Supplemental Information for:

Students Own their Introductory Chemistry Experience: Becoming an Element for a Semester

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Instructions for the project

Elemental Perspectives: iElement Project

For this semester, you will become an element of your choosing! (within the constraints of a list) You will experience the topics of this course from the unique perspective of this element. You will find your place in the class by comparing yourself to other students (elements). You will discover how similar and how different you are to the others. I will guide you in the process by presenting problems to explore and solve from the perspective of your element. You will be required to summarize your findings periodically (no pun intended) throughout the semester – including during exams. Towards the end of the semester you will create a short video summarizing your identity. You will have time to plan this video, and use elements from a pilot video you create towards the beginning of the semester. The final videos from the class will be organized into a virtual periodic table that can be viewed by other students of chemistry.

Construction of Element Videos

Based on what you have learned in class up to this point, and with any other desired resources, you will develop TWO short videos describing your element.

First Take: (50 points)

- Describe the structure of an atom using terminology that would be understood by a fifth grade student. Be creative in your analogy!
- Include information about your particular element (i.e. subatomic particles). Feel free to use class activities as inspiration.
- The length of the video should be 1-2 minutes.
- Your video is due by the end of the day on **Friday February 19, 2016**. This should be uploaded to the Moodle forum for Take 1. Instructions for uploading will follow.
- Your video will be critiqued by your classmates, and you will critique others. Comments are due by **Friday March 11, 2016.** Instructions for commenting will follow.

Grade breakdown, Take 1 (first draft of video):

Requirement	**Points**
Appropriate Discussion of atomic structure, charges, subatomic particles, etc.	35
Comment on at least one other video	5
On time (by 11:59 pm on the due date)	5
Is a video that can be paused, stopped, etc. (not just a ppt)	5

Final Take: (100 points)

- Expand upon your first video to include information about the “oxide(s)” and “chloride(s)” of your element and their properties. Include more specific information unique to your element, such as:

    - Atomic properties, empirical formula, solubility of your compounds, ionic vs. covalent interactions, similarities with other group members, redox reactions, e^- configuration, valence electrons, polarity and structural properties, VSEPR, abundance in the earth, cost, color, and other descriptive properties found in the last three chapters of your textbook. You should be creative and include interesting facts about yourself (as you are assuming the identity of the element)
- Include **one exam question** towards the end of the video that you would like to quiz your classmates on, in terms of your element. For example, perhaps you are carbon and you ask "If I combine with hydrogen, what would my molecular formula be, and what electron and molecular geometries would I form?" This is a reasonable exam question.
    - Keep in mind that a student should be able to answer this question without the internet, textbook, or course notes.
    - **Please do not mention or show the answer to this question after you ask the question.**
- The final video should be ~3 minutes. *Narration is required*.
- An outline and technical plan for this video are due **Friday April 8, 2016** by 11:59pm**.** The instructor will approve your plan, or offer suggestions for improvement.
    - The technical plan is a guideline for the instructor to see what materials you plan to use in your video and how you will construct your video and narrate (i.e. figures, words, particular software, music, narration, etc.)
- The finished video is due by 11:59 pm **Friday April 29, 2016:** upload to appropriate Moodle forum.
- Comments on classmates' videos are due by the last day of class (**May 5**) by 11:59pm.
- The 3-5 best videos will be showcased in a viewing party during the final exam time. If your video is chosen as a winning video, you will earn 5 extra points for the final iElement project grade.

Grade breakdown, Final Take:

Requirement	**Points**
Thorough discussion of material from Take 1, as well as new material and fun facts.	60
Comment on another video	5
On time: by 11:59 pm on the due date	5
Is a video that can be paused, stopped, etc.; not just a ppt	10
Contains a good, useable final exam question without answer given	10
Sharing in Class*	10

*In class you will be asked to share what you have learned about your element. It can relate to the day's topic, or it can be a fun fact. Sharing more than once is encouraged!

Final Exam Material

During the final exam time, you will view the highlighted Final Take videos of several of your classmates. Each video will contain a question towards the end pertaining to the highlighted element. For each of the showcased videos you will:

- Answer the posed question using only the periodic table and other materials provided by the instructor.
- Provide a brief summary of that particular element, based on what the video presented, and highlight what was good and what was not so good (i.e. a movie review!)
- Answer any additional questions on the final exam as provided by the instructor.

Preservation of Work

Your videos will be posted to a webpage for archiving. Each element will be linked to a series of videos. These informative vignettes will be available for viewing to anyone interested in the elements and chemistry.

Video Uploading

1. Go to the Moodle page for CHM 134 and scroll down to “Video assignments for uploading and commenting”. Select “First Take iElement video” (for the first take)
2. This is a forum. You will need to select “Add a new topic” to create a session. This will be your session for your video.
3. In the Subject line, list Element_Lastname_FinalTake (or whatever take it happens to be)
4. In the Message, feel free to introduce us to your element, or just type its symbol. This field cannot be left blank.
5. Upload your video file as an attachment. Keep in mind that there is a 200MB limit for attachments. If it is too large, post your video on YouTube and provide a link in the Message. Your email account is linked to YouTube through Google.
6. Click “post to forum” to finalize your entry.
7. ***NOTE: Once you post to this forum you will be automatically subscribed to it.** You may wish to unsubscribe in order to avoid receiving multiple email notifications when others are posting and commenting.

Video Commenting

1. Click on “Discuss this topic”, and then “reply”. You may also reply to another’s comment within the thread, but try to stick with replying to the original video submission.
2. In your reply, give solid constructive feedback. Or, ask a question. This is where your classmates can really use your advice. If you have something that would help the video improve, please do share it! Click “post” to send your comments live.
3. For the final take, I encourage you to watch as many as you can, and comment.

Learning Objectives aligned with this project

Learning objective covered in lecture	Assessed with final *iElement* video	Assessed with in-class/exam questions related to *iElement*	Assessed with "traditional" homework/exams/lab
Perform standard measurements and calculations using SI units and scientific notation			
Use dimensional analysis in quantitative calculations			
Rationalize periodic trends and use them to predict certain properties of the elements			
Name simple inorganic compounds			
Write the electronic configuration of any atom			
Describe the bonding in certain molecules as ionic, covalent, or polar covalent			
Draw appropriate Lewis dot structures for molecules			
Use the mole concept in stoichiometric problems including limiting reactant			
Predict the outcome of precipitation reactions and balance reactions, including redox reactions			
Describe simple acid-base reactions			
Predict molecular shape using VSEPR theory			

Shaded areas indicate that the particular learning objective is assessed through that type of activity. It should be noted that the final video is flexible, so many times students do include information covered in other learning objectives, but it is not required. For example, a student may include an exam question requiring a stoichiometric calculation.

Additionally, these learning objectives are the same for both before *iElement* and after. No course content was sacrificed for the inclusion of this project. The **context** of the content was adjusted, and thus all desired content remained in the course.

Grading Rubric for the project

Take 1 *(50 points total)*	**Exceeds Expectations >90 % of the points earned**	**Meets Expectations >75% of the points earned**	**Not Yet Meeting Expectations <74% of the points earned**
Content *35 points possible*	Correctly describes element with subatomic particles (including charges), atomic structure (location of SAP) and element description is correct. Includes fun facts.	Correctly describes most properties with one or two small errors. Small spelling or grammar mistakes.	Lacking one or more components (for example does not mention charges of SAP). Or, missing fun facts. Several spelling or grammar mistakes.
Comment *5 points possible*	Complete and on time. (5 points)	N/A	Incomplete or late (0 points)
Deadline *5 points possible*	Posted to Moodle by 11:59pm. (5 points)	N/A	Not posted by the deadline (12:00 am or later) (0 points)
Format *5 points possible*	Is a "playable" video. PPT files are OK, MP4 files are preferred. Is appropriate length. Narration is desired.	Is a video but is too short or too long.	Not a video (0 points)
Final Take *(100 points)*			
Content *60 points possible*	Correctly describes element with subatomic particles (including charges), atomic structure (location of SAP) and element description is correct. Includes fun facts.	Correctly describes most properties with one or two small errors. Small spelling or grammar mistakes.	Lacking one or more components (for example does not mention charges of SAP). Or, missing fun facts. Several spelling or grammar mistakes.
Comment *5 points possible*	Complete and on time. (5 points)	N/A	Incomplete or late (0 points)
Deadline *5 points possible*	Posted to Moodle by 11:59pm. (5 points)	N/A	Not posted by the deadline, 12:00 am or later (0 points)
Format *10 points possible*	Is a "playable" video. Must be MP4 or similar. Must include narration. Is appropriate length.	Playable PPT (not MP4). Length is too long or short. Poor editing or no narration.	Length is >5 min or <2 min. Not a video (0 points)
Final Exam question *10 points possible*	Creative, useable question similar to those asked on in-class assignments. No mistakes.	Question is not rigorous enough or has a mistake.	Question includes answer. Missing question (0 points)
Sharing in class *10 points possible*	Complete and on time. (10 points)	N/A	Incomplete (0 points)

Course Topics and Sample in-class problems given to students

This course is a first-semester course in a two-course sequence of general chemistry and utilizes the Tro textbook, *Chemistry: A Molecular Approach*. The topics by chapter and some sample questions are described below, organized by chapter. Chapters 5 and 6 are covered in the second semester course.

Chapter 1: Matter, measurement and problem solving

- Given the density of *YOUR ELEMENT*, what is the volume (in liters) of a sample of *YOUR ELEMENT* that has a mass equal to 4.73 kilograms?

Chapter 2: Atoms and Elements

- Draw a picture of a neutral atom of *YOUR ELEMENT*. Use (+) for protons, (o) for neutrons, and (-) for electrons. If you have a heavier element, you can abbreviate the number of atomic particles, but list the correct number in a legend.

Chapter 3: Molecules, compounds, and chemical equations

- (a) For *YOUR ELEMENT*, what is the formula of the simplest oxide? (that is, if you have a nonmetal, a monoxide; if you have a transition metal, determine the most common charge of the transition metal from the instructor or the periodic table). (b) Using the molecular formula determined in (a), determine the number of moles of your element alone that are contained in a 50.0 g sample of (a). **If you have a noble gas, use silver(I) as "your element" in part (a).

Chapter 4: Chemical quantities and aqueous reactions

- Consider the reaction of *YOUR ELEMENT* with oxygen to form the oxide product. Group 1-2 and group 13 elements will combine in a general (unbalanced) reaction shown here:

  $M (s) + O_2 (g) \rightarrow M_xO_y$

  The same general concept exists for nonmetals in groups 14-16. That is, the element will combine with oxygen, and with enough energy (high temperatures), will form an oxide product. You may need additional resources to determine the formula of your oxide.
  (a) Determine the chemical reaction required to form the oxide product with *YOUR ELEMENT*; Balance it.
  (b) If you combine 20.0 grams of your element and 35.5 grams of oxygen, what mass (in grams) of product (the oxide) can be formed?
  (c) Assume your reaction regularly gives 74% yield. What amount of product (in grams) can you expect as an actual yield, given your answer for (b)?

Chapter 7: The quantum-mechanical model of the atom

Chapter 8: Periodic properties of the elements

- What is the most common ion (anion or cation) of *YOUR ELEMENT*? Explain why this ion likes to form. For that ion, give the electron configuration. **For transition metals, chose a common cation or ask the instructor for advice. For noble gases, complete this problem using Antimony.

Chapter 9: Chemical bonding I: Lewis theory

Chapter 10: Chemical bonding II: Molecular shapes, valence bond theory, and molecular orbital theory.

Example final exam video questions: student-provided

1. Potassium: The number of valence electrons in a neutral atom of potassium is one. Now, assume that potassium has lost two electrons. Do the following:
    a. Give the new number of valence electrons
    b. State the four quantum numbers [of the outermost electron].
    c. Tell whether [the ion] is paramagnetic or diamagnetic.
2. Iodine: Since our bodies require a daily intake of 0.01 mg of iodine a day, how many moles of iodine are needed?
3. Sodium: In the following precipitate problem, give the full and net ionic equation. Include all the phases in your answer.
   H_2SO_4 (*aq*) + NaOH (*aq*) →
4. Bromine: Bromine was to form a bond with fluorine to make bromine pentafluoride, what would the Lewis structure be? [draw it] Also include the molecular geometry and electron geometry [VSEPR assignments].

Example final exam video questions: required by instructor

These questions were posed for each winning element video viewed during the exam period.

1. What is the element's atomic number?
2. What is the element's electron configuration?
3. What is your favorite fun fact about this element?
4. Finally, provide a 1-2 sentence movie review!

Elements included in the project

Becoming an element!
From the following list, choose an element of which you will assume the role of for the entire semester in General Chemistry I.

Aluminum _____
Arsenic _____
Barium _____
Boron _____
Bromine _____
Calcium _____
Chromium _____
Cobalt _____
Copper _____
Fluorine _____
Gallium _____
Iodine _____
Iron _____
Lead _____
Magnesium _____
Molybdenum _____
Neon* _____
Nickel _____
Nitrogen _____
Phosphorous _____
Potassium _____
Selenium _____
Silicon _____
Silver _____
Sodium _____
Sulfur _____
Tellurium _____
Titanium _____
Vanadium _____
Xenon* _____

*Students that choose these two elements will work together to represent this group (noble gases). The reactivity of these elements differs from each other, and each represents one "more reactive" noble gas and one "non-reactive" noble gas. These two students will be our go-to people when we discuss noble gasses!

Course grades before and after *iElement*

The table and pie charts, although simple, show that there is not a notable difference between course grades before and after implementing this project. Improving grades was not an objective of this project, but it is important to note that overall grades were not impacted negatively as a result of the *iElement* project.

	Pre *iElement*		Post *iElement*	
Grade	n=66	%	n=111	%
3.5/4	23	34.8	41	36.9
2.5/3	30	45.5	52	46.8
2	6	9.1	7	6.3
0/1	7	10.6	11	9.9