

## Final Paper Guidelines

In Chemistry 111, we focus on learning the principles of atomic properties (Chapters 7 and 8) and chemical bonding (Chapters 9, 10, and 23). We do not have much time in the course to consider in detail how these principles apply to specific elements on the periodic table, or how these principles affect their use and role in the “real world.” This assignment gives you the opportunity to choose a set of elements, read in depth about its properties and impact on the world, and write a clear and focused six-to-eight page paper (doubled-spaced, 12 point font) on your research. This assignment will be in lieu of a final examination.

### Timeline and Expectations

- Monday, October 17: Prepare for our second library training session (7:00 p.m., 2nd floor of the Wallace Library) by doing the following tasks:

(1) Read this handout, and come with questions!

(2) Read an article on plagiarism published in the *Chronicle of Higher Education* at <http://chronicle.com/free/v51/i17/17a00901.htm> (I will e-mail this link to you), and be prepared to discuss it.

(3) Choose a set of elements. Your options are the following:

- One of the main groups (1A, 2A, 3A, 4A, 5A, 6A, 7A, or 8A)
- An important subset of the Period 4 transition elements (Cr-Ni)

Tough Decisions. So, how do I make a commitment to a set of elements?? Skim through Chapter 14, Chapter 22, and Sections 1-3 of Chapter 23 in Silberberg. Also check out the super-cool periodic tables mounted on the north side of Olin-Rice 350! Look for interesting chemical properties or intriguing applications. You are also encouraged to find a classmate who shares your passion for, say, alkaline earth elements or halogens. You may find it helpful to share ideas and resources throughout the semester. However, you are not required to collaborate, and note that each person must do his or her own research, and turn in a separate paper at the end of the semester.

- From now until November 23: Reading and writing on your topic

**A. Audience.** Assume you are writing to a fellow Chemistry 111 student. You should therefore avoid an excessively technical discussion. Instead, seek to explain things using the concepts and language we have learned in class. It will be necessary in some cases to go beyond course content (this is a research paper, after all), but even in these situations you should strive to describe things in a way that a classmate could understand.

**B. Content.** Your paper must address each of these issues:

- (1) Atomic Properties. You should discuss the electron configuration of your set of elements, and how its properties vary down the group (or, in the case of the transition elements, across the period). Discuss both properties of individual atoms, like ionization energy, and bulk properties, like each element's state of matter at room temperature and its melting point. With regard to bulk properties, you should also discuss how atoms of the same element interact with each other. This varies widely across the periodic table. While many non-metallic elements form molecules, the metals are held together by metallic bonding (see Silberberg Section 9.6), and Group 8A experiences only intermolecular forces (see Silberberg Section 12.3).
- (2) Chemical Bonding. Discuss how elements in your set form covalent, ionic, or coordinate covalent bonds with other elements. Make liberal use of the concepts we have discussed, or will discuss, in class.
- (3) Chemistry in Context. (This was the title of an American Chemical Society textbook originally edited by my predecessor, Professor A. Truman Schwartz.) Select and discuss one application of your set of elements to the real world. You may discuss either one particular element or a set of elements. However, if you are studying Group 4A, you cannot discuss the application of carbon! The "real world" can involve anything: the environment, interstellar space, new materials, mining, medicine, archaeology. Your discussion must attempt to relate the atomic and/or chemical bonding properties you considered above to this real world context.

**C. Sources.** At a minimum, you must use the following:

- (1) Your textbook. It is rich with information!
- (2) Another general chemistry textbook. I have put four recent titles on 24-hour reserve at the library. (See <http://clicnet.clic.edu/search/p> and search on Kuwata.)
- (3) A book besides a general chemistry textbook.
- (4) At least two articles from the scientific literature. The articles may come either from the popular scientific press (*Chemical and Engineering News* is excellent) or from a peer-reviewed periodical. (Remember the distinction Dave Collins made at our first library session.) The *Journal of Chemical Education* is a good example of a (usually) readable peer-reviewed journal.

Insert a superscript number the first time you cite a particular reference in the main body of the text, and always use the same superscript number whenever you cite the same source in your report. Instead of using footnotes, list all references at the end. (See your lab report handout for the American Chemical Society reference format.)

I know that the scientific literature can get really intense, really quickly. I do not expect you to decipher dense, advanced articles. However, I do want you to read from a variety of sources. The books should help you write about atomic properties and chemical bonding. The articles will be the basis for your discussion of a real-

world application. Silberberg's brief discussion of applications can help you decide on a topic, but you will need to go into greater detail than what he provides.

**D. Writing.** Strive to be as clear and organized in your writing as possible. You should present a highly coherent narrative whose ideas flow from sentence to sentence, and from paragraph to paragraph. No writer achieves this in his or her "unofficial" first draft. You should therefore expect to revise your paper a number of times before you turn in your "official" first draft. Good writing takes lots of hard work, but it is worth it, both to yourself and to your readers. As Samuel Johnson once observed, "What is written without effort is generally read without pleasure."<sup>1</sup>

Coherence within a text presupposes that each sentence is free from errors of grammar, syntax, and punctuation. Consult Andrea Lunsford's *Easy Writer* for the rules of standard written English. Microsoft Word's spelling and grammar checker, and your own careful proofreading, should eliminate most errors.

The structure of this paper will be rather different from the structure of your lab reports. The only things you are required to provide in this paper are a **Title**, a **References** section, and a section of **Acknowledgments**. In the acknowledgments section you must mention everyone who has helped you with your paper, both students and faculty, and state briefly how they helped you. Beyond that, you are free to organize your paper in whatever way makes best sense to you. If having explicit sections for an introduction and a conclusion helps you organize your writing better, you are free to include them—but you are not required to.

Using tables, figures, mathematical equations, and chemical structures may improve the clarity of your discussion. Here are my expectations for each textual device:

1. Tables: Use Microsoft Word's Table utility. Be sure to label each column and row, and give the table a brief title.
2. Figures: You may either draw figures using computer software (don't draw by hand), or use figures from other sources. Remember to give credit to the books, articles, or web sites you took them from. Each figure must have a (brief) caption.
3. Equations: They must not be hand-written. Make sure that subscripts and exponents look like subscripts and exponents! Equations that involve more than one line of characters should be entered using Microsoft Equation. (Access this program by choosing Object from the **Insert** pull-down menu in Microsoft Word.)

For example,

$$\text{rate} = -\frac{d[\text{Mo}(\text{CO})_6]}{dt} = k[\text{Mo}(\text{CO})_6][\text{P}(\text{OPh})_3]$$

is far preferable to

$$\text{rate} = -d[\text{Mo}(\text{CO})_6]/dt = k[\text{Mo}(\text{CO})_6][\text{P}(\text{OPh})_3]$$

4. Chemical structures: You should either scan these in from another source, or use the program ChemDraw to render them. See me, a Chem Department tutor, or Barbara Hirschman for help with ChemDraw. You can run ChemDraw either a Mac in the department computer lab, or a Windows machine in my research lab.

(Learning this software now will give you a head start on Organic Chemistry next year!)

- Wednesday, November 23: Turn in the first draft of your paper. Aim for six to eight pages.
- Sometime after Thanksgiving: Meet with Barbara Hirschman to discuss your first draft.
- Monday, December 19: Turn in your final draft.

### Grading

Barbara and I will assign letter grades (A, A-, B+, B, B-, C+) on both scientific content and writing quality. Careful and thoughtful attention to the above content and writing expectations will earn you an A. The correspondence between letter grades and points is summarized here:

First Draft Graded by Barbara Hirschman Total Possible Points = 50				Final Draft Graded by Keith Kuwata Total Possible Points = 100			
<u>Content</u>		<u>Writing</u>		<u>Content</u>		<u>Writing</u>	
Grade	Points	Grade	Points	Grade	Points	Grade	Points
A	35	A	15	A	70	A	30
A-	32	A-	14	A-	64	A-	28
B+	28	B+	12	B+	56	B+	24
B	25	B	10	B	50	B	20
B-	22	B-	8	B-	44	B-	16
C+	18	C+	6	C+	36	C+	12

### References

(1) Finlayson-Pitts, B. J.; Pitts, J., N., Jr. *Chemistry of the Upper and Lower Troposphere*; Academic Press: San Diego, 2000; Preface.