**Caltech Chemistry Education**

In October 2016, a group of 12 Blacker House students went to the dumpster area of the physical plant and set three of them on fire. Some chemicals from the lockers nearby were added to the fires, leading to a large fireball which attracted attention of some late-working researchers. A student was injured; another stayed to assist him; the other 10 fled the scene. All 12 were subsequently suspended from Caltech for periods up to one year and required to show understanding of the Honor System before being allowed to return. My initial thought was that it was late October. If school starts in September, and Chemistry is a required subject for all freshmen, then the first month of class time can educate new students about exothermic reactions and safety.

Out-of-Control Fires

There are several episodes in the past at Caltech that should be explained. After winning football games (something that is not possible any more), students used to assemble a bonfire at the corner of California and Lake. Mostly wood was used, but large fires pollute the atmosphere, block street traffic, and cause the city of Pasadena extensive cleanup cost. As universities have found out, large bonfires can shift in position, causing fatalities, and burn damage. Adding accelerants (such as gasoline or compounds with high vapor pressure) to large fires can have unintended consequences and unsafely extend the fire range.

Organic Compounds Cleaning

A student in the old Gates Laboratory wanted to clean some baked on organics from a flask. The first step attempted was to use methanol to dissolve the compounds, but this did not work. Now the flask contains some organic compounds and some methanol mixed together. The next cleaning agent tried was concentrated nitric acid. When the flask contents turned green and started bubbling, the student sensibly fled the scene before a large explosion completely wrecked the hood that he was working in and spread shrapnel all over the lab. I wonder why the old freshman chemistry lab in Gates became an administration area.

Another student was also trying to clean a black organic compound mess in a large flask. The standard method was to use cleaning solution, which is a mixture of concentrated sulfuric acid and potassium dichromate. However, at the time, there was no premade cleaning solution or potassium dichromate available. Some potassium permanganate was found and that is a better oxidizing agent. A solution was made by mixing the sulfuric acid with the potassium permanganate. That solution was applied to the contents of the flask, and swirled around by hand. The resulting explosion caused the demise of the student. Perhaps novel chemistry is best explored by using less solvent with the use of smaller glass pieces such as Bantamware.

Unsafe Laboratory Practices

Using a refrigerator to store some volatile chemicals is a common practice. Using the same refrigerator to store your lunch may be a way to eat your lunch. Even a small amount of spilled powder, like strychnine, may not be noticed and have bad consequences. Food is no longer allowed at any time near any chemicals. Incidentally, during research, any of the chemical contents can overheat or spatter. When the Noyes Building was designed in the 1960’s, showers and eyewash stations were provided on the laboratory floors. Some research compounds such as perchlorates (used in rocket fuel) can detonate and have caused many inadvertent explosions. Several students admitted adverse results attempting to make their own rocket fuel. Several common laboratory organic compounds are carcinogenic and/or highly flammable (like benzene).

 Freshman Chemistry Experiments

So I looked up “Caltech chemistry explosions” and found: “Explode! Caltech Chemistry class sodium, potassium, cesium reacts with water.” The video appears to be taken at the Beckman Institute pond. Pieces of the alkali metals or hot water could be thrown off into the audience. This video-taped experiment should not have happened in that public location with the unsuspecting viewers.

When I was in freshman chemistry, there was an experiment that used ethyl alcohol as the solvent. It smelled strange and even dissolved some plastics. I found that, when my skin remained in the alcohol, it turned white and wrinkled over time. As a result, I could not understand why anyone would voluntarily drink the stuff.

Some people thought it would be cute to make up a batch of nitrogen tri-iodide and put it into the keyhole of room locks. When the unsuspecting student put a key in the door, there would be a pop-pop-pop sound. The leftover pieces would then get on the floor and decompose on contact later. Such practices create problems.

For some interesting effects, see the four volume set of *Chemical Demonstrations* by Bassam Z. Shakhashiri.