Chapter Seven

Toxicology

Overview for Teachers

Toxicology is the study of the nature, effects, and detection of poisons and the treatment of poison. Crime labs of today have a toxicology section dealing with identifying substances in all parts of the human body and everyday products.

One of the major tools of the toxicologist is the mass spectrometer. This laboratory instrument measures the mass-to-charge ratio of individual molecules that have been converted into ions. The information is then used to determine the masses of the molecules. All elements have specific molecules that show on the mass spectrometer.

In the lab, scientists take a sample and run it through the mass spectrometer. It is then compared with a database of tens of thousands of chemicals and elements.

Unidentified substances are found in many places. They are most common when a person is caught with an unknown substance, liquid, or solid. Most of the time they are drugs. Police have special kits that can test the substance on the spot. These tests are packets that contain ampoules, activated by crushing. A sample of the suspect drug is placed inside and shaken up. Resulting colors tell whether or not the substance tests positive for a certain drug. However, it must also be sent to a lab for further testing to confirm the drug. The lab expert must first determine the characteristics of the substance and use it to test other substances. The expert should conduct more than one test to positively identify the substance; for best results, there should be several tests for identification. This requires adding chemicals and checking the reaction for color and odor. Another test is to place it on a hot plate to see what kind of reaction is generated.

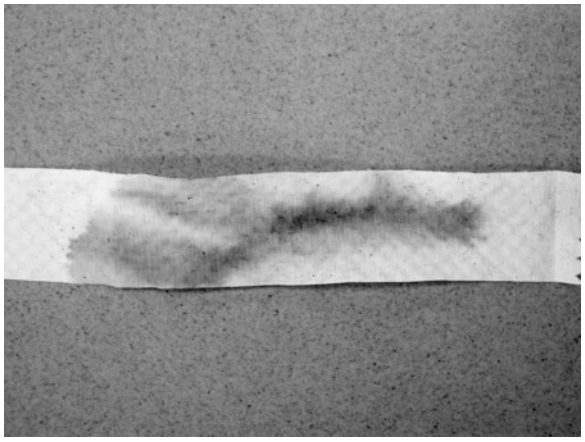
In the case of poisoning, samples are needed from the autopsy. Blood, tissues, and sections of organs are most commonly used to perform toxicology tests. These tests reveal if any chemical has been ingested or otherwise taken into the body. (Incidentally, most women who murder their spouses choose poisoning as their weapon of choice.)

Water contamination is a part of toxicology. In this chapter, there is a groundwater contamination lab activity. This fits in perfectly with units on pH level and using universal indicators (pH stands for the power of hydrogen; this means how many hydrogen ions are in a liquid solution, which is what is actually being measured.)

Many people rely on groundwater for their drinking supply. It may have to travel a long distance to reach its destination, where it is purified. Some people have the luxury of artesian wells, which supply water from a well instead of the pipes used with groundwater. Sometimes there is a contamination of the drinking water. Factories and other establishments along the banks of a major waterway may dump things in the water that are not too healthy for the people drinking it. Toxins ranging from pesticides to fecal matter can be found in water.

Some people think that drinking from a stream in the woods is the freshest source of water. Well, think again. As animals cross the stream bed, they sometimes urinate or defecate in the water. If ingested, this could cause an experience known as CED (chronic explosive diarrhea). Also, when living things die in a stream, their decomposing tissues and matter float downstream. Tell students they shouldn't drink from any water source that has not been treated thoroughly.

In most labs, the mass spectrometer is coupled with chromatography, in the form of gas, liquid, and the newly discovered substance of plasma helping separate compounds before they are broken up into molecules.



Chromatography is used to identify substances too. It separates and identifies individual chemical compounds in a solution or gas. It was first used in 1906 by a Russian named Mikhail Tsvet to separate plant pigments.

Basically, chromatography works in two stages. The first is stationary, in which the material absorbs the components of the mixture. The second phase is mobile, in which the components become soluble. Components are absorbed at different rates; hence they separate in the process. Chromatography can be used with paper, thin layer glass plates, liquid, and gas. It may be used to identify a certain ink or even a lipstick. Lab experts use it to help them match substances that have been collected. In this chapter, ink is used as an illustration of chromatography (see the figure). It can be easily identified by conducting simple experiments using coffee filter paper.

Introduction to Subject Matter

(to be read to students)

Toxicology involves the study of chemistry and how it affects environments and living organisms. Chemicals can enter the body in several ways. They can be ingested, which means that something poisonous is swallowed. They can be inhaled when fumes or gases are present. They can also get into your body if something toxic contacts your skin or gets into your eyes. Toxicology also deals with breaking material into its basic components. With the technology available today, a paint chip or shard of glass can be analyzed and broken down into its various chemical makeups.

Vocabulary

Ampoule packet	A small sealed glass container that holds a measured amount of reagent to react with specific known illegal drugs
Artesian well	A natural water supply that can be tapped as a water source
Atomic mass	A unit of measurement that weighs the amount of atoms in an element
Autopsy	The medical examination of a dead body in order to establish the cause and circumstances of death
Charge	A fundamental characteristic of matter, responsible for all electric and electromotive forces, expressed in two forms known as positive and negative
Chromatography	A method of finding out which components a gaseous or liquid mixture contains; involves passing it through or over something that absorbs components at different rates
Ions	An atom or group of atoms that have acquired an electric charge by losing or gaining one or more electrons
Mass spectrometer	An instrument used to separate compounds and measure their molecular weight
Mobile phase	Components become soluble and travel, leaving marks of separation
Molecule	The smallest physical unit of a substance that can exist independently, consisting of one or more atoms held together by chemical forces
Pesticide	A chemical substance used to kill pests, especially insects
pH	Measure of the number of hydrogen ions in a liquid solution
Stationary phase	The absorption of material into chromatography paper
Toxicology	The study of the nature, effects, and detection of any element that has a toxic effect

Lesson Objectives (with Standards Guide Words)

- Students will understand the term *toxicology* and illustrate examples. (Guide word: definition)
- Students will learn the term *pH.* (Guide word: definition)
- Students will learn to measure pH with a universal indicator and illustrate examples. (Guide words: process learning, constructivist, measurement, definition)
- Students will learn what a mass spectrometer is and illustrate an example. (Same guide words as preceding objective)

- Students will learn the meaning of chromatography and illustrate examples. (Same guide words)
- Students will learn how chromatography is used to solve crimes and illustrate examples. (Same guide words)
- Students will learn how to conduct a chromatography test on a sample and illustrate examples. (Same guide words)
- Students will differentiate between stationary and mobile phase and illustrate examples. (Same guide words, plus: comparison, contrast)

Lessons and Learning Activities

Allotted time: preparation one hour, class two days

Part One: Scenario

For the teacher: You will need a sample test tube for each group. Fill the test tube with 10 ml of water. Test the water beforehand to find out the pH level. If it has a blue color, the pH is around 7. You can leave the water as is or add chemicals to raise or lower the pH to 7.

Other materials:

Dropper
Chemplates
Universal indicator

The Pocono Pond Mystery

On June 3, 2004, Mr. Hutchins shows up at the township building demanding to speak to a supervisor. The secretary asks him to have a seat while she goes to get Miss Davis. After ten minutes, Davis appears and asks Hutchins if she can help him.

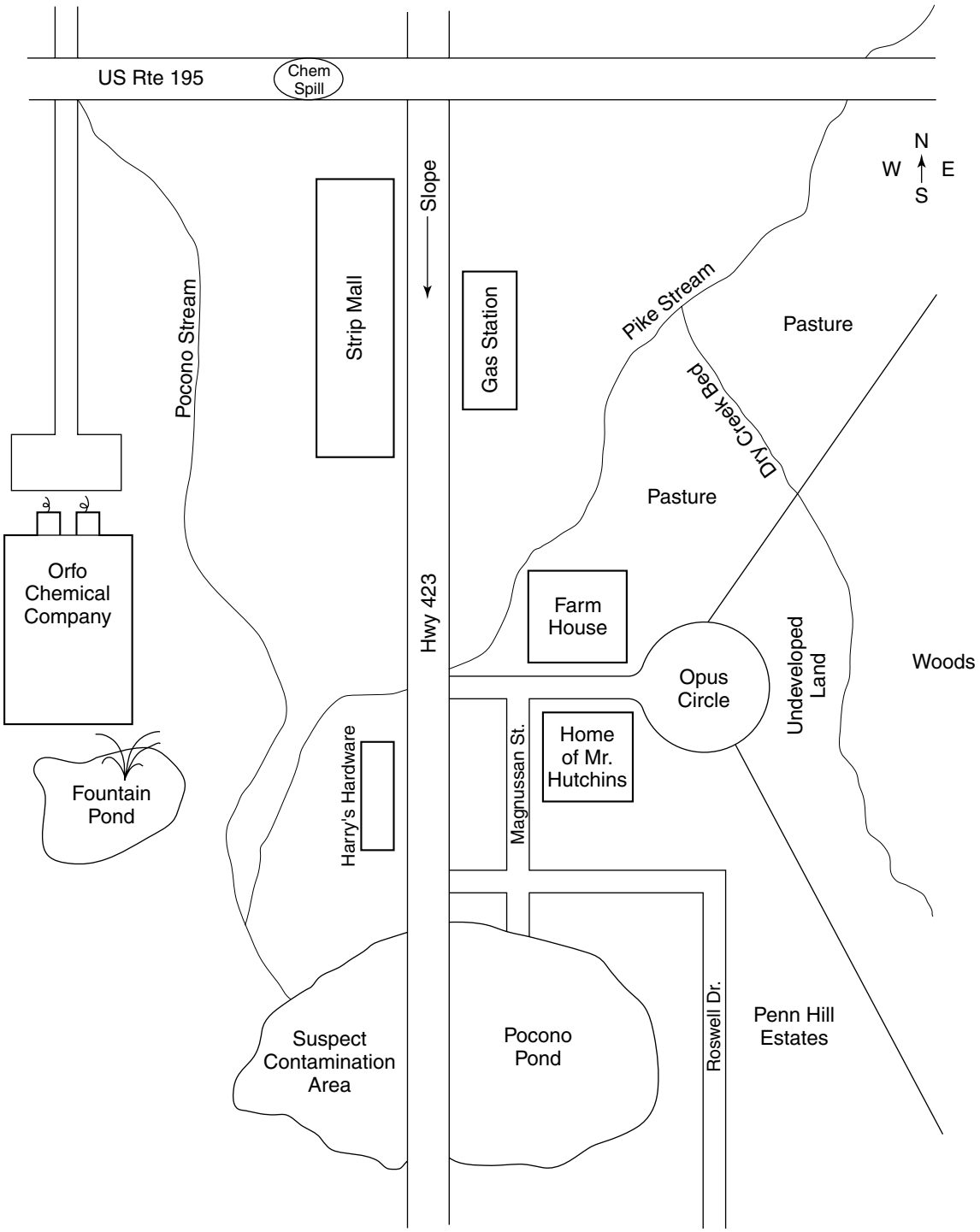
In an irate voice, he explains that his two dogs have become very sick in the past day. He thinks that someone has polluted the water with pesticides. According to Hutchins, the water is the only possible reason for the dogs getting sick. He takes them there to go swimming. They love the water, and it's good practice for duck season.

Hutchins is quite concerned about his two dogs. They are his only friends because he has never married. Hutchins demands that Davis find out what is wrong with the water—and if anything happens to his dogs, he will sue the township. Davis thanks him for his time and says she will get back to him as soon as possible. She returns to her office and starts making phone calls. The first person she calls is Joe Kane, who is in charge of the hazmat team for the county.

Joe goes to the pond and does a sample water test. As he mixes in the chemicals, he discovers that it is contaminated with some kind of toxin found in pesticides. He knows for sure because the chemical reaction shows a red color, which means the water has a very low pH. Also, when

he adds a reagent, it turns the water to greenish blue, indicating that a pesticide is present. He goes back to the township to look at a map of the area.

He remembers that a week ago, there was a truck spill on Route 95. The township brought in the hazmat team for a safe cleanup. The Pocono Creek does run underneath the highway, but it is believed nothing leaked into the water from the spill. He decides to run a test anyway just to make sure.



As the teacher, you need a sample test tube for each group. Follow the instructions appearing in the earlier list of materials.

Have students use a dropper to place five drops in three of the chemplates. Then have them put in two drops of universal indicator. This changes the color of the water to reveal the pH level. The outcome should be a blue color, which shows a pH of 7. Although testing for pH, tell students that these particular pesticides have a low pH level. Once they find an area with this low pH level, they can test for the pesticide. Students should record their results on their map, indicating the color and pH level of the test done at a particular location.

Part Two: Lab

Review the results from the first test. Discuss the conclusions with the class to see if they have any other ideas. Use the map as a guide. When a student mentions the Orfo Chemical Company, tell students that it is the next test site. Take them back to the scenario.

> *Next, Joe notices that Orfo Chemicals has a plant on the Pocono Creek too. They use the water for making chemicals. They have strict guidelines to follow and are supposed to test every month. Joe thinks this is his best bet, so he heads there to test the water.*

Again, create two sample test tubes for each group and have the students follow the same procedures to add drops, label tests, and so on.

Make sure that students label their tests above and downstream from the plant. They should record their results on their map.

Discuss the results with the class and ask them where they should look next. A student should come up with the answer to test the pond, to be really sure the water is polluted. Then go back to the scenario.

Part Three

> *Joe is quite surprised that he has not found anything by the plant. They have been cited in the past for polluting the water with high levels of toxins. Joe wants to make sure that the pond is really contaminated, so he goes to Pocono Pond to test the water.*

For the teacher:
Make a sample test tube for each group with 10 ml of water.

Mix some lemon juice, vinegar, or any acidic solution to bring the pH level to about 2. Students should follow the same process for testing using the chemplates. Once they find out that they have a high pH level, ask them to use the reagent for pesticide testing. For this, you should mix a 10 ml solution with some baking soda or ammonia. Have students add two drops of the solution to the chemplate. If the solution is strong enough, it should bring the color to a bluish green. Tell students that this is a positive test for pesticides in the water. Students should document their findings on their map.

Now that the students know the pond is definitely contaminated, have them generate ideas of what should be done next. Then take them back to the scenario.

Part Four

At 11:00 the next morning, Davis gets a phone call from Hutchins. His dogs were at the veterinary hospital all night. He has just received word that they have both died. Infuriated, he is now planning on suing the township for the loss of his dogs. In a panic, Davis assures Hutchins that they will find out who is responsible and bring them to justice.

After that, she calls Joe to find out how he is doing. Joe reports that the pond is definitely contaminated with some sort of pesticide. He has not completed all of his tests yet. Now the question is, What part of the stream is being dumped in? He has one more area to test. He knows that a farmer named Hendricks uses pesticides to treat his corn crops. He is almost certain that this is the source. Without further delay, he heads up to the Hendricks farm house. He explains to Hendricks what he is doing and asks if he can test the water on his property. The farmer agrees and lets Joe get to work. Joe decides to test upstream and downstream from the crop area.

For the teacher:
Repeat the procedure of creating sample test tubes for each group. When students put in two drops of universal indicator, it will change the color of the water to show the pH level. The outcome should be blue, which shows a pH of 7.

By a process of elimination, students will find that the last place that has not been tested is Harry's Hardware. Take them back to the scenario.

Part Five

Scratching his head, Joe is extremely confused. The only place left along the creek is Harry's Hardware. Joe pulls up to the hardware store to speak to Harry. His son tells Joe that he is out back cleaning out some cans. As Joe walks around back, he sees Harry rinsing out some containers in the stream. In an instant, Joe knows exactly what is happening. Harry is cleaning out the containers with bug pesticide in them! As Joe approaches, Harry stops to talk to Joe. Being the old man he is, he does not realize what he is doing. Joe takes a test kit and samples the water. What do you think happens?

For the teacher:
Repeat the test tube work with universal indicator. Blue shows a pH of 7.

Joe has no clue what is going on. He heads back down to the pond to survey the area. He ends up where the mouth of the creek feeds into the pond. Off to the side in the bushes, Joe notices a large white bucket sitting at the edge of the woods, half shrouded with twigs and leaves. Curious, he walks over to the container and finds out it is (or was) filled with a high

concentration of pesticide that was to be diluted with water. He immediately gets on the phone and calls Davis. She sends the police over to take it in as evidence and have it tested at the lab.

At the lab, scientists have enough material to do a test.

For the teacher:
Repeat the sampling with lemon juice, vinegar, or an acidic solution and then baking soda or ammonia (see the earlier instructions).

Now that the students have found a container matching the sample from the pond, they should be able to deduce that Hutchins dumped it in there himself so that he could sue the township for money. How would the police know that someone dumped a pesticide in the pond?

Well, he has threatened to sue the township, so as the teacher you can take it a step further and plant fingerprints on the bucket. Match them to Hutchins. It also turns out that after detectives looked further they find a record on his credit card indicating he bought the pesticide the day before at Harry's Hardware.

Chromatography Activity

Allotted time: fifty minutes

Who Wrote the Note?

The president of a large corporation received a note from someone that they were planning to sabotage the company's name by publishing a negative letter in the Wall Street Journal*. The president was very upset. She noticed that the handwriting looked familiar. Three secretaries worked for her at desks on the same floor.*

One was named Laurie Nebbia. She had a great personality and was a fantastic worker. She sometimes stayed late to finish her work.

Next was Cathie White. She was very humorous and kept the president in high spirits. She had been known to fly off the handle sometimes and rant and rave at people.

Last was Pam Gerhart. She was a sweet young woman who was polite and helpful and never said more than she had to.

The president suspected all three of them because they were overworked and underpaid. Despite her dubious efforts of arguing with her colleagues, she could not obtain a raise for them.

Police collected felt tip pens with blue ink from each secretary's desk. They were sent to the lab along with the note. The lab experts ran a test on the ink used in the note and on the pens collected. Each secretary had three blue pens. All nine samples were grouped according to the secretary. When detectives interviewed the three suspects, they all denied they were involved.

All of them provided a handwriting sample that was also sent to the lab to be viewed by a handwriting expert. However, two nights later, the lab was burglarized, and the note and handwriting samples went missing. Since the lab technician had already run a test on the ink used in the letter, she could still test the other inks to determine whose desk the pen came from.

This activity should take approximately one class period. You need:

Three large beakers
Straight piece of wire (a coat hanger will work) approximately six inches in length
Paper clips
Hole puncher
Water
Coffee filters cut into strips about four inches long
Nine pens with blue ink

Directions for students:

1. Cut the filter paper into strips about four inches long. You should have nine pieces all together. Fold one end of the strip into a point.
2. Place a paper clip at the pointed end of each filter paper. This will keep the filter paper from curling.
3. Punch a hole in the other end of each filter paper.
4. Using one of the pens, place a sample mark (a dot) just above the paper clip.
5. Thread a piece of wire through the end of the filters where the holes have been punched. Make sure they do not touch each other. There should be three strips of filter paper on each wire.
6. Place each strand of wire over each beaker so the nine pieces of filter paper are suspended inside the beakers.
7. Carefully add water to the beaker until it reaches the point of covering the paper clips and the pointed ends of the nine filter papers. Do not cover the ink marks in the water.
8. Let everything sit until the water has dampened most of the length (two-thirds to three-fourths) of the strips.
9. Remove each piece of wire from the beaker and let it sit on a paper towel until it dries.
10. Once it dries, you will have completed the chromatography process.

Have students compare marks on the filter paper with the sample taken from the note. The students should be able to match up the ink with the sample. The sample should match with Cathie White.

Springboard to Writing

Allotted time: two days; four days for polished final draft
This story is to be read to the students (or it can be received as a handout).

The Sloppy Kisser

On Tuesday, April 20, 2004, Jamal Windle received a mysterious love letter in his mailbox. On the front of it was his name written in green marker. On the back, the envelope was sealed and had a sloppy, smudgy lip imprint. Jamal thought it was obviously a letter from his new girlfriend, Josephine. But when he opened the letter, he found a threatening note: "If you love me, then you should be ready to die for me."

Jamal had never received a letter like that before. Being the jolly fellow he is, he was rather shaken up and a little scared. Could Josephine be responsible for this? She was a sweetheart. Jamal, who is a forensic scientist, decided to get to the bottom of this. He had to figure out a way to get into Josephine's makeup kit and check out her lipsticks. If he got a sample from her, then he could do a chromatography test on them and find out for sure. Now the question is, how will he do it?

Your job is to write a descriptive essay from Jamal's point of view. In your essay, explain how you will obtain the lipsticks from her makeup bag. Then explain how you will test the lipsticks to see if they match up. Here is how you will be graded.

We will use two model essays that you will read through and grade as a class. Notice differences between the two so that we can generate a list of them on the board. These should be taken into consideration when you write your paper.

(To the teacher: use the assessment grading.)

Sample Essay One

Lukas Hendrix, Period 2, "Lopsided Lipstick"

My name is Jamal and I want to tell you about this crazy letter I got. It had a big kiss on the back of it and it said that I was going to die. I didn't really believe it at first, but then I thought it might be my girlfriend. She is real nice and I think she is cool. Why would she do something like this to me?

The first thing I did was take a sample of the lipstick that was used on the back of the letter. I put it on some paper and let it sit in water for a few minutes. Then after it dried, it had all these neat colors on it. This is called chromatography. I do this at my work all the time. Now that I had a sample of the lipstick, I had to find out if it was from my girlfriend Josephine. I needed a plan to get into her house and get her lipstick.

I called her on Friday night when I got home from work. I asked her if I could bring over some popcorn and a movie to watch. She thought about it and decided it would be a great idea. She wanted me to rent a scary movie. I thought this was weird because she doesn't like that kind of stuff. I agreed and hung up the phone.

At the store I picked up *Psycho on the Loose*. It was a movie about a psycho that escapes and runs around killing people. I also bought some popcorn for us. Then I headed to Josephine's house.

When I got there, she had all of the lights turned off and candles were lit all over the place. She welcomed me in and asked me to get comfortable. We popped in the movie and began to watch the previews. This is when I decided to make my move. I told her I had to go to the bathroom before the movie started. When I got into the bathroom I locked the door behind me. I found her makeup bag under the sink. I took all of the lipstick that was in there and shoved them in my pocket. I flushed the toilet and came back to the living room. I told Josephine that I forgot to feed my dog and had to run home quick and I would be back in a half an hour. She agreed and let me go. I thought she could tell I was lying, but I got away with it.

When I got home, I set up my chromatography experiment. I tested all of the lipsticks. When I finally got to the last one, it was a match. I couldn't believe she wanted to kill me. I called the cops and told them what happened. They came to my house first, where I showed them my experiments that I did. Then they went to her house and arrested her for attempted murder. Wow! That was a close one.

Sample Essay Two

Marshall Clapton, Period 3, "The Case of Josephine's Joke"

On Friday morning I received a note in my red mailbox at the end of my driveway. Inside the box were regular bills and weekly flyers. As I stumbled across this odd note, it occurred to me that it only had my name on it and a kiss on the back. The writing was in what appeared to be a green marker. The kiss on the back was smudged and rather sloppy. I haven't received a note like this since I was in seventh grade. I was a little skeptical, but I opened it anyway. Inside, it said, "If you love me, then you should be ready to die for me." I was quite shocked because you never know what kind of whackos are out there. Then a sudden thought hit me like a Mack truck; Josephine! She was my new girlfriend. We had been dating for about two weeks now. She has been talking about getting more serious lately. I don't know if I can make that decision just yet. Anyhow, I took the note inside and locked the door behind me. I sat down at the kitchen table eating my breakfast of poached eggs and crispy bacon. Along with a steamy cup of coffee, I was ready to think about this.

I didn't really know Josephine that well, so I decided that since I am a forensic scientist I could figure out if she was really the one responsible for the note. I didn't want to call the police yet because it could all be a joke. After I gobbled down my breakfast and sipped my coffee, I left for work along with the strange note.

At work, I have all of the necessary equipment to perform chromatography experiments. I collected a sample from the envelope using a clean swab. Then I took a piece of chromatography paper which is about two inches wide by four inches long. Using the lipstick-covered swab, I made a blot about one inch above the bottom of the paper. Then I filled a beaker with 75 milliliters of acetone. Using a hole puncher, I punched a hole in the top of the paper. I placed a medium-sized metal wire through the hole to suspend the paper above the acetone. The paper rested in the solution about a half an

inch deep. After about five minutes, the color had slowly worked its way up the paper. I took it out of the solution and laid it down to dry. After another ten minutes, I had a beautiful stream of colors climbing up the chromatography paper. Now that I had a sample, I would have to figure out a way to test some lipstick at Josephine's house.

I called her during lunch and asked if I could come over later and cook a delicious lobster dinner for her. She said that would be fantastic. Lobster was her favorite and she thought my cooking was to die for. As I hung up the phone, she said that she loved me. I responded with "I have to go now and I will see you tonight."

Now I had to decide what to make for dinner and how to get into her bathroom to test her lipstick.

Before I left for Josephine's house, I placed some coffee filter paper in my pocket. It serves the same purpose as chromatography paper. I jumped into my sporty red Porsche and zipped over to her house.

When I got there, she had some light jazz playing on the stereo and the table was set for two with candlelight. I must say that it did look most delightful. She offered me a Coke while I was preparing our meal. As I was chopping the onions for our scalloped potato mix, I "accidentally" cut my finger. As Josephine screamed, I told her that I could take care of this if I could just use her bathroom. I wrapped a kitchen towel around my finger and went to the bathroom. Luckily for me, she did not like the sight of blood and stayed in the kitchen to finish our dinner.

When I got into the bathroom, I searched frantically for her makeup bag. I finally found it under the sink next to her curling iron and hair dryer. I quickly pulled out my filter paper and began to work. I pulled up the stopper in the sink and poured her nail polish remover in there. It is made of acetone. I found three different kinds of lipstick in the case. One was a red Max Factor. The other two were L'Oreal red lipstick with extra shine. I rubbed a little dot on each piece of paper like I did at the lab. I held them in the sink for one minute. The filter paper seemed to absorb the acetone faster, so I did not have to keep it in there as long. I turned the water back on again as I heard a knock that startled me enough to bang my knee on the sink. Josephine asked if I was all right. "Fine," I said in a strained voice. "The bleeding has almost stopped. Just a few more minutes and I will be as good as new."

With that she left. The paper was starting to dry. I remembered that I had brought the sample with me from the lab. I pulled it out of my pocket for comparison. It looked like the Max Factor lipstick was going to match! One minute later and the process was complete. It was a perfect match.

I panicked and looked around for an escape route. Lucky for me she lived on the first floor and there was a window big enough for me to fit through—or so I thought. About halfway through, my shirt got caught on a nail on the windowsill. There was another knock on the door. I screamed and wiggled as hard as I could.

"RRRRIIPPPPPP!!" went my brand new Polo shirt. I had spent $90 on that shirt too. Oh well, I ran down the street half-naked until I reached an old phone booth at the corner. It was littered with graffiti and cigarette butts. I put in my quarter and dialed 911. I told the police of my amazing adventure and they were stunned that someone other than themselves could solve a crime. They responded immediately, arrested Josephine, and my life was spared.

Now I have to go to psychotherapy because I can't date women who wear lipstick!

Assessment

- **Mastery (A).** Student has a specific order and transitions from one idea to the next. Student uses elaborate details. Student writing is appropriate for audience.
- **Proficient (B).** Student has adequate order and transitions from one idea to the next. Student uses adequate detail. Student writing is acceptable for audience.
- **Satisfactory (C).** Student has limited order and transitions are limited. Student uses limited detail. Student writing is not necessarily geared toward intended audience.
- **Unsatisfactory (D).** Student has events out of order and transitions are choppy. Student uses minimal detail. Student writing is hard to understand because of mistakes.
- **Insufficient (F).** Student does not write about the topic. Sentences are incoherent and paper cannot be understood.

Lesson Accommodations and Modifications

Students who do not understand how to correctly score and revise a paper might have trouble with this assignment. Have them use the first essay as a starting point and rewrite it so it sounds better. This way they have the writing in front of them and do not have to create a new paper. This works well for ESL students too. It allows them to take language already written and make it better, which can be done under the direct instruction of the ESL teacher.

CSI Notebook

Allotted time: fifteen minutes
Have students think about the importance of the periodic chart. What if we did not have certain elements such as carbon or nitrogen? Have them generate a list of elements that they think are most important to our survival. They should write a sentence or two explaining why these elements are needed for us to survive.

For Further Study

If students are interested in learning more about chromatography, they can find various resources online. They can also perform chromatography tests at home. They can test various products in their house using beauty products such as lipstick and nail polish. Markers and pens work well too. Nail polish remover can serve as a mobile phase, or water in the case of water-soluble products. Students can present their chromatography results by photographing them or bringing in the actual results from the experiments.

If a person is interested in becoming a forensic toxicologist or chemist, he or she needs a bachelor's degree in chemistry, toxicology, pharmacology, chemical engineering, physics, or some other related field. From there, on-the-job training and experience in the lab will be useful.

Cumulative Mystery

Allotted time: fifty minutes

After detectives finished dusting for fingerprints, one of the detectives went to throw away her gloves in the trash can. There in the trash can she noticed a crumpled-up piece of paper. She asked one of the detectives who still had his gloves on to come over and retrieve it from the trash. He did and he opened the crinkled paper to see a note that said, "I hate you and you will never get away with this. I am watching you, Jackie." It was written in black ink. It looked as though it were done with a marker rather than a pen. Following procedure, the detective photographed the note and packaged it to be sent to the lab. Detectives would need a warrant to search the houses and cars of the suspects to see if they could find a match.

You can use the same activity as in the lesson and learning activity. Just substitute the three names with the three suspects in this case. The ink will match with a pen found in Jackie's house.

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