

Death of A Salesman

By Christi Schultz

Printed in large letters on the whiteboard was “Who Killed Monty Salesman?” I hear an audible gasp as students file into the classroom. “What’s that about? What are we doing today?” They ask. After all, this is not a forensics class, it’s a 9th grade integrated earth and physical science class.

I hold Forensic Fridays as a way to splice a little intrigue into the classroom. Students really look forward to these days. The task of compacting loads of curriculum within the school year forces me to be inventive with ways to use forensic lessons that are content loaded.

On this particular Friday, I had multicolored liquid in tiny flasks sitting on the front table. As students make their way to their seats they can’t take their eyes off the flasks, as if they were jars of treats in a candy store. Since they were so focused on the colorful liquid in the flasks, I made it clear that no one is to touch these example flasks; whose sole purpose is to help them find the pH during their lab work. Students may come close and look at the flasks for comparison but not touch them.

I announced to the class that it was imperative that they have no food or drink in class today. (One student had a water bottle so I locked it in a cabinet.) I explain that the example flasks in front of me contain cabbage juice along with different substances of varying acids and bases. Under each flask is a 3x5 note card announcing its approximate pH value. For review, I asked, “everything below a pH of 7 is a ...” The kids all shouted out, “Acid.” “And anything that is a pH above 7 is a ...” “Base!”

I then read the first paragraph of the handout. “A car salesman has died. The police have asked you to determine which of the foods that he had on his desk had been tampered with. Which one contained the poison? Since we are a low budget laboratory, we will start with some boiled cabbage, which we are using today as our pH indicator.”

One member of each group of three students will come to the front of class and take their own tiny flask of purple cabbage juice along with a small, disposable, plastic pipette. A second member of the group takes a well plate and pipettes one of each of the food items I have clearly marked in beakers on my cart into each well plate. (Well plates, being tiny plastic trays with small divots in them, are perfect to use for cost effective labs since students only need a drop or two of the sample to test.) Students use masking tape and a sharpie to label their well plates before they add the cabbage juice.

Their first task, after preparing test samples, is to determine if each food item is an acid or base by the color the liquid turned once cabbage juice was introduced. I heard students exclaim in excited voices, “It’s green!” or “Oh look it turned red!” As I walked around I point at the flasks at the front of the room reminding them to determine, “Which ones are acids and which are bases?”

When all students complete the first part, I announce, “The police have contacted us and told us the pH of the substance that poisoned our salesman.” I told them to write down the pH on the line provided on their handout before issuing pH paper to them. I told the students to obtain new samples of each of the food items in their well plate, but this time they were to use pH paper to determine the exact pH value. Each student gets a tiny square of pH paper cut from a longer strip in order to save on the lab budget. With tweezers students can plop the square into the well plate divot and pull it out to compare to the color chart on the side of the pH container. As they filled out their table on the pH handout, students start to discuss amongst themselves which food item could be the one that had been poisoned.

Students get a kick out of writing up an official report and signing their names as lab technicians. I have done this activity twice. Both times it has been successful with keeping the interest of all thirty students for the complete hour period I have been allotted. The wonderful byproduct is teaching students pH of different substances.

I can’t help, but smile to myself as kids clean up the well plates and return the cabbage juice to my cart.

Teacher Preparation

Before lab day:

A. Making cabbage juice. (I find this activity is good to do at home because the smell of boiled cabbage does not endear you to your fellow colleagues in the department.) One small cabbage should do it. Cover the cabbage with

water and boil for over an hour. The cabbage juice infused water can be stored in a glass pickle jar for up to a week. I don't shred the cabbage, just cut a head in half and boil it.

B. Get the multicolored liquid in the flasks ready. I rooted around in the back finding substances that we have stored for labs as well as taking a visit to the chemical stock room to use some strong acids and bases to make my example flasks in the front of the room.

1. Use six molar hydrochloric acid to get a pH of 1.
2. Vinegar gives about a pH of 2.
3. Bottled BBQ sauce gives a pH around 4.
4. Tea gives a pH around 6.
5. Distilled water gives you a pH of 7.
6. Milk (and antacids) give you a pH of about 8 or 9.
7. Bleach gives you a pH of about 10.
8. Ammonia gives you a pH of about 12 or 13.
9. One molar sodium hydroxide gives you a pH of 14.

If students use the same food items for samples as those that you have used to color the cabbage juice, students will be accurate with their colors. For example, milk has a white color and when you add cabbage juice it looks lime green which is a dramatic change. If you use milk in your example flasks then the students would see that their milk is the exact color of the sample. I watered down BBQ sauce so that it wouldn't be red because of the sauce but because of the cabbage juice. Likewise tea and coffee give a brown color naturally so adding cabbage juice gives a deeper color of red.

The foods that I used (vinegar and BBQ sauce) were the foods the dead man ate and I also used them in the color indicators in the tiny flasks – that way the colors would match. The students took a tiny flask of cabbage juice with a plastic disposable pipette and they used this as an indicator to test all of their solutions. The other indicators (flasks with many different colors) stayed near me so I could make sure they didn't use something that was the pH of 2 and get hurt. Students just came up and sighted the colors to see which food they matched after the cabbage juice was introduced.

Because of nervousness of getting my lab prepared in a timely manner, I have set up the sample flasks a few days in advance; however, the unfortunate side effect of being so ambitious is that atmospheric carbon dioxide turns to carbonic acid in the flasks which tends to turn the liquid different colors over time, so it is best to set up the flasks no more than 24 hours in advance. Cover the flasks so that you don't have the confusion of different colors than you started with. For example, over time the bases turn more yellow and brown, but they should have a green to light yellow tint to them.

I have been teaching Integrated Earth and Physical science, Biology, Microbiology and Zoology at Battle Ground High School for eight years. This lesson was used during our walk through the periodic table, to teach properties of matter. The students who did this particular lab were freshman in high school.

I also write mystery novels and these type of activities allow me to marry my two passions. Be creative! If you wish to embellish on the poisoning aspect give symptoms the man went through as well as a list of poisons with their side effects for students to match.

The handout I used during the lesson is on the next couple pages. Add any examples of substances in the table depending on whatever food items you have on hand. Also students can use the approximate pH values written under each sample flask for their pH values if your budget does not allow for the purchase of special pH paper.

Acids and Base Forensic Lab Student Lab Sheet

Name _____ Date _____

You are a lab technician for an investigation into the death of a car salesman. The man died at work. It is believed by the police detectives that this man ingested some type of poison that mixed with an acidic compound and paralyzed him until his heart stopped beating. The problem is that the stomach acid has completely denatured the poison so we don't know exactly what it is or what product he ingested in the last twenty four hours.

You have been given the stomach contents of this man and you have also been given a box of ingredients that were found at his desk at work. Your job is to find out what he ate last in order to determine the direction the detectives can take for what has the poison is in.

Since your lab is on a tight budget you have mixed up some cabbage juice to be your acid and base indicator. Test the following products and tell whether they are acids or bases based in the color they turned in the cabbage juice.

Name of substance	Color before substance is added	Color after substance is added	Acid or Base?

If the stomach contents are normally a pH of 2 and the man ingested something acidic the contents of the stomach would become more acidic. Would the pH go up or down?

Which product did the man most likely eat last? _____

Explain why you think that is.

Give a report as to your findings that you would be willing to stand behind if you were called to testify in a court of law:

Signed,

(The lab technician team)