influenced their professional

development as scientist and educator. Then, with an eye to the year ahead in the MAT Program, candidates articulate some key choices and actions that will advance one’s professional knowledge as scientist and educator. Candidates use a template for the first draft of the revised Assessment 6, with prompts that guide a “looking back and looking forward” reflective analysis of growth relating to self-as-scientist and self-as-educator. Peer sharing and instructor feedback on this first draft of the Professionalism Narrative helps the instructor get to know candidates as individuals. The second draft of the Professionalism Narrative is written mid-year, as a revision of the earlier draft in which candidates elaborate on how professionalism relative to NSTA 6a and 6b are progressing, Also in the second draft, candidates develop 2-3 professional growth goals for the spring semester, with aligned actions and growth evidence. The university supervisor and collaborating mentor teacher receive this second draft of the Professionalism Narrative to enrich the support that they each provide the candidate during their final semester. A third and final draft of the Professionalism Narrative is written in April of the spring semester, at which point NSTA Standard 6 data are collected. Our hope is that the revised Assessment 6 will begin a career-long process of the candidate’s autonomous ability to formulate professional development goals that lead to engaging, productive actions.

**Pedagogical Knowledge and Skill (PdKS):** With regard to the pedagogical knowledge and skill of our MAT science candidates, the rubrics presented for all MAT Biology, Chemistry, and Physics assessments contain discernible criteria that gauge candidates' performance with each element of the standard. All assessment rubrics contain qualitative analytic criteria using operational terms, with individual elements of the NSTA Standard assessed separately. This allows us to make credible claims of candidate proficiency relative to the six NSTA Standards and their 18 elements. Individual elements of the NSTA Standards typically have multiple indicators; yet our rubrics usually devote only one assessment row to each element. In at least one instance, multiple indicators of a single standard element are broken out into separate rubric criteria rows (NSTA Standard 3c (assessment) in Assessment 3, Unit Plan).

**PdKS Goal:** To raise the rigor and probability that assessment data will inform program improvement and candidate learning, we will refine instructional practices and revise Assessment 3 Unit Plan rubric to separately assess discrete indicators of Standards 2b, 3a, and 5b (2b as 2b1 – inquiry to develop/communicate concepts, 2b2 – processes and patterns from empirical evidence, 2b3 – application of science specific technology; 3a as 3a1 – appropriate teaching and learning activities, 3a2 – science for all – inclusive, and 3a3 – science for all – motivating students).

**Impacting 6-12 Science Learning (ISL):** The data related to the capacity of our MAT science candidates to plan and implement instruction are captured in Assessment 3 (Unit Plan), Assessment 4 (CAPS Observation Ratings with Safety Addendum), and Assessment 5 (edTPA Rubrics 7, 8, 9, 11). In our past program review, program faculty noted that our preservice science teacher candidates were able to recognize the extent to which their assessments align with instructional objectives, but they were less proficient at determining the extent to which assessment instrument aligned with instructional practices. Five years ago, our candidates had typically used assessments that were overwhelmingly traditional in nature. Enhancements to Assessment 3 and a greater focus on social/interactive and individualized formative assessment techniques have pushed our candidate norms of practice to a much better place today. MAT candidates generally enact formative assessment frequently and as a routine part of teaching to inform instructional decisions and to guide student metacognition and monitoring of progress. Our candidate’s understanding and enactment of diagnostic or pre-assessment strategies is an area in need of attention. Moreover, since edTPA is a relatively new assessment for our candidates’ proficiency relative to NSTA 5a and 5c, program faculty need to analyze performance trends across all three licensure areas on edTPA rubrics 7, 8, 9, 11. Thus, our **ISL Goal** is to raise the rigor and probability that assessment data will inform program improvement and candidate learning, we will refine instructional practices and revise Assessment 3 Unit Plan rubric to separately assess discrete indicators of Standards 5b (as 5b1 – distinguish science from non-science, 5b2 – science as a human endeavor, 5b3 – analyze assertions).

Program Report for the Preparation of Science Teachers
National Science Teachers Association (NSTA)

**Assessment 1: GACE Content Exams**

1. **Description of Assessment**

The Georgia Assessments for the Certification of Educators® (GACE®) is Georgia’s state-approved educator certification exam. The purpose of the GACE assessment is to assure the Georgia Professional Standards Commission (GaPSC) that candidates have the content knowledge and skills needed as educators in Georgia’s public schools. These computer-delivered assessments are administered by Educational Testing Service (ETS).

All GACE assessments are aligned with the state standards for the P–12 curriculum and with state and national content standards. Each GACE test was developed with diverse representation of Georgia educators from across the state, including the participation of committees of Georgia educators, educator preparation faculty, and other content and assessment specialists, including individuals from school systems, local schools, institutions of higher education (public and private), and other stakeholders. In other words, each GACE assessment was developed by Georgia educators to measure competencies for content taught in Georgia’s P–12 classrooms.

All candidates are required to take the GACE Content exam in their licensure/content area prior to graduation. Passing scores on the exams are one of several requirements for educator certification in Georgia. To prevent candidates from taking GACE Content exams before they are academically ready, candidates are not granted access to take the exam until the semester prior to their final semester.

1. **Alignment with NSTA Standards**

The Georgia Professional Standards Commission establishes the state standards for certification based on the national standards from the Specialty Professional Associations (SPAs). As a result, the GACE Content exam has been specifically designed to assess knowledge and skills within the content area.

The GACE Content Exams for Biology, Chemistry, and Physics assessments are well-aligned with NSTA Standard 1a (assessing candidates’ understanding of “…major concepts, principles, theories, laws and interrelationships of their fields of licensure and supporting fields…” and 1b (assessing candidates’ understanding of “…the central concepts of the supporting disciplines and the supporting role of science-specific technology.”

1. **Assessment 1: GACE Content Exams**

For all three areas of licensure, the GACE Content Assessment consists of two tests, both assessing different subareas of candidates’ content knowledge of the major and supporting fields (NSTA 1a), and one including candidates’ knowledge of scientific processes and technology (NSTA 1b). Content specifications and test objectives for all subareas are provided for the Biology, Chemistry, and Physics GACE Content Exams as attachments and are also accessible at <https://gace.ets.org/about/assessments>.

**GACE Biology**

**Test I Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Cell Biology: Cell Structure and Function | 50% |
| II. | Genetics and Evolution | 50% |

**Test II Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Scientific Inquiry, Processes, Technology, and Society | 30% |
| II. | Organismal Biology | 30% |
| III. | Ecology: Organisms and Environments | 40% |

**GACE Chemistry**

**Test I Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Scientific Processes, Technology, and Society | 32% |
| II. | Nature of Matter and Energy | 40% |
| III. | Nomenclature, Chemical Composition, Bonding and Structure | 28% |

**Test II Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Periodicity and Chemical Reactions | 52% |
| II. | Solutions and Solubility; and Acid-Base Chemistry | 48% |

**GACE Physics**

**Test I Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Mechanics | 60% |
| II. | Thermodynamics, Atomic and Modern Physics | 40% |

**Test II Subareas**

|  |  |
| --- | --- |
| **Subarea** | **Approx. Percentage of Test** |
| I. | Electricity and Magnetism | 40% |
| II. | Optics and Waves | 32% |
| III. | Scientific Inquiry, Processes, Technology, and Society | 28% |

1. **Assessment 6 Scoring Guide**

The following information was adapted from: <https://gace.ets.org/scores/understand>

The passing standards for the GACE assessments were established by the GaPSC with input from committees of Georgia educators and educator preparation faculty. The passing scaled score for each GACE assessment or subtest reflects the minimum level of content knowledge required to be successful as beginning educators or educational leaders in Georgia public schools.

A passing score for any GACE content assessment can fall into one of two categories:

• 220 – passing at the induction level

• 250 – passing at the professional level

At this time, passing at either of these levels meets the Georgia Special Requirement to pass the content knowledge assessment(s) appropriate to the field of certification. Candidates receive a score report that shows their Passed/Not Passed status and passing level, if appropriate. Scaled scores show how candidates performed on any subtest(s) of an assessment taken. Scaled scores are comparable across all versions of the same subtest of an assessment.

The total raw test score on a test is a combination of:

* the total number of scored questions answered correctly on the selected response section of the test
* ratings received on any constructed-response questions as assigned by two independent raters

The total raw test score is then converted to the scaled score scale for reporting.

Please note that for assessments composed of more than one test, candidates must pass all tests for that assessment to meet the certification requirements. If a candidate passes one test within an assessment composed of more than one test, the candidate will not have to retake that part of the assessment again.

1. **Data**

**Please note:** Range scores are not provided in aggregated form in the reports provided to the EPP for GACE. Data tables are included on the following pages.

**Assessment 1: GACE Content Exams in Biology, Chemistry, and Physics**

| **Overall Data SummaryMAT Science GACE Content Exams** | **2014-2015****Cohort** | **2015-2016****Cohort** | **2016-2017****Cohort** |
| --- | --- | --- | --- |
|  **GACE Biology Test I** Test Code: 026 Passing Score: 220 | **n=3****State Average:**251.16**Program Average:**290.67**Pass Rate: 100%**  | **n=4State Average:**249.57**Program Average:**284.25**Pass Rate: 100%**  | **n=8State Average:**248.68**Program Average:**282.00**Pass Rate: 100%**  |
|  **GACE Biology Test II** Test Code: 027 Passing Score: 220 | **n=3****State Average:**258.73**Program Average:**277.67**Pass Rate: 100%**  | **n=4****State Average:**256.66**Program Average:**275.75**Pass Rate: 100%**  | **n=8****State Average:**254.09**Program Average:**275.00**Pass Rate: 100%**  |
|  **GACE Chemistry Test I** Test Code: 028 Passing Score: 220 | **n=5****State Average:**Not Available**Program Average:**262.40**Pass Rate: 100%**  | **n=2****State Average:**262.98**Program Average:**272.00**Pass Rate: 100%**  | **n=1****State Average:**Not Available**Program Average:**270.00**Pass Rate: 100%**  |
|  **GACE Chemistry Test II** Test Code: 029 Passing Score: 220 | **n=4****State Average:**Not Available**Program Average:**258.25**Pass Rate: 100%**  | **n=2State Average:**254.15**Program Average:**276.50**Pass Rate: 100%**  | **n=1****State Average:**Not Available**Program Average:**266.00**Pass Rate: 100%**  |
|  **GACE Physics Test I** Test Code: 030 Passing Score: 220 | **n=2****State Average:**Not Available**Program Average:**264.50**Pass Rate: 100%**  | **n=2****State Average:**250.80**Program Average:**285.50**Pass Rate: 100%**  | **n=1****State Average:**247.25**Program Average:**248.00**Pass Rate: 100%**  |
|  **GACE Physics Test II** Test Code: 031 Passing Score: 220 | **n=2****State Average:**Not Available**Program Average:**250.00**Pass Rate: 100%** | **n=2****State Average:**263.60**Program Average:**270.00**Pass Rate: 100%** | **n=1****State Average:**262.21**Program Average:**266.00**Pass Rate: 100%**  |

| **GACE Biology Data by Test Subarea** | **2014-2015 Cohort****N = 3** | **2015-2016 Cohort****N = 4** | **2016-2017 Cohort****N = 8** |
| --- | --- | --- | --- |
|  **Test I Subarea I: Cell Biology** 1. Basic Biochemistry and Metabolism of Living Organisms 12 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 60.44Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 58.45Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 60.19Program: 82.29 |
| **Test I Subarea I: Cell Biology** 2. Cell Structure/Function and Cellular Processes 18 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 67.63Program: 94.44 | Range Scores Not Provided**Avg. Percent Correct:**State: 63.36Program: 88.89 | Range Scores Not Provided**Avg. Percent Correct:**State: 62.00Program: 73.61 |
| **Test I Subarea II: Genetics and Evolution** 1. Molecular Biology Mechanisms and Genetics Principles 21 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 67.47Program: 91.53 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.59Program: 81.94 | Range Scores Not Provided**Avg. Percent Correct:**State: 60.77Program: 78.57 |
| **Test I Subarea II: Genetics and Evolution** 2. Mechanisms of Evolution, Factors Affecting Evolution 12 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 70.81Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 69.01Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 71.60Program: 87.03 |
| **Test II Subarea I: Scientific Inquiry, Processes, Technology** 1. Nature of Science 11 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 65.62Program: 80.61 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.7Program: 72.05 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.96Program: 77.42 |
| **Test II Subarea I: Scientific Inquiry, Processes, Technology** 2. Science Technology and Society 8 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 68.83Program: 86.90 | Range Scores Not Provided**Avg. Percent Correct:**State: 67.43Program: 68.75 | Range Scores Not Provided**Avg. Percent Correct:**State: 71.05Program: 79.32 |
| **Test II Subarea II: Organismal Biology** 1. Science Technology and Society 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 70.65Program: 72.22 | Range Scores Not Provided**Avg. Percent Correct:**State: 65.54Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 61.71Program: 75.83 |
| **Test II Subarea II: Organismal Biology** 2. Science Technology and Society 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 59.28Program: 52.38 | Range Scores Not Provided**Avg. Percent Correct:**State: 62.93Program: 82.14 | Range Scores Not Provided**Avg. Percent Correct:**State: 69.64Program: 78.57 |
| **Test II Subarea II: Organismal Biology** 3. Science Technology and Society 5 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 65.17Program: 93.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 62.24Program: 85.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 55.25Program: 65.00 |
| **Test II Subarea III: Ecology** 1. Organism Interactions and Population Size 12 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 70.44Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.68Program: 77.08 | Range Scores Not Provided**Avg. Percent Correct:**State: 67.05Program: 75.63 |
| **Test II Subarea III: Ecology 2**. Biomes, Energy Flow in Ecosystems, Biogeochem. Cycles 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 66.62Program: 90.48 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.39Program: 79.76 | Range Scores Not Provided**Avg. Percent Correct:**State: 65.14Program: 73.21 |
| **Test II Subarea III: Ecology 3**. Human Impact on Ecosystems 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 66.14Program: 66.67 | Range Scores Not Provided**Avg. Percent Correct:**State: 63.23Program: 65.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.13Program: 76.88 |

| **GACE Chemistry Data by Test Subarea** | **2014-2015 Cohort** **N = 4** | **2015-2016 Cohort** **N = 2** | **2016-2017 Cohort** **N = 1** |
| --- | --- | --- | --- |
|  **Test I Subarea I: Scientific Inquiry, Processes, & Technology** 1. Scientific Inquiry, Technology, Society, and Environment 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 80.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 86.42Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 84.23Program: 83.33 |
| **Test I Subarea I: Scientific Inquiry, Processes, & Technology** 2. Lab Processes and Data Analysis 18 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 82.50 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.60Program: 81.25 | Range Scores Not Provided**Avg. Percent Correct:**State: 72.32Program: 75.00 |
| **Test I Subarea II: Nature of Matter and Energy** 1. Basic Principles of Matter and Energy 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 80.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 77.78Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 68.45Program: 66.67 |
| **Test I Subarea II: Nature of Matter and Energy** 2. Atomic Model of Matter 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 80.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 81.48Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 73.51Program: 83.33 |
| **Test I Subarea II: Nature of Matter and Energy** 3. Basic Principles of Thermodynamics 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 70.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 68.52Program: 66.67 | Range Scores Not Provided**Avg. Percent Correct:**State: 61.61Program: 66.67 |
| **Test I Subarea III: Nomenclature and Bonding** 1. Nomenclature of Compounds and Chemical Composition 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 63.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 73.15Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.96Program: 83.33 |
| **Test I Subarea III: Nomenclature and Bonding** 2. Types of Bonding, Structure of Molecules 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 65.71 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.63Program: 78.57 | Range Scores Not Provided**Avg. Percent Correct:**State: 61.99Program: 85.71 |
| **Test II Subarea I: Periodicity and Chemical Reactions** 1. Properties of Elements and Periodic Trends 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 65.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 62.64Program: 70.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 53.45Program: 40.00 |
| **Test II Subarea I: Periodicity and Chemical Reactions** 2. Chemical Equations and Stoichiometry 9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 55.56 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.44Program: 77.78 | Range Scores Not Provided**Avg. Percent Correct:**State: 56.57Program: 55.56 |
| **Test II Subarea I: Periodicity and Chemical Reactions** 3. Chemical Equilibrium, Reaction Kinetics, Redox 9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 61.11 | Range Scores Not Provided**Avg. Percent Correct:**State: 69.81Program: 77.78 | Range Scores Not Provided**Avg. Percent Correct:**State: 58.59Program: 77.78 |
| **Test II Subarea II: Solutions, Solubility, Acid-Base Chemistry** 1. Properties of Solutions 10 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 72.50 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.98Program: 70.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 61.82Program: 70.00 |
| **Test II Subarea II: Solutions, Solubility, Acid-Base Chemistry** 2. Acid-Base Chem., pH Calculation, Titrations, Equilibrium 12 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: Not AvailableProgram: 66.67 | Range Scores Not Provided**Avg. Percent Correct:**State: 67.30Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 63.03Program: 83.33 |

| **GACE Physics Data by Test Subarea** | **2014-2015 Cohort** **N = 2** | **2015-2016 Cohort** **N = 2** | **2016-2017 Cohort** **N = 1** |
| --- | --- | --- | --- |
| **Test I Subarea I: Mechanics** 1. Kinematics, Vector and Scalar Quantities  6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 69.17Program: 66.67 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.60Program: 85.71 | Range Scores Not Provided**Avg. Percent Correct:**State: 69.17Program: 66.67 |
| **Test I Subarea I: Mechanics** 2. Newton’s Laws of Motion and Gravitation 12 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 63.75Program: 58.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.60Program: 79.81 | Range Scores Not Provided**Avg. Percent Correct:**State: 63.75Program: 58.33 |
| **Test I Subarea I: Mechanics** 3. Energy, Momentum, and Conservation Laws  9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 62.22Program: 44.44 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.08Program: 87.30 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.17Program: 44.44 |
| **Test I Subarea II: Thermodynamics, Atomic and Modern Physics** 1. Laws of Thermo., Heat, Energy, Molecular Theory  9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 64.17Program: 44.44 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.18Program: 88.89 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.17Program: 44.44 |
| **Test I Subarea II: Thermodynamics, Atomic and Modern Physics** 2. Atomic Models and Spectra, Radioactivity  9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 65.56Program: 66.67 | Range Scores Not Provided**Avg. Percent Correct:**State: 70.53Program: 77.78 | Range Scores Not Provided**Avg. Percent Correct:**State: 65.56Program: 66.67 |
| **Test II Subarea I: Electricity and Magnetism** 1. Electrostatics, Coulomb’s Law, Electric Field & Potential 9 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 74.74Program: 80.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 72.44Program: 60.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 74.74Program: 80.00 |
| **Test II Subarea I: Electricity and Magnetism** 2. Current, Resistance, Circuits, Sources of Potential 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 53.01Program: 71.43 | Range Scores Not Provided**Avg. Percent Correct:**State: 57.46Program: 57.14 | Range Scores Not Provided**Avg. Percent Correct:**State: 53.01Program: 71.43 |
| **Test II Subarea I: Electricity and Magnetism** 3. Magnetic Fields and Forces 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 60.53Program: 50.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 66.67Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 60.53Program: 50.00 |
| **Test II Subarea II: Optics and Waves** 1. Wave Types and Properties and Phenomena 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 64.66Program: 71.43 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.76Program: 71.43 | Range Scores Not Provided**Avg. Percent Correct:**State: 64.66Program: 71.43 |
| **Test II Subarea II: Optics and Waves** 2. Light and Electromagnetic Spectrum; Sound 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 61.28Program: 57.14 | Range Scores Not Provided**Avg. Percent Correct:**State: 68.89Program: 64.29 | Range Scores Not Provided**Avg. Percent Correct:**State: 61.28Program: 57.14 |
| **Test II Subarea III: Scientific Inquiry, Processes, Technology** 1. Scientific Inquiry, Science-Technology-Society 7 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 75.94Program: 57.14 | Range Scores Not Provided**Avg. Percent Correct:**State: 79.80Program: 93.75 | Range Scores Not Provided**Avg. Percent Correct:**State: 75.94Program: 57.14 |
| **Test II Subarea III: Scientific Inquiry, Processes, Technology** 2. Lab Procedures and Data Analysis 6 Questions | Range Scores Not Provided**Avg. Percent Correct:**State: 78.07Program: 83.33 | Range Scores Not Provided**Avg. Percent Correct:**State: 75.11Program: 75.00 | Range Scores Not Provided**Avg. Percent Correct:**State: 78.07Program: 83.33 |

1. **Analysis of Data**

The three applications of the GACE Content Exam reported here assess fifteen MAT Biology candidates, seven MAT Chemistry candidates, and five MAT Physics candidates. Range scores are not provided by the GaPSC, so range data are not reported here. As presented in the Overall Data Summary MAT Science GACE Content Exams table, all of the candidates passed the GACE Content Exam in their respective licensure area, and in all instances, Program Averages exceeded State Averages.

MAT Biology candidates, on average, scored 27 points higher than the State Average on the GACE Biology exam. The 2014-2015 Biology cohort generated a program average (52.38%) below that of the state (59.28) in Subarea II of Test II (Science-Technology-Society), but in the subsequent two applications of GACE Biology exams, MAT Biology candidates exceeded the state average in this subarea. All three cohorts of MAT Biology candidates met or exceeded the proficiency standard for the eleven remaining subareas of the GACE Biology assessment.

MAT Chemistry candidates, on average, scored 16 points higher than the State Average on the GACE Chemistry exam. The 2015-2016 Chemistry cohort generated a program average (66.67%) slightly below that of the state (68.52) in Subarea II of Test I (Principles of Thermodynamics), but in the previous and subsequent two applications of GACE Chemistry exams, MAT Chemistry candidates exceeded the state average in this subarea. In the most recent two applications of GACE Chemistry exams, program averages (83.33% in both instances) were slightly below the state average for Test I Subarea I (Scientific Inquiry, Technology and Society (STS)). STS is actually a dated and somewhat limiting construct, as our emphasis has moved on to socioscientific issues, so that may require further consideration; however, only three candidates generated this finding. Similarly, in the most recent application of GACE Content exams, one candidate scored below the state average for three of the twelve subareas, one of which was a substantial underperformance (Test II Subarea I Periodic Trends). All that said, one candidate does not make a trend. All three cohorts of MAT Chemistry candidates met or exceeded the proficiency standard for the eight remaining subareas of the GACE Chemistry assessment.

MAT Physics candidates, on average, scored 11 points higher than the State Average on the GACE Physics exam. Analysis of performance across the twelve subareas reveals several subareas for which candidate average scores are below that of the state. This is a trend occurring often in two of the three applications of the GACE Physics assessment for many of the 12 subareas. Although the sample size of MAT Physics majors is quite small (n=1 or n=2 in each of the three applications of the GACE Physics Exams reported here), our GACE Physics data are compared to a sample size of approximately 40 Physics teacher candidates completing the GACE Physics assessment each year. We must keep in mind that the GACE exam, for MAT candidates, is completed prior to involvement in the MAT program, with its content, pedagogy and field-based courses.

The triangulation of data across our assessment system provides a fuller picture of our MAT candidates’ ability to apply their content knowledge to teaching. Specifically, the Unit Plan assessment affords candidates the opportunity to demonstrate content-knowledge applied to the design of lessons aligned with state and national standards (NSTA Standard 1c). While Assessment 3 requires our MAT candidates to use their content knowledge in the planning of lessons, Assessment 5 requires the demonstration of content and pedagogical knowledge while implementing instruction (Impact on Student Learning, primarily edTPA). Taken together, assessments 1, 2, 3, and 5 provide substantial evidence in support of our claim that MAT Biology, Chemistry and Physics candidates understand and articulate the knowledge and practices of contemporary science and are able to interrelate and interpret important concepts, ideas, and applications in their field of licensure.

1. **Evidence for Meeting the Standard and Impact on Program**

The fact that 100% of the MAT secondary science teacher candidates passed the GACE Content Exam in the specific area of licensure (biology, chemistry or physics) indicates at least a general, broad, adequate knowledge base for the major discipline and supporting science sub-disciplines. The GACE Content Exam data, coupled with candidate performance in science and mathematics courses aligned with the NSTA Content Analysis Form, meets the preponderance of evidence criteria for Standard 1 by meeting elements a and b of that Standard. NSTA Standard 1c is assessed in Assessment 3, Unit Plan.

**Content Analysis for Secondary Science**

**Master of Arts in Teaching: Biology or Chemistry or Physics
Competency Requirements for All Science Teachers**

# Science Content Requirement Analysis Tables A, B, and C for Biology

|  |  |  |
| --- | --- | --- |
| Percentage of the Core Competencies aligned with course requirement (Table A): | 12/13 | 92.3% |
| Percentage of the Advanced Competencies aligned with course requirement (Table B): | 6/6 | 100% |
| Percentage of the Supporting Competencies aligned with course requirement (Table C): | 14/17 | 82.3% |
| **Overall alignment of courses with competency topics** | **32/36** | **88.8%** |

**Table A: Biology**

|  |  |
| --- | --- |
| **A. Core Competencies (Biology A1 - A13)** | **Required course number & name or advising requirements** |
| A1. Life processes in living systems including organization of matter and energy. | BIOL 1107 & Lab |
| A2. Similarities and differences among animals, plants, fungi, microorganisms, and viruses | BIOL 1108 & Lab |
| A3. Ecological systems including the interrelationships and dependencies of organisms with each other and their environments. | BIOL 1108 & LabBIOL 3370 & Lab |
| A4. Population dynamics and the impact of population on its environment. | BIOL 1108 & LabBIOL 3370 & Lab |
| A5. General concepts of genetics and heredity | BIOL 1107 & LabBIOL 3300 & Lab |
| A6. Organizations and functions of cells and multi-cellular systems. | BIOL 1107 & LabBIOL 3340 & Lab |
| A7. Behavior of organisms and their relationships to social systems. |  |
| A8. Regulation of biological systems including homeostaticmechanisms | BIOL 1107 & LabBIOL 3340 & Lab |
| A9. Fundamental processes of modeling and investigating in the biological sciences | BIOL 1107, 1108, 3340, 3300 with Labs |
| A10. Applications of biology in environmental quality and inpersonal and community health | BIOL 3340 & Lab |
| A11. Bioenergetics including major biochemical pathways | BIOL 1107 & LabBIOL 3370 & Lab |
| A12. Molecular genetics and heredity and mechanisms of genetic modification | BIOL 1107 & LabBIOL 3300 & Lab |
| A13. Molecular basis for evolutionary theory and classification | BIOL 1108 & Lab |

**Table B: Biology**

| **B. Advanced Competencies (Biology B1 – B6)** | **Required course number & name or advising requirements** |
| --- | --- |
| B1. Biochemical interactions of organisms and their environments | BIOL 1108 & Lab BIOL 3340 & Lab |
| B2. Causes, characteristics, and avoidance of viral, bacterial, and parasitic diseases | BIOL 3340 & Lab |
| B3. Molecular genetics | BIOL 3300 & Lab |
| B4. Issues related to living systems such as genetic modification, uses of biotechnology, cloning, and pollution from farming. | BIOL 3300 & Lab BIOL 3370 & Lab |
| B5. Historical development and perspectives in biology including contributions of significant figures and underrepresented groups, and the evolution of theories in biology | BIOL 1107 & Lab BIOL 1108 & Lab |
| B6. How to design, conduct, and report research in biology | BIOL 1107 & Lab BIOL 1108 & Lab BIOL 1107 & Lab BIOL 3300 & Lab BIOL 3340 & LabBIOL 3370 & Lab |

**Table C: Biology**

|  |  |
| --- | --- |
| **C. Supporting Competencies (Biology C1 – C17)** | **Required course number & name or advising requirements** |
| Chemistry |
| C1. General chemistry | CHEM 1211CHEM 1212 |
| C2. Biochemistry | BIOL 1107 & Lab |
| C3. Basic chemistry laboratory techniques | CHEM 1211 LabCHEM 1212 Lab |
| Physics |
| C4. Light | PHYS 1112 & Lab |
| C5. Sound | PHYS 1112 & Lab |
| C6. Optics | PHYS 1112 & Lab |
| C7. Electricity | PHYS 1112 & Lab |
| C8. Energy and order | PHYS 1111 & Lab |
| C9. Magnetism | PHYS 1112 & Lab |
| Earth and space sciences |
| C10. Energy and geochemical cycles | BIOL 3370 & Lab |
| C11. Climate | BIOL 3370 & Lab |
| C12. Oceans |  |
| C13. Weather |  |
| C14. Natural resources | BIOL 3370 & Lab |
| C15. Changes in the Earth |  |
| Mathematics |
| C16. Probability | STAT 3125 |
| C17. Statistics | STAT 3125 |

# Science Content Requirement Analysis Tables A, B, and C for Chemistry

|  |  |  |
| --- | --- | --- |
| Percentage of the Core Competencies aligned with course requirement (Table A): | 14/15 | 93% |
| Percentage of the Advanced Competencies aligned with course requirement (Table B): | 11/12 | 92% |
| Percentage of the Supporting Competencies aligned with course requirement (Table C): | 10/14 | 71% |
| **Overall alignment of courses with competency topics** | **35/41** | **85%** |

**Table A: Chemistry**

|  |  |
| --- | --- |
| **A. Core Competencies (Chemistry A1 - A15)** | **Required course number & name or advising requirements** |
| A1. Fundamental structures of atoms and molecules | CHEM 1211 & Lab |
| A2. Basic principles of ionic, covalent, and metallic bonding | CHEM 1211 & Lab |
| A3. Periodicity of physical and chemical properties of elements | CHEM 1211 & Lab |
| A4. Laws of conservation of matter and energy | CHEM 1211 & Lab |
| A5. Fundamental of chemical kinetics, equilibrium and thermodynamics | CHEM 1212 & Lab |
| A6. Kinetic molecular theory and gas laws | CHEM 1211 & Lab |
| A7. Mole concept, stoichiometry, and laws of composition | CHEM 1211 & Lab |
| A8. Solutions, colloids, and colligative properties | CHEM 1212 & Lab |
| A9. Acids/base chemistry | CHEM 1212 & Lab |
| A10. Fundamental oxidation-reduction chemistry | CHEM 1212 & Lab |
| A11. Fundamental organic chemistry and biochemistry | CHEM 3500 & LabCHEM 3361 & Lab CHEM 3362 & Lab |
| A12. Nature of science: Fundamental processes in chemistry | CHEM 2800 |
| A13. Applications of chemistry in personal and community health and environmental quality |  |
| A14. Fundamentals of nuclear chemistry | CHEM 1212 & Lab |
| A15. Historical development and perspectives in chemistry | CHEM 3400 |

**Table B: Chemistry**

|  |  |
| --- | --- |
| **B. Advanced Competencies (Chemistry B1 – B12)** | **Required course number & name or advising requirements** |
| B1. Principles of electrochemistry | CHEM 2800/L, CHEM 3400 |
| B2. Transition elements and coordination compounds | CHEM 3105/L |
| B3. Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to properties of matter | CHEM 3105/L |
| B4. Advanced concepts in chemical kinetics, equilibrium, gas laws, and thermodynamics | CHEM 3050/L |
| B5. Lewis structures and molecular geometry | CHEM 3050/L |
| B6. Advanced concepts in acid/base chemistry, including buffers | CHEM 2800/L |
| B7. Major biological compounds and reactions | CHEM 3500/L |
| B8. Solvent system concepts | CHEM 3400 |
| B9. Chemical reactivity and molecular structure including electronic and steric effects | CHEM 3050/L |
| B10. Organic chemistry including syntheses, reactions, mechanisms, and aromaticity | CHEM 3361/L, CHEM 3362/L |
| B11. Green chemistry and sustainability |  |
| B12. How to design, conduct, and report research in chemistry | CHEM 2800/L, CHEM 3050/L |

**Table C: Chemistry**

|  |  |
| --- | --- |
| **C. Supporting Competencies (Chemistry C1 – C14)** | **Required course number & name or advising requirements** |
| Biology |
| C1. Molecular biology | CHEM 3500 |
| C2. Ecology |  |
| Earth science |
| C3. Geochemistry |  |
| C4. Cycles of matter |  |
| C5. Energetics of Earth systems |  |
| Physics |
| C6. Energy | PHYS 1111/L |
| C7. Properties and function of waves | PHYS 1112/L |
| C8. Properties and function of motions | PHYS 1111/L |
| C9. Properties and function of forces | PHYS 1111/L |
| C10. Electricity | PHYS 1112/L |
| C11. Magnetism | PHYS 1112/L |
| Mathematical and statistical concepts |
| C12. Statistics | CHEM 2800 |
| C13. Use of differential equations | MATH 1113 |
| C14. Calculus | MATH 1190, MATH 2202 |

# Science Content Requirement Analysis Tables A, B, and C for Physics

|  |  |  |
| --- | --- | --- |
| Percentage of the Core Competencies aligned with course requirement (Table A): | 10/11 | 91% |
| Percentage of the Advanced Competencies aligned with course requirement (Table B): | 9/12 | 82% |
| Percentage of the Supporting Competencies aligned with course requirement (Table C): | 9/14 | 64% |
| **Overall alignment of courses with competency topics** | **28/36** | **78%** |

**Table A: Physics**

|  |  |
| --- | --- |
| **A. Core Competencies (Physics A1 - A11)** | **Required course number & name or advising requirements** |
| A1. Energy, work, and power | PHYS 2211/L |
| A2. Motion, major forces, and momentum | PHYS 2211/L |
| A3. Newtonian physics w/engineering applications | PHYS 2211/L |
| A4. Conservation mass, momentum, energy, and charge | PHYS 2211/L |
| A5. Physical properties of matter: solids, liquids, and gases | CHEM 1211/L |
| A6. Kinetic-molecular motion and atomic models | CHEM 1211/L |
| A7. Radioactivity, nuclear reactors, fission, and fusion | CHEM 1212/L |
| A8. Wave theory, sound, light, the electromagnetic spectrum and optics | PHYS 2212/L, PHYS 2213/L |
| A9. Electricity and magnetism | PHYS 1112/L |
| A10. Fundamental processes of investigating in physics | PHYS 2211/L, PHYS 2212/L |
| A11. Applications of physics in environmental quality and to personal and community health |  |

**Table B: Physics**

|  |  |
| --- | --- |
| **B. Advanced Competencies (Physics B1 – B11)** | **Required course number & name or advising requirements** |
| B1. Thermodynamics and energy-matter relationships | PHYS 2221/L, PHYS 4230 |
| B2. Nuclear physics including matter-energy duality and reactivity | PHYS 3710 |
| B3. Angular rotation and momentum, centripetal forces, and vector analysis | PHYS 3210 |
| B4. Quantum mechanics, space-time relationships, and specialrelativity | PHYS 3710, PHYS 4210 |
| B5. Models of nuclear and subatomic structures and behavior | PHYS 4210 |
| B6. Light behavior, including wave-particle duality and models | PHYS 3710 |
| B7. Electrical phenomena including electric fields, vector analysis, energy, potential, capacitance, and inductance | PHYS 3220 |
| B8. Issues related to physics such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development |  |
| B9. Historical development and cosmological perspectives in physics including contributions of significant figures and underrepresented groups, and evolution of theories in physics |  |
| B10. How to design, conduct, and report research in physics | PHYS 2211L, PHYS 2212L, PHYS 3720L, |
| B11. Applications of physics and engineering in society, business, industry, and health fields. | PHYS 3710/L |

**Table C: Physics**

|  |  |
| --- | --- |
| **C. Supporting Competencies (Physics C1 – C14)** | **B: Required course number & name or advising requirements** |
| Biology |  |
| C1. Organization of life |  |
| C2. Bioenergetics |  |
| C3. Biomechanics |  |
| C4. Cycles of matter |  |
| Chemistry |  |
| C5. Organization of matter and energy | CHEM 2211/L |
| C6. Electrochemistry | CHEM 2212/L |
| C7. Thermodynamics | PHYS 2213/L |
| C8. Bonding | CHEM 2211/L |
| Earth sciences and/or astronomy |
| C9. Structure of the universe |  |
| C10. Energy | PHYS 4230 |
| C11. Interactions of matter | CHEM 2211/L |
| Mathematical and statistical concepts and skills |
| C12. Statistics | PHYS 3500K |
| C13. Use of differential equations | MATH 2306 |
| C14. Calculus | MATH 2203 |

**Course descriptions:**

**BIOL 1107: Biological Principles I***3 Class Hours 0 Laboratory Hours 3 Credit Hours Concurrent: CHEM 1211 and CHEM 1211L.*

The course is an introduction to cell and molecular biology as well as molecular and population genetics. Students who successfully complete the class should be able to describe the fundamental biology of the cell, including cellular anatomy and cellular metabolic processes in both plants and animals. Students will also use molecular genetics to describe the basis for heredity and how this is expressed in populations as well as how it informs evolutionary principles.

**BIOL 1107L: Biological Principles I Laboratory***0 Class Hours 3 Laboratory Hours 1 Credit Hours Concurrent: BIOL 1107*

This lab complements BIOL 1107. Students will learn how to use scientific equipment to explore the cell and molecular biology in plant and animals as well as the biochemistry of life. Students will learn about experimental design and how to generate and interpret scientific data.

## BIOL 1108: Biological Principles II

## 3 Class Hours 0 Laboratory Hours 3 Credit Hours

## **Prerequisite:** A grade of “C” or better in ([BIOL 1107](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&filter%5B29%5D=&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt2142) and [BIOL 1107L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&filter%5B29%5D=&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt4814))  and ([CHEM 1211](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&filter%5B29%5D=&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt9311) and [CHEM 1211L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&filter%5B29%5D=&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt2022))

## This is the second course in a two-semester sequence covering the fundamental principles of biology.

## Students will explore the evolution and diversity of life in this course. Students will have additional focus on

## organismal anatomy and physiology as well as learning basic principles of ecology.

## BIOL 1108L: Biological Principles II Laboratory0 Class Hours 3 Laboratory Hours 1 Credit Hours Concurrent: BIOL 1108

This lab corresponds with the organismal biology topics covered in BIOL 1108 lecture. Students will examine phylogenetics, organismal diversity, ecological principles, and physiology through a combination of lab observations and hypothesis-testing experiments. Students are also expected to perform a fetal pig dissection in order to explore vertebrate anatomy. Application of the methods of experimental design, data analysis, and data presentation will be a major component of this course.

##

## BIOL 3300: BIOL 3300: Genetics Genetics3 Class Hours 0 Laboratory Hours 3 Credit Hours

*Prerequisite:* A grade of “C” or better in ([BIOL 1107](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3300&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6809) and [BIOL 1107L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3300&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt5199)) and ([CHEM 1211](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3300&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt8871) and [CHEM 1211L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3300&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt2319)) This course presents fundamental principles and applications in genetics. Students learn how traits are inherited and to use this information in predicting and analyzing genetic outcomes. Students study nucleic acid structure, learn how DNA replicates and how genes are expressed. Mutation at the gene and chromosomal levels will be surveyed, and their effect on gene structure and function examined. Finally, students will explore various genetic methods, including pedigrees, mapping, and molecular techniques.

BIOL 3300L: Genetics Lab
*0 Class Hours 3 Laboratory Hours 1 Credit Hours Concurrent: BIOL 3300*

This course is designed to reinforce principles and applications of transmission genetics, cytogenetics, and molecular genetics. Students will learn to use problem-solving, data analysis and quantitative methods to explore genetics. Exercises in molecular biology will expose students to methods of recombinant DNA technology.

BIOL 3340: Microbiology
3 Class Hours 0 Laboratory Hours 3 Credit Hours

*Prerequisite:* A grade of “C” or better in ([BIOL 1107](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9546) and [BIOL 1107L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6792)) and ([BIOL 1108](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt1834) and [BIOL 1108L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9791) ) This course is a study of prokaryotes, unicellular eukaryotes and viruses. Students will learn about the nature of microorganisms and the techniques used to study microbes. Students will explore the morphology, metabolism, growth, and genetics of various microbes.

BIOL 3340: Microbiology Lab
*0 Class Hours 3 Laboratory Hours 1 Credit Hour*

*Prerequisite:* A grade of “C” or better in ([BIOL 1107](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9546) and [BIOL 1107L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6792)) and ([BIOL 1108](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=BIOL&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3340&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt1834) and BIOL 1108L ) This course emphasized basic microbiology methods. Students will learn to culture, identify and quantify microorganisms. Students will also explore applications of microbiology, including food and environmental microbiology.

STAT 3125: Biostatistics
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*
*Prerequisite:* [BIOL 1107](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=STAT&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3125&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt655) or [CHEM 1212](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=STAT&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3125&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt1773) or permission of the instructor
In this course students use descriptive statistics and visual displays to describe data. They learn about some common population and sample distributions. They perform and analyze results of statistical inferences, including confidence intervals, correlation, linear regression, odds/risk ratios, and hypothesis testing (F and T- tests for regression, Chi-square for independence, 2 group and paired sample t-tests). Analyses are performed using MS-Excel. The student is required to select, analyze and interpret real life data for a project.

CHEM 1211: General Chemistry I
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* High school chemistry or [CHEM 1151](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=1211&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt3850)
Concurrent: MATH 1113 or MATH 1112 or MATH 1190

This course is the first in a two-semester sequence covering the fundamental principles and applications of chemistry for science majors. Course content includes electronic structure of atoms and molecules, bonding fundamentals, fundamentals of chemical reactions, and gas laws.

CHEM 1211L: General Chemistry I Lab
*0 Class Hours 3 Laboratory Hours 1 Credit Hours Concurrent:*

CHEM 1211, and MATH 1113 or MATH 1112 or MATH 1190

First laboratory course in general chemistry. Designed to introduce the student to the application of cognitive skills utilizing chemical knowledge in the laboratory.

**CHEM 1212: General Chemistry**
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* A grade of “C” or better in [CHEM 1211](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=1211&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt199) and a grade of “C” or better in [MATH 1113](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=1211&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt4598) or MATH 1112 This course is the second in a two-semester sequence covering the fundamental principles and applications of chemistry for science majors. Course content includes chemical kinetics, chemical thermodynamics, liquids and solids, properties of solutions, chemical equilibrium, acids and bases, electrochemistry, and qualitative analysis.

##  CHEM 1212L: General Chemistry II Laboratory

*0 Class Hours 3 Laboratory Hours 1 Credit Hours*

*Prerequisite:* A grade of “C” or better in [CHEM 1211,](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=1211&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt2968) and [CHEM 1211L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=1211&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt3471)

Second laboratory course in general chemistry. Designed to continue the application of cognitive skills utilizing chemical knowledge in the laboratory including qualitative analysis techniques.

CHEM 2800: Quantitative Analytical Chemistry
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* “B” or better in [CHEM 1212](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=2800&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt362) or “C” or better in [CHEM 3361](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=2800&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt286)

This course introduces students to statistics; the use of spreadsheets; principles of gravimetric and volumetric analysis; concepts of chemical equilibria as applied to acid-base, precipitation and complex ion reactions; electrochemistry and potentiometry; ultraviolet-visible spectroscopy; and an introduction to modern chromatographic separations.

**CHEM 3361: Modern Organic Chemistry***3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:*A grade of “C” or better in [CHEM 1212](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3361&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt1348)

This course is the first of a two-semester sequence in modern organic chemistry. The course includes a study of structure, properties, synthesis, and reactions of basic organic compounds using modern structural and mechanical theories.

CHEM 3361: Modern Organic Chemistry Lab
*0 Class Hours 3 Laboratory Hours 1 Credit Hours*

Prerequisite: A grade of “C” or better in CHEM 1212L

Laboratory experiments designed to introduce the students to modern experimental method used in organic chemistry for separation of mixture, purification of compounds, and reactions illustrating single functional group transformation.

CHEM 3362: Modern Organic Chemistry II
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* C or better grade in [CHEM 3361](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3361&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt1487)

This course is the second of a two-semester sequence in modern organic chemistry. The course includes a study of structure, properties, synthesis, and reactions of basic organic compounds using modern structural and mechanical theories.

**CHEM 3362L: Modern Organic Chemistry Lab**
*0 Class Hours 3 Laboratory Hours 1 Credit Hours*

*Prerequisite****:*** C or better grade in [CHEM 3361L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3361&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt3856) Concurrent:CHEM 3362

Laboratory experiments designed to introduce the students to modern experimental methods used in organic chemistry synthesis, characterization of compounds, and multistep synthesis of useful target-compounds from readily available starting material.

CHEM 3050: Physical Chemistry
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* A grade of “C” or better in [PHYS 2212](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3050&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt3773) (or concurrent enrollment), [MATH 2202](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3050&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt7719) and CHEM 2800 This one semester course in physical chemistry provides a survey of thermodynamics, chemical equilibria, and kinetics. It also includes an introduction to the quantum mechanical principles important in understanding molecular spectroscopy and molecular modeling.

CHEM 3105: Inorganic Chemistry *3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* A grade of “C” or better in [CHEM 3050](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3050&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt8329) or [CHEM 3601](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3050&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9941) Concurrent:CHEM 3105L

In-depth study of concepts and theories of inorganic chemistry. Topics include atomic structure, bonding, coordination chemistry, reaction mechanisms, symmetry, and a general survey of descriptive inorganic chemistry.

CHEM 3400: The Teaching and Learning of Chemistry
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* [CHEM 3361](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3400&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt4983) with a grade of “C” or better.

An introduction to the methods of effective chemistry teaching in both the classroom and laboratory settings. Current chemical education research literature on topics such as theories of teaching, active learning strategies, misconceptions, multiculturalism, laboratory design, demonstrations, and assessment will be introduced and discussed. Class meetings will include hands-on activities where demonstrations and laboratory investigations are designed, enacted, and assessed as well as discussions about research-based best practices in the presentation of chemistry concepts to diverse student populations. Time will also be devoted to ensuring that essential chemistry content such as electro chemistry, thermodynamics, kinetics, and bonding are thoroughly understood so that they can be communicated effectively in the classroom.

## CHEM 3500: Biochemistry3 Class Hours 0 Laboratory Hours 3 Credit Hours

*Prerequisite:* C or better grade in [CHEM 3362](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3500&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt7629)

This course is a one-semester, lecture-only biochemistry course. Concepts covered include the structure and function of biomolecules, membranes, enzyme kinetics, metabolism and bioenergetics, as well as biological information flow. Intended for chemistry, biology, or biotechnology majors.

## CHEM 3700: Environmental Chemistry

*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite****:*** A grade of “C” or better in [CHEM 3361](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=CHEM&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D=3700&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6095)

This course will cover the environmental chemistry involving the transport, distribution, reactions, and speciation of inorganic, organometallic and organic chemicals occurring in the air, soil and water environments at the local, national and global scale. Environmental transformations and degradation processes, toxicology, pollution and hazardous substances will be discussed.

MATH 1113: Pre-calculus
*****3**********Class Hours**********0**********Laboratory Hours**********3**********Credit Hours*****
****Learning Support Prerequisites:****
Successful completion of Mathematics Learning Support requirements, if required.
This course is an intensive study of the basic functions needed for the study of calculus. Topics include algebraic, functional, and graphical techniques for solving problems with algebraic, exponential, logarithmic, and trigonometric functions and their inverses.

MATH 1190: Calculus

*****4**********Class Hours**********0**********Laboratory Hours**********4**********Credit Hours**********Prerequisite:***** A grade of “C” or better in [MATH 1112](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=MATH&filter%5B29%5D=1190&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt8582)  or [MATH 1113](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=MATH&filter%5B29%5D=1190&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt9447)  or approval of the department chair
This course is the first in the calculus curriculum and introduces the central concepts of calculus. Topics include limits, continuity, derivatives of algebraic and transcendental functions of one variable, applications of these concepts and a brief introduction to the integral of a function.

MATH 2202: Calculus II

****4**** ****Class Hours**** ****0**** ****Laboratory Hours**** ****4**** ****Credit Hours****
*****Prerequisite:***** A grade of “C” or better in [MATH 1190](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=MATH&filter%5B29%5D=2202&filter%5Bcourse_type%5D=-1&filter%5Bkeyword%5D=&filter%5B32%5D=1&filter%5Bcpage%5D=1&cur_cat_oid=29&expand=&navoid=2356&search_database=Filter#tt6285)
This course is the second in the calculus curriculum and consists of two parts. The first part is concerned with the techniques of integration and applications of the integral. The second part is concerned with infinite sequences and series.

## PHYS 1111: Introductory Physics I3 Class Hours 0 Laboratory Hours 3 Credit Hours

*Prerequisite:* A grade of “C” or better in MATH 1112, MATH 1113 or MATH 1190

This is an introductory algebra and trigonometry-based course on classical mechanics, thermodynamics, and

 waves. The student will be able to apply Newton’s laws and conservation of energy and momentum to various problems in kinematics and dynamics, use the law of universal gravitation to falling objects and orbital motion, describe simple harmonic motion, oscillations, and waves, and explain temperature, heat, and entropy.

##  PHYS 1111L: Introductory Physics Laboratory I0 Class Hours 2 Laboratory Hours 1 Credit Hours

*Corequisite: PHYS 1111*

**PHYS 1111L is an introductory laboratory for the trigonometry-based course on classical mechanics, thermodynamics, and waves. The student will be able to apply Newton’s laws and conservation of energy and momentum to various problems in the laboratory, and perform measurements of simple harmonic motion, oscillations, waves, temperature, and basic fluid dynamics. The analysis of sources of error and formal propagation of uncertainties will also be developed.**

PHYS 1112: Introductory Physics
*4 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* A grade of “C” or better in PHYS 1111, PHYS 2211, or PHYS 1211K, And a grade of “C” or better in MATH 1112, MATH 1113 or MATH 1190

This course is an introductory algebra and trigonometry-based course on electromagnetism, optics, and modern physics. The student will be able to apply the concepts of electric field and electric potential to problems in electrostatics and with electric currents, describe the motion of charged particles in magnetic fields and induction, explain the origin of electromagnetic waves and properties of light, and understand elementary principles of special relativity and quantum physics.

PHYS 1112L: Introductory Physics Lab II
*0 Class Hours 2 Laboratory Hours 1 Credit Hours*

*Corequisite: PHYS 1112 (Pre-req may be taken concurrently)*

PHYS 1112L is an introductory laboratory for the trigonometry-based course on electromagnetism, optics, and modern physics. The student will be able to apply the concepts of electric field and electric currents to problems in the laboratory, and perform measurements on magnetic fields and induction, optics, and elementary quantum physics phenomena. The analysis of sources of error and formal propagation of uncertainties will also be developed, along with graphical techniques and least-squares fits.

PHYS 2211: Principles of Physics
*4 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* A grade of “C” or better in [MATH 1190](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt182)

This course is an introductory calculus-based course on classical mechanics, waves, and special relativity. The student will be able to apply Newton’s laws and conservation of energy and momentum to various problems in kinematics and dynamics, use the law of universal gravitation to analyze the behavior of falling objects and objects in orbital motion, describe simple harmonic motion, oscillations, and waves, and explain the basic ideas of special relativity.

PHYS 2211L: Principles of Physics Lab I

*0 Class Hours 2 Laboratory Hours 1 Credit Hours*

*Corequisite: PHYS 2211*

PHYS 2211L is an introductory laboratory for the calculus-based course on classical mechanics, and waves. The student will be able to apply Newton’s laws and conservation of energy and momentum to various problems in the laboratory, and perform measurements of simple harmonic motion, oscillations, and waves. The analysis of sources of error and formal propagation of uncertainties will also be developed, as well as graphical techniques and the method of least-squares fits.

PHYS 2212: Principles of Physics
*4 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* Grades of “C” or better in [MATH 2202](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9063) and [PHYS 2211](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt8230) or [PHYS 1211K](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6092)

This course is an introductory calculus-based course on electromagnetism, physical optics, and quantum physics. The student will be able to apply the concepts of electric field and electric potential to problems in electrostatics and with electric currents, describe the motion of charged particles in magnetic fields and induction, explain the origin of electromagnetic waves and properties of light, determine the behavior of light waves passing through single or multiple slits, and understand elementary principles of quantum physics.

PHYS 2212L: Principles of Physics Lab
*0 Class Hours 2 Laboratory Hours 1 Credit Hours*

*Corequisite: PHYS 2212*

This is an introductory laboratory for the calculus-based course on electromagnetism, optics, and modern physics. The student will be able to apply the concepts of electric field and electric currents to problems in the laboratory, and perform measurements on magnetic fields and induction, optics, and elementary quantum physics phenomena. The analysis of sources of error and formal propagation of uncertainties will also be developed, along with graphical techniques and least-squares fits.

**PHYS 2213: Principles of Physics III**
*2 Class Hours 0 Laboratory Hours 2 Credit Hours*

*Prerequisite:* Grades of “C” or better in [MATH 2202](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6247) , and ([PHYS 2211](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt5920) or [PHYS 1211K](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6264) )

This is the third course in the 3-semester introductory sequence. Students will learn about pressures produced by fluids and fluid flow. They will also learn the laws of thermodynamics and their applications to physical systems. Students will also examine the behavior of light interacting with lenses and mirrors, and will understand the behavior of sound in air.

PHYS 3220: Electromagnetism
*3 Class Hours 0 Laboratory Hours 3 Credit Hours*

*Prerequisite:* Grades of “C” or better in [MATH 2203](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt5849) , [MATH 2306](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt560) , [PHYS 2212](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt2513) and [PHYS 2212L](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt9525)

This course is a survey of fundamental principles of electricity and magnetism. Students will learn and solve problems in electrostatic fields, magnetic fields of steady currents, and time-dependent electromagnetic fields.

PHYS 3500K: Introduction to Computational Physics
*2 Class Hours 3 Laboratory Hours 3 Credit Hours*

*Prerequisite:* Grades of “C” or better in PHYS 2212/2212L

Students will use a Windows-based Mathcad software environment to perform numerical and symbolic manipulations of equations arising in physics. In addition, they will solve physics problems and analyze physical situations using a collection of problems particularly suited to software analysis.

PHYS 3710: Modern Physics
*4 Class Hours 0 Laboratory Hours 4 Credit Hours*

*Prerequisite:* Grades of “C” or better in PHYS 2212/2212L

PHYS 3710 will present an introduction to the concepts and calculations involved in understanding the structure of matter and the world of the quantum. Students will explore the Planck theory of radiation and wave/particle duality. Students will also calculate Schrodinger equation solutions for simple potentials, and properties of the one-electron atom. Students will also study applications of quantum principles to atomic, molecular, and nuclear structure as time permits.

**PHYS 3720L: Modern Physics Laboratory***0 Class Hours 3 Laboratory Hours 1 Credit Hours Concurrent: PHYS 3710*

This course complements the material in Modern Physics. Students will gather data in x-ray diffraction, photoelectric effect and beta decay. They will also estimate the e/m ratio and study the spectra of hydrogen, helium and mercury.

**PHYS 4210: Quantum Physics**

*4 Class Hours 0 Laboratory Hours 4 Credit Hours*

*Prerequisite:* A grade of “C” or better in [PHYS 3710](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt8547), [MATH 2203](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6440), and [MATH 2306](http://catalog.kennesaw.edu/content.php?filter%5B27%5D=PHYS&amp;filter%5B29%5D&amp;filter%5Bcourse_type%5D=-1&amp;filter%5Bkeyword%5D&amp;filter%5B32%5D=1&amp;filter%5Bcpage%5D=1&amp;cur_cat_oid=34&amp;expand&amp;navoid=2699&amp;search_database=Filter&amp;tt6745) This course presents a systematic development of quantum mechanical laws, emphasizing solutions to Schrodinger’s equation for various potentials. In addition, the concept of spin will be presented.

**PHYS 4230: Thermal Physics**

*4 Class Hours 0 Laboratory Hours 4 Credit Hours*

*Prerequisite:* A grade of “C”’ or better in PHYS 2213 and PHYS 2212/2212L

This course is a study of the principles of thermal equilibrium, physical statistics, irreversible processes, and the approach to equilibrium. Students will learn how to apply the statistical nature of thermodynamics using Boltzmann, Bose- Einstein, and Fermi-Dirac statistics.

Program Report for the Preparation of Science Teachers
National Science Teachers Association (NSTA)

**Assessment 2: GPA and Content Analysis Form**

1. **Description of Assessment**

The purpose of this assessment is to ensure that candidates in the three licensure areas of the science MAT degree have the content knowledge necessary to meet the content-knowledge standards outlined in the NSTA Standards for Science Teacher Preparation. Evidence of candidates’ content knowledge is provided in this assessment by the candidates’ cumulative grade point average (GPA) for required science and mathematics courses upon admission into the program. MAT candidates complete a B.S. degree in biology or chemistry or physics or related discipline at an accredited institution. As part of the admissions review process, the undergraduate transcript(s) of each MAT Science applicant is analyzed for alignment of content courses referenced on the NSTA Content Analysis Form (attached below). Areas of content course deficiency can be addressed via content course offerings available to candidates prior to or during the MAT program. The Programs of Study used in the content-course transcript analysis are attached. Only required courses are used in the GPA calculation. Candidates must earn a grade of “C” or higher in each science content (BIOL, CHEM, or PHYS) course and a GPA of 2.75 to remain in the program.

1. **Alignment with NSTA Standards**

Assessment 2, GPA data, corroborated with the Content Analysis Form, provides evidence for meeting NSTA Standard 1, element a – knowledge of concepts, principles, theories, laws and relationships of science content knowledge, and element b – supporting science content knowledge. The GPA for each licensure area is based on the mandatory science courses in the major as well as supporting courses for all secondary biology, chemistry, and physics candidates. The content within these courses is aligned with the Content Analysis Form (attached). The required undergraduate science and mathematics courses for the three MAT science disciplines are presented below.

|  |
| --- |
| **BIOLOGY – Required Content Courses** |
| **SPA Standard/s Addressed by Course** | **Required Course Name & Number** | **Brief summary of contents (if course title is unclear)** |
|  NSTA 1a(Core and Advanced Competencies) | BIOL 1107: Biological Principles I with Lab |  Cell and molecular biology, population genetics |
| BIOL 1108: Biological Principles I with Lab | Phylogenetics, organismal diversity, ecological principles, and physiology |
| BIOL 3300: Genetics with Lab |  |
| BIOL 3340: Microbiology with Lab |  |
| BIOL 3300: Genetics with Lab |  |
| BIOL 3380: Evolutionary Biology |  |
|  NSTA 1b(Supporting Competencies | CHEM 1211: General Chemistry I with Lab | Electronic structure and bonding of atoms, chemical reactions, gas laws |
| CHEM 1212: General Chemistry II with Lab | Chemical kinetics, thermodynamics, liquids and solids, solutions, equilibrium, electrochemistry, qualitative analysis |
| PHYS 1111: Introductory Physics I with Lab | Mechanics, thermodynamics and waves (algebra and trigonometry-based) |
| PHYS 1112: Introductory Physics I with Lab | Electromagnetism, optics, and modern physics (algebra and trigonometry-based) |
| STAT 3125: Biostatistics |  |

|  |
| --- |
| **CHEMISTRY – Required Content Courses** |
| **SPA Standard/s Addressed by Course** | **Required Course Name & Number** | **Brief summary of contents (if course title is unclear)** |
|  NSTA 1a(Core and Advanced Competencies) | CHEM 1211: General Chemistry I with Lab | Electronic structure and bonding of atoms, chemical reactions, gas laws |
| CHEM 1212: General Chemistry II with Lab | Chemical kinetics, thermodynamics, liquids and solids, solutions, equilibrium, electrochemistry, qualitative analysis |
| CHEM 2800: Quantitative Analytical Chemistry |  |
| CHEM 3361: Organic Chemistry I with Lab |  |
| CHEM 3362: Organic Chemistry II with Lab |  |
| CHEM 3400: The Teaching and Learning of Chemistry | Concepts such as electrochemistry, thermodynamics, kinetics, and bonding are taught for development of pedagogical content knowledge |
| CHEM 3500: Biochemistry |  |
|  | CHEM 2800: Quantitative Analytical Chemistry |  |
|  NSTA 1b(Supporting Competencies | CHEM 3500: Biochemistry |  |
| PHYS 1111: Introductory Physics I with Lab | Mechanics, thermodynamics and waves (algebra and trigonometry-based) |
| PHYS 1112: Introductory Physics I with Lab | Electromagnetism, optics, and modern physics (algebra and trigonometry-based) |
| MATH 1113: Precalculus |  |
| MATH 1190: Calculus |  |
| MATH 2202: Calculus II |  |

|  |
| --- |
| **PHYSICS – Required Content Courses** |
| **SPA Standard/s Addressed by Course** | **Required Course Name & Number** | **Brief summary of contents (if course title is unclear)** |
|  NSTA 1a(Core and Advanced Competencies) | PHYS 2211: Principles of Physics I with Lab | Mechanics, thermodynamics and waves (calculus-based) |
| PHYS 2212: Principles of Physics I with Lab | Electromagnetism, optics, and modern physics (calculus-based) |
| CHEM 1211: General Chemistry I with Lab | Electronic structure and bonding of atoms, chemical reactions, gas laws |
| CHEM 1212: General Chemistry II with Lab | Chemical kinetics, thermodynamics, liquids and solids, solutions, equilibrium, electrochemistry, qualitative analysis |
| PHYS 3210: Intermediate Mechanics |  |
| PHYS 3220: Electromagnetism I |  |
| PHYS 3710: Modern Physics |  |
| PHYS 4210: Quantum Physics |  |
|  NSTA 1b(Supporting Competencies | CHEM 1211: General Chemistry I with Lab | Electronic structure and bonding of atoms, chemical reactions, gas laws |
| CHEM 1212: General Chemistry II with Lab | Chemical kinetics, thermodynamics, liquids and solids, solutions, equilibrium, electrochemistry, qualitative analysis |
| PHYS 2213: Principles of Physics III |  |
| PHYS 4230: Thermal Physics |  |
| PHYS 3500K: Introduction to Computational Physics |  |
| MATH 2203: Calculus III |  |
| MATH 2306: Ordinary Differential Equations |  |

1. **Grade Policy and Minimum Expectations**

Candidates must earn a grade of A, B, or C to have successfully completed any required mathematics or science course. No other grade (D, F, I) qualifies for course completion. If a candidate earns a grade below a C, the course must be repeated.

**Rubric for Science Content Course Grades**

|  |  |  |
| --- | --- | --- |
| **Target** | **Acceptable** | **Unacceptable** |
| Candidate completed required mathematics and science courses with a cumulative GPA higher than 3.0 (grade of A or B+) | Candidate completed required mathematics and science courses with a cumulative GPA between 2.5-3.0 (grade of B to C+) | Candidate completed required mathematics and science courses with a cumulative GPA lower than 2.5 (grade lower than C+ ) |
| **Points per Credit Hour: A = 4, B = 3, C = 2** |

1. **Candidate Assessment Data**

**MAT Candidates’ Cumulative Undergraduate Content GPA for Required Mathematics and Science Courses and Percentage Meeting Expectations Overall and by Content Area**

| **AY 2014-2015 Datan=16** | **Content** **GPA Range** | **Average Content GPA** | **% Meeting expectations**(min. GPA of 2.5) |
| --- | --- | --- | --- |
| *Biology 1* | 3.30 |  |  |
| *Biology 2* | 2.75 |  |  |
| *Biology 3* | 3.33 |  |  |
| *Biology 4* | 3.65 |  |  |
| *Biology 5* | 3.56 |  |  |
| **Biology Cohort (n=5)** | **2.75 – 3.65** | **3.32** | **100%** |
| *Chemistry 1*  | 2.78 |  |  |
| *Chemistry 2* | 2.94 |  |  |
| *Chemistry 3* | 3.23 |  |  |
| *Chemistry 4* | 2.75 |  |  |
| *Chemistry 5* | 2.84 |  |  |
| *Chemistry 6* | 3.55 |  |  |
| *Chemistry 7* | 3.00 |  |  |
| *Chemistry 8* | 3.06 |  |  |
| **Chemistry Cohort (n=8)** | **2.75 – 3.55** | **3.02** | **100%** |
| *Physics 1*  | 2.79 |  |  |
| *Physics 2* | 3.26 |  |  |
| *Physics 3* | 3.02 |  |  |
| **Physics Cohort (n=3)** | **2.79 – 3.26** | **3.02** | **100%** |
|  |
| **2014-2015All Disciplines (n=16)** | **2.75 – 3.65** | **2.92** | **100%** |

| **AY 2015-2016 Datan=12** | **Content GPA Range** | **Average Content GPA** | **% Meeting expectations**(min. GPA of 2.5) |
| --- | --- | --- | --- |
| *Biology 1* | 2.74 |  |  |
| *Biology 2* | 3.32 |  |  |
| *Biology 3* | 2.95 |  |  |
| *Biology 4* | 3.53 |  |  |
| *Biology 5* | 3.79­­ |  |  |
| *Biology 6* | 2.86 |  |  |
| *Biology 7* | 3.35 |  |  |
| **Biology Cohort (n=7)** | **2.74 – 3.79** | **3.22** | **100%** |
| *Chemistry 1* | 3.10 |  |  |
| *Chemistry 2*  | 2.95 |  |  |
| *Chemistry 3* | 2.89 |  |  |
| **Chemistry Cohort (n=3)** | **2.89 – 3.10** | **2.98** | **100%** |
| *Physics 1*  | 2.85 |  |  |
| *Physics 2*  | 3.88 |  |  |
| **Physics Cohort (n=2)** | **2.85 – 3.88** | **3.36** | **100%** |
|  |
| **2015-2016 All Disciplines (n=12)** | **2.74 – 3.88** | **3.18** | **100%** |

| **AY 2016-2017 Datan=9** | **Content** **GPA Range** | **Average Content GPA** | **% Meeting expectations**(min. GPA of 2.5) |
| --- | --- | --- | --- |
| *Biology 1*  | 2.96 |  |  |
| *Biology 2* | 3.63 |  |  |
| *Biology 3* | 3.12 |  |  |
| *Biology 4* | 4.00 |  |  |
| *Biology 5* | 3.07 |  |  |
| *Biology 6*  | 3.07 |  |  |
| **Biology Cohort (n=7)** | **2.96 – 4.00** | **3.30** | **100%** |
| *Chemistry 1*  | 2.80 |  |  |
| **Chemistry Cohort (n=1)** | **2.80 – 2.80** | **2.80** | **100%** |
| *Physics 1*  | 2.92 |  |  |
| *Physics 2* | 2.88 |  |  |
| **Physics Cohort (n=2)** | **2.88 – 2.92** | **2.90** | **100%** |
|  |
| **2016-2017All Disciplines (n=9)** | **2.80 – 4.00** | **3.16** | **100%** |

1. **Data Analysis**
The tables above show the MAT science candidates’ undergraduate cumulative grade point averages for science and mathematics courses required for admission to the program. All candidates exceeded the minimal 2.50 cumulative GPA. Mean and range data are provided for each licensure area, and for the overall cohort, for three applications of this assessment. The candidate cumulative grade point average for courses cited on the Content Analysis Form (CAF) is the basis by which the program assures that all candidates have the requisite content knowledge for each licensure area. For the MAT program, the CAF is used to determine if an incoming applicant has the requisite content. The CAF is used as a checklist, and candidates must achieve at least 80% of the concepts before remediation is required. The CAF indicates that for MAT Biology, Chemistry, and Physics, the alignment required undergraduate courses relative to CAF competency topics is 89%, 85%, and 78% respectively. If a candidate does not meet the 80% level, the candidate must take content courses either at the undergraduate or graduate level, to fill the gaps identified in the transcript review process. Since all program completers successfully passed the GACE Content Exam, their content knowledge met the requirement of the state of Georgia.
2. **Evidence for Meeting Standard**Due to low number of candidates, no generalizations of statistical significance can be made. Nevertheless, the data demonstrate that 100% of the candidates met the science/math content GPA requirement as defined by NSTA Standard 1a and 1b.

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**Assessment 3: Unit Plan**

1. **Description of Assessment**

The Science Unit Plan is a sequence of lessons developed by each MAT Science candidate (approximately 5-10 consecutive lessons, depending on block or traditional schedule, respectively). Candidates complete the Unit Plan during the Fall semester of their Year-long Clinical Experience, while placed in a public high school biology, chemistry or physics classroom with support from a collaborating mentor-teacher and a supervisor. The Unit Plan is completed during the BED/CHED/PHED 6422 course (Pedagogical Content Knowledge for Biology/Chemistry/Physics). The overarching goal of the Science Unit Plan assessment is to develop a reform-based, science specific, instructional design process for our aspiring science teacher. Candidates are evaluated on their ability to (a) plan lessons based on state and national science curriculum standards that support student learning via guided scientific inquiry, (b) develop diagnostic, formative and summative assessments that align with instructional objectives and activities, (3) fulfill the duty of instruction, supervision and maintenance for a safe science learning environment, and (4) explicitly teach the nature of science to foster secondary students’ scientific literacy. Assessment 3, Science Unit Plan data are disaggregated by licensure type and academic year (Fall 2015 and Fall 2016) and presented in this document.

1. **Alignment with NSTA Standards**

In Part I of the Unit Plan, candidates think deeply about desired results. The first task required of candidates in their Unit Plan is to think about what they know about the learning needs and the abilities/assets that their secondary science students bring to the lessons. In the Unit Plan Template, candidates are first directed to describe characteristics of the school and the classroom where s/he will teach the lesson sequence, then describe learner needs and assets for one class. Next, candidates develop the central focus and essential questions that address a phenomenon that will be investigated throughout the unit, as well as the learning objectives for the unit. At this stage candidates plan for how they will guide students’ use of academic language functions and plan for teaching content vocabulary for helping students build science knowledge. As indicated by the rubric, NSTA Standard 1c is assessed in this portion of the Unit Plan. As with all other NSTA Standards assessed in the Unit Plan and all other program assessments, our rubrics contain discernible criteria that gauge candidates' performance with each element of the standard. Assessment 3 and all assessment rubrics contain qualitative analytic criteria using operational terms, with individual elements of the NSTA Standards assessed separately, allowing us to make credible claims of candidate proficiency relative to the six NSTA Standards and their 18 elements.

Part 2 of the Unit Plan focuses on assessment evidence. The Unit Plan template and Assessment 3 rubric require candidates to think about the full range of assessment evidence that will inform teaching and learning as the instructional unit unfolds. Candidates describe what they know about students’ prior knowledge and naïve/misconceptions (NSTA Standard 2c) about concepts and objectives in this instructional unit, and develop pre- and summative assessments to be used in the unit. Next, candidates develop and align instructional objectives and formative assessments, and organize them sequentially across the days planned for implementation of the Unit Plan. Candidates receive formative feedback from their collaborating mentor teacher and their university supervisor as they wrap up Part 2 of the Unit Plan.

Part 3 of the Unit Plan assesses candidates’ ability to develop learning activities that align with lesson objectives and summative assessment items. The objectives from Part 2 are repeated here to ensure that the candidates think about the alignment of daily objectives with all types of learning assessment (pre-, formative, and summative). Candidates develop first drafts of formative assessments before lessons are implemented, to increase the likelihood that frequent formative assessment will serve its optimal role in guiding students’ learning and candidates’ instructional decisions. Candidates complete a table aligning learning objectives (by number) with the applicable assessment method for all learning activities, then summarize all aspects of safety addressed in this unit of instruction. Thus, in Part 3 of the Unit Plan, MAT Science candidates prepare instructional documents amenable to assessment of their proficiency relative to NSTA Standard 2 elements a and b, all four elements of Standard 3, and all three elements of Standard 4. Element b of Standard 5 is also assessed in our Unit Plan rubric.

**Assessment 3: Candidate Instructions**

BED/CHED/PHED 6422

Directions for the Science Unit Plan:

The Science Unit Plan is completed by all students of College of Science and Mathematics enrolled in a pre-service science teaching methods course. Candidates will design a unit of instruction that covers the development of student understanding around a topic from the beginning to the end. The Georgia Standards of Excellence (GSE) for particular science subjects will guide development of objectives, activities and assessments. The Science Unit Plan is based on the National Standards for Science Teacher Preparation (NSSSP) of the National Science Teachers Association (NSTA). Standards not met in this unit plan must be met in subsequent lesson plans and instruction.

1. **Think about the learners:** As you start planning any instructional unit you must think about your students and their learning needs. In the Unit Plan Template you will first describe characteristics of the school and the classroom where you will teach this lesson sequence, then you will describe learner needs and assets for one of your classes.
2. **Desired results:** Develop the Central Focus, Essential Questions that address a phenomenon that will be investigated throughout the unit, and Learning Objectives for your unit. This is also where you start planning for how you will guide your students’ use of academic language functions and plan for teaching content vocabulary for helping your students build science knowledge.
3. **Assessment Evidence:** Describe what you know about your students’ prior knowledge and naïve/misconceptions about concepts and objectives in this instructional unit. Attach pre-assessment and summative assessment documents.
4. **Align Objectives and Assessments:** Learning Objectives from item #2 above are repeated here to “force” you to think about the alignment of daily objectives with all types of learning assessment (pre-, formative, and summative).
5. **Assessment Informing Teaching and Learning:** Formative Assessment (quizzes and other checks for understanding) should improve our teaching and the students’ learning. This is where you report these details.
6. **Learning Plan Overview:** Complete a table aligning learning objectives (by number) with assessment method for all learning activities.
7. **Safe Science:** Summarize all aspects of safety addressed in this unit of instruction.

| **LEVELS/ STANDARDS** | **Developing1** | **Proficient2** | **Target3** | **Score and comments** |
| --- | --- | --- | --- | --- |
| **Using knowledge of learners to support instruction** | Candidate pays limited attention to students’ prior learning or other factors in planning the unit. | Candidate justifies why activities are appropriate for learners using examples of students’ prior learning based on standards and/or research and theory. | Candidate justifies why activities are appropriate using BOTH examples of prior learning AND research/theory. The unit plan also accounts for how personal/cultural aspects influence the designed instruction. |  |
| **Broad goals and unit cohesion.** | Unit plan lacks a coherent unit of study and/or does not contain a complete list of the major concepts, principles, theories, laws, and interrelationships of science fields. | Unit Plan describes an internally consistent unit of study and contains a complete list of the major concepts, principles, theories, and laws  | Unit Plan describes an internally consistent unit of study and incorporates the major concepts, principles, theories, laws, and demonstrates interrelationships of science fields. |  |
| **Connection to Standards** **(NSTA 1c)** | Unit plan provides insufficient evidence that candidates understand state and national curriculum standard and how the standards impact content knowledge for teaching 6-12 students. | Unit plan provides clear, convincing evidence that candidates understand state and national curriculum standard and how the standards impact content knowledge for teaching 6-12 students. | Unit plan provides consistent, extensive evidence that candidates understand state and national curriculum standard and how the standards impact content knowledge for teaching 6-12 students. |  |
| **InstructionalObjectives** | Instructional objectives lacking in required breadth, depth, or specificity. | Instructional objectives are written using measurable verbs, are specific, and represent a full range of performance levels. Learning objective fail to extend beyond content specific objective to also include nature of science, literacy, and technology objectives.  | Instructional objectives are written using measurable verbs, are specific, and represent a full range of performance levels. Learning objective extend beyond content specific objective to also include nature of science, literacy, and technology objectives.  |  |
| **Variety of inquiry(NSTA 2a)** | Minimal evidence documenting approaches to inquiry learning that provide opportunities for students to collect, analyze, interpret, and/or communicate about data. | The unit plan offers approaches to inquiry learning that provide opportunities for students to collect, analyze, interpret, and communicate about data, BUT fails to make is a consistent practice. | Multiple lesson use consistent approaches to inquiry learning that provide extensive opportunities for students to collect, analyze, interpret, and communicate about data. |  |
| **Inquiry with technology(NSTA 2b)** | Unit plan lacks active inquiry using appropriate science-specific technology. | Unit plan guides students in fewer than three learning activities that guide students in active inquiry using appropriate, science-specific technology. | Unit plan includes three or more learning activities that guide students in active inquiry using appropriate science-specific technology. |  |
| **Confront naïve conceptions(NSTA 2c)** | Learning activities planned in the unit plan inadequately addresses naïve concepts and students’ prior-knowledge | Learning activities planned in the unit plan includes instruction and assessment strategies that confront and address naïve concepts and students’ prior-knowledge relative to some of the instructional objectives. | Learning activities planned in the Unit plan includes instruction and assessment strategies that confront and address naïve concepts and students’ prior-knowledge relative to all instructional objectives. |  |
| **Alignment of assessments with objectives** | Minimal evidence of alignment among objectives and assessments. | Alignment chart demonstrates alignment between formative and summative assessment items and most of the instructional objectives. | Alignment chart demonstrates close correspondence between formative and summative assessment items and all learning objectives. Alignment table could be used to analyze student learning (includes item-by-item analysis).  |  |
| **Appropriate activities(NSTA 3a)** | The unit plan does not outline adequate selection of appropriate learning activities in class, lab, field or on-line settings with applicable instruments or technology to support learning. | The unit plan outlines adequate selection of appropriate learning activities in class, lab, field or on-line settings with applicable instruments or technology to support learning. | The unit plan outlines extensive and exemplary variety of appropriate learning activities in class, lab, field and on-line settings with applicable instruments and technology to support learning. |  |
| **Appropriate activities(NSTA 3b)** | Candidate plans for instruction include opportunities for students to engage in scientific practices through inquiry. | Candidate plans for instruction build on each other to support students’ learning of science concepts, investigation of a phenomenon, and generation of explanations based on evidence. Lesson(s) include science-specific technology to support student learning and plans provide for equitable achievement of science literacy for all students. | Candidate plans for instruction build on each other to support students’ learning of science concepts, investigation of a phenomenon, and generation and evaluation of evidence-based arguments. Lesson(s) include science-specific technology to support student learning and plans provide for equitable achievement of science literacy for all students. |  |
| **Assessment and addressing preconceptions (NSTA 3c1)**  | Unit Plan contains few assessments of student understanding and assessments do not probe student preconceptions.  | Unit Plan contains assessment of student understanding however does not consistently evaluate students throughout the unit or assessments do not probe student preconceptions.  | Unit Plan contains constant assessment of student understanding throughout the unit and explicitly probe student preconceptions.  |  |
| **Student self-analysis** **(NSTA 3c2)** | Lesson plans either do not provide students opportunities to analyze and reflect or opportunities are not appropriate for Unit. | Lesson plans provide opportunities for students to analyze their own learning or reflect on their own work. | Lesson plans provide structure for students to analyze their own learning and reflect on and change their own work. |  |
| **Equitable Pre- and Formative Assessment****(NSTA 3c3)** | Some learning objectives are not assessed at formative stage or formative assessments are not varied for equitable opportunity to demonstrate learning. Instructional design is not adequately informed by pre- or formative assessment. | The unit plan offers a variety of assessment strategies to allow students to meet learning objectives in varied ways, including formative and summative assessments to guide instruction. Lessons demonstrate knowledge of how adolescents learn science including alternate conceptions learners may have. | Proficient standard is met and unit plan incorporates multipleforms of assessment which are appropriate to the lesson and needs of the students; Utilizes multiple assessments formative and summative to guide instruction; aligned with goals of the unit; Summative assessment incorporates higher cognitive questioning. |  |
| **Differentiated Instruction** | Unit lessons do not document adequate planning for differentiated instruction. | Unit lessons document adequate planning for differentiated instruction to serve a wide range of learners, including IEP/504 and two other Learning Needs (Gifted, English Learner, Struggling Reader, Lower Achiever) | Proficient standard is met and unit plan incorporates multipleforms of differentiated instruction (content, process, product, learning environment) to meet developmental needs of individual students. Provides remediation, enrichment and acceleration to further student understanding of material. |  |
| **Plan for safety(NSTA 3d)** | Unit lessons do not document adequate planning for safe and ethical actions by teacher and students. | Unit lessons document adequate planning for safe and ethical actions by teacher and students. | Unit plan describes adequate planning for safe and ethical actions by teacher and students and include evidence that students followed these requirements. |  |
| **Safety materials** **(NSTA 4a)** | Learning activities includes a vague description of the safe use and handling of materials.  | All instructional activities adequately direct students in safe use of chemicals and other materials. | All aspects of the safe use and handling of materials related to the Unit Plan are included, and described in detail. |  |
| **Safety procedures** **(NSTA 4b)** | The unit plan does not contain applicable emergency and safety procedures  | Safety/emergency procedures are appropriately outlined for both the teacher and the students for all learning activities in the unit. | Proficient standard is met and all emergency response and equipment maintenance procedures related to lesson activities are detailed in plans. |  |
| **Ethical treatment of living organisms** **(NSTA 4c)** | Ethical treatment and care of living organisms is incomplete or absent (where applicable) | Lesson plans include applicable procedures for the ethical treatment and care of living organisms – OR – statement that this does not apply to the Unit Plan. | Proficient is met and include students in a discussion of ethical treatment and care of living organisms as applicable to Unit Plan. |  |
| **Candidate impact on student understanding of nature of science** **(NSTA 5b)** | Candidate did not collect, organize, and analyze data or did so in a manner that could be interpreted.The data do not show that P-12 students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science. | Candidate collected, organized, and analyzed data in a manner that could be interpreted.The data show that P-12 students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science. | Candidate collected, organized, analyzed and interpreted data.The data show that P-12 students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.The data show that P-12 students have made a change in their understanding and are able to reflect on their changes in understanding. |  |
|  | **Not Met19 pts** | **Met38 pts** | **Target57 pts** | **TOTAL****X / 50** |
|  Comments: |  |

1. **Assessment 3 Scoring Guide**

**Science Unit Plan Rubric**

1. **Data**

**Assessment 3: Unit Plan Data by Licensure Area**

**2015-2016 Cohort (n=12)**

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2015-2016 Cohort MAT Biology (n=7)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 3 | 4 | 0 | 0 | 2.42 | 2-3 |
|  NSTA Standard 2a Inquiry Approaches | 4 | 3 | 0 | 0 | 2.57 | 2-3 |
|  NSTA Standard 2b Active Inquiry | 2 | 4 | 1 | 0 | 2.14 | 1-3 |
|  NSTA Standard 2c Naïve Conceptions | 1 | 5 | 1 | 0 | 2.00 | 1-3 |
|  NSTA Standard 3a Variety Stategies | 2 | 4 | 1 | 0 | 2.14 | 1-3 |
|  NSTA Standard 3b Inquiry Activity | 2 | 4 | 1 | 0 | 2.14 | 1-3 |
|  NSTA Standard 3c1 Address Preconcepts | 3 | 3 | 1 | 0 | 2.28 | 1-3 |
|  NSTA Standard 3c2 Student Self-Analysis | 1 | 5 | 1 | 0 | 2.00 | 1-3 |
|  NSTA Standard 3c3 Equitable Assessment | 2 | 4 | 1 | 0 | 2.14 | 1-3 |
|  NSTA Standard 3d Plan for Safety | 2 | 5 | 0 | 0 | 2.28 | 2-3 |
|  NSTA Standard 4a Chemical Safety | 2 | 5 | 0 | 0 | 2.28 | 2-3 |
|  NSTA Standard 4b Procedure Safety | 2 | 5 | 0 | 0 | 2.28 | 2-3 |
|  NSTA Standard 4c Living Organisms | 1 | 6 | 0 | 0 | 2.14 | 2-3 |
|  NSTA Standard 5b Sci Ways of Knowing | 1 | 2 | 4 | 0 | 1.57 | 1-3 |

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2015-2016 Cohort MAT Chemistry (n=3)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 0 | 3 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 2a Inquiry Approaches | 1 | 2 | 0 | 0 | 2.33 | 2-3 |
|  NSTA Standard 2b Active Inquiry | 1 | 2 | 0 | 0 | 2.33 | 2-3 |
|  NSTA Standard 2c Naïve Conceptions | 0 | 3 | 0 | 0 | 2.00 | 3-3 |
|  NSTA Standard 3a Variety Stategies | 2 | 1 | 0 | 0 | 2.67 | 2-3 |
|  NSTA Standard 3b Inquiry Activity | 2 | 1 | 0 | 0 | 2.67 | 2-3 |
|  NSTA Standard 3c1 Address Preconcepts | 2 | 1 | 0 | 0 | 2.67 | 2-3 |
|  NSTA Standard 3c2 Student Self-Analysis | 0 | 1 | 2 | 0 | 1.67 | 1-2 |
|  NSTA Standard 3c3 Equitable Assessment | 0 | 2 | 1 | 0 | 1.67 | 1-2 |
|  NSTA Standard 3d Plan for Safety | 1 | 2 | 0 | 0 | 2.33 | 2-3 |
|  NSTA Standard 4a Chemical Safety | 3 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4b Procedure Safety | 3 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4c Living Organisms | 0 | 3 | 0 | 0 | 1.33 | 1-3 |
|  NSTA Standard 5b Sci Ways of Knowing | 0 | 1 | 2 | 0 | 1.33 | 1-3 |

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2015-2016 Cohort MAT Physics (n=2)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 1 | 1 | 0 | 0 | 2.00 | 1-3 |
|  NSTA Standard 2a Inquiry Approaches | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 2b Active Inquiry | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 2c Naïve Conceptions | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3a Variety Stategies | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3b Inquiry Activity | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3c1 Address Preconcepts | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3c2 Student Self-Analysis | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3c3 Equitable Assessment | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3d Plan for Safety | 0 | 1 | 1 | 0 | 1.50 | 1-2 |
|  NSTA Standard 4a Chemical Safety | 0 | 2 | 0 | 0 | 1.50 | 1-2 |
|  NSTA Standard 4b Procedure Safety | 0 | 2 | 0 | 0 | 1.50 | 1-2 |
|  NSTA Standard 4c Living Organisms | 0 | 2 | 0 | 0 | 1.00 | 1-1 |
|  NSTA Standard 5b Sci Ways of Knowing | 0 | 1 | 1 | 0 | 1.50 | 1-2 |

**Assessment 3: Unit Plan Data by Licensure Area**

**2016-2017 Cohort (n=9)**

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2016-2017 Cohort MAT Biology (n=6)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 2 | 4 | 0 | 0 | 2.17 | 1-3 |
|  NSTA Standard 2a Inquiry Approaches | 3 | 3 | 0 | 0 | 2.50 | 2-3 |
|  NSTA Standard 2b Active Inquiry | 1 | 5 | 0 | 0 | 2.17 | 2-3 |
|  NSTA Standard 2c Naïve Conceptions | 0 | 3 | 3 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3a Variety Stategies | 2 | 4 | 0 | 0 | 2.33 | 2-3 |
|  NSTA Standard 3b Inquiry Activity | 0 | 3 | 3 | 0 | 1.50 | 1-2 |
|  NSTA Standard 3c1 Address Preconcepts | 1 | 3 | 2 | 0 | 1.83 | 1-3 |
|  NSTA Standard 3c2 Student Self-Analysis | 1 | 5 | 0 | 0 | 2.17 | 2-3 |
|  NSTA Standard 3c3 Equitable Assessment | 2 | 3 | 1 | 0 | 2.17 | 1-3 |
|  NSTA Standard 3d Plan for Safety | 0 | 5 | 1 | 0 | 1.83 | 1-2 |
|  NSTA Standard 4a Chemical Safety | 0 | 6 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 4b Procedure Safety | 0 | 6 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 4c Living Organisms | 0 | 6 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 5b Sci Ways of Knowing | 0 | 2 | 4 | 0 | 1.33 | 1-2 |

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2016-2017 Cohort MAT Chemistry (n=1)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 0 | 1 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 2a Inquiry Approaches | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 2b Active Inquiry | 0 | 1 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 2c Naïve Conceptions | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3a Variety Stategies | 0 | 1 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 3b Inquiry Activity | 0 | 1 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 3c1 Address Preconcepts | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3c2 Student Self-Analysis | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3c3 Equitable Assessment | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3d Plan for Safety | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4a Chemical Safety | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4b Procedure Safety | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4c Living Organisms | 1 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 5b Sci Ways of Knowing | 0 | 1 | 0 | 0 | 2.00 | 2-2 |

|  | **Candidate Ratings for Standards 1c, 2 and 3** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2016-2017 Cohort MAT Physics (n=2)** | **# Candidates Target(3.0)** | **# Candidates Proficient (Met Standard)(2.0)** | **# Candidates Developing****(1.0)** | **# Candidates Unsatisfactory(0.0)** |
|  NSTA Standard 1c State/Nat’l Curric | 0 | 2 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 2a Inquiry Approaches | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 2b Active Inquiry | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 2c Naïve Conceptions | 1 | 0 | 1 | 0 | 2.00 | 1-3 |
|  NSTA Standard 3a Variety Stategies | 1 | 1 | 0 | 0 | 2.50 | 2-3 |
|  NSTA Standard 3b Inquiry Activity | 0 | 2 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 3c1 Address Preconcepts | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3c2 Student Self-Analysis | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 3c3 Equitable Assessment | 0 | 2 | 0 | 0 | 2.00 | 2-2 |
|  NSTA Standard 3d Plan for Safety | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4a Chemical Safety | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4b Procedure Safety | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 4c Living Organisms | 2 | 0 | 0 | 0 | 3.00 | 3-3 |
|  NSTA Standard 5b Sci Ways of Knowing | 0 | 2 | 0 | 0 | 2.00 | 2-2 |

1. **Analysis of Data**

The above tables present candidate Unit Plan data germane to relevant NSTA Standards, by licensure areas (biology, chemistry, physics). Twelve elements from five NSTA Standards are addressed in Assessment 3. This section summarizes evidence that the MAT Science candidates meet or exceed the preponderance of evidence requirement for NSTA Standards 2 and 3, and element c of Standard 1.

Assessment 3 Unit Plan data for the two applications presented for all three licensure areas indicate that all candidates scored in the meet or exceed (target) portion of the rubric for NSTA Standards 1c (State/National Standards), 4a (chemical safety), 4b (safety procedures), 4c (ethical treatment of organisms). Nineteen of twenty-one candidates met or exceeded standard 3d, (planning for safety procedures) during their fall semester unit plan; the other two candidates (one biology, one physics, both in the 2015-2016 cohort) earned a “developing rating” in the fall semester. University supervisors followed up with both of them and documented them both as meeting standard 3d in their final semester.

NSTA Standard 5b is a growth area for our immediate attention. We cannot make the claim that our MAT Science candidates meet Standard 5b, however it was assessed, and elements a and b of Standard 5 are met as evident in our edTPA data, supporting our claim that we have met the preponderance of evidence requirement for NSTA Standard 5. Candidate data for Standard 5b shows that approximately 48% of the candidates meet or exceed the standard, while 52% of the 21 candidates in the past two applications of Assessment 3 did not meet all three requirements of element b of Standard 5 (students able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science). Candidate data for all elements of Standards 2 and 3 indicate that no candidate was rated as “unsatisfactory” and most candidates met or exceeded the proficiency rating for Standards 2 and 3 in their Fall semester Unit Plan. In some instances, candidates’ initial Unit Plan work earned not “met” but the “developing” rating, and in all of these instances, candidates subsequently met the standard element in the final semester of the year-long clinical experience.

Data from the 13 **MAT Biology candidates** from which these two applications of the Unit Plan assessment were applied indicate that all of them met or exceeded Standard 2a (variety of inquiry approaches). Twelve of thirteen (92%) of the Biology candidates met or exceeded Standards 2b (active inquiry lessons) and 3a (variety of teaching strategies), while one biology candidate needed the final semester of the year-long clinical experience to demonstrate meeting 2b and 3a. Nine of thirteen (69%) MAT Biology candidates met or exceeded Standards 2c and 3b in their Fall semester Unit Plan, while 10 of 13 (77%) MAT Biology candidates met or exceeded Standard 3c in their Fall semester unit plan. These 2-3 MAT Biology candidates who ended their Fall semester with “developing” ratings were able to meet all elements of Standards 2 and 3 during the subsequent Spring semester. Data from the four **MAT Chemistry candidates** from which these two applications of the Unit Plan assessment were applied indicate that all of these candidates met or exceeded (target) proficiency for all elements of Standards 2 and 3. Data from the four **MAT Physics candidates** from which these two applications of the Unit Plan assessment were applied indicate that all of these candidates met or exceeded (target) proficiency for all elements of Standard 3 as well as Standard 2 elements a and c. One MAT Physics candidate scored at “developing” for element b in the unit plan and later met the standard, one met and the other two exceeded (scored as “target”) for Standard 2b.

1. **Evidence for Meeting the Standard and Impact on Program**

Assessment 3 directs us to increase support and guidance for our candidates’ impact on student understanding of the nature of science (NSTA Standard 5b). This will begin Spring 2018. The complexity of Standard 5b warrants our instructional support of candidates for addressing each of the three dimensions of 5b separately (science/nonscience, science as human endeavor, scientific assertions).

Although data support that our program meets or exceeds preponderance of evidence requirements for Standards 2 and 3, analysis for each licensure area indicate growth areas for our instruction and support of candidates’ lesson/unit planning for Standard elements 2b (active inquiry lessons), 2c (addressing students’ preconceptions), 3b (inquiry learning with science-specific technology), 3c1 (assess and address misconceptions) and 3c2 (student self-analysis).

Starting this academic year (Fall 2017-Spring 2018) we have changed our point of application of Assessment 3, Unit Plan, from the Fall semester to the Spring semester. We chose to do this because assessment of candidate’s ability to plan at the unit level fits better during the final semester of the Year-long Clinical Experience, at which time candidates have had two semesters of pedagogical instruction and one semester of field experience to draw upon when demonstrating their abilities relative to the twelve NSTA Standard elements assessed in the Unit Plan. Moreover, edTPA requirements and three-dimensional (3D) teaching described in “A Framework for K-12 Science Education” (NRC, 2012) are so valued by program faculty, that we are developing for the Fall semester, a Phenomenon-based Learning Segment (PbLS) assessment. The PbLS is intended to serve as a support step toward development of 3D-teaching and the guided inquiry and academic language support practices assessed of candidates by edTPA.

Program Report for the Preparation of Science Teachers
National Science Teachers Association (NSTA)

**Assessment 4: Candidate Assessment on Performance Standards (CAPS)**

**Observation Summary Form (OSF) with Safety Addendum**

1. **Description of Assessment**

Candidates in the MAT Science program receive supervision and mentoring support from the university supervisor. This is facilitated by two formal observation cycles during the Fall semester (BED/CHED/PHED 6650) followed by four formal observation cycles during the Spring semester (BED/CHED/PHED 6660). In 2015, all teacher education programs at transitioned to a 10-standard student teacher observation instrument, the “CAPS” or Candidate Assessment on Performance Standards” with Observation Summary Instrument. The CAPS Standards are the same standards applied by K-12 public school administrators when evaluating teacher performance. Thus, as an Educator Preparation Provider, program leaders chose to adopt the CAPS as a unit-wide assessment after a year-long state-wide pilot test of the instrument. As a pre-service science teacher preparation program, the MAT Science group added the safety addendum to this document, ensuring that in each of six lesson observations and in each of three progress-check conferences, the required OSF form will be used to assess candidate performance relative to the three elements of Standard 4: Safety.

1. **Alignment with NSTA Standards**

As indicated by the rubric, NSTA Standard 4a, 4b, and 4c are assessed via the addendum of this assessment. As with all other NSTA Standards assessed in our program assessments, our Assessment 4 Addendum contains discernible criteria that gauge candidates' performance with each element of the standard. Assessment 4 and all of our assessment rubrics contain qualitative analytic criteria using operational terms, with individual elements of the NSTA Standards assessed separately. This allows us to make credible claims of candidate proficiency relative to the six NSTA Standards and their 18 elements.

The science-specific addendum of the CAPS and OSF with Safety Addendum is aligned to the 2012 NSTA Standard 4: Safety, elements a, b, and c. Focusing on the science-specific safety-ensuring teaching actions of candidates, the three standard elements have been articulated as specific criteria along a four-part continuum for qualitative analysis of candidate performance relative to the three elements of Standard 4. The OSF serves as a formative assessment that informs CAPS conference ratings and comments, each serving as a summative assessment relative to the previous observations and OSF ratings. Thus, the final CAPS conference at the end of YCE II, based on the same 10 unit-wide standards and the same 3 elements of NSTA Standard 4, serves as the summative assessment of all safety practice and the data presented of this document.

1. **Assessment 4: Candidate Directions**

**Observation Summary Form (OSF) with Safety Addendum on page 11.**

***Observation Summary Form (OSF)***

***Formative Assessment Tool for Collaborating Teachers and Supervisors***

**Description of the Assessment and Its Use in the Program**

What?

The Observation Summary is a formative assessment based on the Candidate Assessment on Performance Standards (CAPS). Some standards/criteria are repeated so that assessor can provide formative support throughout the lesson planning and implementation process.

Who?

This assessment is to be completed by supervisors and collaborating teachers using evidence from the pre-conference, the lesson plan, the observation, the post-conference, and other sources.

When?

TOSS/Methods/YCE I/Practicum II: Twice by each assessor

Student Teaching/YCE II/Practicum III: Twice before the midterm and twice after midterm by each assessor

**Candidate Name** *Click to enter text.* **Date** *Click to enter text.***Supervisor** *Click to enter text.* **Observation #** *Click to enter text*

**School/Grade/Subject** *School*/*Grade*/*Subject* **Collaborating Teacher** *Click to enter text.*

**Person completing form** [ ]  **Cooperating Teacher** **[ ]  Supervisor** **[ ]  Candidate**

**Check one: [ ]  TOSS/Pract. II [ ]  Student Teaching/Pract. III** **[ ]  Yearlong Clinical Practice I** **[ ]  Yearlong Clinical Practice II**

**Part I Evaluation of Planning**

**Directions –**

* If there is no evidence for an indicator, it should become an identified goal for which the candidate should demonstrate proficiency by the mid-term or end of the semester.

* Rate candidates using evidence from the lesson plan, in relation to the standard, not in relation to each other or to a first year teacher. A rating of “4” is exemplary and should be given only when a candidate demonstrates expertise, leadership, and role model skills, and it should be strongly supported with cited evidence and documentation.

|  |  |
| --- | --- |
| **Part I: Standard 2: Instructional Planning -** *The teacher candidate plans using state and local school district curricula and standards, effective strategies, resources, and data to address the needs of all students.* | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 2 During the Planning Phase**** Analyzes and uses student learning data to inform planning.
* Develops plans that are clear, logical, sequential, and integrated across the curriculum.
* Plans instruction effectively for content mastery, pacing, and transitions.
* Plans for instruction to meet the needs of all students.
* Aligns & connects lesson objectives to state & local school district curricula & standards, and student learning needs.
 |
| **Part I: Standard 2** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **inadequately** demonstrates understanding of curriculum, subject content, pedagogical knowledge and student needs, or does not use the knowledge in practice. | **Level 2: Needs Development** The teacher candidate inconsistently demonstrates understanding of curriculum, subject content, pedagogical knowledge, and student needs, or lacks fluidity in using the knowledge in practice. | **L-3: Proficient**The teacher candidate **consistently** demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences. | **L-4 Exemplary:**The teacher candidate **continually** demonstrates **extensive** content and pedagogical knowledge, enriches the curriculum, and guides others in enriching the curriculum. |
| **Planning- Standard 4: Differentiated Instruction -** The teacher candidate challenges and supports each student’s learning by providing appropriate content and developing skills which address individual learning differences. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 4 During the Planning Phase**** Differentiates instructional content, process, product, & learning environment to meet individual developmental needs.
* Provides remediation, enrichment, and acceleration to further student understanding of material.
* Uses diagnostic, formative, & summative assessment data to inform instructional modifications for individual students.
* Develops critical and creative thinking by providing activities at the appropriate level of challenge for students.
 |
| **Part I:****Standard 4** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **does not challenge** students by providing appropriate content orby developing skills which address individual learning differences. | **Level 2: Needs Development** The teacher candidate **inconsistently** challenges students by providing appropriate content orby developing skills which address individual learning differences. | **L-3: Proficient**The teacher candidate challenges students by providing **appropriate** content and by developing skills which address individual learning differences. | **L-4 Exemplary:**The teacher candidate **optimizes** students’ opportunities to learn by engaging them in critical and creative thinking and challenging activities tailored to address individual learning needs. |
| **Part I- Standard 5: Assessment Strategies -** The teacher candidate systematically chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are valid and appropriate for the content and student population. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 5 During the Planning Phase**** Uses assessment techniques that are appropriate for the developmental level of students.
* Involves students in setting learning goals and monitoring their own progress.
* Uses formal and informal assessments for diagnostic, formative, and summative purposes.
* Uses grading practices that report final mastery in relationship to content goals and objectives.
* Collaborates with others to develop common assessments, when appropriate.
 |
| **Part I:****Standard 5** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate chooses an **inadequate variety** of diagnostic, formative, and summative assessment strategies or the instruments are **not appropriate** for the content or student population. | **Level 2: Needs Development** The teacher candidate **inconsistently** chooses a variety of diagnostic, formative, and summative assessment strategies or the instruments are **sometimes not appropriate** for the content or student population. | **L-3: Proficient**The teacher candidate **systematically** and **consistently** chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are **valid** and **appropriate** for the content and student population. | **L-4 Exemplary:**The teacher candidate **continually** demonstrates **expertise** and leads others to determine and develop a variety of strategies and instruments that are valid and appropriate for the content and student population and **guides students to monitor and reflect on their own academic progress**.  |
| **Part I- Standard 6: Assessment Uses -** The teacher candidate systematically gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 6 During the Planning Phase**** Uses diagnostic assessment data to develop learning goals for students, to differentiate instruction, and to document learning.
* Plans a variety of formal and informal assessments aligned with instructional results to measure student mastery of learning objectives.
* Uses assessment tools for both formative and summative purposes to inform, guide, and adjust instruction.
* Systematically analyzes and uses data to measure student progress, design appropriate interventions, and inform long-and short-term instructional decisions.
 |
| **Part I: Standard 6** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **does not** gather, analyze, or use relevant data to measure student progress, to inform instructional content and delivery methods, orto provide feedback in a constructive or timely manner. | **Level 2: Needs Development** The teacher candidate **inconsistently** gathers, analyzes, or uses relevant data to measure student progress, inconsistently uses data to inform instructional content and delivery methods, or inconsistently provides timely or constructive feedback. | **L-3: Proficient**The teacher candidate **systematically** gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents. | **L-4 Exemplary:**The teacher candidate **consistently** demonstrates **expertise** in using data to measure student progress and leads others in the effective use of data to inform instructional decisions.  |

**Part II Assessor’s Evidence/Notes from Observation**

**Directions**

* Type directly in this section of this form or, if preferred, use other pages for handwritten notes from the observation. Please list observed evidence.
* Do not transfer your observation notes to Chalk and Wire; use them to inform your conversation with the candidate during the post-conference and your evaluation.

***Click to enter text here.***

**Part III Evaluation of Implementation and Post Conference Reflection**

**Directions**

* When completing Part III, please rate each standard and list evidence from the observation or Post Conference that was used to determine the rating.
* If evidence for an indicator is not observed, it should become an identified goal for which the candidate should demonstrate proficiency by the mid-term or end of the semester.
* Candidates should be scored in relation to the standard, not in relation to each other or to a first year teacher. A rating of “4” is exemplary and should be given only when a candidate demonstrates expertise, leadership, and role model skills, and it should be strongly supported with cited evidence and documentation.

|  |  |
| --- | --- |
| **Instruction- Standard 1: Professional Knowledge -** The teacher candidate demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 1 During the Instruction Phase**** Addresses appropriate curriculum standards and integrates key content elements
* Facilitates students’ use of higher–level thinking skills in instruction.
* Demonstrates ability to link present content with past and future learning experiences, other subject areas, and real-world experiences and applications.
* Demonstrates accurate, deep, and current knowledge of subject matter.
* Exhibits pedagogical skills relevant to the subject area(s) taught and best practice based on current research
* Bases instruction on goals that reflect high expectations for all students and a clear understanding of the curriculum.
* Displays an understanding of the intellectual, social, emotional, and physical development of the age group.
 |
| **Part II: Standard 1** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate inadequately demonstrates understanding of curriculum, subject content, pedagogical knowledge and student needs, or does not use the knowledge in practice. | **L-1: Ineffective**The teacher candidate **inconsistently** demonstrates understanding of curriculum, subject content, pedagogical knowledge, and student needs, or lacks fluidity in using the knowledge in practice. | **L-3: Proficient**The teacher candidate **consistently** demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences. | **L-4 Exemplary:**The teacher candidate **continually** demonstrates **extensive** content and pedagogical knowledge, enriches the curriculum, and guides others in enriching the curriculum |
| **Instruction- Standard 3: Instructional Strategies -** The teacher candidate promotes learning by using research-based instructional strategies relevant to the content to engage students in active learning and to facilitate the students’ acquisition of key knowledge and skills. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 3 During the Instruction Phase**** Builds upon students’ existing knowledge and skills.
* Reinforces learning goals consistently throughout the lesson.
* Uses a variety of research-based instructional strategies and resources.
* Effectively uses appropriate instructional technology to enhance student learning.
* Communicates and presents material clearly, and checks for understanding.
* Develops higher-order thinking through questioning and problem-solving activities.
* Engages students in authentic learning by providing real-life examples and interdisciplinary connections.
 |
| **Part II: Standard 3** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate does not use research-based instruction strategies, nor are the instructional strategies relevant to the content area. The strategies do not engage students in active learning or promote key skills. | **L-1: Ineffective**The teacher candidate **inconsistently** uses-researched-based instructional strategies. The strategies used are sometimes not appropriate for the content area or for the engaging students in active learning or for promoting key skills. | **L-3: Proficient**The teacher candidate promotes student learning by using research-based instructional strategies relevant to the content area to engage students in active learning and to promote key skills. | **L-4 Exemplary:**The teacher candidate optimizes students’ opportunities to learn by engaging students in higher-order thinking and by identifying and effectively implementing the most appropriate research-based instructional strategies. |
| **Instruction- Standard 4: Differentiated Instruction -** The teacher candidate challenges and supports each student’s learning by providing appropriate content and developing skills which address individual learning differences. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 4 During the Instruction Phase**** Differentiates instructional content, process, product, & learning environment to meet individual developmental needs.
* Uses flexible grouping strategies to encourage peer interaction and to accommodate learning appropriate needs.
* Demonstrates high learning expectations for all students.
 |
| **Part II Standard 4** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **does not challenge** students by providing appropriate content orby developing skills which address individual learning differences. | **Level 2: Needs Development** The teacher candidate **inconsistently** challenges students by providing appropriate content orby developing skills which address individual learning differences. | **L-3: Proficient**The teacher candidate challenges students by providing **appropriate** content and by developing skills which address individual learning differences. | **L-4 Exemplary:**The teacher candidate **optimizes** students’ opportunities to learn by engaging them in critical and creative thinking and challenging activities tailored to address individual learning needs. |
| **Part II- Standard 5: Assessment Strategies -** The teacher candidate systematically chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are valid and appropriate for the content and student population. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 5 During the Instruction Phase**** Uses assessment techniques that are appropriate for the developmental level of students.
* Varies and modifies assessments to determine individual student needs and progress.
 |
| **Part II****Standard 5** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate chooses an **inadequate variety** of diagnostic, formative, and summative assessment strategies or the instruments are **not appropriate** for the content or student population. | **Level 2: Needs Development** The teacher candidate **inconsistently** chooses a variety of diagnostic, formative, and summative assessment strategies or the instruments are **sometimes not appropriate** for the content or student population. | **L-3: Proficient**The teacher candidate **systematically** and **consistently** chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are **valid** and **appropriate** for the content and student population. | **L-4 Exemplary:**The teacher candidate **continually** demonstrates **expertise** and leads others to determine and develop a variety of strategies and instruments that are valid and appropriate for the content and student population and **guides students to monitor and reflect on their own academic progress**.  |

|  |  |
| --- | --- |
| **Part II- Standard 6: Assessment Uses -** The teacher candidate systematically gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 6 During the Instruction Phase**** Provides constructive and frequent feedback to students on their progress toward their learning goals.
* Teaches students how to self-assess and to use metacognitive strategies in support of lifelong learning.
 |
| **Part II Standard 6** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **does not** gather, analyze, or use relevant data to measure student progress, to inform instructional content and delivery methods, orto provide feedback in a constructive or timely manner. | **Level 2: Needs Development** The teacher candidate **inconsistently** gathers, analyzes, or uses relevant data to measure student progress, inconsistently uses data to inform instructional content and delivery methods, or inconsistently provides timely or constructive feedback. | **L-3: Proficient**The teacher candidate **systematically** gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents. | **L-4 Exemplary:**The teacher candidate **consistently** demonstrates **expertise** in using data to measure student progress and leads others in the effective use of data to inform instructional decisions.  |
| **Part II- Standard 7 Positive Learning Environment -** The teacher candidate provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 7 During the Instruction Phase**** Responds to disruptions in a timely, appropriate manner.
* Establishes clear expectations for classroom rules, routines, and procedures and enforces them consistently and appropriately.
* Models caring, fairness, respect, and enthusiasm for learning.
* Promotes a climate of trust and teamwork within the classroom.
* Promotes respect for and understanding of students’ diversity, including, but not limited to, race, color, religion, sex, national origin, or diversity.
* Actively listens and pays attention to students’ diversity, including, but not limited to, race, color, religion, sex, national origin, or diversity.
* Actively listens and pays attention to students’ needs and responses
* Arranges the classroom materials and resources to facilitate group and individual activities
 |
| **Part II****Standard 7** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **inadequately** addresses student behavior, displays a negative attitude toward students, **ignores** safety standards, or does not otherwise provide an orderly environment that is conducive to learning or encourages respect for all. | **Level 2: Needs Development** The teacher candidate **inconsistently** provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all. | **L-3: Proficient**The teacher candidate **provides** a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all. | **L-4 Exemplary:**The teacher candidate **creates a dynamic and vibrant environment** where students feel physically, intellectually, and emotionally safe, and are encouraged to take ownership of their own learning behavior. |

|  |  |
| --- | --- |
| **Instruction- Standard 8 Academically Challenging Environment -** The teacher candidate creates a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 8 During the Instruction Phase**** Maximizes instructional time.
* Conveys the message that mistakes should be embraced as a valuable part of learning.
* Encourages productivity by providing students with appropriately challenging and relevant material and assignments.
* Provides transitions that minimize loss of instructional time.
* Provides academic rigor, encourages critical and creative thinking, and pushes students to achieve goals.
* Encourages students to explore new ideas and take academic risks.
 |
| **Part II Standard 8** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **does not** provide a student-centered, academic environment in which teaching and learning occur at high levels, or where students are self-directed learners. | **Level 2: Needs Development** The teacher candidate **inconsistently** provides a student-centered environment in which teaching and learning occur at high levels orwhere students are self-directed. | **L-3: Proficient**The teacher candidate **creates** a student-centered, academic environment in which teaching and learning occur at high levels and students are self-directed learners. | **L-4 Exemplary:**The teacher candidate **creates** an academic learning environment where students are regularly encouraged to tackle **challenging** material and academic risks. |
| **Instruction- Standard 9: Professionalism -** The teacher candidate exhibits a commitment to professional ethics and the school’s mission, participates in professional growth opportunities to support student learning, and contributes to the profession. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 9 During the Instruction Phase**** Maintains professional demeanor and behavior.
 |
| **Part II Standard 9** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate shows a **disregard** toward professional ethics or the school’s mission orrarely takes advantage of professional grow opportunities. | **Level 2: Needs Development** The teacher candidate **inconsistently** supports the school’s missionor seldom participants in professional growth opportunities. | **L-3: Proficient**The teacher candidate **demonstrates a commitment** to professional ethics and the school’s mission, participates in professional growth opportunities, and contributes to the profession. | **L-4 Exemplary:**The teacher candidate **continually engages in a high level** of professional growth and application of skills and contributes to the development of others and the well-being of the school. |
| **Instruction- Standard 10: Communication -** The teacher candidate communicates effectively with students, parents or guardians, district and school personnel, and other stakeholders in ways that enhance student learning. | **Evidence***Click here to list evidence used to evaluate this standard.* |
| ***Possible Sources of Evidence for Standard 10 During the Instruction Phase**** Uses verbal and non-verbal communication techniques to foster positive interactions and promote learning in the classroom and school environment.
* Uses precise language, correct vocabulary, and grammar, and appropriate forms of oral and written communication.
* Explains directions, concepts, and lesson content to students in a logical, sequential, and age-appropriate manner.
* In partnership with the classroom teacher, creates a climate of openness for parents, students, and other school professionals by demonstrating a collaborative and approachable style
* Listens and responds with cultural awareness, empathy, and understanding to the voice of students.
* Uses modes of communication that are appropriate for a given situation.
 |
| **Part II****Standard 10** | N/E = No Evidence | **L-1: Ineffective**The teacher candidate **inadequately** communicates with students, parents, or guardians, district and school personnel, or other stakeholders by poorly acknowledging concerns responding to inquiries, or encouraging involvement. | **Level 2: Needs Development** The teacher candidate **inconsistently** communicates with students, parents or guardians, district and school personnel or other stakeholders or communicates in ways that only partially enhance student learning, | **L-3: Proficient**The teacher **candidate communicates** effectively with students, parents or guardians, district and school personnel, and other stakeholders in ways that enhance student learning. | **L-4 Exemplary:**The teacher candidate **uses optimal communication techniques** in a given situation to proactively inform, network, and collaborate with others to enhance student learning. |

**ONCE THIS DOCUMENT IS COMPLETE:**

* **Collaborating Teachers will email the completed Observation Summary Tool to the supervisor**
* **Supervisors will enter results into Chalk and Wire and attached the completed tools as “annotated documents.”**

| Addendum for Secondary Science Teacher Candidates: Ensuring Safe Practices |
| --- |
| **NSTA Standard 4a:** The candidate designs activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction. | **Unsatisfactory (L-1)** Does not responsibly establish and follow procedures for the safe labeling, handling, storage and disposal of chemicals, and other materials. OR MSDS file is not kept, readily available or currently maintained. | **Needs Improvement (L-2)**Establishes and follows procedures for the safe labeling, handling, storage and disposal of chemicals, and other materials.BUT MSDS file is not kept, readily available or currently maintained. | **Approaching (L-3)** Establishes and follows procedures for the safe labeling, handling, storage and disposal of chemicals, and other materials. AND Maintains an up-to-date and readily available MSDS file for all materials used in the classroom. | **Target (L-4)**Establishes and follows procedures for the safe labeling, handling, storage and disposal of chemicals, and other materials. AND Maintains an up-to-date and readily available MSDS file for all materials used in the classroom. AND Stays informed of potential hazards and legal concerns. Communicates them to other teachers to maintain a school environment free of potential |
| **NSTA Standard 4b:** The candidate designs and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students. | **Unsatisfactory (L-1)** Does not responsibly plan, practice or enforce safety procedures in all activities in the classroom. OR Is unaware of actions to take during an emergency and to prevent or report an emergency. OR Fails to appropriately respond to hazardous situations once identified. | **Needs Improvement (L-2)**Plans, practices and enforces safety procedures in all activities in the classroom. **BUT**Is unaware of actions to take during an emergency and to prevent or report an emergency. **OR**Fails to appropriately respond to hazardous situations once identified. | **Approaching (L-3)**Plans, practices and enforces safety procedures in all activities in the classroom. AND Knows actions to take during an emergency and to prevent or report an emergency. AND Appropriately responds hazardous situations once identified. | **Target (L-4)** Consistently plans, practices and enforces safety procedures in all activities in the classroom. AND Demonstrates in the classroom that safety is a priority in science. AND Takes action to prevent hazards and communicates needs and potential problems to administrators. |
| **NSTA Standard 4c:** The candidate Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms. | **Unsatisfactory (L-1)** Does not responsibly attend to, obey or enforce rules for the safe, proper and ethical treatment of animals.  | **Needs Improvement (L-2)**Attends to and obeys rules for the safe, proper and ethical treatment of animals.BUTDoes NOT enforce rules for the safe, proper and ethical treatment of animals.  | **Approaching (L-3)** Attends to, obeys, and enforces rules for the safe, proper and ethical treatment of animals. | **Target (L-4)** Consistently attends to, obeys, and enforces rules for the safe, proper and ethical treatment of animals. AND Discusses reasons for such rules with students. |

1. **Data**

**Assessment 4: Candidate Assessment on Performance Standards (CAPS)**

**Observation Summary Form (OSF) with Safety Addendum**

|  | **Overall Rating for Standard 4** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2015-2016 Cohort (n=12)** | **Target(3.0)** | **Approaching (Met Standard)(2.0)** | **Needs Improvement(1.0)** | **Unsatisfactory(0.0)** |
|  NSTA Standard 4a – **MAT Biol. (n=7)** | 3 | 4 | 0 |  0 | 2.42 | 2-3 |
|  NSTA Standard 4a – **MAT Chem. (n=3)** | 1 | 2 | 0 |  0 | 2.33 | 2-3 |
|  NSTA Standard 4a – **MAT Phys. (n=2)** | 1 | 1 | 0 |  0 | 2.50 | 2-3 |
|  |
|  NSTA Standard 4b – **MAT Biol. (n=7)** | 4 | 3 | 0 |  0 | 2.57 | 2-3 |
|  NSTA Standard 4b – **MAT Chem. (n=3)** | 2 | 1 | 0 |  0 | 2.67 | 2-3 |
|  NSTA Standard 4b – **MAT Phys. (n=2)** | 1 | 1 | 0 |  0 | 2.50 | 2-3 |
|  |
|  NSTA Standard 4c – **MAT Biol. (n=7)** | 4 | 3 | 0 |  0 | 2.57 | 2-3 |
|  NSTA Standard 4c – **MAT Chem. (n=3)** | 0 | 3 | 0 |  0 | 2.00 | 2-2 |
|  NSTA Standard 4c – **MAT Phys. (n=2)** | 0 | 2 | 0 |  0 | 2.00 | 2-2 |

|  | **Overall Rating for Standard 4** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2016-2017 Cohort (n=9)** | **Target(3.0)** | **Approaching (Met Standard)(2.0)** | **Needs Improvement(1.0)** | **Unsatisfactory(0.0)** |
|  NSTA Standard 4a – **MAT Biol. (n=6)** | 1 | 5 | 0 |  0 | 2.17 | 2-3 |
|  NSTA Standard 4a – **MAT Chem. (n=1)** | 1 | 0 | 0 |  0 | 3.00 | 3-3 |
|  NSTA Standard 4a – **MAT Phys. (n=2)** | 2 | 0 | 0 |  0 | 3.00 | 3-3 |
|  |
|  NSTA Standard 4b – **MAT Biol. (n=6)** | 1 | 5 | 0 |  0 | 2.17 | 2-3 |
|  NSTA Standard 4b – **MAT Chem. (n=1)** | 1 | 0 | 0 |  0 | 3.00 | 3-3 |
|  NSTA Standard 4b – **MAT Phys. (n=2)** | 2 | 0 | 0 |  0 | 3.00 |  3-3 |
|  |
|  NSTA Standard 4c – **MAT Biol. (n=6)** | 1 | 5 | 0 |  0 | 2.17 | 2-3 |
|  NSTA Standard 4c – **MAT Chem. (n=1)** | 0 | 1 | 0 |  0 | 2.00 | 2-2 |
|  NSTA Standard 4c – **MAT Phys. (n=2)** | 0 | 2 | 0 |  0 | 2.00 | 2-2 |

1. **Analysis of Data**

Results indicate that 100% of the MAT Biology (n=13), Chemistry (n=4), and Physics (n=4) candidates over the past two years have met or exceeded NSTA Standard 4 for demonstrating and maintaining chemical safety, safety procedures, and the ethical treatment of living organisms needed in the 6-12 science classroom, appropriate to their area of licensure.

1. **Evidence for Meeting the Standard and Impact on Program**

The data show that the MAT programs are able to prepare candidates to maintain a safe science learning environment for the secondary science students with whom they work during the year-long clinical teaching experience. Moreover, despite sub-disciplinary expertise and placements, candidates in each discipline were rated as “meeting” or “exceeding” across all three elements of Standard 4. This is credible because final ratings on the Safety Addendum were not limited to instructional observations, but also included candidate performance on a Lab Safety Plan which involved the design and development of 6-12 classroom science activities for teaching safe science practices (aligned with the three elements of Standard 4) to secondary science students (Assessment 7 lab Safety Plan).

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**Assessment 5: Impact on Student Learning**

1. **Description of Assessment**

In accordance with the *Points of Alignment: edTPA Secondary Science Rubrics and CAEP/NSTA Standards* document posted at [www.nsta.org/preservide](http://www.nsta.org/preservide), the MAT Science program reports candidate edTPA data here, to meet the preponderance of evidence requirement with regard to elements “a” and “c” of Standard 5. Element “b” of Standard 5 is assessed in Assessment 3, Unit Plan (see Table 1 below).

1. **Alignment with NSTA Standards**

According to *Points of Alignment: edTPA Secondary Science Rubrics and CAEP/NSTA Standards*:

For NSTA Standard 5 Impact on Student Learning, edTPA aligns well enough that standard 5 would be met with a preponderance of evidence (5a and 5c have the strongest connections to edTPA) as long as candidate proficiency data (L3) are presented for the rubrics 7, 8, 9, and 11, disaggregated by content certification area. Specifically, candidate edTPA data from rubrics 8 and 11 should be presented for NSTA Standard 5a; candidate edTPA data from rubrics 7, 8, and 9 should be presented for NSTA Standard 5c. Other areas of edTPA do not strongly align to the specific elements of the NSTA standards. edTPA may be used as a secondary source of evidence for other NSTA standards, but it is the responsibility of the institution to make the case for using edTPA as a source of evidence for standards other than NSTA Standard 5. Remember that all standard elements must be assessed a minimum of one time in the 6-8 assessments, and edTPA does not meet Standard 5b.

Educators at the Stanford Center for Assessment, Learning, and Equity (SCALE) developed edTPA, building on the expertise of K-12 teachers and university-based teacher educators. edTPA is informed by the Interstate Teacher Assessment and Support Consortium (InTASC) Standards and the National Board for Professional Teaching Standards (NBPTS).

Table 1: Assessment 5 – Impact on Student Learning – Alignment to NSTA Standards

|  |  |
| --- | --- |
| **NSTA Standard** | **Rubrics** |
| 5a | edTPA Rubric Rows 8 and 11 |
| 5b | Please see Assessment 3 Unit Plan |
| 5c | edTPA Rubric Rows 7, 8, and 9  |

1. **Assessment 5: edTPA Rubrics 7, 8, 9, 11**

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1. **Assessment 5 Scoring Guide**

Candidates must earn a rating of L3 on edTPA Rubrics 7, 8, 9, and 11 to demonstrate proficiency for NSTA Standards 5a and 5c. If a candidate earns edTPA ratings below L3 for any of those four rubrics, subsequent evidence for meeting NSTA 5a or 5b is required of the candidate.

**Rubric for Science Content Course Grades**

|  |  |  |
| --- | --- | --- |
| **Target** | **Acceptable** | **Unacceptable** |
| Candidate earns external reviewer rating of L4 or L5 from edTPA scorer on rubrics aligned with NSTA 5a and 5b. | Candidate earns external reviewer rating of L3 from edTPA scorer on rubrics aligned with NSTA 5a and 5b. | Candidate earns external reviewer rating of L2 or L1 from edTPA scorer on rubrics aligned with NSTA 5a and 5b. |

1. **Assessment 5 Data (see next two pages)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2015-2016 MAT Biology DataN=8** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Biology Candidate 1 | 3 | 3 | 2 | 2 | **2.50** | 2.53 | **38** | **M** |
| MAT Biology Candidate 2 | 3 | 3 | 3 | 3 | **3.00** | 2.87 | **43** | **M** |
| MAT Biology Candidate 3 | 3 | 3 | 3 | 3 | **3.00** | 3.20 | **48** | **M** |
| MAT Biology Candidate 4 | 3 | 3 | 3 | 4 | **3.25** | 3.27 | **49** | **M** |
| MAT Biology Candidate 5 | 4 | 4 | 3 | 3 | **3.50** | 3.47 | **52** | **M** |
| MAT Biology Candidate 6 | 3 | 4 | 3 | 4 | **3.50** | 3.67 | **55** | **M** |
| MAT Biology Candidate 7 | 3 | 3 | 3 | 4 | **3.25** | 3.67 | **55** | **M** |
| MAT Biology Candidate 8 | 4 | 4 | 4 | 4 | **4.00** | 3.87 | **58** | **M** |
| **MODE** | **3** | **3** | **3** | **4** | **Percentage passed: 100%** |
| **Rubric Mean** | **3.3** | **3.4** | **3.0** | **3.4** |
| **% Proficient** | **100%** | **100%** | **88%** | **88%** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2015-2016 MAT Chemistry DataN=3** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Chemistry Candidate 1 | 4 | 3 | 3 | 4 | **3.50** | 3.33 | **50** | **M** |
| MAT Chemistry Candidate 2 | 3 | 3 | 3 | 3 | **3.00** | 3.33 | **50** | **M** |
| MAT Chemistry Candidate 3 | 4 | 3 | 4 | 4 | **3.75** | 3.87 | **58** | **M** |
| **MODE** | **4** | **3** | **4** | **4** | **Percentage passed: 100%** |
| **Rubric Mean** | **3.7** | **3.0** | **3.3** | **3.7** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2015-2016 MAT Physics DataN=2** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Physics Candidate 1 | 4 | 4 | 3 | 4 | **3.75** | 3.20 | **48** | **M** |
| MAT Physics Candidate 2 | 4 | 4 | 3 | 3 | **3.50** | 3.67 | **55** | **M** |
| **MODE** | **4** | **4** | **3** | **3, 4** | **Percentage passed: 100%** |
| **Rubric Mean** | **4.0** | **4.0** | **3.0** | **3.5** |
| **% Proficient** | **100%** | **100%** | **100%** | **100%** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2016-2017 MAT Biology DataN=6** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Biology Candidate 1 | 2 | 2 | 2 | 2 | **2.00** | 1.93 | **29** | **B** |
| MAT Biology Candidate 2 | 4 | 4 | 3 | 4 | **3.75** | 3.67 | **55** | **M** |
| MAT Biology Candidate 3 | 3 | 3 | 4 | 4 | **3.50** | 3.27 | **49** | **M** |
| MAT Biology Candidate 4 | 4 | 3 | 3 | 1 | **2.75** | 2.87 | **43** | **M** |
| MAT Biology Candidate 5 | 4 | 3 | 4 | 4 | **3.75** | 3.67 | **55** | **M** |
| MAT Biology Candidate 6 | 3 | 3 | 3 | 3.5 | **3.12** | 3.07 | **46** | **M** |
| **MODE** | **4** | **3** | **3** | **4** | **Percentage passed: 83%** |
| **Rubric Mean** | **3.3** | **3.0** | **3.2** | **3.1** |
| **% Proficient** | **83%** | **83%** | **83%** | **67%** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2016-2017MAT Chemistry DataN=1** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Chemistry Candidate 1 | 3 | 4 | 4 | 3 | **3.50** | 3.00 | **45** | **M** |
| **MODE** | **3** | **4** | **4** | **3** | **Percentage passed: 100%** |
| **Rubric Mean** | **3.0** | **4.0** | **4.0** | **3.0** |
| **% Proficient** | **100%** | **100%** | **100%** | **100%** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **AY 2016-2017MAT Physics DataN=2** | **Rubric 7 Engaging Students in Learning** | **Rubric 8 Deepening Student Learning** | **Rubric 9 Subject-Specific Pedagogy** | **Rubric 11 Analysis of Student Learning** | **Candidate Average NSTA Related Rubrics** | **Overall****edTPACandidate Average** | **Overall Total Score** | **Meets (M) ≥38****Below(B) <38** |
| MAT Physics Candidate 1 | 4 | 4 | 4 | 3 | **3.75** | 3.40 | **51** | **M** |
| MAT Physics Candidate 2 | 4 | 4 | 4 | 3 | **3.75** | 3.33 | **50** | **M** |
| **MODE** | **4** | **4** | **4** | **3** | **Percentage passed: 100%** |
| **Rubric Mean** | **4.0** | **4.0** | **4.0** | **3.0** |
| **% Proficient** | **100%** | **100%** | **100%** | **100%** |

**F. Analysis of Data**

Candidate proficiency for meeting NSTA Standard 5a is assessed via edTPA Rubric rows 8 and 11. Regarding edTPA Rubric 8 (Deepening Student Learning) all candidates in the 2015-2016 cohort earned a Level 3 (proficient, standard met) rating, or a higher rating, with rubric means of 3.4 for biology candidates, 3.0 for chemistry candidates, and 4.0 for physics candidates. On edTPA Rubric 11 (Analysis of Student Learning) one candidate earned a rating of L2, while the other 12 candidates in the 2015-2016 cohort earned a Level 3 (proficient, standard met) rating, or higher, with rubric means of 3.4 for biology candidates, 3.7 for chemistry candidates, and 3.5 for physics candidates.

Candidate proficiency for meeting NSTA Standard 5c is assessed via edTPA Rubric rows 7, 8, and 9. Regarding edTPA Rubric 7 (Engaging Students in Learning) one candidate earned a rating of L2, while the other eight candidates in the 2016-2017 cohort earned a Level 3 (proficient, standard met) rating, or higher, with rubric means of 3.3 for biology candidates, 3.0 for chemistry candidates, and 4.0 for physics candidates. On edTPA Rubric 9 (Subject-Specific Pedagogy) one candidate earned a rating of L2, while the other eight candidates in the 2016-2017 cohort earned a Level 3 (proficient, standard met) rating, or higher, with rubric means of 3.2 for biology candidates, 4.0 for chemistry candidates, and 4.0 for physics candidates.

Candidate proficiency for meeting NSTA Standard 5b is assessed in the Unit Plan, Assessment 3.

1. **Evidence for Meeting the Standard and Impact on Program**

Summative evidence relative to NSTA Standard 5a is seen in the fact that 100% of the candidates in the 2015-2016 cohort demonstrated proficiency for edTPA Rubric 8, as did 100% of the chemistry and physics candidates of the 2016-2017 cohort. For edTPA Rubric 11, also in alignment with NSTA Standard 5a, 100% of the physics and chemistry candidates demonstrated proficiency in the last two applications of this assessment. The proficiency percentage among biology candidates for edTPA Rubric 11 was 67% among the 2016-2017 cohort and 88% among the 2015-2016 cohort. In each of the past two applications of the edTPA assessment, one biology candidate required post-edTPA remedial mentoring for demonstration of meeting NSTA Standard 5a.

Summative evidence relative to NSTA Standard 5c relates to edTPA Rubric 8 (detailed above) and edTPA Rubrics 7 and 9. 100% of the candidates in the 2015-2016 cohort demonstrated proficiency for edTPA Rubric 7, as did 100% of the chemistry and physics candidates of the 2016-2017 cohort. For edTPA Rubric 9, also in alignment with NSTA Standard 5c, 100% of the physics and chemistry candidates demonstrated proficiency in the two most recent applications of this assessment. The proficiency percentage among biology candidates for edTPA Rubric 7 was 83% among the 2016-2017 cohort and 83% among the 2015-2016 cohort. In each of the past two applications of the edTPA assessment, one biology candidate required post-edTPA remedial mentoring for demonstration of meeting NSTA Standard 5c.

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**Assessment 6: Professional Knowledge and Skills Reflection**

1. **Description of Assessment**

Candidates’ professional knowledge and skills within their science discipline and science education are assessed via the *Professional Knowledge and Skills Reflection*. This is a candidate-written reflection, with supporting evidence, of professional activities congruent with NSTA Standard 6 during their time in the MAT Science program. Candidates write an initial draft during the first semester (Fall) of the year-long clinical experience (BED/CHED/PHED 6650) and complete their final draft of this reflection during their final semester (Spring) of the year-long clinical experience (BED/CHED/PHED 6660).

1. **Alignment with NSTA Standards**

As indicated by the rubric, NSTA Standard 6a and 6b are assessed via Assessment 6. As with all other NSTA Standards assessed in our program assessments, our Assessment 6 rubric contains discernible criteria that gauge candidates' performance with each element of the standard. Assessment 6 and all assessment rubrics contain qualitative analytic criteria using operational terms, with individual elements of the NSTA Standard assessed separately. This allows us to make credible claims of candidate proficiency relative to the six NSTA Standards and their 18 elements.

This assessment aligns to the NSTA Standard 6: Professional Knowledge and Skills through an analysis of candidates’ reported evidence of their engagement in professional development opportunities in their science discipline (6a) and in the field of science education (6b). Candidates’ overall rating for *exceeding*, *meeting*, or *not meeting* each element of Standard 6 is based on the candidate’s written description of engagement in professional development activities and their application of these activities to 6-12 student learning, as well as the analysis and self-awareness with regard to reflection on professional growth.

1. **Assessment 6: Candidate Directions

Assessment 6: Professional Knowledge and Skills Reflection**

As NSTA Standard 6 states, effective teachers of science strive continuously to improve their knowledge and understanding of the ever-changing knowledge base of both science content and pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.

**DIRECTIONS:**

To complete this assignment, you should participate in at least one DISCIPLINARY SCIENCE-based professional development opportunity (see list 6a below for examples), and at least one PEDAGOGY-based professional development opportunity (see 6b below for examples). You will find it worthwhile to attend/volunteer/participate in more than one experience from both lists, both to give you a chance to gain knowledge and skill and to give you some choices for this assignment. However, you need only write a reflection for two experiences.

Spend time throughout your program investigating opportunities to learn and participate in science and science education. The choices below are suggestions; if you encounter another opportunity that fits either science content knowledge or science education knowledge, contact your advisor to find out if it qualifies for this assignment. **For one science content experience (e.g., list 6a) AND one science education experience (e.g., list 6b), you will write a reflection on the extent to which the experience has informed your understanding of science, of teaching, and of meeting the needs of learners.** Pay special attention to how this experience could inform your understanding of addressing inequities and inclusion for students in science.

Pre-service teacher candidates will:

6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.

 **To fulfill this standard, pre-service teacher candidates can:**

1. Attend 2 departmental seminars or presentations at a discipline specific meeting in their content field (ACS, ASBMB, MSB, EEOB etc.) and write a 1 page reflection on each presentation based on the content.
2. Help co-organize and preside over a symposium at a professional conference and write a reflection on the experience as a professional in the content field.
3. M.A.T. candidates with lab-based content research experience can submit evidence of this experience in the form of a summary of experience covering areas above and/or poster or research papers presented at conferences.
4. Participate in content area community service projects (e.g., school-based science night, community garden, volunteering at a non-formal science education venue (zoo, aquarium, etc.)) and write a 1-page reflection on the experience.

6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community and reflect on how it can impact your practice.

1. Attend 2 science education seminars or presentations at a science education meeting in their content field (BCCE, AAPT, NSTA, etc.) and write a 1 page reflection on each presentation on how the information can be implemented in their classroom.
2. Participate in a workshop at a science education conference (e.g. NSTA, BCCE, ChemEd, AAPT, NABT) and write a 1-page reflection\* on how the information can be implemented in their classroom.
3. Participate in a Discipline Based Education Research project with one of the Science Education faculty in their content field for at least 1 semester. A research report should be prepared at the end of the semester summarizing your role in the research, methodology, and significant findings.
4. Participate in science education community service projects and write a 1 page reflection on your experience. This could include Lego League Competitions, Science Olympiad, Science Bowl, etc.
5. **Assessment 6 Scoring Guide**

|  |
| --- |
| **Assessment 6:****Professional Knowledge and Skills Reflection Rubric** |
| **Criteria** | **Advanced****(10)** | **Proficient** **(7)** | **Emerging** **(4)** | **Needs Improvement** **(1)** |
| **Analysis & Self-awareness** | The reflection moves beyond simple description of the learning experience to an analysis of how the experience contributed to understanding of content/classroom practice. Clear, detailed examples are provided, as applicable. | The reflection demonstrates attempts to analyze the learning experience but analysis lacks depth of how the learning experience contributed to understanding of content/ classroom practice. Supporting details and concrete evidence from the experience are relevant, but a few connections are unsupported. | The reflection attempts at applying the learning experience to understanding of content/classroom practice but does not demonstrate depth of analysis. Supporting details and concrete evidence from the experience are relevant, but several connections are unsupported. | Reflection does not move beyond description of the learning experience. Supporting details and concrete evidence from the experience show no connections or not related to the experience. |
| **Application to Student Learning** | Reflection includes a clear and detailed explanation that moves beyond simply how the experience will help to address inequalities and inclusion for all students in science by connecting to research and theory.  | Reflection includes a clear and detailed explanation as to how the experience will help to address inequalities and inclusion for all students in science. | Reflection includes an explanation addressing inequalities and inclusion for all students in science, but the connection to the experience is unclear. | Reflection does not include an explanation as to how the experience will help to address inequalities and inclusion for all students in science. |
| **Required Components** | Response includes all components and meets or exceeds all requirements indicated in the instructions. All attachments and/or additional documents are included, as required. | Response includes all components and meets all requirements indicated in the instructions. All attachments and/or additional documents are included, as required. | Response is missing some components and/or does not fully meet the requirements indicated in the instructions. Some attachments and additional documents are missing or unsuitable for the purpose of the assignment. | Response excludes essential components and/or does not address the requirements indicated in the instructions.  |
| **Style:****Clarity &****Accuracy** | The language is clear and expressive. Explanation makes sense to an uninformed reader. | Minor, infrequent lapses in clarity and accuracy.Explanation mostly makes sense to a reader. | There are lapses in clarity and accuracy. Explanation creates many questions. | Language is unclear and confusing throughout.Concepts are neither discussed nor presented accurately. |
| **Grammar &****Spelling:****Conventions** | Writer makes no errors in grammar or spelling that distract the reader from the content. | Writer makes a couple errors in grammar or spelling that do not distract the reader from the content. | Writer makes a few errors in grammar or spelling that tend to distract the reader from the content. | Writer makes many errors in grammar or spelling that distract the reader from the content. |

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| --- |
| **Overall Rating for Meeting Standard** |
|  | **Exceeding** | **Met** | **Developing** |
| **Science** **Element 6a** | Candidate provides convincing and conclusive evidence that candidates engage in leadership opportunities through professional talks, symposiums, research opportunities, and projects within their science field and community. | Candidate provides clear evidence of engagement in professional development opportunities in content field, including but not limited to symposiums, talks, research in content field, or projects within their community, NSTA Learning Center, etc. | Candidate provides insufficient evidence that candidates participate in professional development opportunities in their science field.  |
| **Science Education** **Element 6b** | Candidate provides convincing and conclusive evidence that candidates engage in leadership opportunities through conferences, research opportunities or projects within the science education community. | Candidate provides clear evidence of engagement in professional development opportunities relating to science teaching, including but not limited to conferences, research opportunities, community projects, NSTA Learning Center, etc. | Candidate provides insufficient evidence candidates participate in professional development opportunities within the science education  |

1. **Data**

**Assessment 6: Professional Knowledge and Skills Reflection**

|  | **Overall Rating for Standard 6** | **MeanScore** | **Range** |
| --- | --- | --- | --- |
| **2015-2016 Cohort (n=12)** | **Exceeding(3.0)** | **Met(2.0)** | **Not Met(1.0)** |
|  NSTA Standard 6a – **MAT Biology (n=7)** | 4 | 3 |  0 | 2.57 | 2-3 |
|  NSTA Standard 6a – **MAT Chemistry (n=3)** | 2 | 1 |  0 | 2.67 | 2-3 |
|  NSTA Standard 6a – **MAT Physics (n=2)** | 1 | 1 |  0 | 2.50 | 2-3 |
|  NSTA Standard 6b – **MAT Biology (n=7)** | 1 | 6 |  0 | 2.14 | 2-3 |
|  NSTA Standard 6b – **MAT Chemistry (n=3)** | 1 | 2 |  0 | 2.33 | 2-3 |
|  NSTA Standard 6b – **MAT Physics (n=2)** | 0 | 2 |  0 | 2.00 | 2-2 |

|  | **Overall Rating for Standard 6** | **Mean Score** | **Range** |
| --- | --- | --- | --- |
| **2016-2017 Cohort (n=9)** | **Exceeding(3.0)** | **Met(2.0)** | **Not Met(1.0)** |
|  NSTA Standard 6a – **MAT Biology (n=6)** | 3 | 3 |  0 | 2.50 | 2-3 |
|  NSTA Standard 6a – **MAT Chemistry (n=1)** | 0 | 1 |  0 | 2.00 | 2-2 |
|  NSTA Standard 6a – **MAT Physics (n=2)** | 1 | 1 |  0 | 2.50 | 2-3 |
|  NSTA Standard 6b – **MAT Biology (n=6)** | 1 | 5 |  0 | 2.12 | 2-3 |
|  NSTA Standard 6b – **MAT Chemistry (n=1)** | 0 | 1 |  0 | 2.00 | 2-2 |
|  NSTA Standard 6b – **MAT Physics (n=2)** | 0 | 2 |  0 | 2.00 | 2-2 |

1. **Analysis of Data**

Results indicate that 100% of the graduate (MAT) candidates in biology (n=13), chemistry (n=4), and physics (n=4) over the past two years have achieved the “met” or “exceeding” performance level for science-specific and science education-specific professionalism. Due to the low number of candidates in each content area, it is not possible to make discipline-specific inferences about these data. The descriptive statistics of mean and range and the tallying of candidate ratings do not present patterns of performance difference relative to the two elements of Standard 6 for both applications of the assessment.

1. **Evidence for Meeting the Standard and Impact on Program**

The *Professional Knowledge and Skills Reflection* assessment provides evidence supporting our claim that all candidates have met both elements of Standard 6. The placement of this assessment in both the fall semester (initial draft) and the spring semester (final reflection) of the candidates’ year-long clinical experience has influenced program instructors to discuss and promote individualized professional development activities targeting both the scientific and educational dimensions of candidate growth. However, program faculty have started to recognize that the assessment directions are overly prescribed and perhaps too narrow in scope, in that we suggest specific professional development activities instead of guiding an individualized process of setting professional goals that might be met via specific professional development actions. Moving forward, we are considering a new synthesis of the rubric by elaborating more fully on different dimensions of standard 6a and 6b within a *professional knowledge and skills* reflection format that supports candidates in choosing professional development activities that serve the goals that are authored by and of deep personal value to each candidate. This is an important next step for ensuring that Assessment 6 is not merely an academic exercise, but rather, an educative experience that will equip each candidate to continue aligning goals with actions for growth in the science and science-education dimensions of professionalism in the induction-phase.