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

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 in Major requiring a Research Project
Biology	Biology 457 Research Methods: Ecology OR Biology 458 Research Methods: Physiology
Chemistry	Chemistry 255 Quantitative Analysis Lab
Earth/Space	Geology 315 Environmental Geology
General Science	Physics 201 Phenomenal Science
Physical Science	Chemistry 255 Quantitative Analysis Lab

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 four program completers was two received C's and two received BC's. The breakdown was as follows: the two C's were in Biology and General Science, the two BC's were Chemistry and Biology. 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 majors, there is no distinction and in most cases, the instructors does not know that the education candidates from the major students.

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

All candidates were successful on the assessment, albeit 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.

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

Unacceptable	Content faculty members decided that anything less than acceptable would receive no points
Acceptable	Faculty members have agreed as to the acceptable range of each of the components in the rubric
Exceptional	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 Does not reflect the contents of the research **Points: 0**	Reflects the emphasis and contents of the research Two line maximum Author's name, course, date **Points: 1-3**	Clearly reflects the emphasis and contents of the research Entices the reader to continue reading Two line maximum, 14 point font Author's name, course, date **Points: 4-5**	

NSTA/NCATE Science **Assessment #7**

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

Category	Unacceptable	Acceptable	Exceptional	Score Points Awarded
	design **Points: 0**	**Points: 1-5**	Starts with the most general topic and progressively moves towards the specific In this section, consider including figures, schemes and equations that complement the text. **Points: 6-10**	
Experimental (1d, 5d)	Procedure is numbered steps Incomplete sentences	a logical, coherent recount of the experiment(s) conducted complete enough for a trained scientist to pick up this report and replicate the experiment concise summary of the corresponding section in the laboratory notebook All instruments and equipment specified including the model number of the instrument and the name of the manufacture Laboratory textbooks referenced for common techniques 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	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 Spectroscopic or physical methods are described in their own subsection Modified common procedures noted and referenced	

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

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

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

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

Category	Candidate #1 Biology	Candidate #2 Biology	Candidate #3 Chemistry	Candidate #4 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—Tables/ Schemes/Equations (1d, 1e)	7	7	7	7
Results – Figures/Graphs (1d)	8	8	8	8
Discussion (1d)	9	8	8	8
Conclusion (1d)	8	9	8	8
References	4	4	3	3
Total Points	**81**	**78**	**76**	**76**