Internet Resource Guide
For
Undergraduate Chemistry students

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Information about the guide

Content:
This guide contains valuable resources for undergraduate chemistry major students. The guide covers basic resources regarding undergraduate chemistry classes and labs, jobs after graduation, and undergraduate research opportunities at Penn State.

Audience:
The target audiences of this guide are current undergraduate chemistry students in Eberly College of Science, Penn State University. The guide not only offers valuable resources that will aid underclassmen taking CHEM 113 (freshman chemistry lab) and CHEM 213 (sophomore chemistry lab), it also provides information on chemistry-related jobs and undergraduate research opportunities for upperclassmen.

Assumptions:
The guide was created with the assumption that the students have a basic understanding of chemistry and obtain adequate lab skills. The students should also have access to the Internet. They must have Penn State User ID in order to access some resources.

Organizations:
The resources are organized into seven categories: index, professional journal, technical database, handbook, government resources, career information and undergraduate research information. In each resource, a URL, and the accessibility are provided under the subtitle. Following them are the instructions on what the resource is about and how the resource can help chemistry major students. There are also some tips on using the resource.

Tips:
Students can easily locate the resources by looking at the table of content first. The description of each abstract will help students understand the general function of the resource and how it is related to the students. The tips under each abstract will help students navigate the websites. The access of Word, PDF, PowerPoint, Adobe Reader is expected since the articles from those resources can be in different formats.
Academic Information

Journal of Chemical Education
*Professional Journal*

Location and Availability
http://pubs.acs.org/journal/jceda8
Most of the papers published here are free. To access some of the research papers you need to pay for a temporary access or use Penn State Libraries.

Description
The Journal of Chemical Education is a monthly peer-reviewed academic journal that typically serves for the students that are interested in learning chemistry and instructors in the field of chemical education ranging from middle school to graduate school. This journal is especially important for undergraduate chemistry labs. The lab assistants usually require students to read through and follow the procedures on a certain lab experiment they found on the journal. Also, students often cite those procedures in their lab reports.

“Synthesis of chrysanthemic acid, a multistep organic synthesis for undergraduate student” is a paper published in Journal of Chemical Education. It is used extensively in the CHEM 213M team project. All the team members are required to follow the synthetic route and the exact procedures described in this paper. Most of the mechanisms used in the route are taught in CHEM 212. Students will apply their knowledge of Michael addition, Fischer esterification and hydrolysis of esters in the experiments. At the same time, they will learn new concepts such as protecting groups occurred in the route.

Tips
- Type the keywords in the searching bar located on the upper-right corner to search for papers.
- To broaden the searching range, just simply click “All Publications/Website” under the search bar to search for the papers published in other journals such as journal of organic chemistry under ACS publications.
**Academic Information**

**SciFinder Scholar**

*Index*

**Location and Availability**
https://scifinder.cas.org
Authenticate at the PSU “thumbprint” screen and register for a SciFinder Scholar account.

**Description**
SciFinder Scholar is an online version of a chemical abstract. It contains citations and abstracts to journal articles, conference papers and patents. It also has information about the chemical compound’s structure and substructure searching, reaction searching, and chemical suppliers searching. (3). It is extremely useful for students because it has a wide selection of documents regarding chemistry. Students will find that this website is necessary for their research and lab reports.

A useful paper found in this journal is the “Synthesis of trans-chrysanthemic acid”. It uses a different set of mechanism to synthesis chrysanmthemic acid which is a perfect comparison to the lab procedures given in CHEM 213M. Students can have a better understanding on how to design a safer, cleaner and quicker mechanism in their future research.

**Tips**
- Search options have been divided into three categories: reference, substances and reactions. The default category is “research topic”.
- Use “analyze” and “refine” tabs in the left margin to narrow the searching parameters.
- If students have further questions, contact Nan Butkovich, librarian of Penn State Mathematical and Physical Science Library, via email. (njb2@psu.edu)
**Academic Information**

**Sigma-Aldrich**

*Technical database*

**Location and Availability**

[https://www.sigmaaldrich.com/united-states.html](https://www.sigmaaldrich.com/united-states.html)

Free access.

**Description**

Sigma-Aldrich Corporation is an American multinational chemical, life science and biotechnology company. Sigma-Aldrich main website provides the information on the physical and chemical properties of over 200,000 chemical products.

As chemistry majors, students need to understand chemistry at both the apparatus and the molecular level. In the Sigma-Aldrich website, students can easily find a compound’s molecular weight, color, boiling and melting points which help us in determining the unknowns in the experiment. Safety information such as flammability, erosion and health hazard can also be found in the website. This helps them be aware of the potential danger the compound brought and keep them safe during lab period. However, the organic compounds students synthesized via multiple steps or the intermediate may not be described in the website because of their rareness.

**Tips**

- When searching for a compound, it is better to search for its IUPAC ID or its common name instead of its formula in the search bar on the upper right corner.
- To check on the meanings of chemical safety signs, click on those signs for further information.
Quick guide: ACS Citation Style

Handbook

Location and Availability
https://www.libraries.psu.edu/content/dam/psul/up/pams/documents/QuickGuideACS.pdf

Quick guide: ACS Citation style is a chapter from the book: The ACS Style Guide, 3rd ed. The PDF version of the quick guide can be accessed through Penn State Libraries website. The book is available in Penn State Physical and Mathematical Science Library located in 201 Davey Lab.

Description
This quick guide gives the basic information about ACS citation styles. The ACS style is a set of standards for writing documents relating to chemistry, including a standard method of citation in academic publications, developed by the American Chemical Society (ACS). The ACS Style Guide, 3rd ed. is a book that talks about writing styles, word usage, names and numbers for chemical compounds. This book is required in CHEM 400, chemistry literature, a chemistry elective course that focuses on improving chemistry major students' writing skill especially on academic papers.

This quick guide describes all kinds of standards on various publications or websites when the students need to cite the content. It gives specific examples such as the format of citing a book with authors, data sets, journal articles and preprints, and non-government websites. The quick guide is well organized and easy to use.

Tips
- Follow the exact examples shown in this guide for citation including italicization, bold text and organization.
Career Information

Catalog of U.S. Government Publications

Government resource

Location and Availability
http://catalog.gpo.gov/F?RN=20444824
Free access.

Description
Catalog of U.S. Government Publications provide all kinds of federal documents to the public. It is a great resource for students to see how their chemistry knowledge could apply and help the society after graduation.

Unlike other publications that focus on academics, Catalog of U.S. Government Publications offer more papers on solving real life problems. For example, when searching for the key word ‘chemistry’ in the website, there is a federal document called “Water Chemistry, Seepage Investigation, Streamflow, Reservoir Storage, and Annual Availability of Water for the San Juan-Chama Project, Northern New Mexico, 1942-2010”. Since surface-water chemistry varies with streamflow, scientists analyze dissolved organic carbon, major ions, nutrients and semi volatile compounds in the water to determine the change of streamflow in Heron Reservoir. This helps them predict the annual water supply for Albuquerque metropolitan area, New Mexico. Chemistry major students will gain hands-on experience testing for major ions and dissolved organic compounds in the water in CHEM 113 and CHEM 213 labs by using mass spectrometry, 1H NMR and 13C NMR. Students will have a better understanding on how the lab skills learned in undergraduate chemistry labs can help solving real life problems.

Tips

• Besides searching for keywords, title, author and subject can also be searched by using the scroll down menu.
• To narrow the searching parameter, use the advanced search by word/phase, year, format, language and catalog.
Career Information

Statistical Abstract of the United States

Government resource

Location and Availability
https://www.census.gov/library/publications/time-series/statistical_abstracts.html
Free access.

Description
The Statistical Abstract of the United States ranges from the most recent edition to the historical abstracts compiled throughout the decades. The abstract is useful for students because it serves as a great statistical reference and a convenient link to other statistical publications. In this website, students can access valuable data on STEM employment and STEM workforce. They can also have a better understanding on what a STEM major can bring to them and a clear prediction on the future employment opportunities and working conditions.

For instance, there is an American community survey report on “Disparities in STEM Employment by Sex, Race, and Hispanic Origin”. It analyzes the occupational distribution of STEM workers by showing the exact numbers of people employed in different kinds of STEM occupations. It also presents the percentage female, Hispanic or Latino origin and black African American in those occupations. In addition, it contains several trend lines depicting the age distribution of STEM workers from 1970 to 2011.

Tips
• Find information by typing the keywords and place names.
• Click on “We found more geographies” to see a list of more places with the same name.
Career Information

Occupation Outlook Handbook

Job Information

Location and availability
http://www.bls.gov/ooh/
Free access.

Description
This handbook is published by the Bureau of Labor Statistics, United States Department of Labor. It can help students find career information on duties, education, training, pay and outlook for hundreds of occupations. It also has several rankings on highest paying occupations, fastest growing occupation (projected) and most new jobs occupation (projected).

On the left side, select “Life, Physical, and social science”. A list of occupations related to this field is shown on a table along with their job summaries, typical entry-level education and 2015 median pay. Students can also click on a certain occupation to seek out more information. For example, after selecting “hydrologist”, there is more information about what hydrologist do, how to become a hydrologist as well as the working environment and the job outlook.

Tips
• The list of the occupation can be rearranged by entry-level education or median pay. The default setting is to arrange the list alphabetically.
• After clicking on a question mark on the right side of a specific term, a detailed definition or explanation of the term will appear.
Research Opportunities

Research Opportunities for Undergraduates

Undergraduate Research Information

Location and Availability
https://undergradresearch.psu.edu/index.cfm
Free access.

Description
Penn State offers many opportunities for undergraduate students to participate in research in their field with a faculty mentors. Students can not only gain more hands-on experience on the lab skills and explore more career choices, but also get to know the faculty members in their department better. For chemistry major students, the experience in undergraduate research will help them in job interviews if they are looking for research positions in academics or in industries. It will also be a bonus for students applying for graduate schools.

For example, Dr. Wayne Cutis, a professor in chemical engineering department, has a research project on bioreactors for Africa Food Security. He provides a concise summary of his project, the number of undergraduates needed and minimum qualifications. He also provides his contact information and his research project website. Interested students may browse his website first for more information and contact him in person to know the specific requirements and expectations for this project.

Tips
• Students can narrow down the searching parameters by specifying the Penn State campus and college.
• It is strongly advised that students look through professor’s research project website before contacting him or her in person.
References

(1) Journal of Chemical Education http://pubs.acs.org/page/jceda8/about.html (accessed July 7, 2016)

(2) Statistical Abstract of the United States: 2010

(3) Butkovich, N. SciFinder Scholar Tutorial (Draft Version)
   https://cms.psu.edu/section/default.asp?id=201516SPUP__RCHEM_213M001&goto= (accessed July 10, 2016)