Computers in Chemical Education Newsletter Spring 2000

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Submissions: Articles, announcements, etc., should be setup on your own website and the website address of the article sent to editor Brian Pankuch at pankuch@eclipse.net or pankuch@hawk.ucc.edu for review and acceptance. Authors are requested to keep material available for at least a year after publication, longer would be preferred since the Newsletter will be searchable from the Internet. We anticipate increased communication between authors and readers and plan to make these discussions available to all subscribers. A listserv will be provided and managed for these discussions.

Suggestions are welcome!

Submission deadlines: Fall issue - Sept. 25; Spring issue - March 15.

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Outgoing Chair's Comments
HAVING FUN!

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During a recent review session, I asked one of my students to go to the board and demonstrate a general chemistry problem that she said she couldn't work. She did have some difficulty, but finally was able to work through to the answer successfully with only a little help. As she sat down, I said, "Now, that wasn't too bad, was it?" With a smile, she replied, "Actually, it was kinda fun." Aside from any chemistry that she learned, I hope that she recognized that facing a challenge can be fun, especially if you can count on support to help you through the tough spots.

I was reminded of this student as I prepared to write my message as outgoing chair of the CCCE Committee. It has, indeed, been a challenge, but it could have been much harder without the assistance that so many of you have provided. Most important of all, as my student learned, it is fun to meet a challenge when you have the right support.

I believe that higher education has set out on a voyage of discovery into new, unexplored terrain, and this committee is serving as pathfinders for one part of that exploration. It has been exciting (and perhaps a little frightening) to be a part of this process. If you think back to a decade ago, it is amazing to remember how many developments that we now take for granted weren't even visible on the horizon. Higher education, long renowned for its resistance to change, has probably moved more rapidly in that past decade than it has in the previous fifty years. And the pace of change still seems to be accelerating! It is hard to imagine where we may be in another decade.

The job of this committee is to stay ahead of these developments. It will probably continue to be both exciting and a little frightening. As my student discovered, despite all the stress, it can be fun as long as we work together to support each other. Thanks to all of you who have helped me through the past two years, and I hope that you will continue to enjoy the trip.

Optimizing our Newsletter

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This is our last printed version of the Newsletter. We are going to put our future editions on the Web. You can see a draft version (http://www.eclipse.net/~pankuch/Pages/NewsletterCCE.html) and subscribe (http://www.science.lcc.whecn.edu/CCEN/) to be notified when new editions are available. Your subscription will be handled by this listserv. We would also like to experiment using a listserv to provide a convenient method of allowing you to query authors and share the question and response with everyone on the listserv.

My own vision comes partially from work as an outside contractor about six years ago at Sandia National Labs where I set up my first website. Sandia was in the process of getting people to save everything online with no paper backups. They were trying to do everything electronically. I've experimented and found myself moving in that direction, with notable exceptions like this Newsletter. I haven't had a printer connected to my main system for years, and it changes how I work. For instance I was reading an interesting review article on the web, and it had well over a hundred references. Many of them were linked to the abstracts or complete papers. I got a lot more out of the review by being able to click and read much of the supporting material.

Recently I was giving a PowerPoint lecture on using PowerPoint in our professional development series at my College. Before the presentation I had a request for hardcopy from the head of Interpreters for the Deaf program. As I sent it out I was struck by how much would be missing since a good part of the presentation was use of color, animated text, sound, links to video clips, animations, simulations, computer programs, QuickTime movies, panoramas, etc. All were presented by working examples, a lot was lost in translation to text.

I understand and agree that hardcopy has many advantages. At the moment my vision for the Newsletter is what you see in the draft. A page of contents with links to the authors' sites. All the text material should be printable from the authors' site. This requires authors to put up their own material at their own site or to work with one of our editors to put the material up at the editors site (http://www.eclipse.net/~pankuch/Pages/Submissions.html). Suggestions have been made that the Newsletter be available as one file that would be readable and printable from one site. This is a fine idea and is just waiting for someone to volunteer to put the material available at the Newsletter site together at their own site. We are completely open to new ideas and volunteers to make them work. This is your Newsletter and should reflect your interests.

Over the last decade as we shifted from receiving articles on diskettes to email, articles have had more text and fewer pictures, diagrams, etc. If all we are going to provide is text as usual why go on the Internet at all? I'm hoping people will not just write articles, but will experiment with innovative techniques and show us as well as tell us what they are doing. For example see Jack Kotz's articles (http://www.eclipse.net/~pankuch/Pages/NewsletterCCE.html) on using and developing PowerPoint lectures in general Chemistry. Not only does Jack explain what he is doing he provides links (http://www.oneonta.edu/~kotzjc/LecShell.html) to actual PowerPoint material (http://www.oneonta.edu/~kotzjc/PowerPoint.html) he is using. It can be quite exciting. As an experimenter in some new techniques I find it far easier to get them working on my own site and have students use them on my site.

If we are receptive to experimenting with new modes and methods we may develop some new exciting lines of communication and learning. I'd like to encourage new ideas and suggest that working examples of what you are doing are much easier to understand than just a written description.

Perhaps we can also provide links to How To sites on topics of interest such as using computers in lab, video clips, animations, simulations, computer programs, QuickTime movies, panoramas, PowerPoint, etc. For example Yale Style Manual-Table of Contents: (http://info.med.yale.edu/caim/manual/) is quite helpful in designing web pages.

Your input is welcome.

Dreamweaver 3

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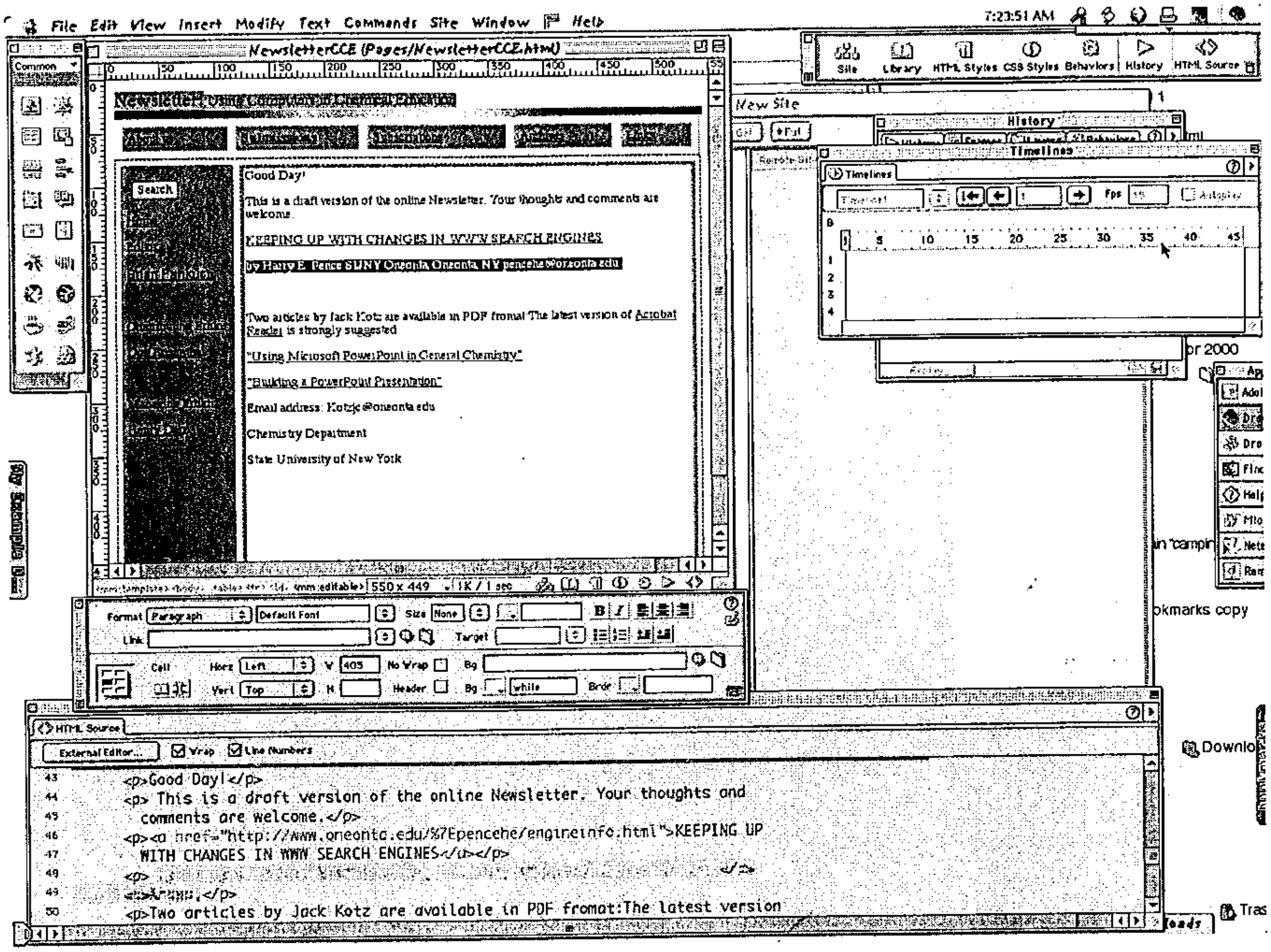
Dreamweaver 3 is a professional quality web design program from Macromedia. It is part of a growing suite of products (Director, Fireworks, Shockwave, etc.) from Macromedia, that are usually state of the art, for developing material and putting it up on the Internet. The advantage of using a suite is similar to using Microsoft's Office the tools usually work together a bit better than unconnected programs and you have some similarity in program design so similar operations can be close in each program. If you learn one you may have some carryover to the other. This is a hope not yet fully attained with Macromedia products.

This is a very powerful program. It is a What You See Is What You Get (WYSIWYG) HTML code generator. You can design a page by typing it in and add art and special effects to the page and watch in another window as Dreamweaver 3 creates the HTML. I've on occasion wanted to do something that I couldn't find in the numerous menus and windows so I just typed the HTML in. If you don't like the code generated you can change it. Changes written in the HTML window are shown when you return and click on the document window and vice versa.

Press function key (F12) and your favorite browser comes up showing the page you are working on. Or you can have both Netscape and Explorer running at the same time and switch back and forth to see how your page looks in each (surprisingly different sometimes!) When you are going back and forth checking how something looks from Dreamweaver 3 to the browser be sure to save the changes in Dreamweaver 3 (otherwise you'll just see the page as previously saved). In the browser hit reload (Netscape) or refresh (Explorer) so you see the new page not the cached old page.

One can get some surprises. I put a Shockwave movie from Director in a page, uploaded and clicked on it in a browser and it played fine. The page was uploaded to my site and rechecked in the browser- no movie just an awful looking text file. I had used a copy of the movie in the page which instead of movie.dcr was movie.dcr copy, this played fine in the browser from the Dreamweaver 3 file on my drive, but not when uploaded to the server site and read from there. Once I took the



Dreamweaver with a working copy of our Draft On-line Newsletter

word copy off it worked fine in both locations. Not my idea of WYSIWYG, but it works better than this most of the time.

It also can test the entire site for broken links, external links, and orphaned files. Click on the broken links or external links and you'll be whisked right to that code. For the external links it will show you the link but it does not test to see if it goes anywhere. Does anyone know of a program that does test external links to see if they go anywhere? It doesn't do anything with the orphaned files.

In the figure the document window to the left has areas blocked in red, that is the part of the page from the template for the entire site. The HTML source window shows that code in red and you can't change this code without a direct override in a working page. You can easily change the template itself. When you do you can have every page affected updated by Dreamweaver 3.

It has a filter for Word HTML, which cleans up the code. Supposedly to make it look better on the versions of browsers you've chosen. First it reported Dreamweaver could not find the correct filter, but chose Word 2000 (I have Word 1998), I tried it and it worked ok then I chose the filter for Word 1998 and it removed almost all formatting and the text looked much worse.

You can choose from a number of Common Objects including, Shockwave, Flash, Fireworks and Insert Tabular Data. The latter will take a spreadsheet from Excel and produce an HTML table. Save the spreadsheet as tab or space delimited, click on the Insert Tabular Data button and you have a table where you want. You can use the properties window to change a large number of parameters and customize your table fully. The system keeps a full record of all changes made during a session. From the history window you can go back to the way your page looked at any point. This is better than infinite undo's which tend to be permanent. You can backtrack, try another series of changes then return if needed. If you are going to use a number of spreadsheets, with the series of modifications you just did, you can select the steps from the history window and save them as a command (appears in the command menu). Select the command and have the series of modifications performed on other spreadsheets-like a macro.

You can use Dynamic HTML such as JavaScript, Document Object Model (DOM), Cascading Style Sheets (CSS). DHTML and XML Extensible Markup Language) are newer and more likely to give quite different results or no results with older browsers.

Dreamweaver 2 came bundled with BBEdit for working with text, Dreamweaver 3 comes with FireWorks 3, which is for text, pictures, etc., editing. I was surprised when I'd click on an object such as a GIF picture to be edited and FireWorks 3 couldn't be found-with no option of going to find it. Going to Preferences, External Editors, several FireWorks versions were listed none located where the actual copy was. Browsing to the actual location for Fireworks allowed a multitude of objects to be double clicked and edited. Choose other programs such as Photoshop, BBEdit, etc., for specialized file editing.

If you want to edit tags from the document window you can select the tag and with command T, a Quick Tag Editor window opens and you can edit the tag, wrap a new tag around the existing tag, or insert HTML. Shortcuts sometimes appear, but seem erratic and more distracting than helpful.

I have been testing a number of tools for keeping my web sites updated with the ability to keep track and change relatively easy.

KEEPING UP WITH CHANGES IN WWW SEARCH ENGINES

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INTRODUCTION

It is becoming increasingly common for students to use the World Wide Web as a source of information, even in science courses. This creates several challenges for science faculty members. In addition to teaching students how to effectively use information to create papers and talks, it has become much more important to help students learn how to evaluate data. The WWW is a confusing combination of truth and falsehood, and it can require a discerning eye to distinguish between the two.

In addition, faculty are finding that it is difficult to direct students to the best search engine. Since the search engine is the main tool for finding information on the web, search engine selection can be a key decision in student research. The most widely advertized engines are often relatively poor for scientific searches. Indeed, it sometimes seems that there is an inverse relationship between the amount of advertizing and the effectiveness of the engine.

As discussed in an earlier article (http://snyoneab.oneonta.edu/~pencehe/engineevae search engines, there are at least three important criteria that should be used to evaluate search engines, comprehensiveness, currency, and efficiency. Comprehensiveness is a measure of what fraction of the total web sites the search engine actually reviews. Currency measures how often the search engine revisits sites to determine whether or not there have been any changes. Efficiency is determined by whether the most useful sites are not just included but listed early in the search results. Comparing engines based on these criteria is problematic, because the characteristics of engines seem to be constantly changing.

During the past few months, several of the main search engines have been competing to attract more traffic to their sites by making claims about the effectiveness of their product. The mode of competition has varied from increasing the size of the engine index (a generally beneficial effort) to publicizing rationalizations of why an engine that has poorer metrics is still preferable (including blatant deception). The purpose of this article is to suggest where an individual can go to obtain non-biased and up-to- date information about search engines.

PRIMARY SOURCES FOR SEARCH ENGINE EVALUATION

A major source of data about the accessibility of science information on the Web is provided by Steve Lawrence and C. Lee Giles from the NEC Research Institute in

Princeton, NJ. Their three studies of web search engines are especially valuable because they are mainly concerned with scientific searches. All are available on the web, including the most recent (http://wwwmetrics.com/). Since this is apparently an ongoing study, it would be a good idea to check back from time to time to learn if more recent results have become available.

Danny Sullivan's Search Engine Watch (http://searchenginewatch.com/) seems to be the most extensive source of general information about engines. This site includes a current listing of index sizes (http://www.searchenginewatch.com/reports/sizes.html). Page down to see that even the largest index is less than half of the total web sites. Sullivan's site also links to many reviews (http://www.searchenginewatch.com/reports/reviewchart.html). The only problem with this site is that there is so much information that it is easy to find that you have just clicked away from something that you can no longer find. Either drop bread crumbs as you surf or else use the excellent site-specific search engine that is provided. Sullivan also offers a subscription service that promises even more information, but the part of the site that is open to the general public is an excellent starting point for anyone who is trying to keep up with recent search engine developments.
These sections only scratch the surface of what Sullivan offers. Be sure to look at the informative tutorial on how engines work (http://searchenginewatch.com/webmasters/work.html), and Search Tips (http://searchenginewatch.com/facts/index.html), which, as the name suggests, explains how the major engines work and how to maximize the possibility that a given engine will give the best possible results. The tutorials are aimed at all levels of experience, ranging from novice (http://searchenginewatch.com/facts/math.html), through advanced tips (http://searchenginewatch.com/facts/powersearch.html) and boolean algebra (http://searchenginewatch.com/facts/boolean.html).

The third major resource on index size and number of dead links is Search Engine Showdown (http://www.searchengineshowdown.com/), a site maintained by Greg Notess. He factors the dead links data into the index size charts and gets results that look somewhat different than the numbers that are often cited by the search engines (http://www.searchengineshowdown.com/stats/sizeest.shtml). Another feature of Greg's site is Search Engine Inconsistencies. (http://www.searchengineshowdown.com/inconsistent.shtml). These pages list search engine problems, both temporary and long-term, for four of the most popular engines, AltaVista, Google, HotBot, and Northern Light.

SECONDARY SOURCES FOR SEARCH ENGINE EVALUATION

After the big three, there are a number of sites that may not be as generally useful, but do have some interesting features. Search IQ (http://www.searchiq.com/) has a listing of more engines than you probably dreamed existed, complete with a rating number (the IQ) and some very frank criticisms.

The portal concept is still a hot topic on the net, and if you wish to compare the features of the various portals (which often appear to be search engines to those of us who think the net is primarily an information source instead of a place to catch suckers) there is a site devoted to these comparisons, called traffick (http://www.traffick.com/). Even for those who don't care about portals, the set of articles under the general title, "Andrew's Metaguide" offer good analysis of topics related to searching.
About.com uses live guides, who write brief reviews, with appropriate links, about topics of general interest. The special section dedicated to web searching (http://websearch.about.com/internet/websearch) is written by Chris Sherman, who has gathered an impressive variety of useful articles and links.

CONCLUSIONS

It seems inevitable that the WWW will continue to evolve rapidly and in unpredictable directions. Search techniques for printed materials may remain relatively constant for years and even decades, but the internet world can change within months or even days. The only way to remain current in the new information environment is to use the environment itself to keep track of new developments. It is hoped that these net references will make this job a little easier.

Using Microsoft PowerPoint in General Chemistry

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Alex Johnstone suggested that chemists view their field within a triangular matrix of ideas.(1,2,3) We make observations of macroscopic physical and chemical changes and codify these observations in symbols, in the form of chemical or mathematical equations. In this regard we are rather like musicians who hear music and represent it on paper in the form of notes with an indication of time and key. But chemists go beyond this by trying to visualize what we see and symbolize with models of chemical behavior on the particulate or atomic and molecular level. These visualizations can take the form of physical or computer-drawn molecular models or computer-generated animations. The computer has especially opened up the atomic and molecular level to visualization by chemists and their students, and it is now relatively easy to bring these visualizations to students in our lectures. My interest in using computers in chemical education began about 10 years ago. It was clear that, appropriately applied, computers had the potential of opening up new insights for students and helping them become more involved in the learning process. Our activity in computer-enhanced chemistry has been in four areas: (i) software development; (ii) the use of images, videos, and animations in traditional lectures; (iii) the use of interactive software in tutorials; and (iv) the use of computer-based molecular modeling at all levels of the curriculum. This paper briefly describes only the second of these.

COMPUTER-ENHANCED LECTURES

Our intention is to enrich lectures with visual illustrations of chemical phenomena and representative molecular structures. It is intended to remind the students continually of the triangular matrix of ideas by showing chemical and physical changes, by showing how those are symbolized by chemists, and by modeling these phenomena at the atomic and molecular level. For these reasons, the computer-generated slides used in lectures include photos or diagrams, videos and animations, and molecular models. In addition, a button on a slide can trigger an event such as another program, say an Internet browser, a Java applet, or a molecular modeling program.

Photos and Diagrams

Static visual materials come from a wide variety of sources. One of the best sources are the CD-ROMs publishers provide with textbooks, as these disks usually contain book figures and other images from the relevant textbooks. For example, Saunders College Publishing provides several hundred figures on the Instructor's Resource CD-ROM. The current version of this disk has digital versions of the overhead transparencies from five of Saunders's current textbooks. A utility on the disk allows one to view the figures, modify them, add legends, copy them to a hard drive, or make a slide show from a series of figures. The World Wide Web is of course a rich source of figures. My colleague Harry Pence has recently discussed the sources of images and their uses.(5) A website that has images that can be used to add "spice" to a lecture is the "Comic Book Periodic Table."(6) Digital cameras are now less expensive and widely available.(7) Adequate images of chemicals, apparatus, or chemical phenomena can be obtained readily and imported into Microsoft PowerPoint™ presentations. Finally, relatively inexpensive color scanners can be used to obtain digital images from books and magazines (although personal experience suggests that it takes practice to obtain high quality images).

Videos and animations

Videos of chemical phenomena and animations of processes on the atomic and molecular level are especially useful. In our case, virtually all are from the Saunders Interactive General Chemistry CD-ROM.4 Other sources include the disks distributed by JCE: Software. Materials we have found especially useful are: a) The Periodic Table CD, Special Issue 10, October 1995 b) Solid State Resources, Special Issue 12, December 1995 c) Periodic Table Live!, Special Issue 17, July 1997 d) Chemistry Comes Alive!, Volume 1, Special Issue 18, 1998 It is also possible to make simple animations using drawing programs. A sequence of drawings can be generated and then assembled into a movie using Quicktime Pro™ or other similar software.(8) Finally, one can make videos of chemical phenomena, and the videos can be turned into digital movies adequate for chemistry lectures. This of course requires one of the new digital movie cameras or a digitizing board in a computer to convert analog movies.

Copyright Issues

Before going on, it is well to mention that most of the images, videos, and animations one is likely to use are under copyright by an individual or publishing company. Although the laws surrounding the use of copyrighted digital images in the classroom are not yet completely clear, and are very much under review, it seems that use of copyrighted material in lectures would fall under the "fair use" part of the law.(9) That is, it is acceptable to use such images in the classroom but it is not appropriate to distribute them beyond the boundaries of the classroom.

Molecular Models(10)

Chemistry is a visual science, so we use molecular models almost from the first lecture. The Saunders Interactive General Chemistry CD-ROM has hundreds of molecules generated using the software from Oxford Molecular (often called the "CAChe" software, after the original name of the company).(11) These models can be viewed using the CAChe software on the CD-ROM and can be manipulated in various ways. An image can be copied from the modeling program and pasted into

PowerPoint. Another method of viewing molecules is with Rasmol, a modeling viewer that can be downloaded from the internet.12 A large number of models in the appropriate "Brookhaven" or pdb format can be found on the Internet. However, we usually create our own using the CAChe software. The basic version of this software includes a program for conversion of CAChe structures to various formats, in particular to pdb files that can be used by Rasmol. Yet another excellent program for viewing molecular models is MacMolecule or PCMolecule.13 The program is similar to Rasmol but displays higher quality images and has much greater flexibility. One can not only rotate molecules on the screen, display ball & stick or other types of representations, and measure bond angles and distances, but the motions of the molecular model can also be recorded as a Quicktime movie. These movies can be played back through PowerPoint or displayed independently.

Putting It All Together in a Lecture

Microsoft PowerPoint™ is a good choice for presenting images, videos, and other multimedia in a lecture setting. It is widely used, can be used after relatively little training, can be used for adequate presentations at the simplest level, and can be used in a very sophisticated manner. Finally, the presentations can be converted for running on the World Wide Web. Building a PowerPoint presentation is relatively simple. One places some text on a slide and adds a photo, diagram, video, or animation. An example of building a slide is given in the accompanying paper, and all of the slides for a general chemistry course are available at http://www.oneonta.edu/~kotzjc/JCKHome.html. After having done this for some years, we can offer some guidelines: a) Use text that is large enough to be read in the back row of a large lecture theater. In general, use nothing smaller than 28-point type; 32-point type may be the best size. b) Sans serif fonts (such as Arial or Helvetica) seem more readable than serif fonts (such as Times or Palatino). c) Experiment with different colors and types of backgrounds. Appearance, readability of text, and so on can depend on the brightness of the projector and level of room light. In general, it seems best to use white or single color backgrounds such as blue with black or white text (depending on the background color and intensity). d) Slides should of course be kept as simple as possible with one or two major points being made on a single slide. An important point to be made regarding videos and animations is that their file size can be very large. Therefore, the individual file is not copied from a CD-ROM to the hard drive of the computer used in lecture. Instead, the "insert a movie" command in PowerPoint is used to add the video or animation to the slide, the file remaining on the CD-ROM. When the slide is opened, the opening frame of the video or animation is shown. To play the movie, PowerPoint accesses the file on the CD-ROM. Thus, while the file size for the lectures on a book chapter may be 5-15 MB, if the movies were added to collection of files necessary to show the presentation, the accumulated file size could exceed 50 MB. We transfer the PowerPoint files to the lecture room computer on a Zip disk or over the campus network. The CD-ROM is mounted in the CD-ROM drive before class begins. The latest version of PowerPoint makes it easy to "build" a slide. That is, once the slide is on screen, some text can be brought in and then a diagram can be built up a piece at a time. Animations can begin when the slide is opened or can be brought in with a mouse click and then played. The PowerPoint slides used in our general chemistry lectures for a portion of the first term of the course are available at http://www.oneonta.edu/~kotzjc/GenChem.html. (Note that these slides are in the form of an Adobe Acrobat document and are without animations.)

Using PowerPoint in the Lecture

Although we believe the usefulness of presentation programs such as Microsoft PowerPoint™ is now evident, some may have the opinion it is a passive environment. Rather, we believe it is an enriched environment. I have found that, before showing a video or animation or a slide of information, it is best to develop the ideas first on the blackboard. The PowerPoint slides are used to summarize the idea, to show it more accurately, to expand on it, or to help make the connection between the macroscopic, particulate, and symbolic viewpoints. Availability of PowerPoint Notes The PowerPoint notes are available to our students on several computers in the Chemistry Computer Center. At their leisure they can examine the notes as they would have seen them in lecture and make additional notes.14 To make this experience even more useful I have added voice annotations that give context to a slide or series of slides. (This is easy to do, but be aware that it adds enormously to the file size. A 10-20 second voice-over adds 300-500 KB to the file size.) In addition to the "live" notes, they are available on our course web site in the form of Adobe Acrobat files (with six slides per page). Thus, students can access them from residence halls or home and can print out a set of notes for a unit of the course. An end-of-semester survey of the general chemistry class indicates that these notes are heavily used.

OTHER ASPECTS OF LECTURES

Using multimedia in lectures is only one of the techniques available to enrich the lecture experience and to engage students more actively.

Demonstrations

Every attempt is made to have a "live" demonstration of a reaction or concept in every lecture. Even demonstrations shown in Quicktime™ movies (or on laserdisc or videotape) are also done "live" as often as possible so the students have a sense of time and scale.

Worksheets

It is important to promote, as much as possible, an active environment during lectures. For this reason students are given sheets with one or two short questions or problems in almost every lecture. We pause during the lecture several times for them to work with their neighbors to answer these questions. I walk around the room during these periods to help them and to assess their progress. Students hand these in and are given credit as part of a block of points that may be earned for lecture and recitation participation and for other activities.(15)

Lecture Outlines

A question often asked about the lectures is if students still take notes when the lectures are laden with graphics. We give students sufficient time during the lecture to make notes, and a cursory examination of their notes indicates that they do indeed sketch important graphics. In addition, we are developing exercises that help students learn to make meaningful sketches of molecular structures. One way to assist students in note-taking has been developed at the University of Auckland in New Zealand.(16) There students in the general chemistry courses are given "lecture shells," a set of incomplete course notes with spaces for them to add information from the lecture. In my lectures while on sabbatical leave at Auckland I gave students shells that contained the key PowerPoint slides but usually with an important point missing. Next to each slide was a space to add additional information. In addition, questions were often added that would prompt class discussion or that could be the basis of an examination question. For example, the lecture shell question associated with a figure on heat transfer asked students to explain how heat energy and molecular motion are related.

Examinations

If we are to present chemistry in an enriched environment, students need to be examined in the same environment. Therefore, the examinations in my general chemistry course now include questions that can only be answered by watching an animation or video demonstration. For example, after watching a short video of an experiment involving the diffusion of bromine vapor in air and in a vacuum, students are asked to describe their observations and explain why the diffusion rates are so different in the two experiments.

Lecture Room Design

Finally, it is very important that rooms for computer-enhanced lectures be properly designed. The classroom in which my lectures are held has two computers (one G3 Macintosh and one Windows computer), a laptop connection, a laserdisc player attached to each computer, a videotape player, a very good stereo sound system, and two LCD projectors, one for the computers and a second one for the disc and tape players.(17) In addition, there is generous blackboard space and an overhead projector. Of particular importance is the room lighting. It must be designed so that the projector screens are not lighted by room light. At the same time the seating area has to be well lighted so that students can take notes. These conditions are difficult to achieve and may be the most costly item in renovating lecture space.

Student Response

Surveys at the end of the academic year always suggest that students find the use of multimedia in the lectures, combined with other lecture enhancements, to be useful. Results from one recent survey are typical: 55% of the students strongly agreed that the format of the computer-enhanced course was conducive to learning chemistry; 34% agreed and 11% were neutral. None disagreed. When individual comments are solicited, we always hear such things as the following: (a) "Using the CD and computers for more student-centered learning versus lectures would improve learning in chemistry." (b) "The most effective use of multimedia is through integrating the movies and [animations] with the lecture material." (c) Multimedia "can show things that can't be explained as well in a textbook." (d) "The 3D graphics on the CD helped in spatially picturing chemical structures in my mind." (e) The "multimedia devices were incredibly helpful .... They made the lecture and text materials easier to understand by making some of the abstract theories more concrete. Especially helpful [to understand] orbitals... ." One student comment was particularly striking: "The use of multimedia clarifies ideas that seem to be very abstract. My retention of material is at a much higher level than in other classes." The latter part of this statement is extremely gratifying—if true. In fact, this is a testable idea, and it would be very useful to discover if retention of chemical concepts is indeed increased and if performance in succeeding courses is genuinely affected.

SUMMARY

"Our technologies for representing reality have always constrained the questions we could pose and the things we could teach." This statement appeared in Campus Tech magazine in 1993 and I believe illustrates the potential impact of computers on chemical education. Blackboards and textbooks did indeed constrain the questions we could ask. Now, however, we can hope to give students deeper insights into chemistry, certainly at the atomic and molecular level. As enthused as I am by our experiment with multimedia, after some years of teaching general chemistry I am convinced that students are better served by an environment in which they spend most of their time engaged directly with the material and only a small amount of their time listening to a lecturer. In this regard, you are urged to read the essay "The New Technologies and the Future of Residential Undergraduate Education" by Gregory C. Farrington.(18) "Some subjects invite far more radical experiments in learning using the new media. Beginning science and math are good examples. It takes an optimistic professor indeed to believe that first-year students learn much physics by sitting through a set of introductory physics lectures. In fact, most students actually learn beginning physics ... when they sit down and grapple with the course content, either in the form of a text or notes, and the problems that accompany it. The lecture may actually be a waste of everyone's time, but it is a ritual that is followed out of habit (on the part of the faculty) or out of fear of missing something that might be on the exam (on the part of students)." (Italics added for emphasis.)

ACKNOWLEDEGEMENTS

First, I would like to express my appreciation to my many students over the years who have sat through my lectures and tolerated my experiments on them. I also thank the people in Academic and Instructional Technology Support at SUNY-Oneonta for trying their very best to provide the equipment and services needed. Bill Vining, now at the University of Massachusetts, was my coauthor on the Saunders Interactive General Chemistry CD-ROM; without that software, developed with the help of Bill's creativity and supported by Saunders College Publishing and Archipelago Inc., the lectures would not be as rich. Finally, I thank Dr. Sheila Woodgate for inviting me to spend some time as a Medium-Term visitor at the University of Auckland in 1999. The "lecture shell" idea came from her, and she helped and advised as I experimented on her students in one of their general chemistry courses.

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4. J. Kotz and W. Vining, Saunders Interactive General Chemistry CD-ROM, Saunders College Publishing, Philadelphia, 1999, Version 2.5.

5. H. Pence, Computers in Chemical Education Newsletter, Fall, 1999, pp. 16-18.

6. The Comic Book Periodic Table: http://www.uky.edu/~holler/periodic/periodic.html

7. Extensive information on digital cameras is available on the Internet. See, for example: http://www.dcresource.com. See also Consumer Reports, November 1999, pp. 36-41.

8. An example of relatively simple software for making Quicktime movies is "MooVer," a shareware program from esp Software of Encinitas, California (espsw@compuserve.com).

9. Two useful web sites on copyright issues are: (a) Penn State University Media and Technology Support Services: http://www.libraries.psu.edu/mtss/fairuse/default.html (b) The Legal Information Institute at Cornell University: http://www.law.cornell.edu/topics/copyright.html

10. Several recent articles on using molecular models are: (a) B. W. Pfennig and R. L. Frock, J. Chem. Educ. 1999, 76, 1018-1022 (b) T. Poon, S. A. Bodolosky, and C. M. Norris, J. Chem. Educ. 1999, 76, 983-985 (c) H. Ungar, Syllabus, May, 1999, pages 53-56

11. Oxford Molecular can be contacted at www.oxmol.com. Our Chemistry Department has a site license for the basic Oxford Molecular modeling software, and it is used at all levels of the curriculum. For example, an experiment has been developed that allows students in general chemistry to learn for themselves the principles of VSEPR theory. A copy of the experiment can be found as a pdf file at http://www.oneonta.edu/~kotzjc/GenChem.html/111Lab.html.

12. RasMol is a standalone molecular model viewer and Chime is its counterpart used for viewing model over the World Wide Web. Both can be obtained at http://www.umass.edu/microbio/rasmol. This site contains links to support files for the two molecular viewing applications. There are tutorials on using the programs and links to other modeling sites.

13. MacMolecule (and its Windows counterpart PC Molecule) can be obtained from Molecular Ventures, Inc. of Phoenix, Arizona. See http://www.molvent.com/manual/quick/quick1.html

14. One problem is that, if students have missed lectures, they are tempted to print out the notes for those lectures, and this can amount of many pages. And, as students do not pay for printing costs, expense to the department.

15. 15% of the course credit may be earned by handing in the lecture sheets, the worksheets used in recitations (where students use the Saunders Interactive General Chemistry CD-ROM), the "Element of the Week" puzzle, and Quick Quizzes.

16. Some of these lecture shells can be viewed at the website for the general chemistry courses at Auckland while they remain. See http://www.che.auckland.ac.nz/Stage1/Courses/410150/JKotz/JKHome.htm.

17. If possible, it is very desirable to have two projectors. The video of a reaction or physical change can be run from a tape or laser disk on one projector, and commentary and questions about the process can be on the computer projector.

18. Gregory C. Farrington, "The New Technologies and the Future of Residential Undergraduate Education," Educom Review, page 38, July/August, 1999.

Using PowerPoint Page 6

Using Multimedia IV -Catching the Students' Eyes

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As noted in the previous articles in this series, there are several sound educational reasons for using presentation software in chemistry lectures. It allows an instructor to combine text and images in a single frame, hopefully making it easier to remember the concepts. Events and processes that were formerly difficult to make interesting now come to life, and students can actually see the real-world applications of chemistry that had previously only been described. Perhaps equally important, although less obvious, is the ability of presentation software to catch and hold the students' eyes, literally guiding their attention through the presentation.

Presentation software packages include various ways to guide the students' eyes. Probably the most important idea to keep in mind, however, is the need to stick to the same process from one frame to the next and to avoid unnecessary distractions. A uniform slide background can provide useful information, but it can also be a constant diversion. Many of the standard backgrounds provided with the software seem to be designed to distract the viewer from the text. During one memorable presentation, every slide was framed with a beach scene, complete with palm trees. Judging from the restlessness of the crowd, the audience kept wondering how this lush background was supposed to be related to the speaker's topic. If the goal was to make them wish that they were somewhere else, it was completely successful. If it had that effect on an interested audience of professionals, what effect would this distraction have on a typical group of students.

A typical software presentation package offers a multitude of background choices. Many of these may be artistically interesting but may also distract the audience from the material. Some presenters create problems by using complex pictures as a background. In either case, it may be so hard to find the text that the frames begin to resemble the child's game, "Where's Waldo." A good piece of advice about writing is that if something seems so cute that it is difficult to leave it out, it should definitely be eliminated. Similarly, the best rule with slide backgrounds is simpler is better.

In general, when a frame appears on the screen, most viewers in our society will begin by either looking at the center or the upper-left hand corner of the image. This habit is based on the way that we normally read. It is very helpful to guide the viewer's eye towards that part of the screen which contains the material which is most important in the frame. One way to do this is to make background color a little brighter in the upper-left hand corner (as you face the image) and a little darker in the lower right. The brighter image will naturally draw the eye towards that corner. This is called a gradient and is easy to set with the master frame so that it will always occur in a presentation.

To reinforce the importance of the upper-left hand corner, use a frame transition that will reveal that part of the slide first. A good example is the wipe right transition. As the new material becomes visible, the viewer's eye is naturally attracted to the change. After a few frames, the viewer has become accustomed to having new material presented in the upper left hand corner for the frame, and so this is where the eye will enter the frame. In general, it is a good idea to place the material that is most important, whether it is text or an image, in the upper-left hand corner.

Like any consistent practice during a presentation, giving special status to the upper-left hand corner sets the stage for another way to emphasize an important point. When the eye expects the transitio be a simple wipe right, it magnifies the impact of a different transition, like a box-out or a dissolve. The viewer probably will not consciously recognize what has happened that was so different, but the change is noticeable. Similarly, placing an amusing image in the lower-right corner catches the viewer off-guard and can make a mildly amusing picture seem much more striking.
Once the viewer's attention has been captured in the upper-left hand corner, the build (or animate) function can be used to guide the eye through the frame at a pace that matches the presentation. Exposing all of the text on a frame immediately invites the viewer to ignore the speaker and read through all the text. That is fine if the frame contains all of the material that is to be presented, but if that is the case, why not just hand out a printed copy? The goal of using presentation software is to make the speaker more effective, not to make the speaker redundant!

For many types of presentations, it is reasonable to have the build function eliminate preceding lines. This further helps to keep the audience up with the speaker. Unfortunately, like many capabilities of presentation software, this is not appropriate for a classroom session where students are trying to take notes. It is reasonable to change the color and make the previous points less obvious, but totally eliminating lines with the build process will be quite likely to produce student rebellion.

Most professors spend hours organizing lectures to make them more effective and memorable. The goal is to present material in such a way that it gives the maximum support for student learning. When properly used, presentation software can help to accomplish this purpose.

Building a PowerPoint Presentation

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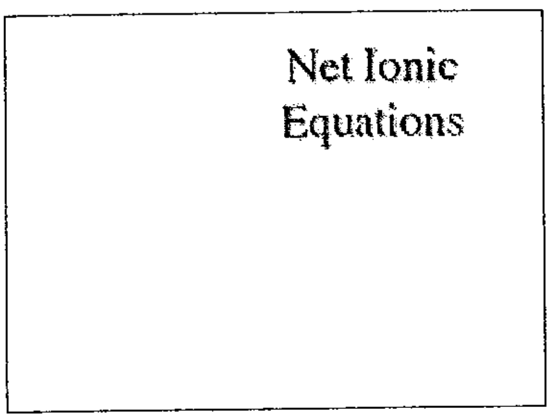
Oneonta, NY 13820

Jack and I decided to keep his paper in his Acrobat format since much of the concern of the paper is formatting PowerPoint slides. The paper begins on the next page.

Building a PowerPoint™ Presentation

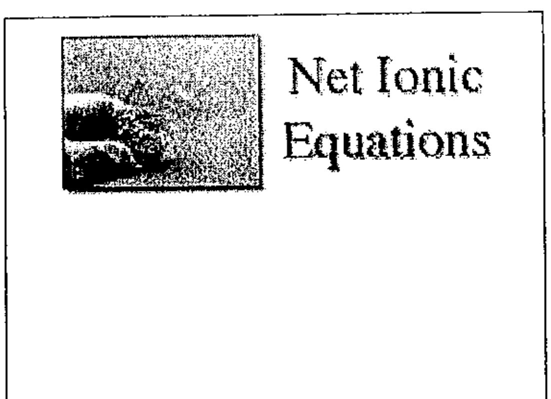
The purpose of this document is to illustrate how one can build a PowerPoint slide to be used to illustrate one idea, here the concept of net ionic equations. The directions are based on the version of PowerPoint (Version 8.0) in Microsoft Office 98 for the Macintosh. To do this one must also have the *Saunders Interactive General Chemistry CD-ROM* mounted in the CD drive.

Adobe Acrobat versions of the PowerPoint slides used in some sections of General Chemistry 111 at SUNY-Oneonta are found at http://www.oneonta.edu/~kotzjc/genchem.html. Users of Saunders textbooks can download the PowerPoint slides for all of general chemistry from the website for the Saunders general chemistry books: http://www.saunderscollege.com.



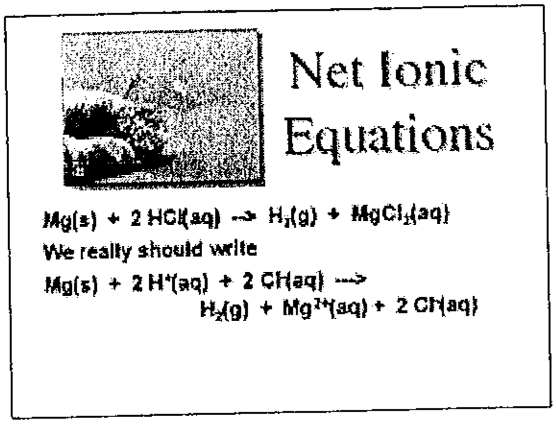
STEP 1: SLIDE TITLE

In the "Insert" menu request "New Slide." A plain white background is used here but we often use blue. In the area for the title type in the title of the slide, here *Net Ionic Equations.* Note that the title is in a 72-point serif font and a light gray shadowing has been added.



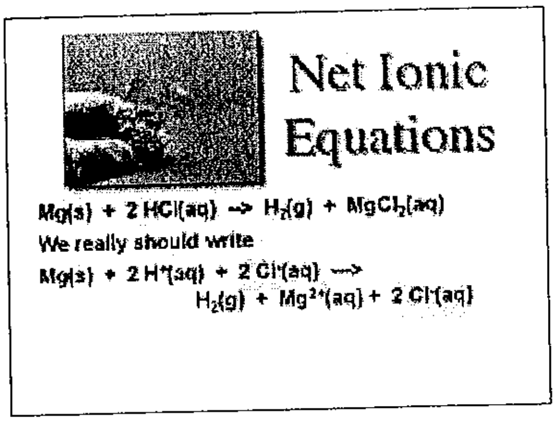
STEP 2: INSERT MOVIE

In the "Insert" menu go to "Movies and sounds." You will see a dialog box asking what movie. Navigate to the CHAPTERS folder on the *Saunders Interactive General Chemistry CD-ROM.* In that folder go to the MEDIA folder and within that find CH04_MED. The latter contains all the media for Chapter 4 on the CD-ROM. On a Macintosh one can see a thumbnail of the movies. Find 04M14VD3.MOV. This code tells you the chapter number (04), that the number of the screen on which the movie is found in that chapter is 14, that the video is the third one on that screen (VD3), and that it is a Quicktime movie (.MOV). [Note: animations have AN in the code instead of VD.] Place the movie where you want it on the screen.



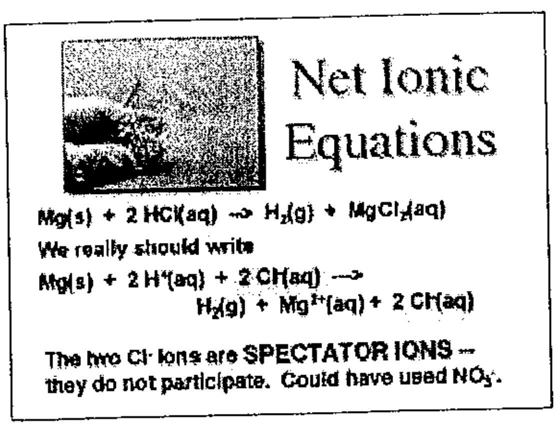
STEP 3: INSERT MAIN TEXT

Type in the main text for the slide. Here, as in almost all slides, we have used a san serif font (Arial), boldfaced and shadowed. 28-point type is used here, but we often use 32-point type as well.



STEP 4: ADD HIGHLIGHTS

Here we want to call attention to the spectator ions in the equation, so yellow rectangles are arranged under the chloride ion symbols. (This can be tricky to do. Here rectangles were drawn using the PowerPoint drawing tool and filled with yellow color. The "Send to back" tool was used to put the text in the background so the yellow rectangles could be placed in the correct position. Then the "Bring to front" button was used to bring the text to the foreground, leaving the yellow highlight behind the text.)



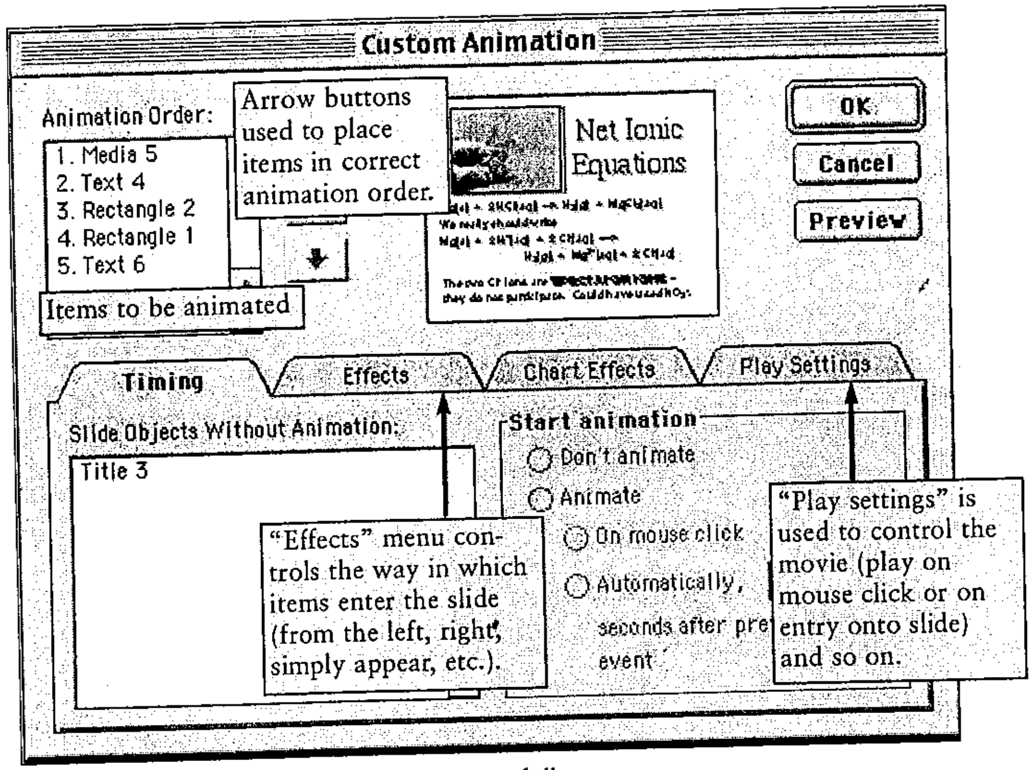
STEP 5: ADD SECOND TEXT

The last two lines with a light yellow background were typed in, and the background of the text was filled with the lightest yellow available in the color palette. Again a 28-point san serif font was used except for the words SPECTATOR IONS, which were given a contrasting color and were 32-point type.

Tip: When using PowerPoint and showing slides, set the application to use as much memory as can be spared in RAM. We generally use 15-30 MB.

STEP 5: ANIMATE THE SLIDE

To animate the objects on the slide, click on the "Animate" button (or go to the "Slide show" menu). The "Custom Animation" window opens. In the "Timing" menu click on the items to be animated and place in them in the correct order with the arrow buttons.



After setting the animation, the slide is shown as follows:

1. The slide appears on screen with the title and the movie frame.
2. The movie plays when clicked with the mouse. (We always do the same reaction "live" in a dish on an overhead projector at the same time and ask the students to make observations.) We also try to get the students to write the overall, balanced equation.
3. Next a mouse click brings the first equation on the screen. The students are asked to write out the species as they would actually occur in solution, that is, write the equation with HCl and $MgCl_2$ broken into their ions. Another mouse click brings the second equation onto the screen.
4. We then look for the spectator ions, and mouse clicks cause the yellow rectangles to appear to highlight those ions.
5. Finally, the last sentence is brought onto the screen with a mouse click.
6. Other reactions are demonstrated in the lecture and students are asked to write net ionic equations on a worksheet provided in the lecture.

RECORDING SOUND: As a final point, note that one can add voice-overs to slides. Go to the "Insert" menu, then to "Movies and sounds," and then to "Record sound." After the sound is recorded, a "speaker" icon appears on screen. Clicking on this plays the recorded sound. This is useful when you want to students to look through the slides by themselves but you want to fill in details and add context.

Using Multimedia IV -

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MESSAGE FROM THE CHAIR

Donald Rosenthal
Department of Chemistry
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Phone: 315-268-2352
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On January 1, 2000 I became Chair of the Committee on Computers in Chemical Education (CCCE) succeeding Harry Pence, SUNY Distinguished Teaching Professor, State University of New York at Oneonta. Harry has been a member of the CCCE since 1987 and served as Chair for two years. For many years he wrote book reviews and served as book review editor for this publication. He has organized symposia at many of the ACS National Meetings and BCCE meetings and presently serves as a member of the Division of Chemical Education's Program Committee. He was Co-Chair of the Division's program at the National Meeting in New Orleans in the Fall of 1999, continues as a member of the CCCE and has agreed to help organize and coordinate computers in chemical education symposia at national ACS meetings. On behalf of the Committee and myself, I would like to thank Harry for his many contributions.

COMMITTEE MISSION

The Committee on Computers in Chemical Education (C.C.C.E.) seeks to encourage and support the development, implementation and assessment of computing technologies in chemical education. We solicit your assistance in these endeavors. Your ideas and suggestions are always welcome.

MEMBERS OF THE COMMITTEE

The Committee currently consists of twenty-two members. Their names, addresses and computer interests may be found on the Committee website (http://www.ched-ccce.org/index.html/).

CCCE ACTIVITIES

COMPUTERS IN CHEMICAL EDUCATION NEWSLETTER

This Newsletter has been published in its present format for about twenty-two years. We have decided to discontinue publication of a printed copy and instead make it available on the Committee's website (http://www.ched-ccce.org/newsletter.html/). Initially, publication will occur twice each year, as at present. On-line discussion of the Newsletter and Newsletter topics will be a feature of the new format. The on-line version of the Newsletter will be available in October 2000.

SYMPOSIA AT NATIONAL MEETINGS

Harry Pence is coordinating the organization of computer symposia by the CCCE. If you would like to organize a symposium or have suggestions for future symposia, please contact Harry (pencehe@oneonta.edu). The Washington ACS Meeting this fall includes a CCCE sponsored symposium entitled "What's the Next Big Step in Using Computers to Teach Chemistry?"

CONFCHEM ON-LINE CONFERENCES

A schedule of on-line conferences is available on the CONFCHEM website (http://www.ched-ccce.org/confchem/). These conferences generally have between 600 and 800 registrants. If you have suggestions for future topics or are interested in organizing an on-line conference, please contact Brian Tissue (tissue@vt.edu) or me (rosen@clvm.clarkson.edu). If you would like to present a paper at an already scheduled conference, contact the conference organizer.

NATIONAL COMPUTER WORKSHOPS

National Computer Workshops have generally been held the weekend before BCCE meetings. Four or five workshops run concurrently. No workshop has been scheduled for the BCCE at the University of Michigan.

We expect to offer workshops for the 2002 BCCE. If you have workshop suggestions, please contact me (rosen@clvm.clarkson.edu).

ON-LINE INTERCOLLEGIATE COURSES

The CCCE has sponsored four on-line courses since the spring of 1996. Sylvia Esjornson served as chair of the organizing committee for the Spring 2000 course on Environmental and Industrial Chemistry. Consult http://www.ched-ccce.org/olcc/index.html/ for more information on OLCC courses.

DIVISION OF CHEMICAL EDUCATION WEBSITE

A CCCE subcommittee continues to maintain the Division of Chemical Education website at: http://divched.chem.wisc.edu/divched/.

OPEN CCCE MEETING AT BCCE

The Committee on Computers in Chemical Education will hold an open meeting at 12:30 PM on Monday, July 31, 2000 in Chemistry Room 1200 at the University of Michigan BCCE. Have an early lunch and join us. Many members of the Committee will be there. We welcome your comments and suggestions.

Additional information can be found at the BCCE Website (http://www.umich.edu/~bcce/meetings.html/).

HOW YOU CAN HELP

The success of the Committee depends upon our interaction with you and other chemical educators. Please send us your ideas and suggestions. Your articles submitted to this Newsletter are published in a timely manner. I hope to see some of you at our open meeting at the BCCE.

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CCCE MEMBERSHIP LIST

Here is a list of members of the Committee on Computers in Chemical Education In addition to name, addresses and phone number, some committee members have provided information on their computer activities and interests.

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Liz Dorland teaches chemistry at Mesa Community College in Mesa, Arizona. She has taught in the Phoenix area for 15 years and in various community colleges and universities since 1972. Her interests in chemistry and computers include data collection in laboratory using laptops and Vernier probes, development of web pages with chemistry resources and tutorials for students and faculty with emphasis on using the Chime plugin, and placement of course resources and grades online for campus based students using WebCT.

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Steve Lower recently retired from Simon Fraser University (Vancouver, Canada) where he taught general, physical, and environmental chemistry and where he has specialized in the development and integration of computer-based instructional materials in General Chemistry. As the proprietor of Chem1Ware Ltd. (http://www.chem1.com) he continues to develop and market this instructional software. He is also developing a set of publically available Reference Textbook chapters, and maintains a major Web-based site for Chemistry teachers (http://www.sfu.ca/chemcai).

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Cathy Middlecamp teaches general chemistry for non-science majors at the University of Wisconsin-Madison, and has her students search for, evaluate and utilize chemical resources on the world wide web (www.chem.wisc.edu/courses/spring99/108/). She is a co-author on the 3rd edition of Chemistry in Context (www.mhhe.com/cic/), a project of the American Chemical Society, and designed the web activities for this edition. She also teaches a graduate seminar on teaching chemistry (www.chem.wisc.edu/courses/spring00/901/) that helps prepare future faculty in the use of instructional technology, and has presented over a dozen workshops nationally on teaching and learning with the web.

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Abby Parrill has incorporated technology into the classroom in several ways. First, she has developed an extensive collection of educational materials for supplemental use by organic chemistry students (www.cem.msu.edu/~parrill). Second, she actively uses computational models in the classroom to help students visual three-dimensional concepts such as stereochemistry and conformations. Finally, she is integrating computational modeling as part of a drug design project in an organic medicinal chemistry course.

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Harry E. Pence (SUNY Oneonta) is mainly interested in classroom applications of computing technologies. He has been working for over a decade on the combination of multimedia and presentation software with cooperative learning. His main focus is on the pedagogy of using technology, that is, how to produce the greatest impact on learning. His web site, the Alchemist's Lair (at http://snyoneab.oneonta.edu/~pencehe/) includes a widely used set of material on careers in chemistry. This work has led to a recent focus on WWW search engines.

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Donald Rosenthal is currently Chair of the Committee on Computers in Chemical Education (C.C.C.E.) and Professor Emeritus at Clarkson University. He helps to organize the CONFCHEM on-line conferences and manages the Majordomo Discussion List. During the summer of 1999 he organized a World Wide Web Workshop at the Northeast Regional Meeting of the American Chemical Society. A website containing links to selected sites of interest to high school and college chemistry teachers and their students was established and is currently available (http://www.clarkson.edu/~rosen2/webwork.htm.

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Michael J. Sanger is an Assistant Professor of Chemistry and Science Education at the University of Northern Iowa. His primary research interest is in improving students' abilities to visualize chemical processes at the molecular level. To facilitate these skills, he has created computer animations of chemical processes at the molecular level and has used computer-generated electron density models of simple molecules. He also teaches a technology methods course for secondary science teaching majors which focuses on calculator- and microcomputer-based laboratory data collection devices, spreadsheets, WWW search engines, and the evaluation of laser disc, computer, and videotape software.

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Originated the University of Miami Chemistry Department's "Computing in Chemistry" Course and leads the teaching team. Teaches introductory and advanced mini-courses in the creation of Web pages through scripted HTML coding. Taught a distance education section of chemistry for nonscience students. Serves on several campus-wide committees dealing with computing in education. Creates Web pages for all his courses. Converts all multiple-choice file-examinations into Web-based, interactive JavaScript versions.

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Brian Tissue is an associate professor of chemistry at Virginia Polytechnic Institute and State University. He began writing hypermedia for the Web in 1993, and has incorporated extensive Web-based prelab exercises in an Instrumental Analysis course. His major interest now is finding ways to help students use all of their learning resources effectively, including hypermedia, textbooks, and lectures. He also manages the website for the CONFCHEM on-line chemistry conferences, http://www.ched-ccce.org/confchem/index.html.

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Scott Van Bramer actively uses technology in the classroom. The primary focus is to use computers to help students visualize chemistry on the molecular scale and to develop mathematical models. In a addition, he also makes extensive use of the web as a communications tool to provide students with additional information to help them study more effectively. These resources are available on the web at: http://science.widener.edu/~svanbram/

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Development of Web-based instructional technologies for General and Physical Chemistry and for middle school and high school science. Development, research and implementation of assessment methods for computer-assisted learning, especially Web-based.

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David Whisnant is interested in Web-based applications in chemical education. Recently, he has developed a set of HTML multimedia problems for General Chemistry. He also is working on Web-based Physical Chemistry laboratory projects that use computational chemistry software.

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During the past year I have been engaged in several exciting projects. First, the Physical Chemistry On-Line project was funded by NSF for 10 faculty to develop, assess, and disseminate physical chemistry instructional materials that are based in concrete real life applications of physical chemistry. The project will last five years. Second, I continue to edit the Mathcad in the Chemistry Curriculum column for the Journal of Chemical Education. Third, I maintain the Mathcad in the Chemistry Curriculum Web page for dissemination of Mathcad templates for other teachers to use with students. Fourth, I was an invited speaker at the NSF TechEd99 Workshop in July 1999. Fifth, I am serving on the Physical Chemistry ACS exam committee. My latest venture is adding/upgrading computer technology in the chemistry and physics laboratories as well as directing departmental efforts for using laptops in chemistry and non-science classes.