

Review of *Introductory Chemistry Version 4 Kit*

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Introductory Chemistry Version 4. eScience Labs, LLC: Sheridan, Colorado, 2009.

Finding a way for distance education students to have a comparable experience to traditional “flesh and blood” classes is an obstacle all online instructors face. A particular challenge is to incorporate students actually handling chemicals in the course curriculum for laboratory classes. My university requires students to actually handle chemicals (rather than watch videos or use simulation software) for a course to be designated a physical science laboratory. The way in which I provide this service to my students is to have them purchase a lab kit from eSciencelabs.



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The kits are “green” so that waste disposal is not an issue. Municipal and drain disposal are adequate for these kits. Because of that fact, students are able to use the kits in places where there are not chemistry laboratory facilities, such as military bases. This way we can offer laboratory classes all across all the Hawaiian islands. The unique geography of Hawaii poses challenges to the university and our student population in general. Use of these kits for both our distance education classes and for classes using other facilities expands our capacity to serve our students. The lab kits could also be used in this application for rural areas without labs or in high schools without laboratory capacity.

I require students to take pictures during certain aspects of the lab exercises. I do this to provide instructor feedback to them and to prevent plagiarism. For plagiarism, I look to see that the same pictures are not submitted over and over again. All students now have access to either cameras of their own, or friends who have them, or cameras on cell phones or other electronic devices.

Another difficulty in administering online lab courses is showing that there are student-to-student interactions similar to face-to-face courses. I allow students to work alone, but I also

give the option of having a lab partner. Many times a student needs to work alone, either in instances of geographic isolation or for situational reasons, such as a single mother with children. These and similar examples were sufficient evidence to persuade my institution’s curriculum committees to allow a laboratory class to be offered in distance education. Other schools may require similar evidence.

eSciencelabs has four different lab kits, including ones for first-year chemistry, preparatory chemistry, and chemistry for students not majoring in scientifically rigorous studies. I use a custom version of lab kit 4, which is designed for nonscience majors. I use a custom kit because of shipping concerns. The standard kit will suffice for use in the Continental United States. My students purchase the kits directly from eSciencelabs, bypassing the school’s bookstore, which most students appreciate. The chemicals in the kit are relatively safe (i.e., chloride salts). Nothing in the kit is extremely toxic (unlike the chemistry kits of my youth).

Lab kit number 4 provides nine experiments and starts first with a lab dealing with safety. eSciencelabs also has an introduction video on the company’s Web site that includes safety.¹ This first lab also has the students ensure that all the contents of the lab are included. In instances when my students or I contacted eSciencelabs about missing items, the company has always assisted.

The second lab deals with scientific analysis. In this lab, the students do not handle chemicals. They are given a series of data sets or concepts and are asked to analyze them. I use this laboratory exercise to explain the concepts of noise and data analysis by providing feedback to the students. In the third lab, the students take measurements with rulers and thermometers. The thermometers provided in the kit are glass with alcohol inside. Sometimes these break in shipping; some kits also offer digital thermometers. The fourth lab is a flame test lab. I provide the electronic structure of the atoms and explain the discrete energy levels of these atoms in a prelaboratory lecture that is posted online. This course is for nonscientists, so in a more rigorous course, I would not provide as much information.

Molecular models are presented in the fifth lab. The most common mistake in this lab is students constructing the models in two-dimensions rather than three-dimensions. This is where the photographs students take can aid in instructor feedback. When the students make their models two-dimensional, I let them redo the lab and I provide links to VSEPR sites.

The sixth lab concerns chemical reactions in which students look for a precipitate to prove the fluoride content of mouthwashes. Often, the students will not get the intended results owing to the lab kit itself. More often than not, the students have not adequately cleaned their glassware.

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The seventh lab typically is a quite difficult lab for the students. In this lab, using cinnamon and dish soap, the students try to estimate Avogadro's number. The eighth lab, which deals with the decomposition of hydrogen peroxide to water and oxygen, is also difficult for most students. The ninth lab, dealing with acids and bases, finishes the course. Students use a grape juice indicator to test the pH of household items. They tend to enjoy this lab and it is a nice lab to end the course with.

Some general observations about distance education hold true for laboratory classes as well. For example, students may not understand that instructors will read students' lab reports in their entirety; in my experience, students have written quite humorous things (e.g., a student once reported a flying spaghetti monster appearing in his lab report). Students also perceive that distance education is easier than traditional education. Both the instructor and the student may be surprised to find out the difficulty involved in distance education.

Whether a course calls for a distance education lab or when comprehensive lab facilities are not available, lab kits are an option, and eSciencelabs kits are useful for those types of applications. The "green" nature of the kits will decrease overhead for disposal and alleviate many safety concerns.

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■ REFERENCES

(1) eSciencelabs Safety Video. <http://www.esciencelabs.com/students/safety> (accessed Jan 2012).