# “In the Lab before Christmas” – A Chemical Demonstration and Education Show

David P. Licata,
Pacifica High School, Garden Grove, California, Retired
Treasurer, Board of Publication, Division of Chemical Education, ACS

Most chemical educators will agree that exciting demonstrations are excellent motivators to create interest in science. They are also a way to create interest in the community, motivate the student_demonstrators, and perhaps to make a little money to support special activities of an ACS Chem Club. Chemical demonstration shows, organized around holidays or other special occasions have a long and honored history. Pacifica High School (Garden Grove, CA) took its inspiration from the lecture_demonstrations of Michael Faraday, given during the Christmas holidays of 1860_61. (The Chemical History of A Candle).

"In the Lab Before Christmas" regularly attracted more than 400 students and community members. We had an attendance of more than 800 at the final show in 2012. The annual event, begun in 2003, was billed as the start of the holiday season at the high school, and was eagerly anticipated by club members and other students. The show was conceived with three purposes, first to entice students to enroll in Advanced Placement Chemistry; second to introduce a variety of chemistry concepts to the general population of students and the community in an exciting and entertaining way; and finally as the principal fund_raising activity of the AP Chemistry class, and later the ACS Chem Club.

The show was most often presented the week immediately before, or preferably on Thursday of the first full week of December (about two weeks after Thanksgiving). Depending on the size of the AP class, from 14 to 18 demonstrations were presented at each show. In addition to researching an interesting demonstration and the chemistry and safety issues it encompassed, students were also required to write and perform a short, "humorous" skit (of course some were funnier than others), and prepare a two_ to four_minute PowerPoint presentation (preferably with animation) to illustrate the basic chemistry concept. As AP Chemistry was a second_year class at our high school, students had already had at least an introduction to each of the topics, and were expected to do their own research if they needed more information for the PowerPoint "lesson." The teacher consulted with students on their selection of demonstrations to try and spread the choices across as many different chemistry topics as possible. Students were required to learn and apply the Division of Chemical Education "Minimum Safety Guidelines for Chemical Demonstrations" (rev. 1995).

Due to the limitations of time, resources, and venue, the show could not be interactive, and attendees watched the skits, demonstrations, and lessons, but could not participate actively. However, both the students doing the demonstrations, and those who watched (as well as parents, and other community members) were enthusiastic about the effort of the students, the educational opportunity, and the motivation to continue studies in science that resulted from the show. Growing attendance and enthusiasm forced the school administration to provide larger and larger venues to accommodate the crowds, until with much trepidation it was agreed that the show could be done in the school gymnasium with four_foot by eight_foot sheet metal panels placed on the floor in the demonstration area (four total panels) to protect the basketball court.

The remainder of this article will outline the steps to preparing and presenting the show. Associated material gives sample programs, tickets, and PowerPoint lessons based on the demonstrations. Unfortunately (or, perhaps fortunately) scripts of the skits are not extant and cannot be included. I am happy to provide more information or suggestions from the experiences at Pacifica to anyone who is interested, and would be happy to have other ideas added to this blog entry.

Planning the show began in the late spring, when the school "master calendar" was being prepared. The AP Chemistry teacher reviewed the sports schedule (particularly football and basketball), to choose a date that would present the fewest conflicts. Also important to consider were the holiday music concerts, drama productions, and dances. Once the popularity and educational benefit of the chemistry show was established, the Thursday after Thanksgiving was "reserved" for it, and only the sports schedule (which was somewhat beyond the control of the school administration) presented any problems.

Planning for the show began on the first day of school. After discussing the AP syllabus and expectations, I reviewed the purpose and procedures for the show. When ACS introduced the Chem Clubs, all AP students were invited to join, and preparing for "In the Lab Before Christmas" became the program for the first several club meetings. The first order of business for the students was to choose a group to work with. Group size depended on the number of AP Chem students. The desired number of demonstrations was 10 to 14. So with a typical enrollment of 50 to 60 students, there were usually three students per group.

The second task was to find appropriate demonstrations. Appropriate demonstrations would be exciting, interesting, and clearly visible in a large auditorium or lecture hall. After the first several shows, the club purchased a video camera and projected a closeup of each demonstration on a large screen (borrowed from student government). This made it possible to do many more demonstrations that might have been difficult to see in a large room. Several class references were available, including: Chemical Demonstrations, A Handbook for Teachers of Chemistry (Volumes 1_4), Bassam Z. Shakahashiri, University of Wisconsin Press, 1983; Chemical Demonstrations: A Sourcebook for Teachers (Volumes 1 and 2), Summerlin, Lee R. and James L. Ealy, Jr., American Chemical Society, 1988. Useful demonstrations could also be found in the teachers' guide to many textbooks, from Flinn Scientific, and on the Internet. Once students had selected a demonstration they were required to write the title, page numbers, and complete reference on a full_size sheet of paper along with the names of each group member and a list of chemicals and equipment needed. This was turned in to the teacher.

I reviewed each proposed demonstration to make sure that it was appropriate for a stage presentation, was withing the safety guidelines, and that it did not require chemicals or equipment that would not be available. In addition, I assigned each demonstration to a topic area in chemistry to try and include as many different chemistry topics as possible, and also to guide the students when they prepared their PowerPoint lessons. Most demonstrations involve several chemistry topics, so I helped the students choose the particular topic to emphasize for each of the demonstrations to avoid duplication. This task was to be completed by the end of the second full week of school.

Once a demonstration was approved, students were directed to collect the equipment and chemicals. If chemicals or equipment were not available, then the students were directed to find the missing items in the catalog of the school's preferred provider, and list the item, amount required, product code, and page number from the catalog. For items that were available, students collected them and placed them in a box or cabinet, clearly labeled with group names and demonstration title. As the missing items were delivered, these too went into the box or cabinet. This had to be completed by the end of September, or the end of the third week of school.

The students were given two weeks to come up with a "humorous" skit to provide a setting for the demonstration. They were required to turn in one copy of the script, with a list of properties, for each group member, and one for the teacher. Incomplete (or inappropriate) scripts, or those that required clarification were returned to the group for a rewrite within a week. I cannot recall that any were every inappropriate, though a group of swimmers insisted their costumes had to be Speedos one year.

The next task was the most important: making the demonstration understandable to the audience. Students were directed to prepare a PowerPoint presentation with a title screen and at least four additional screens to explain the chemistry in the demonstration. Students were encouraged to use animated sequences to enhance their explanation. These explanations were to focus on the chemistry principles, and were NOT to give directions for performing the demonstration (as most were on the edge of acceptable safety considerations). The mini_lessons were to be ready by the end of the first week of November, about two weeks before Thanksgiving.

The first week of November was devoted to preparing for the demonstrations. This was done as part of the classroom activities for the AP Chemistry class. Even after the ACS Chem Club was organized, it was an exclusive privilege of the AP Chem members to be part of the demonstration show. Preparations included making posters and writing entertaining announcements for the regular morning "news" and activities report given by student government members. Many of the announcements focused on the likelihood of explosions and fire at the show, so there would not be a "Silent Night" at "The Lab before Christmas." Students also prepared the program and tickets.

The second week of November was devoted to a complete run_through of the show (not in the eventual show order). Each group did their entire skit (with props), demonstration, and presented their lesson. After each lesson, I critiqued the screens and the information, pointing out where things could be clarified, more interesting graphics used, how to animate a model to better illustrate the chemistry, or correcting errors. Students had until the week of Thanksgiving to complete their revisions and turn in their completed PowerPoint either on digital media or by uploading to the class Dropbox. If they wanted sound effects or background music, this was also delivered (along with instructions for the use of sound and lights during the skit).

Posters went up during the week before Thanksgiving. Announcements had started the week before that. Ticket sales started the week of Thanksgiving, with reduced prices for advance

purchases, and higher prices at the door. Boy Scouts, Girl Scouts, Cub Scouts, Brownies, Campfire Girls, and Indian Guides in the immediate school attendance boundary, and the neighboring boundaries, were all contacted by AP Class members with flyers. Often a class member would attend a meeting just before the show to sell tickets. Elementary schools and middle schools were sent posters. The local newspaper was also given information and almost every year the show was included in the "Calendar of Events" for the holiday season. AP Class members also visited each of the other science classes to talk about the show and sell tickets. Parents, siblings, and nearby relatives could all be counted on to attend.

The week of the show, the AP Class gathered necessary articles for safety and good stagecraft. A complete list of sound and light cues was prepared by a few of the students. The Drama Department lent its lapel microphones, student government provided a giant screen, sound board, and speakers, the band lent its high intensity "shop lights" (which were used for nighttime band practice). The "shop lights" made it possible to illuminate different sides of the stage so that one group could do their skit and demonstration on one side while another group was setting up on the other side of the stage. This was important to keep the show moving quickly and preventing the audience from getting restless as changes were made. Another consideration was the order of demonstrations. Several of the demonstrations involved smoke, explosions, or fire/fireworks. These were distributed throughout the show so that the exhaust fans would not be overwhelmed with the task of clearing the stage area, and so that similar types of demonstrations did not come too close to one another. Programs were printed and stage decorations were painted and made. Sometimes a student would bring in an artificial Christmas tree and students decorated it. This extra work was done outside of class.

Finally, the day arrived. After school students moved equipment, chemicals, and safety equipment to the venue. When the administration finally agreed to make the gym available the previously mentioned sheets of metal were placed on the floor under the demonstration tables. Chairs, benches, lights, decorations, and so on were set up. Four students sold and collected tickets, and two more handed out programs. Others helped people find seats. Two students were appointed to run the lights, two for the camera, two for the computer (PowerPoint), and two for the sound so that when one person had to set up and perform, there was someone else already identified to take over one of these important jobs. The LED projector, camera, computer, sound, and lights were all checked with a complete run_through (without performances). Each student did a sound check to make sure they could be heard on their microphone. About 90 minutes before the show my wife brought in pizza from the best place in the area (thankfully discounted by this business to help support our school) and the class shared dinner together. Then, with a final pep_talk, the show was ready to go on.

I had started a tradition of beginning the show with a dramatic recitation of the section from Ira Remson's diary about why experiments are important in chemistry (see supporting materials). Remson described how he learned what the phrase "acts upon" meant. He placed a penny in nitric acid, observed the noxious fumes produced, picked up the penny and flung it out the window, then wiped his fingers on his pants to rid them of the nitric acid. The events described were acted out. My wife prepared a special pair of pants in which a large rip had already been made and sewn back together with a few thin threads so that as I recited how Remson drew his fingers across his pants after flinging the penney, the large rip would appear to

reveal a glimpse of a colorful pair of holiday boxer shorts. This was followed by a brief explanation of how this shows the importance of labs and demonstrations for science, and an invitation to enjoy a night of "exocharmic" (George Bodner, Chemunity Newsletter, September 1986) chemical "magic" and fun.

When the show was over, of course everyone pitched in to clean up. Parents were complimentary, excited, and especially helpful in getting materials back to the classroom and restoring the venue to its original condition. The custodial staff, who shared the pizza, and usually took their breaks at the venue to see at least part of the show, always went out of their way to be helpful and supportive. They helped clean up and did more than their share of extra work to help us return everything to the way we found it.

After I retired, the new AP Chemistry teacher was too unsure of the schedule to want to take time away from class before the AP Exam. So, instead, the "Chemistry Demo_lition" show was born and produced early in June (Pacifica's year usually ends after June 20). The time_frame for activities is somewhat different (and substantially elongated, starting about February 1 with the new semester), but the overall plan is the same. This will be the fourth year of the "Chemistry Demo_lition" and the fourteenth year overall, in which Pacifica High School has presented an interesting and engaging program to motivate students and the community to greater interest in science.