Chemistry 123 DUE NO LATER THAN Monday, February 26, at 5:30 p.m. Winter 2003
Pop Sci Project An individual paper or small group project related to chemistry! Instructor: R. Rossi

This page describes the Chem 123 popular science project, which will constitute 15% of your final grade. (That's a sizeable chunk, so do a good job with this assignment, and by all means don't blow it off!!!)

This assignment is due *no later than* 5:30 p.m. on Monday, February 26, the middle of eighth week. I ***strongly*** encourage you complete it well before then, however! **You will not do a decent job of this if you try to put it all together in the last week!** You can hand this assignment in any time you like, up until the due date. A modified version of the Early Bird Bonus will apply, where each *day* before the due date, up to 10 days, gets you 1% of grace toward your grade on this assignment. **SO DON'T PUT THIS OFF UNTIL 7th WEEK!**

Basically, I'd like you to prepare some sort of tangible work that demonstrates your ability to utilize what you are learning in chemistry class to understand and explain the workings of the "real world." Most likely you will write a paper, but you can make a model, write a computer program, etc. …do whatever you like, as long as it satisfies the criteria of demonstrating your ability to apply what you have learned to something new.

If you write a paper, I don't care how long it is, provided that it is understandable, well-researched, and would make your mom or uncle or sister say "Neat, I didn't know that! Now I get it!" when they read it. By "well-researched," I mean you should be careful to get corroboration of what you learn! *Don't just paraphrase what you read on one web page!!!* There's a lot of really poor and even completely bogus science explanations on the web! I also mean that you should go beyond what you can find in an encyclopedia: not necessarily in more depth, but what you write should be clearly explained so that it makes "popular science" sense. The target audience you should have in mind would be a typical person sitting next to you on a plane. You should spend about 20 hours working on this project; ideally you should have someone else (like your parents or your roommate) look at it, and they should understand it even if it is well outside of their field of expertise!

You can work alone, or you can choose to do a group project with up to three other people. Understand that for this project (unlike lab) you won't reduce your workload by working with others. If four people work together on a project, I will expect it to be four times as nifty a project as that handed in by someone who works alone. Moreover, everyone in the group will get the same grade, even if you contributed differentially, because I have no good way of knowing who contributed what to the end result. In contrast to your "special project" lab, what you produce for this assignment need not be based on the results of experiments you perform yourself. This allows you to delve into topics for which you could never do the experimental work. This project calls for reading up on a subject, coming to fully understand it, and then preparing something capable of conveying an interesting part of your understanding to the general public.

The subject matter, as with the "special project" lab, is at your discretion, subject to the constraint that it have something vaguely to do with science, broadly defined. Whatever topic you pick, you should be sure to *explain* the science part of it: don't talk about the history of alchemy, for example, without explaining the science behind alchemy: what it means to transmute an element, how nuclear reactions can do it, and how others can not. Ideally, you'll think of something you want to learn about, and this project will be your ticket to spend some time learning about it and sharing your discovery with the rest of the world. But if this happy circumstance doesn't occur, the back of this page offers a bunch of suggestions for topics on which you might want to base your final assignment.

It is very important that your final project not consist of a simple regurgitation of what you read or see elsewhere. There should be a good deal of "you" in what you submit! It should be obvious to me and anyone else that the information you present passed through your brain and through your hands. Try to avoid a boring, stodgy book report. Be lucid, humorous, and interesting! Include your opinions, your wit, and your personality in what you submit for this assignment! Believe it or not, that's a big part of what scientists do, at least at a fundamental level. Scientific papers in scientific journals are usually dreadfully boring, so don't mimic them![1]

Be sure to **cite the references** used in putting your work together. This should include people you talked to, books you read, and internet sites you visited. The Endnote program[2] available on ITS computers is a very handy way to record and cite bibliographic data. We'll give you a crash course in how to use it in lab week 5. Be sure to heed the comments provided in the plagiarism handout.

Press me to hand out some "good examples" of these projects if I don't do so of my own volition…it will help you a lot!

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[1] Exception: you should indicate the uncertainty in the values you cite, wherever it is possible to do so! Uncertainty is important!

[2] See http://www.library.carleton.edu/it/EndNote/index.html for details. Use the "CHEM 123-CC" style in formatting your bibliography. You can copy your bibliography into Powerpoint, or anything else, using the "Copy Formatted" command.

Here are some suggestions for possible topics and formats. You don't have to pick from this list! Pick something you find interesting and don't already know everything about; be creative and have fun! The best projects wed something you are passionate about (children's books, politics, fishing, whatever!) to science!

1) See what "professional" scientists have to say about the subject you pick for your special project lab. If you get an answer from your experimental work, is it the "scientifically accepted" answer? Note that in some cases the scientific community may not be in agreement about what a number should be or what the explanation for a phenomenon is! In other cases, the only scientific work on your subject may have been done a long time ago, in a faraway place! Even if that is the case, you'll find that the scientific literature is amazingly accessible (if not easily readable), even back to the early 19th century. If you didn't get an answer from your experimental special project work, you can look up an answer and perhaps thereby come to understand what went wrong.

2) How much energy goes into producing a kilogram of agricultural-source ethanol? How much money goes into doing the same? How much energy does a kilogram of ethanol provide? How much is it worth? (How much of the market price is attributable to subsidies?!?) Hopefully one of our final lab periods will involve an optional field trip to a farm and/or an ethanol processing plant, which will allow you to ask questions of the people who make (fuel-grade!) ethanol for a living. By finding out how much gasoline it takes to run a tractor pulling a combine or tractor, how much an acre of land costs, and so on, you can attempt to piece together an answer to the real bottom-line question: does agricultural ethanol make common sense?

3) Analyses similar to that described above can be applied to solar power, wind power, and lots of other things: even turning lights on and off! Does recycling actually save on resources? Understand that for almost any analysis of this sort one must make a lot of assumptions in deciding upon and crunching the numbers. The assumptions different people make will lead them to different answers. Take the price of gasoline: is it representative of the true production cost? Well, that depends on whether you include the "cost" of pollution and environmental catastrophes, wars fought to "ensure" the free flow of oil, and the transportation and refining processes, above and beyond the simple market price of a barrel of crude oil. Surely the petroleum companies turn a profit, but how much and at who's expense? Are they saving up for the day they get hammered like the tobacco companies? (Don't count on it!)

4) Given how many gallons of oil, natural gas, and coal we burn each year, and an estimate of the heat capacity of the earth, how fast are we heating up the great big calorimeter that is planet earth? How does this energy release compare with the energy hitting the earth in the form of solar radiation? Can you explain the relevance of the Greenhouse Effect in light of these numbers?

5) Pick something from your daily life and figure out how it works and/or how it is made. If it has plastic in it, where does that plastic come from? What about the metal, if there is any: how is it extracted, refined, and treated to make the final product you hold in your hand? Don't pick something too complex for this, you would be shocked at how much there is to say about something as seemingly simple as a golf ball or a safety match! Or explain an invention you've heard about and are interested in, like the Segway, Prius, etc.

6) Play informed-science-fiction author! Anti-matter is real. Flux capacitors are real. Wormholes really exist. Learn about some possible future technology and write either an expository piece on what the future might or might not really hold (it's OK to argue that some given device or idea, e.g. a Star Wars light saber, is possible or impossible, provided you do so based on current scientific understanding!) or a fiction story that contains ideas that make sense in light of current scientific understanding. [Understand that current scientific understanding is not static! It is very fluid, at least in new areas! You will find plenty of older scientific papers that claim there is no such thing as antimatter! Scientists only gradually come to a consensus, and only on certain issues!]

7) How do CD's work? What are they made of? What are the lasers in CD players made of and how do they work? How about a computer chip, or a car engine, or a microwave oven? How is the fabric of your favorite outfit made, colored, and woven? [Yes, even for cotton or hemp this involves some chemistry, I promise!] How do photocopiers and laser printers work, and what's toner?

8) How are coffee and tea decaffeinated? How is soap made, as compared with detergents? What's wood made of, chemically?

9) Forensic scientists figure out all kinds of things based on chemistry! Learn about one or two of their techniques and explain them.

10) They do all kinds of things to make money hard to counterfeit. Like these funny markers they sometimes run over your bills to check them…what's up with those? What other security measures are used in currency, either here in the U.S. or around the world?

11) The chemistry of the planets and the sun are pretty darn amazing. Educate yourself on some aspect of astrochemistry and share your understanding with those not yet up on the funky chemistry of extraterrestrial objects. (I have a book to get you started.)

12) Be a singer, poet, or songwriter - write a poem or song lyrics and liner notes (and even record a song, if you are up for it!) that says something informed about science and society. There are countless places where science (for better and for worse) influences policy, society, and individual's lives. From laughable to dead serious, this offers a ton of possibilities: for example, from "Olestra shrank my Bootie" to "My Folks Planned it This Way" (about, say, a genetically engineered child).

13) Critique an existing web page, or a speech you've heard, or even a textbook, explaining in everyday English where that source makes mistaken or misleading statements. Back up your assertions with the best evidence you can offer.

14) I could spit out more ideas for pages and pages…if you are stuck on how to approach a topic you are interested in, or can't see how science is related to something you would like to investigate, please talk with me. Religion, economics, classics; yes, there is a connection! (What's myrrh? Is gold *really* valuable? What about the chemistry of all those poisons the ancient Greeks used?)