

Mystery Writing in High School Chemistry

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Overview

Mystery Writing in High School Chemistry brings together the discipline of science with the writing of short mystery stories. It is a unit of study created for students taking an introductory level course of chemistry during tenth grade. The expectation is that students with two different types of abilities, one the savvy science geek and the other a wordsmith aspiring author, will benefit from a mutual synergism while preparing to write a mystery story. They will collaborate on how to approach, and then write the story after applying scientific disciplines to physical evidence collected by forensic protocols. A collection of five standard protocols are incorporated and presented to students in the form of individual experiments. Since you cannot control the sample material in forensic science, putting together pieces of the puzzle allows the investigator to see if a crime was committed and who did it.

The aforementioned framework plays intricately into mystery writing as part of the English standards for the state of Pennsylvania that require students to become proficient as writers, organizing their writing and ideas, and creating a written product that satisfies the rubrics developed for the Pennsylvania System of School Assessment (PSSA). The

use of laboratory tests in chemistry, analysis, critical thinking, and evaluation of evidence feeds into the clues developed by the writer of the mystery in the organization, use of characterization, dialogue, sequencing, and development of plot. A combination of skills, both analytical and creative, leads the student toward the goal of creating a scientifically accurate and suspenseful piece of writing.

The use of chemical forensic technology in this mystery writing curriculum is a unique approach to foster student writing skills while learning introductory chemistry. It is intended to allow the budding mystery writer to write a mystery story and focus attention on details that are analyzed in the laboratory and relevant to a crime scene.

Russell W. Ayres

Comment: Writers/their or writer/his or simply focus attention and leave out the their pronoun which is problematic here.

Rationale

Since childhood I have enjoyed the mystery writings of the Scottish author, Sir Conan Doyle. In this most notable series of detective tales, the super sleuth, Sherlock Holmes, along with his trusted companion, Dr. Watson, intrigued generations of followers like me to become readers of mystery stories. I was always fascinated when the main character went to the lab to apply scientific skills to unravel the clues of a mystery. This sort of clue finding has also made its way into popular culture by means of such television series as Crime Scene Investigation (CSI) and Cold Case Files, where detectives and forensic scientists unlock the story behind a criminal mystery. It is in this spirit of using scientific principles to solve a mystery that tenth grade chemistry students will use lab tests that meet the parameters required in the curriculum of the Pittsburgh Public Schools. They will connect together the disciplines of science and language arts by creating a mystery story where something is guaranteed to happen, then further understood by crafting an explanation from empirical data.

The type of science that the students will use is called forensics. It is a science based upon the study of physical evidence left behind at a crime scene. Clues concerning the nature of the perpetrator of the crime are collected and analyzed by the investigating scientist, who examines materials and conditions at the site in question. To illuminate the factors of the crime, the investigator uses the scientific principles of chemistry, physics, and biological phenomena, to explain and relate what happened in a real-world situation.

To become a forensic scientist requires training in criminal law, criminal investigation, firearms, toxicology, medical chemistry, population genetics, DNA profiling, psychiatry, security management, medicolegal death investigation, industrial espionage, photo and video analysis, evidence analysis, telecommunications, steganography and watermarking, and personnel security.

Some real world jobs specific to law enforcement and forensic science are the positions of medical examiner, forensic odontologist, crime laboratory analyst, crime scene examiner, forensic engineer, psychological profiler, and technicians that specialize in computer analysis, polygraphing, and composite drawing (Nute).

The medical examiner does autopsies on corpses to determine the cause of death. To be a medical examiner requires a medical degree with specialization and residency to support forensic examination protocols. This profession provides for great variety in case work and requires someone who is not only highly capable as a problem solver, but is also skilled in techniques of chemical instrumentation to test for the composition of body fluids.

Forensic odontologists are licensed dentists who examine the teeth of a corpse to evaluate the identity of someone who can no longer be recognized due to severe decomposition of the body. The forensic odontologist uses dental x-ray records to track down the identity of a nameless corpse. Most often the forensic odontologist is a practicing dentist that is only used on a consultant basis.

Russell W. Ayres

Comment: who

The crime laboratory assistant job is much the same as a bench chemist in private industry. The tests involve solution chemistry and analytical instrumentation of fluids. The best background to prepare for this position is to attain a bachelor's degree in chemistry. Electives in science courses that pertain to this job include microbiology, biochemistry, botany, genetics, optical mineralogy, entomology, anthropology, zoology, and textile chemistry. The good way to prepare for this type of employment is to get a basic science educational background in the areas of chemistry or biology.

Forensic engineers must have a degree in one of several fields of engineering, which include; mechanical engineering, materials engineering, electrical engineering, civil engineering, and traffic engineering. The forensic engineer examines the crime scene and pays close attention to any objects that are suspected of being involved in committing the crime. Forensic engineers hold well-paid positions.

The crime scene examiner does the type of work that is seen on television shows like Cold Case Files, or CSI. The job requires them to go to the scene of the investigation and collect the data that is needed to conduct a full criminal investigation into the facts of the crime. These examiners must have a bachelor's degree in natural science, and electives in forensic archeology and criminal justice. Crime scene examiners often work with psychologists to create a psychological profile of the perpetrator of the crime.

Psychologists are often hired as consultants to assist in understanding the motives of the perpetrator of the crime. Much of their work is based upon the pattern of behavior and specific psychological profile of repeat offenders.

Forensic science relies upon a team approach between members of the local and county police force to solve a crime. When a corpse is found and there is suspicion that a murder has taken place the county responds by dispatching a deputy sheriff from the coroner's office to the scene of the crime. The deputy is a specialist who guards the rights of the corpse until it can be safely transported to an examination site for the autopsy. Homicide detectives are trained in the practice of evidence protection and work closely with the

medical examiner's team to insure for accuracy of the evidence collected. It is important that students experience working as a team and it is for this reason that I will have students work together while doing the experimental protocols in the lab.

In mystery writing and in life there is often a struggle between opposing forces, which the reader perceives as good versus evil. Since justice is unpredictable in real life, the student as a mystery writer has the pleasure of duly rewarding the good guy. Even better, the bad guy often pays restitution, possibly heavily, depending upon the writer's whim. By the final chapter, the villains usually reap what they've sown. Mysteries and life often include a variety of clues, both obvious and hidden, to lead discerning readers down the path of real clues pointing in the correct direction rather than following a trail of more obvious false clues. Often clues, like events in our lives, can be interpreted two ways. For example, a negative clue may involve a student who breaks a rule in the chemistry lab that endangers his safety or that of others. Or it may be a positive clue pointing to the identification of a chemical reaction using two unrelated substances producing a chemical change. Whether in life, chemistry, or mysteries, how clues are read can determine the direction taken.

In mystery writing, the story's setting must be integrated with the crime, the plot, and the mood of the story (Scholastic 2). A well known, familiar place is the easiest place for students to begin since the actual place is nearby. Alternatively, the setting may include those that have a built-in mystery potential: ancient castles, deserted parking lots, or an amusement park's House of Mirrors maze. Common settings often include making use of weather conditions (especially during the climax) such as lightning that knocks out electricity, heavy rain that washes out crucial footprints or creates some misleading evidence, fog, and darkness. Students should also consider the terrain of the setting (flat, mountainous, caves, ravines), rich or poor neighborhoods (mansions with locked gates challenge the sleuth in gathering evidence), transportation (subways or cabs for villains to escape the city, tractors or pickups when on the farm), and sensory details including sights, sounds, tastes, and smells typical to the setting (salt on your lips from the surf pounding at the beach, sand scorching your feet, and the smell of rotting fish washed ashore).

As mystery writers, the students will make the crime fit the setting, allow the action involved in solving the mystery fit the hero, and consider whether the crime fits the villain. Students will determine how to decide if the hero due to age, health, and size can believably solve it. Could the villain really pull off the crime and get away with it? Students will modify the crime or suspenseful happening until it fits the sleuth's abilities and the villain's capabilities.

Throughout the process of combining forensic science with creating an original mystery, the student benefits by developing writing skills, inquiry, cooperation, and authentic assessment. In the laboratory, students demonstrate the experimental limitations on observation and accuracy. Students collaborate and are given time to investigate their own ideas as an active participant in the learning process. Use of research tools and techniques of the forensic chemist will lead students to perform laboratory analyses to

pinpoint clues and create a plausible mystery story. In addition to the academics involving chemistry and writing, the students will benefit from being exposed to opportunities for career development in the sciences

Russell W. Ayres

Comment: In your conclusion here, you might want to refer back just in a sentence or two to the jobs mentioned earlier. Something like, in addition to achieving academic experience in both chemistry and writing, they will be exposed to opportunities for career development in the sciences. Some such, which shows both long term benefits as well as short term. This would tie the lengthy job descriptions to the rationale. You might also choose to do that when you into the occupations. Up to you where, but the coherence will be more striking if you mention it. Another choice too, might be to place such a statement in the objectives section.

Objectives

The intended outcome of this curriculum unit is that students will attain competency in identifying and applying key concepts of content that are stated in the Pittsburgh Public Schools Curriculums for Chemistry and English. They will become skillful at observation, data collection, analysis, pattern recognition, and then demonstrate how to make inferences and predictions based upon the relationships among science, technology, and society. Similarly, relevant writing standards focus on the ability of the student to utilize dialogue, apply literary conflict, include varying characteristics (from whimsical to dramatic), use precise language and specific detail, include cause and effect, write with a sharp, distinct focus, and revise writing to improve style, sentence variety and subtlety of meaning.

Strategies

As an introduction, the teacher will present students with a short sample mystery story. Students identify the elements of an effective mystery story. Included among these elements are: writing an opening sentence that will capture a reader's attention, creating a cast of characters, including character descriptions that appeal to the senses, using dialogue to tell the reader about the characters, developing suspense throughout the story making use of the element of surprise, inserting both relevant and misleading clues to add suspense, and using the setting to add to the mood of the mystery.

The teacher will address three basics in mystery writing including the amateur sleuth, the villain, and the victim. The teacher will make the following recommendations relative to the **amateur "sleuth"**: create a thumbnail sketch of your hero's appearance, make the details regarding your hero vivid so that he will be remembered for his unique traits, and answer the question of the motive for the hero, decide the special skills or knowledge (chemistry) your amateur detective possesses to solve the mystery, and determine your ending at the beginning of the writing process. The teacher will recommend the following ideas relative to the **villain**: a character description that includes specifics about physical traits (hair color, clothing style, age, size), a believable motive and emotion behind the crime, a personal connection between the villain and the victim (a greedy relative with a grudge, an angry classmate, a jealous student on the hero's basketball team) making the surprise more horrifying and the implications more complex (Holl 9). Finally, the teacher will recommend the following relative to the perfect **victim**: create someone who is naïve or easily deceived. Recommend creating strong story people who have been victimized but do not have a victim mentality. The teacher will recommend

making the victim either someone nobody likes or someone everybody likes to increase the suspense of the mystery. For example, a victim who doesn't have common sense will cause the reader to lose sympathy and interest in your sleuth's solving the crime. This type of victim unlocks the front door when the villain is trying to break in. Readers won't sympathize with such a victim and may feel they suffer the consequences of poor judgment. Additionally, victims who have a "poor me" attitude seldom cause readers to feel sorry for their characters. Instead create strong story people who have been victimized but do not have a victim mentality. The reader should care that your victim was injured in some way. The teacher will explain that to create logical victims (it is more logical for a teenager to rob a small local shop than the largest bank in the city), create character flaws for the victim to fit the mystery keeping in mind that someone, either openly or in secret, dislikes this person enough to commit a crime against him/her. At least two or three suspects with motives for committing the crime are necessary so the victims should have character traits or flaws that will lend themselves to annoying a few people. Even likable victims will aggravate people, possibly by their very "goodness" that leads to jealousy and vengeful feelings in others – perfect motives for the crime. If the victim is disliked by one and all, then there will be many possible suspects. If the victim is liked by one and all, then there will be very few suspects, making the mystery just as challenging for the hero and the reader. The teacher will recommend that giving sufficient attention to the victim provides depth to the story, adds tension, gives your hero a strong motive for acting, and increases the reader's interest.

Russell W. Ayres

Comment: Noun/pronoun disagreement again, leave out their own and you're fine.

The teacher will then present the students with a prompt in which a perpetrator's inappropriate behavior leads to an accident in the lab. The teacher will ask the students to write about a possibility that may occur as a result of the misconduct they have invented. The teacher will tell students to address the scene of the crime. Mysteries don't happen in a vacuum and the story's setting must be integrated with the crime, the plot, and the mood of the story. Weaving the setting together with the mystery's crime convinces the reader that the story could not have taken place anywhere but in this particular setting. A well known, familiar place is the best place to begin. It is easy to duplicate sensory details when the actual place is nearby. Sometimes the more familiar the setting, the more horrible the story can actually become (the hero's home or bedroom, a mall or park, the local fast food place, or school). Additional considerations for the setting may include those that have a built-in mystery potential: ancient castles, dark caves, deserted parking lots, or an amusement park's House of Mirrors maze. An appropriate strategy also includes the use of many details to describe the setting, choosing those that add to the mood. Common settings often include making use of weather conditions (especially during the climax) such as lightning that knocks out electricity, heavy rain that washes out crucial footprints or creates some, fog, and darkness. On the other hand, the reader may be surprised if the weather is beautiful (a bright, sunny day at the baseball game) when a body is found under the bleachers. Also consider the terrain of the setting (flat, mountainous, caves, ravines), rich or poor neighborhoods (mansions with locked gates challenge the sleuth in gathering evidence), transportation (subways or cabs for villains to escape the city, tractors or pickups when on the farm), and sensory details including sights, sounds, tastes, and smells typical to the setting (salt on your lips from the surf pounding at the beach, sand scorching your feet, and the smell of rotting

Russell W. Ayres

Comment: ??? what's this supposed to mean?

fish washed ashore). The use of details and mood will make the reader feel more involved and tense.

Finally, the teacher will instruct the students to choose the crime. Readers know that in a mystery a crime will have been committed or a mysterious happening threatens the hero. A better strategy to regard the use of a crime include: make the crime fit the setting, allow the action involved in solving the mystery fit the hero, and consider whether the crime fits the villain. Is it possible for the hero due to age, health, and size to believably solve it? Could the villain really pull off the crime and get away with it? Modify the crime or suspenseful happening until it fits your sleuth's abilities and the villain's capabilities.

Russell W. Ayres

Comment: This usage is awkward, can you find a better way to express X2

The teacher will provide a list of what not to do that also exists for creating an effective mystery. Don't begin writing at the beginning of the story without first planning the ending. Don't use dialogue that sounds unnatural or doesn't fit the characters. Don't have loose ends at the end of your story. For example, if a minor character offers to help the main character search for a missing friend, bring him/her back after the friend is found (not allowing him to wander in the night forever). Don't overuse exclamation points. Usage should be limited to when one of the characters, or the writer, is exclaiming. For example, "It was a wild, exciting ride," does not require an exclamation point. However, "What a wild, exciting ride!" does. Don't use the same word two or three times in the same paragraph. Try using a thesaurus to find synonyms. Don't use sentences that are too long or with too many clauses or phrases. It can be confusing. Finally, don't forget to proofread, spell check, or use a dictionary to make sure that words are used and spelled correctly.

Russell W. Ayres

Comment: space

The teacher will then proceed to allow students to conduct forensic tests before beginning to write a mystery. A mock crime scene will be set up in the classroom before the students arrive for class. Each student will belong to a team that spends ten minutes examining the crime scene to collect evidence. A document provided to the team will explain what sort of evidence can be useful to solve the case. The evidence gathered will be placed into zip-lock bags. Each team will proceed to the lab to make tests following a full explanation concerning proper lab technique, including a description of how to handle evidence to prevent contamination. They will also be supplied with the laboratory equipment needed to do each test. Samples will be supplied for comparisons between a possible suspect and the evidence collected by the team at the crime site. Each team will use a data table to record the results for each test that was run. They will do five tests, and then decide if the results point to the suspect as the perpetrator of the crime.

Classroom Activities

Day 1: Introduction to the Mystery Genre

The objective of this lesson is to introduce students to the genre of mysteries. Provide each student with a copy of the same short mystery to read silently. Following their reading, a classroom discussion follows to identify the following elements: background information including characters, setting, mood, plot (including basic facts and sequence of information), rising action, climax, and resolution. Students relate portions of the mystery just read silently with each of the basics listed. An overview of the upcoming crime scene investigation, specimen collection, laboratory analysis, and mystery writing is provided to students in preparation for the upcoming series of lessons.

Days 2 and 3: Crime Scene Investigation

Test One (The Lip Print Examination)

Information provided in document concerning evidence to be collected:

The teams will find a paper cup with a lipstick print imprinted on it in the trashcan. It is possible that the perpetrator of the crime left behind the paper cup. The suspect acquired a beverage from a nearby vending machine, which dispenses various liquids in the same type of paper cup that was found in the trashcan. Lip prints have been taken from the suspect to use for comparison with the evidence lip print found on the paper cup. Lip prints are not as reliable as fingerprints to identify a criminal, but they can be used to a limited degree when screening a potential criminal.

Experimental Procedure:

A chart illustrating the five major categories of lip print patterns will be available for inspection by the student (Seagraves 2). In addition to the chart will be lip prints taken of the suspect. A ten-power magnifying glass will be provided so that the lip lines in the evidence lip print can be compared to the examples provided on the lip print chart. This test will require students to have good observational skills as they look at the physical characteristics of the specimens being examined. They will inspect the evidence lip print for the types of line patterns that are present in the chart print, and then compare this with the three suspects' samples. The five major categories of lip prints are: short vertical lines; long vertical lines; lines that form diamond patterns; rectangular lines that crisscross; and branching lines like those in a plant root.

Test Two (The fiber test)

Information provided in document concerning evidence to be collected:

After the crime was committed a tiny patch of torn cloth was found on a jagged door latch. It is a white fiber strand. The suspect's clothing contained white fibers. The document will instruct team members that fibers from clothing found at a crime scene are often studied by forensic investigators. These fibers often contain evidence in the form of body fluids like blood and sperm. Fibers are either natural or synthetic. Natural fibers include animal fibers like silk, cashmere, wool and hides, or plant fibers like cotton.

Fibers are frequently examined microscopically to see specific physical characteristics like surface texture and color. Chemical behavior can also be tested. The rate of speed that a fiber burns is a chemical property. Both physical and chemical properties of the products of combustion of a fiber can be used to identify the type of material that it is made from (Rainis 95).

Experimental Procedure:

Part 1

The students will use a microscope to examine a strand of the evidence fiber that was found snagged on the door latch of the safe. Using thumb forceps to handle the fiber they will put the strand onto a microscope slide and then add a drop of water to the fiber before covering it with a cover slip. The fiber will be examined under a 75x-magnifying lens. The microscope will have a top lighted stage, but a bottom-mirrored stage can also be used if desired. Students will then repeat this process to examine samples taken from the clothing of the suspects. This test will require students to use their observational skills to look at the physical properties of the sample strands of the suspects, and then compare these features with the evidence strand. The students will be told before doing the examination that there is a difference in the way that synthetic fibers look when compared to most natural fibers under a microscope. They will be told that the surface of a synthetic strand is smooth like the fibers produced by a silk worm, but that most natural fibers appear to have rough surfaces when under magnification. Students should also look for external features like tightly versus loosely braided fibers, and orderly versus disorganized strands.

Part 2

Distinguishing between the fibers of different synthetic materials is sometimes difficult; therefore students will do an additional test where they burn sample fibers from the suspects to see which one burns in similar manner most similar to a strand of fiber from the evidence material collected at the scene of the crime. The student will use thumb forceps to hold onto the fibers, and then ignite the different fibers using a match. The fiber should not be allowed to burn completely, and the remaining portion should be examined under magnification. Students will be informed that synthetics tend to melt upon heating and that when fibers burn they will often produce a different colored product. The product of the evidence burn test will be examined under 10x and 20 x stereoscopic microscopes, and then compared with the test burn products of the suspect samples to identify the closest match. If stereoscopic microscopes are not available the use of a single lens hand held magnifying glass will be sufficient for accurate observations.

The following facts about burned fabrics should be shared with the students at the start of the test: polyester fiber when burned produces a black bead of melted plastic residue at

the tip of the strand; natural fibers do not yield a beaded end upon burning, but produce an ash residue.

Test Three (The paper chromatography test)

Information provided in document concerning evidence to be collected:

A post-it note was left behind by the perpetrator with the words “catch me if you can” written in black ink. The suspect owns a black ink pen. The pen was volunteered by the suspect and supplied to the student. Most ink is a mixture of different molecules that have a different color as a physical characteristic of their chemical structure. Mixtures of molecules can be separated by the use of a technique called paper chromatography, where fibers in a porous material like filter paper slow down the movement of different sized molecules that have different colors. This process will be used to compare the ink from each of the suspect’s pens to the evidence collected (Owen 84).

Experimental Procedure:

The student will take the pen supplied by the suspect and use it to place a 1mm dot of ink onto a separate strip of porous filter paper. The black spot mark will be placed exactly 2 cm of distance from the cut end of each strip. Each strip will be 3 cm in width and 8 cm in length. At the side of each strip of filter paper opposite from the ink spot, the students will insert a toothpick through the strip exactly 1 cm from the cut papers end. The same procedure will apply to the post-it note, with the exception that the post-it note will be covered with a strip of porous filter paper that is touching up against the spot to allow migration from the post-it note into and upon the filter paper. Paper clips can be used to hold the filter paper in close contact with the post-it paper. Both strips will then be suspended over a Styrofoam cup that contains 1cm of water. The students will position the strips by using the toothpicks as a bridge across the top of the Styrofoam cup edge so that 0.5 cm of the filter paper is submerged in the water. The end of the filter paper strips upon which the ink spots are marked will allow water to move upward through the filter papers, and then past the ink spots as it continues up towards the toothpicks. This method of separating a mixture of colors from an ink spot is called paper chromatography, and the students will see the different colors appear as a spectrum on the filter paper spreading upward above the ink spots. By comparing the patterns of the ink pen spectrum with the pattern of the post-it note spectrum, the process of identifying the suspect’s pen as the one that wrote the thank you note will then be possible.

Russell W. Ayres

Comment: ditto

Test Four (The pH Test)

Information provided in document concerning evidence to be collected:

The paper cup in the trash still contained some liquid that was not consumed. A vending machine that this liquid came from has three different beverage selections. It is known

that the suspect has a favorite beverage that is offered as one of the choices in the vending machine. Each of the beverages dispensed by the vending machine has a different pH value range. The pH of the beverage in the paper cup can be tested using a specially treated paper called "pH litmus paper." This paper will change color when placed into the evidence liquid. The color of the pH paper is compared with a color test scale found on the pH paper container box that indicates the pH value of that liquid. By measuring the pH value of the evidence in the paper cup the student is testing how acidic or basic the beverage is in the cup, with acids having a pH of less than seven, and bases having a pH of more than seven on the scale.

Experimental Procedure:

Liquid from the paper cup is placed into a tiny vial. Samples of the vending machine beverages are also placed into separate similar vials. The team will test each of the liquids using a piece of universal pH paper, and then compare the pH values to determine which beverage has the closest pH value to the liquid found in the paper cup. The beverages that are being tested are: iced tea, with a pH range of between 5.0-5.8; apple cider, with a range of between 2.9-3.3; and prairie moon flavored water, with a range of 6.5-7.5. There is a minor qualitative difference in the color of these three beverages, but the pH value will help to quantitatively verify that the evidence collected is definitely one of the three possible beverages.

Test Five (The spot of blood test)

Information provided in document concerning evidence to be collected:

Kleenex was found on the floor with a small dot of reddish-brown liquid that appeared to be dried blood. The suspect has volunteered a small sample of blood to cooperate with the investigation. Forensic blood analysis is used at many crime scenes when blood is present on any surface. The human red blood cells carry antigens on their surface that will cause these cells to clump together when treated with matching antibody solutions. This form of blood typing is referred to as Rhesus factor (Rf), and can be used to identify ABO, and AB blood groups.

Experimental Procedure:

Part 1

Students will examine the spot on the evidence to test for the presence of blood. They will apply a tiny drop of hydrogen peroxide to one side of the spot to see if it gives off gas bubbles, which is a result that indicates positive for blood. If the test supports that the spot is blood, they will then go on to the part two with a follow-up test.

Part 2

Having identified the presence of blood on the evidence there will be a follow-up test for blood type by using a blood-type test kit for human blood. Using various testing solutions, they will determine if the blood on the evidence collected is Type O, A, B, or AB. Students will use the results of the test to see if the suspect has the same blood type as the sample. Blood testing kits are to be prepared by the teacher prior to the day of the lab. The teacher will use his own blood taken from a lanced thumb for doing this lab. As a safety measure the students will glove up for protection. A kit to test for different blood types is readily available from any major biological supplies catalog.

Russell W. Ayres

Comment: students be consistent throughout—go back and check to make sure you use either singular or plural for all the plan. Now, just a question here—using human blood, will you have the students glove up as a precaution. This seems wise in terms of safety for them and also would add a real-world feel to the process here.

The student will prepare the remaining evidence blood stain by adding 3 ml of distilled water into a 50 ml beaker, and then soaking the stained cloth in the water for two minutes to extract the dried material and make a solution for testing. Using a transfer pipette they will then add four small drops of the extracted blood solution onto a glass slide. The droplets should be spaced apart by a distance of 1.5 cm. To each of the test droplets the student will add a similar sized droplet of blood typing antiserum solution. Tiny dropper bottles are used for storing and distributing the kit antisera. The student by means of a toothpick will then stir each of the resulting test droplet mixtures. The students will use four different toothpicks for stirring, or they can thoroughly wash a single toothpick with distilled water between stirrings to prevent false positive readings from occurring.

Day 4: Analysis of Evidence

Students work within their assigned teams to collaborate regarding evidence collected, brainstorming an appropriate mystery using scientific principles as well as mystery writing basics, and create flesh out the story using individual index cards in lieu of outlining the plot. Upon completion of the basic mystery plot, students branch their plot by developing specific characteristics of the sleuth, victim, and villain. In addition, both real and false clues are developed and inserted into the plot line as desired. Students then number their note cards (or clip them onto poster board) as a framework for writing. The team works together to write the first rough draft of the mystery starting with a strong beginning and developing an appropriate setting. Students may complete the mystery as a homework assignment.

Day 5: Presentation of the Rough Drafts/Mysteries

Teams present their mystery rough drafts orally to the class for feedback. Peer feedback and review is very valuable. Allow time for classmates to volunteer feedback to the group orally. Students are also required to write down their ideas for each team to be collected and reviewed by the mystery-writing team. While some students will have no difficulty volunteering their ideas and suggestions orally, many will be more comfortable writing their feedback and ideas for the team.

Russell W. Ayres

Comment: Teams present their

Day 6: Second Rough Draft Writing

Each team reads peer feedback sheets, considers ideas, suggestions, and additional thoughts. Students summarize and reflect on what has been heard and rewrite the first rough draft making changes to the dialogue, characterization, plot, setting, word choice, and sentence length as needed to synthesize various aspects of their writing.

Day 7: Final Copy

Each teammate receives a photocopy of the second rough draft for the developed. Each student individually edits and revises the draft for clarity, word usage, plot, and conventions of language (spelling, punctuation, grammar). Students then collaborate with their revised drafts to create a single final copy of their mystery. Students may word process their mysteries using stylistic mechanics of their choice.

Day 8: Oral Presentation of the Mystery

Each team orally presents the final mystery to the class. Following oral presentation, classmates are encouraged to provide feedback to the authors. All mysteries are then collected and compiled by the teacher into a Forensic Mystery Collection to be provided to the school newspaper for possible publication. The collection of mysteries may be shared with other chemistry classes for their reading enjoyment.

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Scholastic. Writing with Writers. 13 April 2007
<<http://www.scholastic.com/write/wit/mystery/index.htm>>.

This website provides a great volume of valuable specific information regarding the process of mystery writing for students.

Seagraves, Steve. Lip Prints. 11 April 2007.
<<http://www.geocities.com/sseagraves/lipprintsbackground.htm>>.

This site shows students the five basic types of lip prints used by forensic scientists.

Reading List for Students

Grafton, Sue. Writing Mysteries: A Handbook by the Mystery Writers of America. Cincinnati, Ohio: Writers Digest Books, 2002.

This book provides helpful suggestions to the aspiring student who wants to write a mystery story see what sorts of things go into this creative process.

Nute, Dale. Advice About a Career in Forensic Science. 5 June 2007.
<http://www.criminology.fsu.edu/faculty/nute/FScareers.html>>

Students will enjoy reading about the various types of jobs that are associated with the process of crime scene investigations.

Owen, David. "Police Lab: How Forensic Science Tracks Down and Convicts Criminals." Toronto, Ontario. Firefly Books. 2002.

This book focuses on the techniques and technology of forensic science and makes for fascinating reading by the students as a follow-up to the lab work done in class.

Rainis, Kenneth G. "Crime-Solving Science Projects Forensic Science Experiments." Berkley Heights, New Jersey. Enslow Publishers, Inc. 2000.

This book is geared to younger readers, but it can be useful in explaining the simple lab projects that can be added to those mentioned in this curriculum unit. Follow-up exercises described in this book will further student understanding of forensic science.