I. Writing Plan Cover Page

Please fill in the gray areas on this form.

September 30, 2014

☐ First Edition of Writing Plan


Earth Sciences

<table>
<thead>
<tr>
<th>WEC Unit Name</th>
<th>College of Science and Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences</td>
<td>College of Science and Engineering</td>
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<tr>
<td>Department</td>
<td>College</td>
</tr>
<tr>
<td>David L. Fox</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>WEC Faculty Liaison (print name)</td>
<td>Title</td>
</tr>
<tr>
<td><a href="mailto:dffox@umn.edu">dffox@umn.edu</a></td>
<td>612-624-6361</td>
</tr>
<tr>
<td>Email</td>
<td>Phone</td>
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</tbody>
</table>

Writing Plan ratified by Faculty

Note: This section needs to be completed regardless of Writing Plan edition.

Date: 10/3/2014

If Vote: #yes / #total

Process by which Writing Plan was ratified within unit (vote, consensus, other please explain):
Dissemination of draft by email to faculty for comment and approval. Not all faculty responded, but all that did supported the Writing Plan and its proposed implementation activities as appropriate.
II. **Unit Profile:** Earth Sciences  
*Please fill in the gray areas on this form.*

**Number of Tenured and Tenure-Track Faculty:**

<table>
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<th>Role</th>
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<td>Associate Professors</td>
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<td>Assistant Professors</td>
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**Comments about Faculty/Instructors**

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**Major(s)**  
*Please list each major your Unit offers:*

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<th>Major</th>
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<th>Total # students graduating with major AY 13-14</th>
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<td>20</td>
</tr>
<tr>
<td>BA Earth Sciences (CLA)</td>
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**Total:** 44 30

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**WEC Processes**

<table>
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3. Electronic signatures

WEC Faculty Liaison

David L. Fox
Associate Professor, DUGS
Print name
Title
Signature
Date

Department Chair/Hear

Donna Whitney
Professor, Department Head
Print name
Title
Signature
Date

Associate Dean

Paul J. Strykowski
Professor, Associate Dean for Undergraduate Programs
Print name
Title
Signature
Date
IV. Writing Plan Narrative

Please retain section headers and prompts in your plan.

Executive Summary (1-page maximum): For what reason(s) did this unit (department, school, college) become involved in the WEC project? What key implementation activities are proposed in this edition of its Writing Plan and what, briefly, is the thinking behind these proposed activities? If this is a second+ edition of this unit’s Writing Plan, please describe activities that have been successfully completed and those that are new to this edition.

Writing in various forms is fundamental to what Earth scientists do as research scientists and academics, and we know from our professional affiliates that it is seen universally as one of the most critical skills for employees in the private sector and government agencies. It is essential that we prepare our students for future success as Earth scientists regardless of their career paths, and better writing is central to that effort. The departmental Undergraduate Studies Committee is beginning an assessment a new curriculum that began in F2010. The WEC process has positioned us well to move into this assessment phase, and the proposed WEC implementation plans for S2014-F2016 will mesh nicely with that effort, provide us with even more information on the new curriculum and changes that need to be made, and help us incorporate assessment of student writing into our process for assessing SLOs.

The initial survey of faculty and self-reporting of types of writing in our curriculum assigned identified The first addition of our Writing Plan sought to address a contrast between faculty dissatisfaction with the writing abilities of our students and coverage of our desired writing abilities in our courses (based on self-reporting by faculty). We addressed this contrast with two implementation activities:

1) Curriculum mapping. During AY13-14, the RAs coded all assignments (exams, lab exercises, homeworks, problem sets, formal writing assignments, others) in relation to the desired writing abilities for Earth Sciences students for four required 2xxx courses, one elective 2xxx course, two required 3xxx, and seven elective 4xxx courses (a total of 1,808 individual questions in 14 courses). Results of this mapping are attached as an appendix. The two most notable results of the mapping are that on average (1) assignments in the analyzed courses explicitly address most of our desired writing abilities to some degree and (2) the degree to which most abilities are explicitly addressed decreases from 2xxx through 4xxx courses.

2) Teaching modules. During S2014, the RAs developed the following teaching modules as planned in the first edition: a) a guide to types of figures common in Earth Science research, b) a detailed guide specifically for making XY scatter plots, c) style and design guides for Powerpoint and poster presentations, d) a gallery of posters given by graduate students and faculty in Earth Sciences at various conferences, f) a common set of editing marks for marking papers, and g) a single five minute workshop on figures using materials collected from ESCI 4501 Structural Geology in Fall, 2012. These materials are going online during F2014.

The primary goals of proposed implementation activities for S2015-F2016 are to increase the visibility and understanding by students of our desired writing abilities, to assess the impact of the modules on student achievement of our desired writing abilities, and to integrate ongoing assessment of student writing explicitly into the required Annual Progress Report on Assessment of Student Learning Outcomes as a means of continued assessment of writing after financial support from the WEC program is no longer available. To achieve these goals we propose four implementation activities:

1) Continued development of teaching modules, emphasizing five minute workshops and peer-review exercises specific to each course, and assessment of usage and effectiveness of the modules.

2) Discussion of curriculum mapping with individual instructors to revise instructions for individual assignments to make expectations of student abilities clearer and more uniform in the curriculum.
3) Work with instructors to implement use of the menu of grading criteria in assessing student writing and developing rubrics to make grading of writing more efficient and fair.

4) Develop a means by which ongoing assessment of writing in our curriculum can be combined with the assessment of Student Learning Outcomes, on which we must now report annually.

Discussion with faculty during development of the second edition indicates broad support for these efforts, which suggests that participation in the implementation activities should also be broad.

**Section 1: DISCIPLINE-SPECIFIC WRITING CHARACTERISTICS**: What characterizes academic and professional communication in this discipline?

Through the first two WEC meetings during Fall, 2012, the Earth Sciences faculty generated a list of the characteristic types of writing used in the discipline both academically and in the private and state sectors. These include:

- Scholarly journal articles (primary research papers and reviews)
- Research and other grant proposals
- Reviews of journal articles and grant proposals as a referee
- Technical reports following specifications of a company or state agency (e.g., Environmental Impact Statements)
- Abstracts and Executive Summaries
- PowerPoint presentations
- Posters
- Field notes that document original field observations and ideas
- Lab notes that document lab procedures and results and ideas
- Lab report
- Figures and figure captions
- Tables and table captions
- Emails to collaborators/supervisors
- C.V.
- Job application (academic and non-academic)
- Science blogs

The Earth sciences are unique in that they require researchers to understand the historical background of a system in order to understand its current configuration and behavior and to predict its future behavior. The time dependence of many of the physical, chemical, and biological processes is such that even some modern processes can only be studied completely by including consideration of the geological record. Moreover, the configuration and behavior of the Earth and its biota as an integrated system of physical, chemical, and biological processes has evolved over 4.5 billion years, so even purely theoretical or experimental studies must often consider the temporal dimension. As writers, Earth scientists synthesize the geological history of a topic and place their own scientific examination within the context of this setting, whether the writing is in an academic mode or in the context of clients or stakeholders in the private or state sectors. In any particular instance of writing, Earth scientists commonly draw on concepts not only from many sub-disciplines of the field.

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*Adjectives, or adjectival phrases are typically most useful here, for example, “transparent to logic,” (Nursing); “Analytic (versus journalistic) and argumentative” (Political Science).*
but also from disparate other disciplines (e.g., physics, chemistry, mathematics, statistics, evolutionary biology, ecology, computer science). Consequently, writing in Earth sciences frequently is highly integrative. Beyond this, writing in the Earth sciences is generally similar to writing in any other branch of the physical and life sciences in terms of the typical attributes of the different types of writing. These include:

- A logical structure that links questions, hypotheses, and/or models to data and/or observations and reflects the scientific reasoning from observations to conclusions
- Concise, clear, and logical statement of the problem(s) under investigation or hypothesis being tested, including discussion of the motivation for the observations or tests
- Appropriately comprehensive summary of the current state of knowledge of the system
- Synthesis of ideas and data from disparate sources and often scientific disciplines outside of Earth sciences proper
- Concise descriptions of observational settings; field, analytical, and/or experimental methods; and results in an organized fashion using clear and precise language
- Precise, complete, and explicit description and discussion of concepts, data, relationships between patterns and processes, and interpretations
- Use of informative graphics and appropriate quantitative concepts to present and describe the questions, hypotheses, and/or models under consideration and to present and describe data and results in support of interpretations and conclusions
- Summarize contributions of a particular study and lay out future work on the problem

**Section 2: DESIRED WRITING ABILITIES **: With which writing abilities should students in this unit’s major(s) graduate?

The desired writing abilities with which majors in Earth Sciences should graduate are a combination of desired pedagogical outcomes from our curriculum, preparation of writing skills that will be valuable for continued education and research in an academic setting as a graduate student or professor, and/or preparation of writing skills that will be valuable for work in either the private sector or with government agencies. These include:

1. Synthesize information and ideas from multiple and/or disparate sources to gain information about the world around us and explain this understanding to readers. Students should be able to combine ideas into a novel combination to describe the evolution of a system in geological time and, ideally, answer a question or test a hypothesis or model rather than simply list individually ideas from various sources.
2. Communicate Earth Science concepts and information to diverse audiences, including other scientists, general public, government officials, and various stakeholders in a given issue involving Earth science.
3. Write explicitly, precisely, and intentionally to the potential reader(s) so as to minimize alternative or ambiguous meanings or readings (except as intended).
4. Communicate clearly in writing what they did and observed (in the field and/or lab), read (in an article, book, and/or website), or heard (in class, lab, and/or the field) so that the observations are understandable to someone who was not present.
5. Explain in words the meaning of data and figures so that they are understandable to a reader who does not have the data or figures.
6. Explain in words the meaning of complex equations that describe processes or concepts beyond simply stating the identity of each variable or component of an equation.

**Verbs or verbal phrases are typically most useful here, for example, “Take a principled, not arbitrary position” (Geography); “Visually represent designs and explain salient features of a part or concept” (Mechanical Engineering).**
7. Design and create figures, graphs, and diagrams that communicate information and concepts clearly, economically, and efficiently
8. Write clear and informative sentences and paragraphs in a logical order to answer a question or make a point
9. Summarize and synthesize observations, data, and information in abstracts or executive summaries
10. Write a research paper or report on a specific topic, question, problem, hypothesis, or model in the style of an article in a scientific journal (abstract, introduction, background, results, discussion, conclusion; proper citations).
11. Write articulate, professional correspondence when required and know when to do so

Section 3: INTEGRATION OF WRITING INTO UNIT’S UNDERGRADUATE CURRICULUM: How is writing instruction currently positioned in this unit’s undergraduate curriculum (or curricula)? What, if any, structural plans does this unit have for changing the way that writing and writing instruction are sequenced across its course offerings? With what rationales are changes proposed and what indicators will signify their impact?

Currently, writing is not being used as strategically within the Earth Sciences curriculum as it could be to achieve our desired student outcomes. We have one required core course (ESCI 3303W: Geochemical Principles), one upper division elective core course (ESCI 4971W: Hydrogeology Field Course), two upper division elective courses (ESCI 4102W: Vertebrate Paleontology; ESCI 4103W: Fossil Record of Mammals), and one graduate level course open to upper division undergraduates (ESCI 5504W Neotectonics) that satisfy the Writing Intensive requirement. Otherwise, our current curriculum has not been designed or implemented to date in a way that explicitly considers the uses of writing, the types of writing assignments, and the sequence of assignments and writing abilities across the curriculum as a whole. Our curriculum is by design rather flat and students take seven required courses through the fall of the third year and then choose from among a variety of upper division electives spread across six broad sub-disciplines of Earth Sciences. We do not currently have a single course that obviously stands as a capstone course.

Consequently, the types of writing used and the expected student abilities are distributed across our courses in a way that reflects the goals and intentions of instructors on an individual basis and not yet as part of a unified effort to use writing most effectively to achieve desired student outcomes. However, the initial WEC survey in Fall, 2012 indicated that most faculty in Earth Sciences have strong desires to incorporate more in-class writing activities (7 of 14 or 50%) and to design more effective, course-relevant writing assignments (10 of 14 or 71%).

The survey of the faculty indicated all faculty members who responded (19 out of 22) consider writing to be either extremely important or very important to the scholarly and professional work done in Earth Sciences. The survey results from professional affiliates and discussions over the last year with professional affiliates from various areas of the private sector and government agencies both indicate strong agreement with the importance of writing to their work. However, the survey of faculty in particular indicated considerable dissatisfaction with the writing abilities of our students, with six respondents expressing dissatisfaction, nine neutrality with regard to satisfaction, and only four expressing satisfaction; no faculty expressed extreme satisfaction. In terms of strength of student writing abilities, a majority of faculty rated as weak the abilities of our students to create concise summaries of ideas, texts, or events (11 of 18 or 61%), to analyze and/or evaluate ideas, texts, or events (10 of 18 or 56%), and to report complex data or findings (9 of 18 or 50%). Additionally, large pluralities reported as weak the abilities of our students to synthesize disparate ideas (8 of 17 or 47%), create precise descriptions of processes, objects, findings, environments, etc. (8 of 19 or 42%), and use writing to develop and deepen thinking (7 of 17 or 41%).
As part of our process over first year in the program (2012-2013), we undertook a limited curriculum mapping exercise based on self-reporting by faculty members. Instructors of the required core courses and the upper division elective courses with high enrollments were asked to indicate which of the types of writing listed in Section #1 and writing abilities in Section #2 above they assign in their course(s). The goal was to get an initial look at the sequence of assignments and desired abilities over the curriculum, at least from the perspective of the faculty making the assignments. The results are presented in Appendix 1. We currently appear to cover all of the types of writing we have identified in our field with the exceptions of grant proposals, C.V.’s or resumes, job applications, and science blogs.

Given the expressed dissatisfaction (or lack of satisfaction) of the faculty with the writing abilities of our students, it is perhaps a bit surprising that we also appear to have assignments across these courses that account for all of our desired writing abilities. Under the first edition of our Writing Plan (2013-2014), we undertook a detailed curriculum mapping at the assignment level (1,808 questions scored), including all exams, problem sets, lab assignments, formal writing assignments, and other types of assignments in the seven required courses and X elective courses in the major. Each assignment was scored for how explicitly it addressed or called for our desired writing abilities in Section 2. Overall, the results (see Appendix 2) indicate that, on average, most of our writing abilities are explicitly addressed in our course assignments to some degree, but that the connection between our desired writing abilities and our assignment instructions weakens from 2xxx courses to 4xxx courses. Thus, it appears that we are generally informing our students of our desires with regard to writing in our assignments, although we clearly can make this more explicit at all levels in our curriculum.

The contrasts between faculty satisfaction with overall writing abilities, the self-reported coverage of writing types in our courses, and the patterns of referencing the desired writing abilities in our assignments suggests that writing instruction is not yet as well integrated into our curriculum as it could be. The disconnect between satisfaction and assignments could be the result of at least two problems. First, the types of writing assignments are not currently sequenced through the curriculum according to a plan that would lead to incremental increases in the sophistication of assignments. Consequently, different students in the same course might have had different combinations of writing assignments in previous courses and therefore not all be similarly prepared for the assignments in their current courses. Second, the assignments themselves may not adequately and explicitly express the intention behind the assignment nor the expectations of how the assignment should be completed.

The first edition of our writing plan laid a foundation for beginning to address the faculty dissatisfaction with writing abilities by providing a detailed curriculum map of how our assignments express our desired writing abilities and by developing an initial set of web-accessible instructional modules for various components (figures) and modes (posters) of writing in Earth Science. Under the second addition, we plan to 1) develop more modules for use in courses with specific emphases on five minute workshops using content from individual courses and peer-review exercises and 2) work with individual instructors to evaluate the results of the curriculum mapping and consider ways in which to improve specific assignments and/or modify assignments so as to insure a better progression of expectations for student achievement of our desired writing abilities across the curriculum. For example, required courses at the 2xxx and 3xxx level and elective courses at the 4xxx assign abstracts as stand alone assignments or as a part of larger, formal writing assignments. These courses provide an excellent opportunity to use the assignments for abstracts across this sequence of courses to teach abstract writing in a logical progression in terms of expectations and student abilities, but to do so will require working with the instructors individually and collectively. Similarly, two of our 2xxx courses and two our 4xxx courses routinely assign Powerpoint presentations as a component of the course grade. The assignments in these courses could be examined to insure that the expectations are realistic for each level and that the more advanced courses can rely on the abilities learned in the 2xxx courses, both of which are required in the major.
Thus, at this time we do not have plans for largescale structural changes to our curriculum (instituted in its current form in 2010), but we will use the previous efforts at mapping our curriculum as a guide to ways in which we can adjust assignments and expectations across the existing curriculum to achieve better student outcomes and greater faculty satisfaction with regard to our desired writing abilities. This work will take place over S2015 through F2015 and could possibly result in a decision to expand an existing 4xxx course or add a new course to the curriculum that could be a formal “capstone” course that could bring together most or all of the writing abilities desired for our students.

Section 4: ASSESSMENT of STUDENT WRITING: What concerns, if any, have unit faculty and undergraduate students voiced about grading practices? What, if any, new grading systems or practices are proposed, whether for individual courses or for a program? How satisfied is the unit faculty that students are adequately familiar with writing expectations? What do these expectations look like when they are translated into grading criteria? Please include a menu of criteria extrapolated from the list of Desired Writing Abilities provided in Section II of this plan. (This menu can be offered to faculty/instructors for selective adaptation and will function as a starting point in the WEC Project’s longitudinal rating process.)

Overall, the initial survey of faculty and students in Earth Sciences during our first year in the WEC program did not identify major concerns about current grading practices. A majority of faculty in Earth Sciences expressed a desire to explore further ways to provide more useful feedback in drafts of writing assignments (7 of 14 or 50%), organize effective peer review activities (7 of 14 or 50%), and grade writing in ways that are efficient and fair (9 of 14 or 64%). Most students in the program who responded (16 of 22 or 73%) indicated that they are satisfied with the methods used to respond to and/or evaluate their writing, but most (12 of 23 or 52%) also indicate only some consistency in the approach to writing and writing instruction across the curriculum.

Given the concerns among the faculty described in Section #3 regarding student writing abilities, it is safe to say that the faculty are not satisfied that the students understand expectations. The results of our curricular mapping under the first edition of our Writing Plan suggest that this is at least in part a result of poorly expressed expectations from the level of individual assignments to the role of writing in the curriculum as a whole and even the discipline. However, in the initial survey, 5 of 19 faculty (26% of respondents) were not confident or not very confident in their abilities to help students meet writing expectations in the major prior to the initiation of the WEC process. Publication of the approved first version of the Writing Plan in the department’s handbook for undergraduate students and as part of the online teaching modules will help disseminate the overall expectations of writing in the major.

The menu of grading criteria that can be used by faculty and by WEC staff in the longitudinal rating is included as an appendix. This menu of criteria was approved with the first edition of the Writing Plan. Under the second addition of the Writing Plan, we will work with individual instructors to implement some or all of the menu in how they assess student writing in their courses. We hope that better dissemination of the expectations to students and use of the menu of grading criteria, which are expressly tied to the desired abilities, will also improve student writing outcomes and increase faculty satisfaction with student writing abilities.

Section 5: SUMMARY of IMPLEMENTATION PLANS and REQUESTED SUPPORT: Based on above discussions, what does the unit plan to implement during the period covered by this plan? What forms of instructional support does this unit request to help implement proposed changes? What are the expected outcomes of named support?
The Department of Earth Sciences has four primary objectives during the period covered by the second edition of our Writing Plan (S2015-F2017):

1. Complete development and implementation of online teaching modules that can be used by students and instructors across our curriculum, with an emphasis on five minute workshops that use content from individual courses and peer-review exercises.
2. Work with individual instructors and instructors in sequences of courses to revise instructions for individual assignments in light of the curriculum mapping completed under the first edition of the Writing Plan.
3. Work with individual instructors to implement use of the menu of grading criteria in assessing student writing.
4. Develop a means by which ongoing assessment of writing in our curriculum after the completion of support from WEC can be incorporated into the assessment of Student Learning Outcomes, specifically SLO 7, on which we must now report annually. This will provide a structured and continuing means of assessment of the writing abilities of our students.

To achieve these objectives, we are requesting the equivalent of salary, tuition, and fringe benefits for a 25% time graduate research assistantship for a student with advanced standing during the four academic year semesters from S2015 to F2017. We plan to hire a student with advanced standing because more senior students have completed their course work and their research projects are better developed than students earlier in the program, because their greater experience teaching (typically) will make them more effective in the WEC program, and the lower costs allow us to extend the involvement of a graduate RA throughout the second edition of the Writing Plan.

David Fox, who is both the DUGs and WEC Liaison for Earth Sciences, will supervise the RA each semester. They will meet regularly (weekly to biweekly) to discuss progress and problems. The RA will meet with faculty instructors, at times alone and at times with the WEC Liaison, each semester over the Writing Plan as part of implementation.

A proposed schedule for these activities is included at the end of this section specifying activities, planned means of assessment, and personnel in each semester.

The first objective, planned for S2015, is to complete the development and implementation of online teaching modules and disseminate these to the faculty and students via a dedicated Moodle page that will also host both editions of the Writing Plan and other associated information. Under the first addition of the Writing Plan, we had planned to develop a relatively large number of teaching modules and associated materials. In retrospect, our plans were too ambitious, particularly given the fine-grained detail we achieved with our curriculum mapping, which took longer than we anticipated. Online implementation was planned for Summer, 2014, but drastic changes in the IT support for Earth Sciences began in S2014 and continue into F2014, disrupting technical support. With the support from the first edition of the Writing Plan, we developed:

1) a guide to types of figures common in Earth Science research and why to choose one type of graph over another,
2) a detailed style guide for making XY scatter plots that was tested this summer in ESCI 4971W,
3) a style and design guide for Powerpoint presentations,
4) a styled and design guide for scientific poster presentations,
5) a collection of posters given by graduate students and faculty in Earth Sciences at various conferences as a gallery that students can use for ideas about designing their own posters,
6) a set of editing marks that we will propose all instructors so that papers are marked consistently across the curriculum and students have a resource that explains the marks on their papers, and

7) a single five minute workshop on figures using materials collected from ESCI 4501 Structural Geology in Fall, 2012 as examples that can be used in that course or otherwise.

We had hoped develop more five minute workshops and other resources, such as instructions for peer reviews and guides to writing grading rubrics. However, the curriculum mapping took longer than originally planned as a result of an evaluation of all individual assignments (and summaries of all questions on each assignment by type of question) for a total of 14 courses (four required 2xxx courses, one elective 2xxx course, two required 3xxx courses, and seven elective 4xxx courses). All current materials will be online via a Moodle page during F2014 and tracking of usage will begin based on numbers of times materials are accessed on the site.

For completing online modules under the second edition of the Writing Plan, we will focus on five minute workshops and peer review exercises designed with and for the instructors of individual courses using content from those courses. Beginning in the first semester of the second edition of the Writing Plan (S2015), the RA will meet with instructors of those courses we mapped during the first edition to discuss the results of the mapping, identify assignments in the course that correspond to one or more of our writing types (Section 1) and/or abilities (Section 2), and design a five minute workshop using course materials from students during S2015. The instructor will save student materials (without identifiers) for the assignment or assignments that include examples of correspond to poor, adequate, and exceptional writing that can then be used later that semester and/or in subsequent years in that course. The RA will also work with the instructors to identify assignments that are suited to peer review exercises in part or in whole and devise a schedule and a grading scheme for those assignments that can either be implemented in S2015 or in subsequent years.

This effort will continue in F2015 with the courses offered that semester and potentially into the second year of the Writing Plan at lower effort as some of our 4xxx courses are only offered every other year.

To support this effort, we will request support from the WEC program in the form of one or more demonstrations of five minute workshops to faculty, other instructors, and interested graduate teaching assistants during S2015.

The outcome of this effort will be a set of tools for teaching with writing that are tailored not only to Earth Sciences generally but to the content and assignments of specific courses in our curriculum. The modules will be stored on a Moodle page that will also serve as the repository for the various editions of the Writing Plan, the poster gallery, and other materials related to the WEC program in Earth Sciences.

The second objective will build on the meetings between the RA and individual faculty during the design of five minute workshops and peer review exercises under the first objective. A key step in that process will be examining the quantitative assessment of assignments for each course during the curriculum mapping under the first edition of the Writing Plan. Perhaps the clearest pattern in the mapping is that higher level courses tend to be less explicit about the expectations of student writing abilities in assignments. This is possibly because instructors expect that more advanced students know what is expected, but faculty satisfaction with outcomes from the survey indicate that students are not performing in a way that indicates they know our expectations. Thus, an obvious place to improve how we use writing in our teaching is to revise the assignments in our courses to increase the explicitness with which we express our expectation.

In the process of discussing the curriculum mapping results with individual instructors, the RA and faculty can identify ways in which individual assignments can be revised. Additionally, the mapping exercises have identified
at least two assignment types that are used at different levels within our curriculum. Powerpoint presentations are assigned in 2xxx, 3xxx, and 4xxx courses, and abstracts are assigned as stand alone assignments or parts of larger, formal writing assignments in 2xxx and 4xxx courses. The assignments in these courses can potentially be designed so that the expectations of writing abilities are sequenced across the curriculum and the assignments in the higher level courses refer explicitly to those in the lower level required courses. This type of integration of assignments and explicitness of expectations can only serve to help students see our curriculum as a whole rather than as a series of independent courses.

The main work to achieve the second objective will be spread out over the first two semesters of the second edition of the Writing Plan (S2015-F2015). In the second year of the Writing Plan will revisit the instructors and discuss outcomes of any changes to assignments and ways to make further improvements.

The third objective is to incorporate the menu of grading criteria for writing abilities into the grading schemes of our courses and to help instructors develop grading rubrics for writing in our courses that not only implements the menu but also achieves the increased efficiency and fairness of grading for which faculty expressed a desire in the initial survey. This work will also grow out of the discussions between the RA and the faculty over the first year of the Writing Plan for the implementation of the first two objectives. In the second year of the Writing Plan, the RA will meet with individual faculty to assess use of the menu of grading criteria and any rubrics developed and used and make modifications as deemed necessary.

I anticipate that we will ask for assistance from WEC program staff in working with individual faculty in designing rubrics for writing that incorporate the menu of grading criteria for writing abilities and that can improve the efficiency and fairness of grading. It is unlikely that a graduate RA will have sufficient teaching experience to do this work on their own. We will coordinate with WEC staff to identify the best means of assistance, whether that is participating in the meetings between individual faculty and the RA or workshops with small groups of faculty.

The final objective is the least concrete of our four objectives at this point and likely will benefit from conversations with both WEC staff and other WEC liaisons. Over the course of the second edition of the Writing Plan, we would like to incorporate our assessments of student writing abilities, as judged by the menu of grading criteria for individual assignments in courses, into how we assess Student Learning Outcomes. This work will specifically target how assess ESCI SLO 4: “Students can communicate scientific information and ideas effectively to various audiences in appropriate modes (writing, verbally, visually)”. We are now required to submit an Annual Progress Report (APR) on Assessment of Student Learning. As DUGS, I submitted an APR for AY 2013-2014 that was effectively a draft version of what we will do going forward and that focused on exam scores to assess individual SLOs. This year and going forward, the Undergraduate Studies Committee in Earth Sciences will work with the instructors of most of the same courses we mapped in the first edition of the Writing Plan to revise our process to focus on assignments other than exams that will be more useful for assessing the SLOs going forward. SLO 4 and the overall assessment process for the APR have obvious parallels to the need for ongoing assessment of writing abilities, and improving student achievement in our desired writing abilities logically should improve achievement on SLO 4.

The RA will not be tasked with writing the APR. Rather, the RA will begin discussions with the DUGS and the Undergraduate Studies Committee during S2015 of ways in which assessment of writing under the Writing Plan and more routinely in our courses can be used to inform the APR. The goal is to leverage the required APR as a mechanism for ongoing assessment of writing at the curriculum level in the later editions of the Writing Plan. Beyond strategizing how to implement this, the RA will be tasked with gathering graded assignments archived by faculty for use in the APR. A likely approach will be for the Undergraduate Studies Committee to assess writing assignments from a selection of courses each year using the menu of grading criteria used by the outside rater,
providing an ongoing parallel process. Our goal by the end of the second edition of the Writing Plan is to implement continued assessment of student writing via the required APR. As the APR process becomes a more routine task of faculty in the department, so will the regular assessment of writing abilities above the individual course level. Achieving this somewhat open ended objective will likely involve continued discussion with WEC staff both to define the problem more clearly and devise ways to combine assessment of writing and assessment of the SLOs. That consultation likely will take the form of meetings with the DUGs and the RA and also with the Undergraduate Studies Committee.

**Work scheduled for implementation of second edition of Writing Plan**

**Semester 1 (S2015)**

*Activity 1 Develop and implement teaching modules.*

- One or more demonstrations by WEC staff of five minute workshops to faculty, other instructors, and interested graduate TAs
- Meet with instructors of courses this semester at least once to discuss results of curriculum mapping for each course individually during the first edition of the Writing Plan, to discuss specific assignments for which five minute workshops and/or peer review exercises would be useful to improve both student understanding of desired abilities and performance on those abilities, make plans to archive student materials without identifying information.

  Courses: ESCI 2202, 2203, 2302, 3891, 4102W, 4401, 4602, 4702, and 4801
  Personnel: Graduate RA and WEC Liaison (Fox) will be at all meetings.
- At end of semester, gather archived student materials that will be used for developing five minute workshops and/or peer review exercises for courses this semester.
  Personnel: Graduate RA will gather and store the materials.
- Develop additional modules suggested by faculty during meetings, edit existing modules, track usage through Moodle page and through surveys of students
  Personnel: Graduate RA will be responsible for development and editing of modules and for compiling data from the moodle page on access and use of modules. WEC Liaison (Fox) will consult and supervise and review modules as they are developed.

*Activity 2 Suggest revisions to assignments to increase visibility of desired writing abilities*

- Based on materials gathered for and results of curriculum mapping under the first edition and discussions with faculty in courses this semester (listed under Activity 1), suggest concrete changes to assignment instructions that could increase student awareness of desired writing abilities.
  Personnel: Graduate RA will be review materials for possible edits and discuss with the WEC Liaison (Fox) at regular meetings during the semester. The grad RA will discuss suggestions by email or in person with faculty. These changes would be for implementation in S2016.

*Activity 3 Implement grading criteria and assist faculty with design of grading rubrics for writing*

- Plan meeting with grad RA, WEC Liaison (Fox), and WEC staff to discuss rubrics and develop ideas for assisting faculty with this effort. This activity will be discussed in regular meetings between the RA and the Liaison during the semester.
  Personnel: Graduate RA, WEC Liaison (Fox), WEC staff

*Activity 4 Work to implement assessment of writing in annual assessment of SLOs*

- The grad RA will work the DUGS and meet with Undergraduate Studies Committee to observe how the Annual Progress Report on the Assessment of Student Learning Outcomes is assembled and to consider how the
process can be implemented to incorporate ongoing assessment of student writing abilities. The grad RA will not have responsibility for the APR.

Personnel: Graduate RA, WEC Liaison (Fox).

Semester 2 (F2015)

Activity 1 Develop and implement teaching modules.
- Possibly one or more demonstrations by WEC staff of five minute workshops to faculty, other instructors, and interested graduate TAs
- Meet with instructors of courses this semester at least once to discuss results of curriculum mapping for each course individually during the first edition of the Writing Plan, to discuss specific assignments for which five minute workshops and/or peer review exercises would be useful to improve both student understanding of desired abilities and performance on those abilities, make plans to archive student materials without identifying information.
  - Courses: ESCI 2201, 2301, 3302, 3303W, 4103W, 4211, 4401, and 4501
  - Personnel: Graduate RA and WEC Liaison (Fox) will be at all meetings.
- At end of semester, gather archived student materials that will be used for developing five minute workshops and/or peer review exercises for courses this semester.
  - Personnel: Graduate RA will be gather and store the materials.
- Develop five minute workshops and/or peer review exercises for courses in S2015 based on student materials gathered from those courses.
  - Personnel: Graduate RA will be responsible for initial development, WEC Liaison (Fox) will consult and supervise and review modules as they are developed.
- Develop additional modules suggested by faculty during meetings, edit existing modules, track usage through Moodle page and through surveys of students
  - Personnel: Graduate RA will be responsible for development and editing of modules and for compiling data from the Moodle page on access and use of modules. WEC Liaison (Fox) will consult and supervise and review modules as they are developed.

Activity 2 Suggest revisions to assignments to increase visibility of desired writing abilities
- Based on materials gathered for and results of curriculum mapping under the first edition and discussions with faculty in courses this semester (listed under Activity 1), suggest concrete changes to assignment instructions that could increase student awareness of desired writing abilities.
  - Personnel: Graduate RA will be review materials for possible edits and discuss with the WEC Liaison (Fox) at regular meetings during the semester. The grad RA will discuss suggestions by email or in person with faculty. These changes would be for implementation in F2016.
- Meet with faculty individual or in groups for courses across the curriculum that use common writing assignment types (Powerpoint presentations, abstracts) to discuss how assignments can be coordinated across the curriculum.
  - Personnel: Graduate RA, WEC Liaison (Fox).

Activity 3 Implement grading criteria and assist faculty with design of grading rubrics for writing
- Meet with interested faculty either individually or in groups to discuss development and implementation of grading rubrics that incorporate the menu of grading criteria.
  - Personnel: Graduate RA, WEC Liaison (Fox).

Activity 4 Work to implement assessment of writing in annual assessment of SLOs
• Gather and archive graded course materials not being saved by faculty already that can be used to assess writing broadly speaking (i.e., SLO 7) in the APR.
  Personnel: Graduate RA, WEC Liaison (Fox).

• Meet with the DUGS and the Undergraduate Studies to discuss plans to incorporate ongoing assessment of student writing into the APR of SLOs.
  Personnel: Graduate RA, WEC Liaison (Fox).

Semester 3 (S2016)

Activity 1 Develop and implement teaching modules.
• Develop five minute workshops and/or peer review exercises for courses in F2015 based on student materials gathered from those courses.
  Personnel: Graduate RA will be responsible for initial development, WEC Liaison (Fox) will consult and supervise and review modules as they are developed.

• The grad RA will assess usage of the existing modules in courses this semester by compiling data on access through the moodle page, surveys of the students, and discussion with the faculty of courses this semester. Patterns of usage from F2015 will be used to make changes in the modules.
  Personnel: Graduate RA with supervision by WEC Liaison (Fox).

Activity 2 Suggest revisions to assignments to increase visibility of desired writing abilities
• Meet with faculty and students (separately) to discuss course assignments and awareness of desired writing abilities based both on course assignments and published Writing Plans. Based on these meetings, suggest additional changes to course materials.
  Personnel: Graduate RA will be primarily responsible for the meetings and reviews of course materials.

Activity 3 Implement grading criteria and assist faculty with design of grading rubrics for writing
• Meet with interested faculty either individually or in groups to discuss development and/or results of implementation of grading rubrics that incorporate the menu of grading criteria.
  Personnel: Graduate RA, WEC Liaison (Fox).

Activity 4 Work to implement assessment of writing in annual assessment of SLOs
• Gather and archive graded course materials not being saved by faculty already that can be used to assess writing broadly speaking (i.e., SLO 7) in the APR.
  Personnel: Graduate RA, WEC Liaison (Fox).

• The grad RA will work more closely this semester with the DUGS and the Undergraduate Studies Committee to implement assessment of student writing into the Annual Progress Report on the Assessment of Student Learning Outcomes is assembled and to consider how the process can be implemented to incorporate ongoing assessment of student writing abilities. The grad RA’s role will be to provide quantitative measures of student writing abilities based on gathered graded materials and to provide ratings in the context of the menu of grading criteria used by the outside raters. The grad RA will not have responsibility for writing the APR.
  Personnel: Graduate RA, WEC Liaison (Fox).

Semester 4 (F2016)

Activity 1 Develop and implement teaching modules.
• The grad RA will assess usage of the existing modules in courses this semester by compiling data on access through the moodle page, surveys of the students, and discussion with the faculty of courses this semester. Patterns of usage from F2015 will be used to make changes in the modules.
Personnel: Graduate RA with supervision by WEC Liaison (Fox).

- Develop additional modules suggested by faculty during meetings, edit existing modules, track usage through Moodle page and through surveys of students
  Personnel: Graduate RA will be responsible for development and editing of modules and for compiling data from the moodle page on access and use of modules. WEC Liaison (Fox) will consult and supervise and review modules as they are developed.

**Activity 2 Suggest revisions to assignments to increase visibility of desired writing abilities**
- Meet with faculty and students (separately) to discuss course assignments and awareness of desired writing abilities based both on course assignments and published Writing Plans. Based on these meetings, suggest additional changes to course materials.
  Personnel: Graduate RA will be primarily responsible for the meetings and reviews of course materials.

**Activity 3 Implement grading criteria and assist faculty with design of grading rubrics for writing**
- Meet with interested faculty either individually or in groups to discuss development and/or results of implementation of grading rubrics that incorporate the menu of grading criteria.
  Personnel: Graduate RA, WEC Liaison (Fox).

**Activity 4 Work to implement assessment of writing in annual assessment of SLOs**
- Gather and archive graded course materials not being saved by faculty already that can be used to assess writing broadly speaking (i.e., SLO 7) in the APR. This work will devolve to the faculty going forward.
  Personnel: Graduate RA, WEC Liaison (Fox).

**Section 6: PROCESS USED TO CREATE THIS WRITING PLAN:** How, and to what degree, were stakeholders in this unit (faculty members, instructors, affiliates, teaching assistants, undergraduates, others) engaged in providing, revising, and approving the content of this Writing Plan?

A draft of the Writing Plan was written by David Fox, the WEC Liaison for Earth Sciences, based on discussions with the graduate and undergraduate RAs supported by the first edition of the Writing Plan during AY 2013-2014. The draft was circulated to the Earth Sciences faculty for comments prior to submission to the Writing Board. Six faculty members responded with edits on the text or comments. General comments were all very positive and supportive. Approval was not based on an explicit vote but was inferred from support for the draft version.

**Section 7:** Briefly, please describe the ways that the ideas contained in this Undergraduate Writing Plan address the University's Student Learning Outcomes ([http://www.slo.umn.edu](http://www.slo.umn.edu)).

**University SLO:** Can locate and critically evaluate information

**ESci SLO2:** Students demonstrate the ability to locate and collect data relevant to problems in Earth Sciences and to analyze those data in an appropriate manner.

We plan to develop a module that will specifically address methods for finding sources for research papers and projects that will help students learn how to locate and evaluate information.

**University SLO:** Have mastered a body of knowledge and mode of inquiry
ESci SLO 3: Students will demonstrate the ability to apply knowledge of Earth Sciences, including the processes of the integrated Earth system and the history of the Earth system, at an appropriate level of sophistication and rigor.

The intent of the modules we developed under the first edition and the current edition of the Writing Plan is to provide our students with tools that will help them improve their writing abilities. We expect that better writing skills will help them to increase their mastery of Earth Sciences.

University SLO: Can communicate effectively

ESci SLO 4: Students can communicate scientific information and ideas effectively to various audiences in appropriate modes (writing, verbally, visually).

The modules we will develop under this Writing Plan will improve our students abilities to communicate in writing and by poster and PowerPoint presentations.

University SLO Have acquired skills for effective citizenship and life-long learning

Good communications skills are critical for effective citizenship as they allow Earth Scientists working in academia, in the private sector, or in government to communicate critical information about the Earth and our environment to others.
## Appendix 2: Proposed Menu of Grading Criteria

<table>
<thead>
<tr>
<th>Desired Writing Abilities</th>
<th>Grading Criteria</th>
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</thead>
</table>
| 1. Synthesize information and ideas from multiple and/or disparate sources to gain information about the world around us and explain this understanding to readers. | 1. Synthesizes multiple ideas  
2. Explains disparate ideas to lay audiences                                               |
| 2. Communicate Earth Science concepts and information to diverse audiences, including other scientists, general public, government officials, and various stakeholders in a given issue involving Earth science. | 3. Consistently uses language, content, and formats appropriate for scientific audiences  
4. Consistently uses language, content, and formats appropriate for non-scientific audiences (e.g., the general public, policy-makers) |
| 3. Write explicitly, precisely, and intentionally to the potential reader(s) so as to minimize alternative or ambiguous meanings or readings (except as intended). | 5. Communicates clearly and unambiguously                                             |
| 4. Communicate clearly in writing what they did and observed (in the field and/or lab), read (in an article, book, and/or website), or heard (in class, lab, and/or the field) so that the observations are understandable to someone who was not present. | 6. Describes what is seen (in the field and/or lab), read (in an article, book, and/or website), or heard (in class, lab, and/or the field) so that the observations and information is understandable to someone who was not present. |
| 5. Explain in words the meaning of data and figures so that they are understandable to a reader who does not have the data or figures. | 7. Explains the meaning of data and figures so that they are understandable to someone who does not have the data or figures. |
| 6. Explain in words the meaning of complex equations that describe processes or concepts beyond simply stating the identity of each variable or component of an equation. | 8. Moves beyond identification of the variables or components of an equation to explain the meaning of equations in terms of processes and/or concepts. |
| 7. Design and create figures, graphs, and diagrams that communicate information and concepts clearly, economically, and efficiently | 9. Communicates information, data, and concepts in figures, graphs, and/or diagrams clearly with adequate labels and complete captions and without extraneous or distracting elements. |
| 8. Write clear and informative sentences and paragraphs in a logical order to answer a question or make a point | 10. Answers a question or makes a point using logically sequenced, clear, and informative sentences. |
| 9. | Summarize and synthesize observations, data, and information in abstracts or executive summaries |
| 10. | Write a research paper or report on a specific topic, question, problem, hypothesis, or model in the style of an article in a scientific journal (abstract, introduction, background, results, discussion, conclusion; proper citations). |
| 11. | Summarizes and synthesizes observations, data, and information in abstracts or executive summaries concisely and including only necessary information. |
| 12. | Reports on a specific topic in an appropriate style using suitably technical language |
| 13. | Relays information using professional correspondence. |
| 11. | Write articulate, professional correspondence when required and know when to do so |
Summary of mapping of Earth Sciences curriculum, 2013-2014

Material collection and analysis by Chris Crosby (grad RA) and Darren Cheah (undergrad RA)

All assignments, including exams, analyzed for the following courses:

ESCI 2201 Solid Earth Dynamics (required)
ESCI 2301 Mineralogy (required)
ESCI 2302 Petrology (elective)
ESCI 2202 Earth History (required)
ESCI 2203 Earth Surface Dynamics (required)
ESCI 3202 Fluid Earth Dynamics (required)
ESCI 3303W Geochemical Principles (required)
ESCI 4211 Solid Earth Geophysics I (elective)
ESCI 4401 Aqueous and Environmental Geochemistry (elective)
ESCI 4501 Structural Geology (elective)
ESCI 4602 Sedimentology and Stratigraphy (elective)
ESCI 4702 General Hydrogeology (elective)
ESCI 4801 Geobiology (elective)
ESCI 4971W Hydrogeology Field Course (required, choice of two courses)

Table of contents by page in appendix

1-12 Summary of number of questions analyzed by type (exam, non-exam) and course level
13-30 Examples of each score for each writing ability from assignments
31-32 Semi-quantitative comparison of independent reviewers ratings and those used in the mapping
33-44 Summary of scores for each writing ability for all assignments by type (exam, non-exam) and course level
45-50 Comparison of scores for each writing ability for all assignments by type for courses in successive levels
All levels • All assignments
Number of writing questions (n = 1075)

— Writing criteria —

Writing criteria category subdivisions

**Category 1: Synthesis, thought development**
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
1-7: Summarize & synthesize info into an abstract

**Category 2: Writing to a specific audience**
2-1: Writing to a specific audience

**Category 3: Description of own experiences**
3-1: Describe own field/lab work so others could reproduce
3-2: Describe what was read/heard & seen
3-3: Draw clear sketches of own observations

**Category 4: Expression of ‘non-prose’ concepts**
4-1: Expl figures so the info c/b understood w/o the figure
4-2: Expl meaning of math or chemical equations
4-3: List and describe variables & components of equations
4-4: Make figure/graph/diagram clearly & economically

**Category 5: Language mechanics**
5-1: Write clear & informative sentences
5-2: Organize sentences into ¶ and ¶ into logical order
5-3: Write a research paper on a specific topic in journal style
5-4: Write articulate, professional correspondence
5-5: Know when professional correspondence is called for

* Note on categories  2.1 and 5.1
Some questions requiring a limited amount of writing, such as a short answer question, addressed no criteria explicitly. In these cases, the following comments are relevant:

**Category 2.1**: In nearly every instance, there was no indication of the target audience. In these cases, questions were given a rating of 1 (implied but not stated explicitly) as students presume their audience to be the assigning TA or professor.

**Category 5.1**: Where instructions indicated the need for clear grammar, spelling, etc. questions were rated as 1 (implied but not stated explicitly.) For the purposes of this project, more specific directions re: the mechanics of writing was considered ‘remedial’ and not the realm of the department. In cases of need, it is expected that students will be directed to seek the assistance of the Writing Center and/or various forthcoming modules.
All levels • Non-exam assignments

Number of writing questions (n = 733)

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<tr>
<th>Category</th>
<th>Description</th>
<th>1.1</th>
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--- Writing criteria ---

**Category 1: Synthesis, thought development**
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
1-7: Summarize & synthesize info into an abstract

**Category 2: Writing to a specific audience**
2-1: Writing to a specific audience

**Category 3: Description of own experiences**
3-1: Describe own field/lab work so others could reproduce
3-2: Describe what was read/heard & seen
3-3: Draw clear sketches of own observations

**Category 4: Expression of 'non-prose' concepts**
4-1: Expl figures so the info c/b understood w/o the figure
4-2: Expl meaning of math or chemical equations
4-3: List and describe variables & components of equations
4-4: Make figure/graph/diagram clearly & economically

**Category 5: Language mechanics**
5-1: Write clear & informative sentences
5-2: Organize sentences into ¶ and ¶ into logical order
5-3: Write a research paper on a specific topic in journal style
5-4: Write articulate, professional correspondence
5-5: Know when professional correspondence is called for

* Note on categories 2.1 and 5.1
Some questions requiring a limited amount of writing, such as a short answer question, addressed no criteria explicitly. In these cases, the following comments are relevant:

**Category 2.1**: In nearly every instance, there was no indication of the target audience. In these cases, questions were given a rating of 1 (implied but not stated explicitly) as students presume their audience to be the assigning TA or professor.

**Category 5.1**: Where instructions indicated the need for clear grammar, spelling, etc. questions were rated as 1 (implied but not stated explicitly.) For the purposes of this project, more specific directions re: the mechanics of writing was considered ‘remedial’ and not the realm of the department. In cases of need, it is expected that students will be directed to seek the assistance of the Writing Center and/or various forthcoming modules.
Number of writing questions (n = 342)

--- Writing criteria ---

Category 1: Synthesis, thought development
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
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Category 2: Writing to a specific audience
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**2000 level • All assignments**

Number of writing questions (n = 303)

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**Writing criteria**

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<td>4-4: Make figure/graph/diagram clearly &amp; economically</td>
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</tbody>
</table>

<table>
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<td>5-4: Write articulate, professional correspondence</td>
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<td>5-5: Know when professional correspondence is called for</td>
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* Note on categories 2.1 and 5.1

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Number of writing questions (n = 158)

--- Writing criteria ---

**Category 1: Synthesis, thought development**
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
1-7: Summarize & synthesize info into an abstract

**Category 2: Writing to a specific audience**
2-1: Writing to a specific audience

**Category 3: Description of own experiences**
3-1: Describe own field/lab work so others could reproduce
3-2: Describe what was read/heard & seen
3-3: Draw clear sketches of own observations

**Category 4: Expression of ‘non-prose’ concepts**
4-1: Explain figures so the info can be understood w/o the figure
4-2: Explain meaning of math or chemical equations
4-3: List and describe variables & components of equations
4-4: Make figure/graph/diagram clearly & economically

**Category 5: Language mechanics**
5-1: Write clear & informative sentences
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## Writing criteria category subdivisions

### Category 1: Synthesis, thought development
- 1-1: Cite multiple references
- 1-2: Synthesize disparate ideas
- 1-3: Express broad (or novel) understanding
- 1-4: Place in geological time & evolution
- 1-5: Develop your own hypothesis
- 1-6: State & answer a scientific question
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3000 level • Non-exam assignments

Number of writing questions (n = 139)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Synthesis, thought development</td>
<td>54</td>
</tr>
<tr>
<td>1.2</td>
<td>Write to audience</td>
<td>2</td>
</tr>
<tr>
<td>1.3</td>
<td>Describe own experiences</td>
<td>3</td>
</tr>
<tr>
<td>1.4</td>
<td>Explain ‘non-prose’ concepts</td>
<td>4</td>
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<td>1.5</td>
<td>Language mechanics</td>
<td>10</td>
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<td>1.6</td>
<td>Writing to a specific audience</td>
<td>2</td>
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<td>2.1</td>
<td>Writing to a specific audience</td>
<td>1</td>
</tr>
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<td>3.1</td>
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<td>1</td>
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<td>Language mechanics</td>
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</tr>
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</tr>
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</tr>
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</tr>
<tr>
<td>4.3</td>
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<td>1</td>
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<td>Language mechanics</td>
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— Writing criteria —

Category 1: Synthesis, thought development
1-1: Cite multiple references
1-2: Synthesize disparate ideas
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**3000 level • Exams**

Number of writing questions (n = 43)

--- Writing criteria ---

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4000 level • All assignments

Number of writing questions (n = 590)

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Number of writing questions (n = 436)

**Category 1: Synthesis, thought development**
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4000 level • Exams

Number of writing questions (n = 154)

--- Writing criteria ---

Writing criteria category subdivisions

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1-1: Cite multiple references
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1.1: Cite multiple references

Thursday, July 3, 2014
9:45 PM

2 - Stated unambiguously as an expectation

ESCI 3303W - Short writing assignments description

Non-exam, WFS (1-2 pgs, single-spaced)

Write a 1-2 page, single-spaced summary of the article that you have chosen. The title of your summary should be: “A Summary of ____________,” where the blank will contain the full citation of the article that you summarize (see Formatting References link on Moodle page). In your paper, you should:

a. summarize the main points of your chosen article
b. summarize the basis (new data, new analysis of old data, new arguments) for their conclusions

ESCI 2301 - Term paper

Non-exam, WIS (< 3 pgs, single-spaced)

You will be using the reference and citation style of the American Geophysical Union (AGU). Please see the pdf that is available on the class website for detailed instructions on how to properly prepare your references. Also, please follow their recommendations for citing articles and books in the text.

1 - Implied but not stated explicitly

ESCI 4501 - Lab 6, Part III, Q1

Non-exam, LW, SA

In class, it was shown that temperature is a very important factor for quartz microstructures. However, it is not the only factor that influences the behavior, or microstructures, of quartz. List at least TWO other factors that influence quartz deformation mechanisms? Explain how these factors change the observed structures. Use evidence from the readings.

0 - No indication of expectations, only informal instructions

ESCI 2203 - Final paper assignment instructions (page 3)

Non-exam, WFL (10 pgs, single-spaced)

The final report is to be ~10 single spaced pages of text, not including figures, which are encouraged. If you refer to published material or work (journal articles, etc.) cite them in a references section, following any style. It is not necessary to follow the style of any given journal, as the styles encountered in journals differ. The important thing is that you address the above points in a well-written and well-organized report.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not addressed

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not addressed
1.2: Synthesize disparate ideas
Thursday, July 3, 2014
10:58 PM

2 - Stated unambiguously as an expectation

Not addressed

1 - Implied but not stated explicitly

<table>
<thead>
<tr>
<th>ESCI 2203 - Final writing assignment (10 pgs, double-spaced)</th>
<th>Non-exam, WFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much (but not all) of this semester’s lab focused on Twin Lake, where interactions between biological, chemical, and physical processes could be readily observed. You may focus on the Twin Lake related observations, or you may expand your discussion to include other labs and observations as you prefer. Below are some questions to frame your analysis; we suggest that you not try to address them all but instead choose 2-4 of them to focus on:</td>
<td></td>
</tr>
<tr>
<td>• What can the spatial and temporal variations of organic matter in Twin Lake tell us about spatial and temporal variations in biological, chemical, and physical processes in the lake and watershed?</td>
<td></td>
</tr>
<tr>
<td>• How might human activity influence the type, distribution, or abundance of organic matter in different parts of the lake?</td>
<td></td>
</tr>
<tr>
<td>• Why are Twin Lake bottom waters anoxic? Would you expect it to remain anoxic year round? How, where, why is anoxia evidenced in cores or other data?</td>
<td></td>
</tr>
<tr>
<td>• What impact might temperature have on element cycling or anoxia in Twin Lake? How might summer data differ from winter data?</td>
<td></td>
</tr>
<tr>
<td>• How do the size, shape and composition of the Twin Lake watershed/basin influence the sediment and/or geochemical characteristics of the lake?</td>
<td></td>
</tr>
<tr>
<td>• What evidence of stratification does this lake show? What effect would permanent stratification have on chemical and biological processes in the lake?</td>
<td></td>
</tr>
</tbody>
</table>

0 - No indication of expectations, only informal instructions

<table>
<thead>
<tr>
<th>ESCI 4801 - Literature review paper (10 pgs, single-spaced)</th>
<th>Non-exam, WFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>For this course, you will be required to write a literature review on a geomicrobiological process or group of geobiologically-important organisms. The paper should be a minimum of 10 pages (12 point font, 1 inch margins, single-spaced) and a maximum of 15 pages. You should cite a minimum of 15 articles from the peer-reviewed literature.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESCI 2302 - Integrated Metamorphic petrology lab activity</th>
<th>Non-exam, LR, WIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective: to integrate several important aspects of metamorphic petrology (mineral identification, textural observation, inferences about metamorphic grade and protolith) with spatial information (location of samples on a map) to interpret the geologic history of a region</td>
<td></td>
</tr>
<tr>
<td>For the rest of the semester in lab, you will look at a wide range of metamorphic samples that together record an interesting petrologic and tectonic history for a region.</td>
<td></td>
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</tbody>
</table>

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed
2. **Stated unambiguously as an expectation**

**ESCI 3303W - Final exam, Q A1**
**Exam, EE**

An atom of $^{16}$O is in a calcite crystal, which is part of a foraminifera shell in a layer of marine sediments on the seafloor. Given your knowledge of geochemistry, give a plausible life history of the matter that makes up this atom, from the Big Bang to present. Be sure to include times for the events in this bit of matter’s journey from the Big Bang to the bottom of the ocean.

1. **Implied but not stated explicitly**

**ESCI 4602 - Lab 7: Siliciclastic Petrology II, Q4**
**Non-exam, LW, SA**

Describe 4 stages of the cementation and secondary-porosity history in the order in which they occurred in this sandstone. Be sure to indicate whether porosity increased or decreased at each stage.

**ESCI 2201 - Exam 2, Q7**
**Exam, ESA**

On the remainder of this page, write a one paragraph overview of the geologic history of the Taylors Falls area. Just include the highlights and do not exceed the limits of this page. Note that if you did an alternative field trip, you may choose to write about that area instead.

0. **No indication of expectations, only informal instructions**

**ESCI 4401: Term paper**
**Non-exam, WFL, DI**

A ten page paper formatted in the style of the journal Geochimica Cosmochimica Acta is required and due the last day of class. The paper constitutes 20% of the grade. The last week of the class, students will make in class presentations on term-paper highlights.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
2 - Stated unambiguously as an expectation

*ESCI 2202: Final Exam, Q. E2
Exam, EE*

Explain (not just list) **three changes in the Earth system that resulted from the evolution of land plants from the Devonian into the Carboniferous.** Be as detailed about patterns and mechanisms as possible.

1 - Implied but not stated explicitly

*ESCI 2202: Final Exam, Q S1
Exam, ESA*

The Paleocene Thermal Maximum was driven by what change in the global carbon cycle? **How is this change recognized in the carbon isotope composition of the linked ocean-atmosphere-terrestrial biosphere system from the Late Paleocene to the Early Eocene?** What impact did this change have on deep-water marine carbonate sediments and why?

0 - No indication of expectations, only informal instructions

*ESCI 4401: Midterm, EC
Exam, ESA*

You've discovered an oracle of ultimate geophysical knowledge. You can ask the oracle one question about the solid Earth and be assured of a complete and accurate answer. What question do you ask and why? There are no wrong answers to this question, but to get points, you do need to provide a response.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
1.5: Develop your own hypothesis

Thursday, July 3, 2014
10:59 PM

2 - Stated unambiguously as an expectation

ESCI 4801 - Final, Q1
Exam, EE

This question is not so much about getting the right answer. It’s more about demonstrating a grasp of some reasonable possibilities based on what we’ve talked about in class, and demonstrating how you might go about testing those possibilities. If you don’t have enough preliminary “data” from what I have told you here, you might want to talk about other types of preliminary data that you’d like to collect, or other observations that you would want to make.

You are walking along the edge of a large closed basin lake in an arid region. You notice a small ~10 m² patch of whitish material on the lake bottom near shore (see picture below). You wade out and scoop up some of the material. What you observe is a ~5 cm thick crust of a rigid white-colored material (possibly a mineral) overlaying a layer of black-colored gelatinous material, also concentrated in a layer about 5 cm thick. You walk around the area, and don’t see any additional patches of whitish material or black gelatinous material. The sediment surrounding the white patch is typical granite-derived mud and gravel. Write one page proposing a hypothesis for the origin of this strange patch of material, and discuss how you plan to test that hypothesis.

1 - Implied but not stated explicitly

ESCI 2201: Field trip guide, Stop #4, Q2
Non-exam, SA

2. Some of the vesicles are filled with other minerals such as quartz and feldspar. When filled, the vesicles are called amygdales. How do you think they might have formed?

0 - No indication of expectations, only informal instructions

Not assessed.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
2 - Stated unambiguously as an expectation

ESCI 2203: Term paper assignment
Non-exam, WFL (10 pgs, single-spaced)

Below are some questions to frame your analysis; we suggest that you not try to address them all but instead choose 2-4 of them to focus on:

- What can the spatial and temporal variations of organic matter in Twin Lake tell us about spatial and temporal variations in biological, chemical, and physical processes in the lake and watershed?
- How might human activity influence the type, distribution, or abundance of organic matter in different parts of the lake?
- Why are Twin Lake bottom waters anoxic? Would you expect it to remain anoxic year round? How, where, why is anoxia evidenced in cores or other data?
- What impact might temperature have on element cycling or anoxia in Twin Lake? How might summer data differ from winter data?
- How do the size, shape and composition of the Twin Lake watershed/basin influence the sediment and/or geochemical characteristics of the lake?
- What evidence of stratification does this lake show? What effect would permanent stratification have on chemical and biological processes in the lake?

1 - Implied but not stated explicitly

Not assessed.

0 - No indication of expectations, only informal instructions

ESCI 4401: Midterm, EC
Exam, ESA

You've discovered an oracle of ultimate geophysical knowledge. You can ask the oracle one question about the solid Earth and be assured of a complete and accurate answer. What question do you ask and why? There are no wrong answers to this question, but to get points, you do need to provide a response.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
1.7: Summarize and synthesize information into abstract
Thursday, July 3, 2014
11:00 PM

2 - Stated unambiguously as an expectation

ESCI 3303W: Term Paper structure
Non-exam, WFL (15 pgs, double-spaced, 12-pt TNR)

Abstract:
This is one paragraph summary of the paper, including a summary of your conclusions. This is the first, and sometimes only, part of a scientific paper that will be read.

1 - Implied but not stated explicitly

Not assessed

0 - No indication of expectations, only informal instructions

ESCI 4401: Term Paper
Non-exam, WFL

A ten-page paper formatted in the style of the journal Geochimica Cosmochimica Acta is required and due the last day of class. The paper constitutes 20% of the grade. The last week of the class, students will make in class presentations on term-paper highlights.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
It is also important that you are able to clearly describe each of the characters you choose, so that there is no confusion. Imagine that you are talking to one of your lab partners on the phone, and are describing one of the specimens to them as they write down your description. Each feature you describe to them represents a potential character that can be used for phylogenetic analysis, and your partner should be able to clearly understand which features (characters) you are describing without actually being able to see the specimen.

Presentations: You will be required to give two in-class presentations, summarizing each of the two readings from the peer-reviewed literature that will be assigned to you. You can use Powerpoint, or you can give a "chalk-talk" with handouts. An excellent presentation will start with an introduction to put the paper in context, a discussion of the major results and discussion, along with a few comments of your own about what you thought was interesting, what could have been done better/differently, etc. At the end of the talk, you will ask the class for questions and comments, and lead a five-minute discussion. The “Participation” portion of your grade will be determined by your active participation in these discussions as an audience member.

Discuss two processes that create waters saltier than sea water in aquifers.

Briefly explain the difference between the active and passive models that are used to explain the dynamics of plate motion, and the main driving forces invoked for each.

Why are the cosmic abundances of Li, B, and Be in the Cosmic Abundance Curve (p.16) so low compared to their neighbors up to Fe?

Audience/reader learns what you have learned about your topic, no assumption of prior knowledge. You, the writer, are the authority on the subject, and need to teach the reader.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
3.1: Describe own field/lab work so others could reproduce it

2 - Stated unambiguously as an expectation

ESCI 4971W: Pumping test field report (paper requirements)
Non-exam, TR

Background and Methods: Present and discuss equations, a geologic cross section including all wells used in distance drawdown calculation, flow and water level measurement techniques, and field site geology.

1 - Implied but not stated explicitly

Not assessed.

0 - No indication of expectations, only informal instructions

Not assessed.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
3.2: Describe what was read/heard & seen

Thursday, July 3, 2014
11:01 PM

2 - Stated unambiguously as an expectation

ESCI 2301: Lab 7 - Optics I (general instructions)
Non-exam, LW

Answer or describe all properties on a separate sheet of paper. Choose only ONE of the thin sections. Title each thin section with its number and/or circle the one that you selected on this lab.

1 - Implied but not stated explicitly

ESCI 2203: Winogradsky column lab - data sheet
Non-exam, LW

0 - No indication of expectations, only informal instructions

ESCI 2302: Met lab 1
Non-exam, LW, SA

3. Examine the sample labeled NW08-4A. This is an eclogite (a rock name you need to know); a rock that forms when basalt or gabbro is metamorphosed at very high pressure, such as deep in a subduction zone. The green mineral in the eclogite is omphacite, a clinopyroxene that contains Na and Ca.

Note the reddish grains in the rock. What mineral is this? How did you identify the mineral? How could you test if you are right (other than asking Roxanne or Johnny)?

How could you test whether the protolith for this rock was likely basalt (or, at least, basaltic in composition)?

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don't concern yourself with ")

Not assessed
3.3: Draw clear sketches of own observations
Thursday, July 3, 2014
11:02 PM

2 - Stated unambiguously as an expectation

ESCI 2302: Igneous lab 2 (general instructions)
Non-exam, LW

Sometimes it can be helpful to sketch what you observe. Please include sketches for at least two of the following questions where you think it is most useful for documenting the textures. Make sure to label your sketch properly and indicate the scale.

1 - Implied but not stated explicitly

ESCI 2202: Lab 8 - Marine invertebrates
Non-exam, LW, SA

Name 3 diagnostic features of this group. Make a rough sketch of a member of this group.

0 - No indication of expectations, only informal instructions

ESCI 2302: Metamorphic petrology lab project (general instructions)
Non-exam, LR, WIS

You may use sketches or other images of key textures to accompany your report.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
4.1: Explain figures so the info can be understood without the figure

Thursday, July 3, 2014
11:02 PM

2 - Stated unambiguously as an expectation

ESCI 2202: Final, E3
Exam, EE

Below is a basic model for part of the Earth system during the Permo-Triassic mass extinction. Complete the 13 links between each component with correct symbol (arrow head for positive coupling and open circle for negative coupling, as indicated below the Earth system model for the case of increases in the first component) and use the completed diagram to explain how Siberian flood basalt volcanism could have driven changes in the Earth system to cause the mass extinction. You should refer to the linkages between each pair of boxes and follow a logical sequence through the connections. Be sure to indicate what changes might have acted as kill mechanisms. Finally, indicate whether each closed loop is a positive or negative feedback loop.

1 - Implied but not stated explicitly

ESCI 2301: Term paper (general instructions)
Non-exam, WFS

Your paper can contain up to four figures and/or tables, and each will be graded on their quality (use Adobe Illustrator in the lab!), their relevance to the paper’s central theme, and whether appropriate credit was given to any outside workers.

0 - No indication of expectations, only informal instructions

ESCI 4801: In-class presentations
Non-exam, DI

You will be required to give two in-class presentations, summarizing each of the two readings from the peer-reviewed literature that will be assigned to you. You can use Powerpoint, or you can give a “chalk-talk” with handouts. An excellent presentation will start with an introduction to put the paper in context, a discussion of the major results and discussion, along with a few comments of your own about what you thought was interesting, what could have been done better/differently, etc. At the end of the talk, you will ask the class for questions and comments, and lead a five-minute discussion. The “Participation” portion of your grade will be determined by your active participation in these discussions as an audience member.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed
2 - Stated unambiguously as an expectation

_ESCI 3303W: Final, QA3_
_Exam, ESA, F_

Write the isochron equation (identify the variables and constants) and an isochron diagram (with axes labeled) used in Rb-Sr dating. Explain how this equation can be used to obtain an age and an initial Sr isotopic composition. Be sure to state assumptions made in obtaining an initial value and an age using this method.

1 - Implied but not stated explicitly

_ESCI 4702: Final, Q7_
_Exam, SA_

Define hydraulic head, \( h \) (provide an equation and define each parameter) and explain why absolute values of \( h \) are not of interest but only relative differences in \( h \).

0 - No indication of expectations, only informal instructions

_ESCI 4801: Term paper instructions_
_Non-exam, WFL_

For this course, you will be required to write a literature review on a geomicrobiological process or group of geobiologically important organisms. The paper should be a minimum of 10 pages (12 point font, 1 inch margins, single-spaced) and a maximum of 15 pages. You should cite a minimum of 15 articles from the peer-reviewed literature.

-1: Confused/ambiguous (i.e. asks for thorough answer w/ no indication of how)

_ESCI 2301: Exam 2, Q3_
_Exam, SA_

What is Bragg’s Law? Label each of the variables.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed
4.3: List & describe variables & components of equations
Thursday, July 3, 2014
11:03 PM

2 - Stated unambiguously as an expectation

ESCI 2202: Final, Q 54
Exam, SA

Explain δ (delta) notation for stable isotope ratios using the carbon isotope system. Give the equation for calculating the δ13C value and explain each term.

1 - Implied but not stated explicitly

ESCI 3202: Final Q 9.1
Exam, SA, calc

If the sand is fully saturated with water, find the unit discharge (volume discharge per unit width of cliff face) of groundwater at the cliff face at right. Be sure to label your variables and explain what you are doing.

0 - No indication of expectations, only informal instructions

ESCI 4801: Term paper instructions
Non-exam, WFL

For this course, you will be required to write a literature review on a geomicrobiological process or group of geobiologically-important organisms. The paper should be a minimum of 10 pages (12 point font, 1 inch margins, single-spaced) and a maximum of 15 pages. You should cite a minimum of 15 articles from the peer-reviewed literature.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed
2 - Stated unambiguously as an expectation

ESCI 2201: Exam 1, Q 1a
Exam, F

Draw a simple stratigraphic section for typical oceanic crust and upper mantle. Include the names of the rock types and indicate on your sketch the location and depth of the crust-mantle boundary.

ESCI 4501: Field trip report (Baraboo)
Non-exam, WFL

Plot your structural data on Stereoplots, using different symbols for different structural elements (for lineations: F1 fold axes, F2 fold axes (if you measured these), Boudin axes, Bedding/Cleavage intersections). You may plot planar structures (bedding, S1 cleavage, S2 axial planes, joints) as planes or poles to planes.

1 - Implied but not stated explicitly

ESCI 3202: Lab 2, Q2
Non-exam, LW, SA

Draw a pressure-depth diagram with pressure along the x-axis and depth along the y-axis. Note that the depth of the system ranges from A to A’ and B to B’.

ESCI 2302: Igneous petrology homework 2 (general instructions)
Non-exam, H

Using the rock and mineral analyses on the following page, construct variation diagrams in order to answer the following questions. You will probably want to use Excel or some equivalent program to do the plotting.

0 - No indication of expectations, only informal instructions

ESCI 4801: Term paper instructions
Non-exam, WFL

For this course, you will be required to write a literature review on a geomicrobiological process or group of geobiologically-important organisms. The paper should be a minimum of 10 pages (12 point font, 1 inch margins, single-spaced) and a maximum of 15 pages. You should cite a minimum of 15 articles from the peer-reviewed literature.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

ESCI 4211 - Midterm Q7
Exam, SA

State, in words, the basic premise of isostatic equilibrium. Include all relevant details, but don’t waste words on specific types (e.g. Airy). You can use no more than 50 words and no graphics.
2 - Stated unambiguously as an expectation

ESCI 3303W - General Grading Rubric for Term Paper
Non-exam, WFL (15 pgs, double-spaced, 12-pt TNR)

6) Mechanics/polishing
   • Grammar (overuse of ‘this’ as a pronoun, subject/verb agreement, spelling)
   • Correct use of punctuation - avoid run-on sentences
   • Correct references/citation use and formatting

1 - Implied but not stated explicitly

ESCI 4702: Midterm, Q1
Exam, ESA

Define briefly and/or compare and contrast the following terms in words, give examples, where applicable you may also use equations or sketch a figure. [a couple of sentences expected for each term.]

0 - No indication of expectations, only informal instructions

ESCI 4501: Midterm 1, Q5
Exam, ESA

State what is meant by any four of the following:
a. Competence
b. Line of no infinitesimal elongation
c. Irrotational strain
d. Homogeneous stress
e. Deviatoric stress
f. Shear strain

ESCI 3202: Lab 13 - Coriolis force, page 2
Non-exam, LW

Imagine that the disk is a pole-down view of Earth. Remembering that Earth’s rotation is counterclockwise when viewed from the North Pole, what does the path of the marble suggest about how global winds and ocean currents will be affected by the Coriolis force?

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)
   Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")
   Not assessed.
5.2: Organize sentences into ¶, and ¶ into logical order

Thursday, July 3, 2014
11:00 PM

2 - Stated unambiguously as an expectation

ESCI 3303W: Term paper instructions
Non-exam, WFL

Organization: Your draft should be organized like a scientific research article, with the following features in sequence: title and authorship, abstract, introduction, presentation of data and discussion, conclusions, and references.

1 - Implied but not stated explicitly

ESCI 2202: Final, Section C
Exam, EE

Answer TWO of the three questions below in detailed and thorough essays that are clearly and logically written. Write neatly and in complete sentences.

0 - No indication of expectations, only informal instructions

ESCI 3303W: Final
Exam, EE

To receive full credit, your answers should be clear and complete.

A1. What is the modern estimate of the age of the universe? Describe how this was determined starting with Fraunhofer Lines and Cepheid Variables.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed

-2: Counter-indicated (i.e. "don’t concern yourself with ...")

Not assessed
5.3: Write research paper on a specific topic in journal style
Thursday, July 3, 2014
11:00 PM

2 - Stated unambiguously as an expectation

ESCI 2301: Term paper
Non-exam, WFS

References do not count towards the final page count and should be cited within the text of the paper using the conventions of the American Geophysical Union (downloadable as a PDF from the class website). You are expected to cite at least 3 peer-reviewed JOURNAL articles in your paper.

1 - Implied but not stated explicitly

ESCI 4801: Term paper instructions
Non-exam, WFL

For this course, you will be required to write a literature review on a geomicrobiological process or group of geobiologically-important organisms. The paper should be a minimum of 10 pages (12 point font, 1 inch margins, single-spaced) and a maximum of 15 pages. You should cite a minimum of 15 articles from the peer-reviewed literature.

0 - No indication of expectations, only informal instructions

Not assessed.

-1: Confused/ambiguous (i.e. asks for thorough answer w/no indication of how)

Not assessed.

-2: Counter-indicated (i.e. "don't concern yourself with ...")

Not assessed.
Comparison of Independent Reviewers’ (IR) ratings to our internal ratings

— Alignment of our rating categories w/IR categories —

Independent reviewers’ (IR) categories

1  1.2  Synthesize multiple ideas
2  2.1  Consistently uses content appropriate for scientific audiences
3  2.1  Consistently uses language appropriate for scientific audiences
4  2.1  Consistently uses formats appropriate for scientific audiences
5  5.1†  Communicates clearly & unambiguously
6  3.1+3.2  Describe what is seen (in the field/lab) read or heard so observations and info is understandable to someone who was not present
7  4.1  Explains meaning of data/figures so they’re understandable to someone who doesn’t have the data/figures
8  4.4  Communicates info, data & concepts in figures, graphs, diagrams clearly with adequate labels
9  4.4  Communicates info, data & concepts in figures, graphs, diagrams clearly with adequate labels
10  4.4  Communicates info, data & concepts in figures, graphs, diagrams clearly w/o extraneous or distracting elements
11  5.2  Answers a question of makes a point using logically sequenced sentences
12  5.1  Answers a question of makes a point using clear & informative sentences
13  2.1  Reports on a specific topic in an appropriate style using suitably technical language

Our ratings categories

Category 1: Synthesis, thought development
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
1-7: Summarize & synthesize info into an abstract

3-3: Draw clear sketches of own observations

Category 2: Writing to a specific audience

3-1: Describe own field/lab work so others could reproduce
3-2: Describe what was read/heard & seen

Category 3: Description of own experiences

Category 4: Expression of ‘non-prose’ concepts
4-1: Expl explains so the info c/b understood w/o the figure
4-2: Expl meaning of math or chemical equations
4-3: List and describe variables & components of equations
4-4: Make figure/graph/diagram clearly & economically

Category 5: Language mechanics
5-1: Write clear & informative sentences
5-2: Organize sentences into ¶ and ¶ into logical order
5-3: Write a research paper on a specific topic in journal style
5-4: Write articulate, professional correspondence
5-5: Know when professional correspondence is called for
Specific observations

1) IR categories 2, 3 & 4 parse our category #2.1 into subcategories, as addressing scientific audiences only. I am unclear as to how to interpret their category # 4. For comparison, IR ratings for individual categories 2, 3 & 4, as well as an average of them, were each compared to our category 2.1.

2) IR category 13 also most closely correlates with our category 2.1

3) Re: IR category 6: this may relate to the original DWA #4. For comparison, this was compared to the average of our categories 3.1 & 3.2.

4) IR categories 8, 9 & 10 parse our category #4.4 into subcategories. For comparison, each of these IR categories were compared to our category 4.4.

5) The following of our categories are not addressed in the Aug. 2013 IR assessments: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 3.3, 4.2, 4.3, 5.3, 5.4, 5.5.

Summary observations

1) Variance in focus
   • IR focus is on our categories 2.1 (esp: writing to a scientific audience) and 4.4 (figures/graphs/diagram) while our assessments incorporate additional criteria. Is there any possibility of having the IR do another assessment to include our additional criteria?

   — Reconciled as shown on previous page —

2) Criteria: apples & oranges
   • IR ratings run from 0 to 1, signifying insufficient to sufficient
   • Our ratings are:
     -2 = counter-indicated
     -1 = confused/ambiguous
     0 = no indication of expectation, only informal instructions
     +1 = implied but not stated explicitly
     +2 = stated unambiguously as an expectation

   — Reconciled by dividing our average ratings by 2 —

   We acknowledge that this is not necessarily an accurate reflection of ratings, as the scales are different: IR ratings don’t identify counter-indicated (our negatively-valued ratings) while ours sought to identify this.

3) Ratings: apples & oranges
   • IR ratings are of student work
   • While our ratings are of instructions re: writing.

   — Recognition of this should inform interpretation of the data —

4) Primary lessons
   For the purposes of showing advances in the writing categories as assessed by IR, specific attention should be given to:
   1) working with figures and captions, and
   2) distinguishing content, language and formats of writings addressed to scientific audiences.
**Writing criteria category subdivisions**

**Category 1: Synthesis, thought development**
- 1-1: Cite multiple references
- 1-2: Synthesize disparate ideas
- 1-3: Express broad (or novel) understanding
- 1-4: Place in geological time & evolution
- 1-5: Develop your own hypothesis
- 1-6: State & answer a scientific question
- 1-7: Summarize & synthesize info into an abstract

**Category 2: Writing to a specific audience**
- 2-1: Writing to a specific audience

**Category 3: Description of own experiences**
- 3-1: Describe own field/lab work so others could reproduce
- 3-2: Describe what was read/heard & seen
- 3-3: Draw clear sketches of own observations

**Category 4: Expression of ‘non-prose’ concepts**
- 4-1: Expl figures so the info c/b understood w/o the figure
- 4-2: Expl meaning of math or chemical equations
- 4-3: List and describe variables & components of equations
- 4-4: Make figure/graph/diagram clearly & economically

**Category 5: Language mechanics**
- 5-1: Write clear & informative sentences
- 5-2: Organize sentences into ¶ and ¶ into logical order
- 5-3: Write a research paper on a specific topic in journal style
- 5-4: Write articulate, professional correspondence
- 5-5: Know when professional correspondence is called for

**Ratings descriptions**

+2: Stated unambiguously as an expectation
+1: Implied but not stated explicitly
0: No indication of expectations, only informal instructions

-1: Confused/ambiguous
  (i.e. asks for thorough answer w/no indication of how)
-2: Counter-indicated (i.e. “don’t concern yourself with …”)
All levels • Non-exam assignments

$n = 752$

--- Writing criteria ---

**Category 1:** Synthesis, thought development
1-1: Cite multiple references
1-2: Synthesize disparate ideas
1-3: Express broad (or novel) understanding
1-4: Place in geological time & evolution
1-5: Develop your own hypothesis
1-6: State & answer a scientific question
1-7: Summarize & synthesize info into an abstract

**Category 2:** Writing to a specific audience
2-1: Writing to a specific audience

**Category 3:** Description of own experiences
3-1: Describe own field/lab work so others could reproduce
3-2: Describe what was readheard & seen
3-3: Draw clear sketches of own observations

**Category 4:** Expression of ‘non-prose’ concepts
4-1: Expl figures so the info c/b understood w/o the figure
4-2: Expl meaning of math or chemical equations
4-3: List and describe variables & components of equations
4-4: Make figure/graph/diagram clearly & economically

**Category 5:** Language mechanics
5-1: Write clear & informative sentences
5-2: Organize sentences into ¶ and ¶ into logical order
5-3: Write a research paper on a specific topic in journal style
5-4: Write articulate, professional correspondence
5-5: Know when professional correspondence is called for

--- Ratings descriptions ---

+2: Stated unambiguously as an expectation
+1: Implied but not stated explicitly
0: No indication of expectations, only informal instructions
−1: Confused/ambiguous
(i.e. asks for thorough answer w/no indication of how)
−2: Counter-indicated (i.e. “don’t concern yourself with …”)
### Writing criteria category subdivisions

**Category 1: Synthesis, thought development**
- 1-1: Cite multiple references
- 1-2: Synthesize disparate ideas
- 1-3: Express broad (or novel) understanding
- 1-4: Place in geological time & evolution
- 1-5: Develop your own hypothesis
- 1-6: State & answer a scientific question
- 1-7: Summarize & synthesize info into an abstract

**Category 2: Writing to a specific audience**
- 2-1: Writing to a specific audience

**Category 3: Description of own experiences**
- 3-1: Describe own field/lab work so others could reproduce
- 3-2: Describe what was read/heard & seen
- 3-3: Draw clear sketches of own observations

**Category 4: Expression of ‘non-prose’ concepts**
- 4-1: Expl figures so the info c/b understood w/o the figure
- 4-2: Expl meaning of math or chemical equations
- 4-3: List and describe variables & components of equations
- 4-4: Make figure/graph/diagram clearly & economically

**Category 5: Language mechanics**
- 5-1: Write clear & informative sentences
- 5-2: Organize sentences into ¶ and ¶ into logical order
- 5-3: Write a research paper on a specific topic in journal style
- 5-4: Write articulate, professional correspondence
- 5-5: Know when professional correspondence is called for

### Ratings descriptions

- **+2:** Stated unambiguously as an expectation
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- **−2:** Counter-indicated (i.e. "don’t concern yourself with …")
2000 level • All assignments

- Chart showing ratings for different categories:
  - Category 1: Synthesis, thought development
    - 1-1: Cite multiple references
    - 1-2: Synthesize disparate ideas
    - 1-3: Express broad (or novel) understanding
    - 1-4: Place in geological time & evolution
    - 1-5: Develop your own hypothesis
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  - Category 2: Writing to a specific audience
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    - 4-1: Expl figures so the info c/b understood w/o the figure
    - 4-2: Expl meaning of math or chemical equations
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- Chart with x-axis showing categories 1 through 5 labeled, and y-axis showing ratings from -3 to +3.
- Legend showing average, max, and min values for each category.
### Writing criteria category subdivisions

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### 2000 level • Exams

**n = 145**

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3000 level • Non-exam assignments

--- Writing criteria ---

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4000 level • Non-exam assignments

n = 1095

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**2000 – 3000 comparison • All assignments**

- **2000 × 3000**
2000 – 3000 comparison • Non-exam assignments

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2000 – 3000 comparison • Exams

○ 2000 × 3000

— Writing criteria —

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3000 – 4000 comparison • All assignments

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3000 – 4000 comparison • Non-exam assignments

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V. WEC Writing Plan Requests

Unit Name: Earth Sciences

Financial Requests *(requests cannot include faculty salary support)* drop-down choices will appear when cell next to "semester"is selected

Total Financial Request: $23,291.46

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<tr>
<td>Fringe benefits, 26% grad RA</td>
<td>$1,272.00</td>
<td>Fringe benefits, 25% grad RA</td>
<td>$1,303.80</td>
<td>Fringe benefits, 26% grad RA</td>
<td>$1,336.40</td>
</tr>
</tbody>
</table>

Semester 1 Total: $5,609.00  
Semester 2 Total: $5,749.23  
Semester 3 Total: $5,892.96

Rationale for costs and their schedule of distribution

Stipend, tuition, and fringe benefits for the 25% time graduate RA are based on expected rates for 2014-2015 and assumes an increase of 2.5% each semester. The plan of work for each semester is described in Section #5 of the Narrative for the Writing Plan. Semester 4 is F2016 but the pull down menu does not go that far forward in time.

Service Requests *drop-down choices will appear when a cell in the "service" column is selected*

<table>
<thead>
<tr>
<th>Service</th>
<th>Qty</th>
<th>Service</th>
<th>Qty</th>
<th>Service</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation</td>
<td>1</td>
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<tr>
<td>Workshop</td>
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<td>Workshop</td>
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<td>Workshop</td>
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Description and rationale for services

We anticipate at least one formal consultation with WEC staff each semester beyond normally planned meetings to discuss modules being developed, use of modules, assistance with grading rubrics, and ways to implement assessment of student writing into the Annual Progress Report on SLOs. We anticipate at least one workshop with faculty led by WEC staff in the first two semesters on five minute workshops and one in the third semester on grading rubrics.
<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Item</th>
<th>Cost</th>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>25% Grad RA salary</td>
<td>$4,670.47</td>
<td>Fringe benefits, 25% grad RA</td>
<td>$1,369.80</td>
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<tr>
<td>Semester 4 Total:</td>
<td>$6,040.27</td>
<td>Semester 5 Total:</td>
<td>$0.00</td>
<td>Semester 6 Total:</td>
<td>$0.00</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Service</th>
<th>Qty</th>
<th>Service</th>
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<tbody>
<tr>
<td>Consultation</td>
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October 24, 2014

To: David Fox, Earth Sciences
From: Robert McMaster, Office of Undergraduate Education
Subject: Decision regarding WEC funding proposal

The Department of Earth Sciences recently requested the following funding to support its Writing Enriched Curriculum:

<table>
<thead>
<tr>
<th></th>
<th>25% Graduate Assistant</th>
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</thead>
<tbody>
<tr>
<td>Spring 2015</td>
<td>$4,337.00</td>
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<tr>
<td>Spring 2015</td>
<td>$1,272.00</td>
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<tr>
<td>Fall 2015</td>
<td>$4,445.43</td>
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<tr>
<td>Fall 2015</td>
<td>$1,303.80</td>
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</tr>
<tr>
<td>Spring 2016</td>
<td>$4,556.56</td>
<td></td>
</tr>
<tr>
<td>Spring 2016</td>
<td>$1,336.40</td>
<td></td>
</tr>
<tr>
<td>Fall 2016</td>
<td>$4,670.47</td>
<td></td>
</tr>
<tr>
<td>Fall 2016</td>
<td>$1,369.80</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL REQUEST</strong></td>
<td><strong>$23,291.46</strong></td>
<td></td>
</tr>
</tbody>
</table>

The highlighted items above have been approved by the Office of Undergraduate Education, for a total of $11,359. Please provide Pat Ferrian (ferri004@umn.edu) with your department’s EFS information so the funds may be transferred. The funds transfer request must be initiated by your department no later than 30 days after the receipt of this letter.

The Office of Undergraduate Education is largely supportive of the full fiscal request, and is very enthusiastic about the data that have already been collected. However, experience has shown that maintaining a Graduate Assistant (GA) in the same project over multiple years can be difficult if goals and deliverables are not examined and reorganized periodically. Therefore, the Office of Undergraduate Education requests that you provide a report after two semesters describing what has been accomplished thus far, and how the project will move forward during the following two semesters. Here are the specific areas that should be addressed in the report:

- Describe briefly for each of the four primary objectives (writing plan, page 10): what happened, how well it worked, and next steps; with emphasis on the role of the GA.
- Explain how often the liaison and GA met, and how that influenced the outcomes of the project. We are interested in this primarily due to concerns expressed by both you and others regarding a GA’s standing and ability to navigate among faculty.
- Describe what aspects of the project are left to complete in the latter two semesters.

Please send this letter to Leslie Schiff in the Office of Undergraduate Education, with a CC to Pamela Flash, by December 15, 2015. Based on the information provided, the Office of Undergraduate Education will grant approval for the remaining fiscal request of $11,933.

CC: Suzanne Bardouche, Molly Bendzick, Will Durfee, Pat Ferrian, Pamela Flash, Doug Johnson, Leslie Schiff