

**1. A brief description of the assessment and its use in the program**Assessment Administration:

This project/report is assigned during one of the candidate's major classes that require a research project (please see table below). The content instructor administers and grades the formal report. The Science Education instructor is responsible for obtaining the grade from the content instructor for archiving the data.

Assessment Description:

All candidates are required to conduct an original research project. The research is a topic of their choice, approved by the science content instructor. They must research the topic, design an experiment based on their research and yet unique, conduct the experiment, run appropriate instrumentation (technology) to collect data, analyze the data (including charts and graphs), and make conclusions on their report.

This assessment is an evaluation of candidate's ability to demonstrate through a report that they can conduct scientific research. Faculty members that teach research methods/projects have agreed to use this as an assessment tool for the following courses required in the major for the following fields of licensure:

| Field of Licensure | Required Course(s) in Major requiring a Research Project |
|--------------------|----------------------------------------------------------|
| Biology            | BIO 211, Genetics                                        |
| Chemistry          | CHEM 251, Quantitative Analysis                          |
| Earth/Space        | GEOL 315, Environmental Geology                          |
| General Science    | INPHYS 201, Phenomenal Physics                           |
| Physics            | PHYS 260, Electronics                                    |

The candidate must pass this assessment with a C or better in order to pass the above course in their major. The following chart is used to assign letter grades:

|        |       |       |       |       |       |       |     |
|--------|-------|-------|-------|-------|-------|-------|-----|
| A      | AB    | B     | BC    | C     | CD    | D     | F   |
| 93-100 | 88-92 | 83-87 | 78-82 | 73-77 | 68-72 | 63-67 | <63 |

**2. A description of how this assessment specifically aligns with the standards**

This assessment specifically addresses Standard 1d: candidates understand research and can successfully design, conduct, report, evaluate investigations in science. This assessment also demonstrates candidates' knowledge of 1e: can understand and successfully use mathematics to process and report data and solve problems in their fields of licensures and 5d: can successfully use technological tools, including but not limited to computer technology to access resources, collect and process data, and facilitate the learning of science.

**3. A brief analysis of the data findings**

The results of the assessment for the five program certification areas indicate students can conduct independent research. The average grade for the completers was BC. Although the grades do not appear to be high, the content majors are challenging and a C represents an average grade. The education candidates are in the same classes as the content majors, there is no distinction and in most cases, the instructors do not know which students are education candidates. There has been a slight increase in grades since the original 2006 NCATE submission. This is due to better communication between the candidates, the Secondary Science educator, and the Science faculty.

**4. An interpretation of how that data provides evidence for meeting standards**

All candidates were successful on the assessment, although grades are not high. The report rubric is a direct reflection of the research and notebooks that the candidates complete. The candidates were able to define a relevant scientific problem, design an experiment, carry out that experiment with highly technological instrumentation, record and analyze data, and make pertinent conclusions. Better communication between the Science Education coordinator and the various content majors would insure that candidates understand the connection between their research and their future teaching careers requiring their ability to teach inquiry.

## 5. Assessment Documentation

### Attachment A: Assessment Tool

#### Assignment

#### Scientific Research Project/Report

During the semester you will be responsible for conducting and reporting on a research topic of your choice. Use the Scoring Rubric below as a guideline for your report on your research project. Deadlines will be given for:

- Approved topic
- Annotated references (minimum of 5 scientific articles)
- Experimental design
- Timeline for conducting the experiment
- Formal lab report

### Attachment B: Scoring rubric

|                     |                                                                                                 |
|---------------------|-------------------------------------------------------------------------------------------------|
| <b>Unacceptable</b> | Content faculty members decided that anything less than acceptable would receive no points      |
| <b>Acceptable</b>   | Faculty members have agreed as to the acceptable range of each of the components in the rubric  |
| <b>Exceptional</b>  | Candidate has demonstrated initiative and gone above the acceptable requirements for the report |

**Scores are awarded for each category and then totaled at the end of the scoring rubric**

| Category | Unacceptable                                                   | Acceptable                                                                                            | Exceptional                                                                                                                                                            | Score Points Awarded |
|----------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Title    | No title page<br>Does not reflect the contents of the research | Reflects the emphasis and contents of the research<br>Two line maximum<br>Author's name, course, date | Clearly reflects the emphasis and contents of the research<br>Entices the reader to continue reading<br>Two line maximum, 14 point font<br>Author's name, course, date |                      |
|          | <b>Points: 0</b>                                               | <b>Points: 1-3</b>                                                                                    | <b>Points: 4-5</b>                                                                                                                                                     |                      |

**NSTA/NCATE Science**      **Assessment #7**  
**Scientific Research Project/Report**

| <b>Category</b>      | <b>Unacceptable</b>                                                                                                                                    | <b>Acceptable</b>                                                                                                                                                                                             | <b>Exceptional</b>                                                                                                                                                                                                                                                                                               | <b>Score Points Awarded</b> |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Generic Style Issues | Appearance sloppy<br>Single-spaced, hard to read font<br>No page numbers<br>Many grammatical errors<br>Many spelling errors<br>Often uses first person | Overall pleasing appearance<br>Report demonstrates uniformity of style<br>Double-spaced, 12 point font, easy to read<br>Pages numbered<br>Grammar and spelling—very few errors<br>Written in the third person | Exceptional appearance<br>Double-spaced, 12 point font<br>No grammatical or spelling errors<br>Written in the third person                                                                                                                                                                                       |                             |
| Abstract             | <b>Points: 0</b><br>Only one to two sentences given presenting an incomplete picture                                                                   | <b>Points: 1-5</b><br>One paragraph summary<br>Written in the present tense                                                                                                                                   | <b>Points: 6-10</b><br>One paragraph summary—the first one to three sentences briefly introduce the reader to the problem. Next the approach, major results, significance of the findings presented.<br>All abbreviations are written out and/or defined<br>References included                                  |                             |
| Introduction         | <b>Points: 0</b><br>Poor presentation of the problem<br>Does not explain why the experiment was conducted<br>No explanation of the experimental        | <b>Points: 1-5</b><br>Presents the scientific problem<br>States why the experiment was conducted<br>How the experiment was designed                                                                           | <b>Points: 6-10</b><br>Clearly present the scientific problem<br>Clear explanation of the importance of the experiment<br>States the goals of the experiment<br>Clear, concise explanation of the experimental design<br>Relevant literature incorporated to help the reader understand the context of the study |                             |

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| Category              | Unacceptable                                                            | Acceptable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Exceptional                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Score Points Awarded |
|-----------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                       | design                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Starts with the most general topic and progressively moves towards the specific<br>In this section, consider including figures, schemes and equations that complement the text.                                                                                                                                                                                                                                                                                     |                      |
| Experimental (1d, 5d) | <b>Points: 0</b><br>Procedure is numbered steps<br>Incomplete sentences | <b>Points: 1-5</b><br>a logical, coherent recount of the experiment(s) conducted<br>complete enough for a trained scientist to pick up this report and replicate the experiment<br>concise summary of the corresponding section in the laboratory notebook<br>All instruments and equipment specified including the model number of the instrument and the name of the manufacture<br>Laboratory textbooks referenced for common techniques<br>Syntheses of substances are reported, the synthetic procedure used to make each substance is described in its own separate paragraph, the mass and percent yields are reported, new compound's characteristics are included at the end of the paragraph describing its synthesis: melting point range (and literature value, if known), elemental analysis (both calculated and found), selected peaks from the mass spectrum (with assignments), selected IR peaks (also with assignments), and any NMR peaks with their chemical shift, multiplicity and | <b>Points: 6-10</b><br>In addition to the acceptable criteria, Includes key chemicals used in the procedure (statements to the effect that they were used as received, chemical supplier's name and the substance's purity noted, synthesized material referenced to literature procedures, purification or drying of compounds noted<br>Spectroscopic or physical methods are described in their own subsection<br>Modified common procedures noted and referenced |                      |

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| Category                                         | Unacceptable                                                    | Acceptable                                                                                                                                                                                                                                                                                                                                                                     | Exceptional                                                                                                                                                                                                                                                                                                                                     | Score Points Awarded |
|--------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                                                  | <b>Points: 0</b><br>Presents raw data, not summarized           | integration<br><b>Points: 1-5</b><br>Results are presented and summarized in a reader-friendly form                                                                                                                                                                                                                                                                            | <b>Points: 6-10</b><br>Results are presented and summarized clearly, accurately, and reader-friendly<br>Figures, schemes and equations that complement the text are included<br>Reports comparable literature values for the properties obtained and/or calculated<br>Observation of trends in the numerical data is noted                      |                      |
| Results—Tables/<br>Schemes/Equations<br>(1d, 1e) | <b>Points: 0</b><br>No data tables<br>No calculations explained | <b>Points: 1-5</b><br>Calculations clearly explained<br>Data summarized in an organized, grid fashion<br>Columns and Rows clearly labeled<br>Units included in column headings<br>Tables make the data interpretable and understandable<br>Data expressed with proper amount of significant figures<br>Schemes (series of reactions or equations) are correct, clear, relevant | <b>Points: 6-10</b><br>All of the items in the “acceptable”<br>Data not only has the proper amount of significant figures but also includes standard deviations<br>Provides the maximum amount of information with the minimum amount of work<br>Schemes are well defined, relevant, properly presented<br>Every scheme/equations has a caption |                      |
| Results –<br>Figures/Graphs<br>(1d)              | <b>Points: 0</b><br>Do not represent data<br>Improperly labeled | <b>Points: 1-5</b><br>Presented in the paper as a Figure<br>Proper title<br>Abscissa and Ordinate axes correctly labeled with units                                                                                                                                                                                                                                            | <b>Points: 6-10</b><br>Professional appearance, all axes labeled properly with explicit titles<br>Excellent visualization of the data<br>Figures are clear, concise, and readable                                                                                                                                                               |                      |

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| Category           | Unacceptable                                                                                                           | Acceptable                                                                                                                                                                                                                                                                                                                                                                                                                                           | Exceptional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Score Points Awarded |
|--------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                    | <b>Points: 0</b><br><br>Data does not support the result<br>No statistical analysis<br>No mention of systematic errors | Figures are clear, concise, and readable<br><br><b>Points: 1-5</b>                                                                                                                                                                                                                                                                                                                                                                                   | and support the arguments in the Discussion<br><br><b>Points: 6-10</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |
| Discussion<br>(1d) | Data does not support the result<br>No statistical analysis<br>No mention of systematic errors                         | Good interpretation of the results<br>Data's reliability is convincing<br>Data is evaluated<br>Results compared to literature values or other precedents<br>Includes statistical analysis of results<br>Explanation of the results that should have been obtained and whether or not these results were obtained<br>Notes systematic errors<br>Clearly states how the results of the experiment helps in the understanding of the scientific problem | Excellent interpretation of the results<br>Honest evaluation of data<br>Honest evaluation of results<br>When expected results were not obtained, an explanation of why<br>Uses and evaluates the statistical analysis to support claims<br>Clearly states how the results of the experiment adds to the contextual understanding of science<br>Ties the results to the concepts outlined in the introduction<br>Logical argument and supporting evidence of the value of the study<br><br><b>Points: 6-10</b> |                      |
| Conclusion<br>(1d) | Summary does not address the goals of the experiment<br>Goals were not achieved<br>No importance given to the study    | Clear summary of the laboratory report:<br>summary of the goals of the experiment, statement of whether the goals were achieved, description of the implication of the study<br><br><b>Points: 1-5</b>                                                                                                                                                                                                                                               | Clear, concise summary of the laboratory report: summary of the goals of the experiment, statement of the goals achieved and/or not achieved, importance of the study, possible follow-up experiments that could be done<br><br><b>Points: 6-10</b>                                                                                                                                                                                                                                                           |                      |

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| Category            | Unacceptable            | Acceptable                                                                                                                    | Exceptional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Score Points Awarded |
|---------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| References          | Insufficient references | Other people's work properly cited<br>Compilation of all citations made within the paper<br>Correct format for field of study | Properly cited references<br>Correct format for field of study<br>References compiled at the end of the paper in the <i>References</i> section.<br>References numbered in the order that they appear in the paper. For citations in the narrative, numbers superscripted and appear after the punctuation mark.<br>No empty lines inserted between reference entries.<br>This section should be double spaced<br>A reference is only listed <u>once</u> in the<br>References section--multiple citations of the reference in the report are correspondingly numbered in the report. Common abbreviations used in footnotes and references (e. g., <i>op. cit.</i> , <i>ibid.</i> ) are not used in scientific writing. |                      |
|                     | <b>Points: 0</b>        | <b>Points: 1-3</b>                                                                                                            | <b>Points: 4-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |
| <b>Total Points</b> |                         |                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |

The following chart is used to assign letter grades:

|        |       |       |       |       |       |       |     |
|--------|-------|-------|-------|-------|-------|-------|-----|
| A      | AB    | B     | BC    | C     | CD    | D     | F   |
| 93-100 | 88-92 | 83-87 | 78-82 | 73-77 | 68-72 | 63-67 | <63 |

**Attachment C: Candidate Data**

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**2005-2006**

| Category                                          | Candidate #1<br>Biology | Candidate #2<br>Biology | Candidate #3<br>Chemistry | Candidate #4<br>General Science |
|---------------------------------------------------|-------------------------|-------------------------|---------------------------|---------------------------------|
| Title                                             | 5                       | 5                       | 5                         | 5                               |
| Generic Style Issues                              | 9                       | 7                       | 8                         | 8                               |
| Abstract                                          | 8                       | 8                       | 8                         | 8                               |
| Introduction                                      | 7                       | 7                       | 7                         | 7                               |
| Experimental (1d, 5d)                             | 8                       | 8                       | 7                         | 7                               |
| Results—General (1d)                              | 8                       | 7                       | 7                         | 7                               |
| Results—<br>Tables/<br>Schemes/Equations (1d, 1e) | 7                       | 7                       | 7                         | 7                               |
| Results –<br>Figures/Graphs (1d)                  | 8                       | 8                       | 8                         | 8                               |
| Discussion (1d)                                   | 9                       | 8                       | 8                         | 8                               |
| Conclusion (1d)                                   | 8                       | 9                       | 8                         | 8                               |
| References                                        | 4                       | 4                       | 3                         | 3                               |
| <b>Total Points</b>                               | <b>81</b>               | <b>78</b>               | <b>76</b>                 | <b>76</b>                       |

**2006-2007**

| Category              | Candidate #1<br>General Science | Candidate #2<br>General Science |
|-----------------------|---------------------------------|---------------------------------|
| Title                 | 5                               | 5                               |
| Generic Style Issues  | 8                               | 9                               |
| Abstract              | 8                               | 8                               |
| Introduction          | 7                               | 7                               |
| Experimental (1d, 5d) | 9                               | 8                               |
| Results—General (1d)  | 8                               | 7                               |
| Results—<br>Tables/   | 7                               | 7                               |

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|                                  |           |           |
|----------------------------------|-----------|-----------|
| Schemes/Equations (1d, 1e)       |           |           |
| Results –<br>Figures/Graphs (1d) | 8         | 8         |
| Discussion (1d)                  | 8         | 8         |
| Conclusion (1d)                  | 8         | 8         |
| References                       | 4         | 3         |
| <b>Total Points</b>              | <b>80</b> | <b>78</b> |

**2007-2008**

| <b>Category</b>                                   | <b>Candidate #1<br/>General Science</b> | <b>Candidate #2<br/>General Science</b> |
|---------------------------------------------------|-----------------------------------------|-----------------------------------------|
| Title                                             | 5                                       | 5                                       |
| Generic Style Issues                              | 9                                       | 8                                       |
| Abstract                                          | 8                                       | 8                                       |
| Introduction                                      | 7                                       | 7                                       |
| Experimental (1d, 5d)                             | 8                                       | 9                                       |
| Results—General (1d)                              | 7                                       | 8                                       |
| Results—<br>Tables/<br>Schemes/Equations (1d, 1e) | 7                                       | 7                                       |
| Results –<br>Figures/Graphs (1d)                  | 8                                       | 8                                       |
| Discussion (1d)                                   | 8                                       | 8                                       |
| Conclusion (1d)                                   | 8                                       | 8                                       |
| References                                        | 4                                       | 4                                       |
| <b>Total Points</b>                               | <b>79</b>                               | <b>80</b>                               |

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**2008-2009**

| <b>Category</b>                                   | <b>Candidate #1<br/>General Science</b> | <b>Candidate #2<br/>Biology</b> | <b>Candidate #3<br/>Earth/Space</b> |
|---------------------------------------------------|-----------------------------------------|---------------------------------|-------------------------------------|
| Title                                             | 5                                       | 5                               | 5                                   |
| Generic Style Issues                              | 9                                       | 9                               | 9                                   |
| Abstract                                          | 8                                       | 9                               | 9                                   |
| Introduction                                      | 7                                       | 8                               | 8                                   |
| Experimental (1d, 5d)                             | 8                                       | 9                               | 9                                   |
| Results—General (1d)                              | 7                                       | 8                               | 8                                   |
| Results—<br>Tables/<br>Schemes/Equations (1d, 1e) | 7                                       | 7                               | 8                                   |
| Results –<br>Figures/Graphs (1d)                  | 8                                       | 8                               | 9                                   |
| Discussion (1d)                                   | 8                                       | 8                               | 8                                   |
| Conclusion (1d)                                   | 8                                       | 8                               | 8                                   |
| References                                        | 4                                       | 4                               | 5                                   |
| <b>Total Points</b>                               | <b>79</b>                               | <b>83</b>                       | <b>86</b>                           |