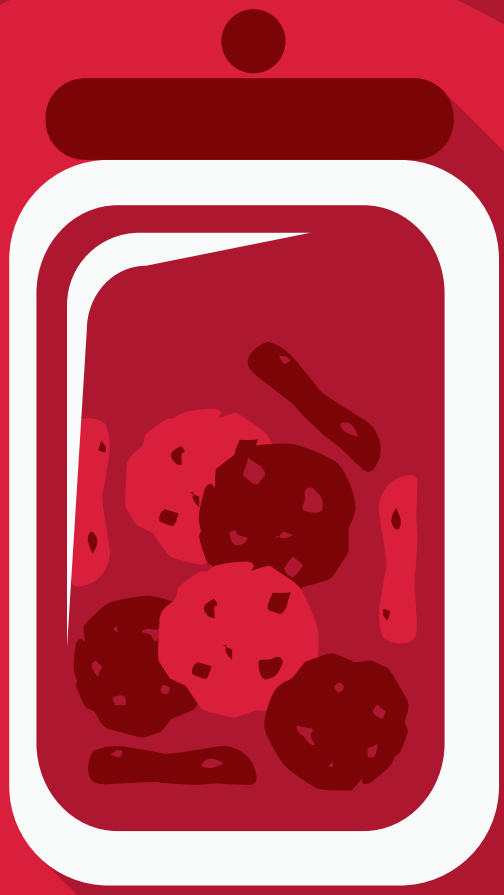
A Study in Forensic Science

Cookie Jar MYSTERY



INSTRUCTOR'S GUIDE

Community LEARNING

The Cookie Jar Mystery
A Study in Forensic Science

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Preface

Welcome!

The Cookie Jar Mystery: A Study in Forensic Science is a 12-activity course aimed at students in grades four and five. It is designed to ignite curiosity and stimulate authentic learning by creating real-life contexts ranging from lab analyses to field work to criminal investigation. *The Cookie Jar Mystery* has been used enthusiastically in all 50 states, stimulating young minds and engaging young hands for many years. In fact, thematic integration—over an extended period of hands-on engagement—forms the driving concept behind all Community Learning's courses. The Cookie Jar Mystery is aligned to Next Generation Science Standards (NGSS) disciplinary core ideas for grades 4-5. In addition, the activities included in this unit align to the Common Core Learning Standards. For more information on the standards please see the Standards Matrix provided in the appendix.

Who Can Teach *The Cookie Jar Mystery* and Where?

Instructors are supported by easy-to-manage materials and step-by-step plans. No specialized knowledge is required to launch the course, making this entertaining forensic science mystery ideal for classrooms, after-school programs, intersession programs, museum groups, summer camps, youth groups, and clubs . . . anywhere young people are gathered.

"The Cookie Jar Mystery had my students fully engaged in a hands-on learning experience. Each session my students came with more questions and an eagerness to dig into the exercises to piece together the puzzle."

- Robert K., Middle School Science Teacher, University of Wisconsin Continuing Education

Hands-on Enrichment in Science and Critical Thinking

The call for hands-on activities that build critical thinking skills, confidence, competence, and science literacy can be heard on the national, state, and local levels. To be sure, educators and officials in both the public and private sectors point to the critical role ongoing, quality after-school programs play, especially programs with a focus on science, math, and reading—the same skills now tightly linked to the economic productivity of our society.

The Cookie Jar Mystery exposes students to this and more. The course sets up scenarios that invite students to solve problems creatively, think critically, work cooperatively in teams, and use evidence, models, tools, and scientific techniques effectively.

"Children don't stop learning when the last bell rings. That's why ongoing, quality after-school programs are so important, and why school leaders need to consider how in-school and after-school learning are connected."

- Vincent Ferrandino, Executive Director of the National Association of Elementary School Principals

Bringing the Mystery to Life

A crime has occurred in Mrs. Randall's classroom! Her favorite cookie jar was broken and some of her homemade cookies were eaten. While breaking a cookie jar and snitching a few cookies are hardly serious crimes, they are nevertheless crimes that can be solved using a forensic science approach. Mrs. Randall turns this misfortune into opportunity and calls in a "Chief Crime Scene Investigator" (your course instructor) to lead her "forensics team" (your students) in how to use the tools of forensic science in analyzing clues left at the crime scene. Each student member of this team is a "Crime Scene Investigator"

tasked with solving the mystery through scientific observation, sample examination, analysis, lab work, testing, interviews, and field work.

To draw the students into the mystery, the instructor sets the stage by recounting Mrs. Randall's intriguing tale. In advance, the instructor creates names for the four student suspects—names that students will find believable and relatable. These names replace "Suspects 1 – 4" used throughout the course materials. The suspects are three girls and one boy, and two of the girls are sisters. Having the instructor choose the names allows the course to be taught again and again, as this approach prevents incoming students from discovering prematurely who committed the crime.

> *"This amazing program has enabled my students to comprehend the process of forensic science as well as the sophisticated vocabulary encompassed in the program's lessons."*
>
> - Erika T., Teacher, Freehold Public Schools, Freehold, NJ

Making the Most of Each Lesson

With all the necessary materials provided in convenient, lightweight carryalls, and the setups, processes, and procedures explained in detail, instructors will find *The Cookie Jar Mystery* easy and fun to teach. Each lesson provides an activity that teaches a new but related aspect of scientific reasoning and a particular scientific process. None of the labs require special handling or complicated setups.

After familiarizing themselves with the lesson, vocabulary, and intended outcome of the activity, instructors set up their classroom so that it is easy for students to work in groups. Clear guidance is provided in each lesson on how to set up the demonstration area with all the relevant materials at hand.

Any necessary safety precautions specific to individual lessons are also provided. The instructor should be sure to know where emergency help and supplies are located.

Each lesson activity that the students accomplish becomes part of their crime scene portfolio and contributes, ultimately, to solving the mystery. Because of this, instructors need to review the corresponding pages in the Student Book in order to guide students in completing their part of the activity.

Course Kit Components

Each course kit contains an Instructor Guide, Teacher Resource CD, and all of the materials and tools necessary to teach the course to a class of 30 students. Start by reviewing this guide, and tutorials on the Teacher Resource CD.

Course Kit Contents

Packed in easy-to-manage carryalls, every material or tool needed to solve the mystery is organized in a way that makes the course easy to teach again and again. Among some of these materials are:

- fingerprint "ten cards"
- ink strips
- hand lenses
- chromatography paper
- simulated blood and pollen samples
- hair and fiber samples

Instructor's Guide

Every step is taken to provide an easy-to-follow format and fun-to-read instructions for each lesson. In addition to a brief listing of objectives, materials, and setup procedures, useful icons point the instructor to a number of key elements:

Notes for the Instructor

Brief instructor notes introduce the subject matter and challenges presented in the particular lesson. They often contain real-life, age-appropriate examples from crime in history or popular culture.

Notes for the Students

These notes "set the stage" for each lesson by presenting brief material to read, listen to, and discuss.

Vocabulary

New and relevant terms are defined here. Note, too, the comprehensive "Glossary" at the rear of the Instructor's Guide and Student Books.

Activity Description

Here, step-by-step procedures are provided for both the instructor's demonstration and the students' immersion in the activity.

Wrap-up

Discussion-provoking questions are designed to summarize learning and help students take their inquiry further.

Clean-up

Clear instruction on preserving and storing materials is provided to ensure kit longevity and cost effectiveness.

Other Directions, Discussions and Destinations

To extend lessons and deepen understanding across disciplinary and cultural divides, relevant links to multimedia, web resources, and books are provided here.

Student Books

Designed for students to record their discoveries class after class, the Student Books acquire a narrative quality that keeps the young "Crime Scene Investigators" engaged in scientific investigation over time. The books serve as companions to the Instructor's Guide and contain reports, charts, places to attach samples, and areas to record observations, as well as a full glossary of terms used in the course.

The complete *The Cookie Jar Mystery: A Study in Forensic Science* student book is provided in PDF on your resource CD, with an unlimited license for reproduction for your school or organization's use.

Companion Resources

When you adopt *The Cookie Jar Mystery: A Study in Forensic Science*, your instructors will have access to a number of companion resources. A Resource CD offers tips, lesson extensions, and other great ideas for the classroom. Word search and crossword puzzles help reinforce newly learned and used vocabulary. Links to forensic videos and other multi-media resources provide authentic lesson extensions. Immediate support is always available by phone, email or webinar from the experts at Community Learning.

To extend the mystery and bring it to an authentic conclusion, the follow-up course, *The Cookie Jar Case: A Role-Play Mock Trial* is available through our website at http://www.commlearning.com. Here, students follow the legal steps to charge a suspect formally and bring him or her to justice.

> *"The program is awesome! I'm doing it as part of an after-school enrichment time. Our kids really enjoy the projects, and it's wonderful to use as everything is provided.*
>
> - Kathy S., Middle School Teacher, Olympic Middle School, WA

About Community Learning

Community Learning is a socially responsible company focused on impacting positive youth development through STEAM education. We create curriculum designed to expose students to careers and inspire their development into lifelong learners. Our products are developed in collaboration with subject area experts, providing complete support for program administrators desiring rich, engaging educational programs for their students.

If you have any questions, suggestions, or feedback, please visit our website or email us at info@commlearning.com.

Preparation Overview

	Lesson 1 **Heads Up: Observation Skills**	Lesson 2 **Think Ink: Ink Chromatography**	Lesson 3 **The White Stuff: White Substances and Toxicology**	Lesson 4 **Pull Some Strings: Fiber Analysis**
Print/Copy	Student Book pages iii-9	Student Book pages 10-12	Student Book pages 13-14	Student Book pages 15-17
Organize Kit Supplies	• Sets of practice pictures • Cookie Jar Mystery crime scene photos • Pencils	• Suspect pens • Isopropyl alcohol • Plastic cups • Foam plates • Plastic straws • Chromatography paper • Pencils • Scissors • Paper clips • Rolls of tape	• Iodine and dropper • Vinegar • Permanent marker • Dropper bottles • 2,000 mL container • Set of white powders • Black paper squares • Foam plates • Hand lenses • Portion cups • Wooden splints • Pencils	• Black fiber samples • Tweezers • Fiber samples card-stock • Wide tape • Hand lenses • Pencils
Prepare	• Read Instructor's Guide Preface and Introduction • Select and name your suspects	• Make crime scene chromatography strips for each group	• Fill and label dropper bottles with water and vinegar • Set up chemical distribution center	• Unravel fabric samples • Tear pieces of tape
Acquire Additional Supplies		• Paper Towels	• Water	

Preparation Overview

	Lesson 5 **Hair We Go: Hair Samples**	Lesson 6 **Follow the Grain: Pollen Analysis**	Lesson 7 **Make an Impression: Bite Marks**	Lesson 8 **Bloody Brilliant: Blood Types**
Print/Copy	Student Book pages 18-20	Student Book pages 21-22	Student Book pages 23-25	Student Book pages 26-28
Organize Kit Supplies	• Hair samples • Hand lenses • Tweezers • Scissors • Hair samples cardstock • Rolls of tape • Pencils	• Pollen samples • Hand lenses • Toothpicks • Pollen samples cardstock • Rolls of tape • Pencils • Scissors	• Foam cups • Hand lenses • Plastic bag for cut slides • Scissors • Pencils • Rulers • Permanent markers	• Simulated blood and anti-sera • Blood exam trays • Permanent markers • Pencils • Toothpicks • Disposable gloves • Blood typing guides
Prepare	• Set up activity demonstration • Print Hair Slide Transparenices from master on Teacher Resoure CD.	• Print Pollen Slide Transparenices from master on Teacher Resoure CD • Cut transparency sheets into columns • Set up activity demonstration	• Print Cookie Tarnsparenices from master on Teacher Resoure CD. • Cut cookie transparences into slides	• Set up activity demonstration
Acquire Additional Supplies	• 30 blank transparenices	• 10 blank transparenices	• Paper Towels • 10 blank transparenices	• Lined Paper • Paper Towels

Preparation Overview

	Lesson 9 One of a Kind: Fingerprint Evidence	Lesson 10 Crack the Code: DNA	Lesson 11 Let's Talk: Questioning the Suspects	Lesson 12 Who Dunnit?: Piecing Together the Evidence
Print/Copy	Student Book pages 29-32	Student Book pages 33-36	Student Book pages 37-43	Student Book pages 51-53 Certificates of Completion
Organize Kit Supplies	• Ink strips • Ink towelettes • Ten cards • Hand lenses • Pencils	• 2,000 mL container • Dish soap • Salt • Isopropyl alcohol • Measuring spoons • 250 mL containers • Plastic spoons • Resealable plastic bags • Coffee filters • Plastic cups • Wooden splints • Pencils • Foam plates	• Pencils	• Pencils
Prepare	• Set up activity demonstration	• Remove any strawberry leaves and stems • Put isopropyl alcohol into the freezer • Put water into the refrigerator	• Organize groups of students	• Print and fill out Certificates of Completion
Acquire Additional Supplies		• Fresh or Frozen Strawberries • Water		

Introduction

Instructor's note: please read this to students prior to beginning the course or, if this is not possible, at the first lesson. This will help to build intrigue for *The Cookie Jar Mystery.*

The Cookie Jar Mystery

Mrs. Randall is a science teacher. She enjoys baking chocolate chip cookies and sharing them with her students. One morning when Mrs. Randall entered her classroom, she found her favorite cookie jar in pieces on the floor. She had baked cookies the day before, but now only a few pieces of broken cookies were left on the floor, next to the pieces of the cookie jar.

Mrs. Randall loves to teach, and she loves to use science to solve mysteries and answer questions. She decided to use "forensic science" to solve this mystery of the broken cookie jar, and she got her students to help her. Now she wants you to use forensic science to solve the mystery, too!

So what is forensic science? Forensic science is science that relates to the law. The word "forensic" means anything related to the handing out, or administration, of justice. You will look at the clues left in Mrs. Randall's classroom and use forensic science to decide who broke the cookie jar and ate the missing cookies.

On the morning that Mrs. Randall discovered the broken cookie jar, she entered her classroom from the door at the back of the room. She set some books and papers on the work counter, then she checked on the plants her students were growing on the windowsills. It was when Mrs. Randall got to the front of the classroom that she saw her favorite cookie jar on the floor in pieces. The door to the storage cabinet where Mrs. Randall usually kept the cookie jar was open, and pieces of cookies were scattered between the cabinet and Mrs. Randall's desk. It was a mess.

Mrs. Randall stopped by the front work table while she thought about what she should do. She knew it was important not to touch anything that could give clues about who had broken the cookie jar. But she had to get ready for her class to arrive. She decided to look at everything carefully and take notes about what she found. She took a digital photo of the crime scene. Then she put anything that looked unusual or out of place into a box so she could look at it all carefully later. She also made a map that showed the layout of the "crime scene."

Here is what she found on the floor: fragments of the broken cookie jar, pieces of cookies, lots of crumbs, and an old science test. A couple of pieces of broken cookie jar looked as if they had something on them. Mrs. Randall swept the floor and looked at everything in the dustpan carefully. She noticed some hair and maybe some threads or tiny, tiny pieces of material. She put it all in plastic bags to analyze later.

When Mrs. Randall went to her desk with the box, she found something else: a note and a half-eaten cookie! She put the note and the half-eaten cookie in the box, too. She wondered, who could have done this? Later, she decided it had to be one of four suspects, students who had the opportunity to be in her classroom while she was out. The suspects are:

#1_____(male);

#2_____(female);

#3_____(female); and

#4_____(female, sister of #3).

You will be a Crime Scene Investigator to help solve this mystery. Your instructor will be your Chief. Are you ready to solve this mystery?

Lesson 1

HEADS UP!

Lesson 1

Heads Up: Observation Skills

Objectives

Students will:

- Practice observational skills by trying to notice and recall details in a photograph
- Learn about the job of a document examiner and the techniques used in handwriting analysis
- Practice observational skills of comparing and contrasting characteristics of handwriting

Materials

Instructor:

- 10 sets of "practice pictures" (2 pictures per set)
- 3 Cookie Jar Mystery crime scene photos

Students (per group of three):

- Student Book pages (on Resource CD)
- 3 pencils

Preparation

- This activity will introduce the four suspects to the mystery. If you have not already, it is important to give each suspect a name (see Introduction page). Keep in mind that suspect names can be changed each time you teach the course. This can be helpful in keeping the ending a secret in each session.
- Read the Introduction (found on page ix) to students before beginning this lesson.

Notes for the Instructor

The Cookie Jar Mystery is a project-based learning experience that asks your students to complete a series of activities in order to figure out who ate Mrs. Randall's cookies. Students will learn about specialized jobs, techniques and tools employed by forensic scientists. The more realistic the mystery seems to your students, the more engaged and invested they will be in learning the information and conducting the science experiments. As the instructor, your enthusiasm and investment is key!

This introductory lesson is focused on observation skills. In the first activity students will be challenged to see how many details they can notice and recall. You will guide students through observations, discussions, and an analysis of two different photographs. Then, students will be introduced to *The Cookie Jar Mystery* with a photo taken from the crime scene. Students will utilize their powers of observation to begin to unravel the mystery. Taking in details at the scene and being able to recall them later is a key skill for investigators. Students will realize that these skills can be strengthened with practice and by implementing helpful strategies.

In the second activity, students will use their powers of observation to compare and contrast the note left behind at the cookie jar crime scene and handwriting samples taken from the four suspects. Notes or other written documents that are part of the evidence at a crime scene, usually with an unknown or unverified author, are called **questioned documents**. Handwriting experts called **document examiners** are called in to compare the questioned document to handwriting samples taken from the suspects.

Handwriting samples can be collected in two ways. The first way is called **request writing**, and is obtained from a suspect during the investigation and with a witness present. The second type of sample is called **non-request writing**. These are samples that were written previously, before the person became a suspect in the investigation. If the authorship can be verified, a non-request writing sample is preferred. This is because request-writing samples can vary from a person's true writing, possibly because the person is nervous about being questioned, or perhaps because he is deliberately trying to change his handwriting.

In forensics, experts study the unique characteristics and nuances of an individual's handwriting, including its **form**, **line quality**, **arrangement**, and **content**. They also look at the type of pen and paper used. Often the work of a document examiner is to notice differences rather than similarities. This is especially the case if a document is suspected of being forged, or written by someone other than the

assigned author. While it is possible to copy someone else's writing, it is almost impossible to erase all traces of our own individual writing style.

Some characteristics of writing are visible to the **naked eye**, meaning they are visible without the use of any additional tools. However, forensic scientists often use hand lenses, microscopes, and special lighting to analyze handwriting as well. These tools can highlight inconsistencies in the paper or ink of a note. Angled lights can show indents on the paper that might suggest a signature was traced. Backlighting reveals eraser marks and use of correction fluid. The observations made by your students today will be with the naked eye.

The activities in this lesson address Next Generation Science Standards practices of Planning and Carrying Out Investigations and Analyzing and Interpreting Data. In addition, they address Common Core Learning Standards. See the appendix on page 105 for more details.

Notes for the Students

Welcome to the investigative team! Throughout the investigation you will be presented with a lot of **forensic evidence** that may help you to figure out what happened in the Cookie Jar Mystery! Remember, forensic evidence is anything that can be used to prove that a person did or did not have something to do with a crime.

There will be many tools that we will need throughout this investigation, however the tools you need first are already right in front of you, literally! The number one tool or skill for any investigator is the ability to make **observations**. Observations are any bits of information that you gather about the environment using one or more of your five senses: sight, smell, hearing, touch, taste.

As a lead investigator it is important your observational skills are top notch. That means using all of your senses and slowing down so that you don't miss any details. It also means being able to spot similarities and differences between objects. In order to make sure you are up for the task of solving the crime, we are going to spend a bit of time today working on our observational skills.

We will test our observational skills in two different ways. First, we will practice looking at various scenes, including the cookie jar crime scene. The goal will be to slow down and take in as many details of the scene as possible. The challenge will be trying to recall these details with accuracy afterwards.

Second, we will look closely at the note left behind by the person who took the cookies. Notes or other documents that are part of a crime scene investigation are called **questioned documents**. Often investigators need to find out who the author of the note is, or verify that the assigned author is actually the person who wrote the note. This can be done by observing the small similarities and differences in how people write. Suspects in a case will be asked to provide a writing sample that can be compared to the questioned document. People who study notes or documents associated with crimes are called **document examiners**.

A person's handwriting is very specific to him. The way someone holds a pen, how he shapes letters, the amount of space he leaves between words and lines, as well as the amount of pressure applied while writing are all features of handwriting that can be used to analyze a document. They can reveal clues, including the identity of the author. Today you will learn about many characteristics that help document examiners distinguish handwriting.

Sometimes handwriting analysis can help solve a case! In 1922, a few scraps of paper helped capture the Yule Bomb Killer. On December 27th, Clementine Chapman opened a package that she thought was a late Christmas gift. It exploded. The packaging was pieced back together, and from just a few words recovered from the address label, the police were able to trace the bomber. The misspelling of words pointed to someone who did not speak English well. When police looked for suspects in the small community, there was only one person who had been feuding with Chapman over land boundaries. This gave the person a motive for the crime and made him a suspect. A handwriting sample, as well as ink and bomb-making materials, were found in the suspect's home. They led to the arrest of John

Magnuson. Investigators were correct. Magnuson was born in Sweden and did not speak English well.

Today we will use these same techniques of handwriting analysis to try to match the four cookie jar suspects' handwriting with the note found in Mrs. Randall's classroom.

Vocabulary

Arrangement: in handwriting, how the letters and words are placed on the page, including spacing and alignment

Content: in handwriting, the spelling, phrasing, punctuation, and grammar of the written document

Document examiners: professionals who analyze notes or documents associated with a crime

Forensic evidence: any physical thing that may be used in a criminal court to convict or clear a person

Form: in handwriting, the shape of letters and their slant

Line Quality: in handwriting, the thickness of the line caused by the type of writing tool and the pressure used while writing

Naked eye: looking at something without assistance of any device like a hand lens or microscope

Non-request handwriting: an example of a person's handwriting that was written before the investigation began

Observation: information gathered about the environment using one or more of the five senses (sight, smell, taste, touch, hearing)

Questioned document: notes or written articles related to a crime scene where the author is unknown

Request handwriting: an example of a person's handwriting provided as part of an investigation with a witness present

Suspect: one who authorities think may have committed a crime

Activity 1: Practice Pictures

15 Minutes

1. Divide students into groups of three. Ask students to position themselves so that when photos are turned over for viewing, all group members can see clearly.

2. Ask one student to turn over photo #1 for 20 seconds. All students should examine the photo carefully. After the period of study is complete, ask students to turn photo #1 face down and answer questions on *Activity 1: Practice Pictures* found in their activity books on page 2. Allow time for students to answer questions before you move on to the next photo. Repeat for photo #2.

3. Ask students to compare their answers for photo #1 to the actual photo. Allow some time for discussion of responses. How did student answers differ to questions #1? Why do you think people saw different things? Did anyone answer questions #2, 3 and 4 correctly? What techniques did they use to remember these details? What details led to your answer to question #5?

4. Repeat the process for photo #2. Again, allow time for students to discuss their answers and how they lined up with the picture. Were students better able to recall details in photo #2 than in photo #1? Why might this be?

5. Display or pass around *The Cookie Jar Mystery* crime scene photo so everyone can see it. Ask the students to observe the photo for clues. After a few minutes, take the photo back and ask students what they saw that may be pertinent to solving the mystery.

6. Refer to the crime scene photo during future lessons as needed.

Activity 2: Comparison of Handwriting Samples

30 Minutes

1. Read out loud *Activity 2: Comparison of Handwriting Samples* found in the Student Book while students are following along with examples of each handwriting characteristic on the activity sheet *Handwriting Exemplars* on pages 5-6.

2. Direct students to *Activity 2: Suspect Handwriting Samples* on page 7. Have them complete the *Handwriting Analysis Summary* chart on page 8 for each suspect.

3. Have students study the note left behind at the crime scene. Complete the last column of the chart based on this sample.

4. Using the results from the chart, ask students to compare the handwriting characteristics of the four suspects with the note left behind at the crime scene.

5. Have students work in pairs to discuss their charts. Did both people have the same answers? Why might answers be different? Have students share which suspect's handwriting they think best matches the note left at the crime scene. Do students agree? Encourage students to use their charts and point out examples to defend their idea.

6. If time permits, have students analyze one another's handwriting by completing the *Wrap-up Activity: Student Handwriting Samples* on page 9.

Wrap-Up

10 minutes

1. Discuss the results from today's lesson. Why is observation important to forensic scientists?

2. In what ways can observation be helpful?

3. What are some ways to improve your powers of observation and memory recall?

Clean-up

5 Minutes

1. Make sure the room is back in order.

2. Collect and store all materials.

Other Directions, Discussions and Destinations

1. To make *The Cookie Jar Mystery* more fun and exciting, you can mock up a "crime scene" in your room. Locate a cookie jar, cookies, and catsup or red dye. Carefully break the cookie jar on the floor so that it looks like it was knocked over. Drip a small amount of artificial blood on a piece of the jar. Now for the fun part: partially eat a few cookies and drop them around the broken cookie jar to look like a thief did it. If you want to make it even more realistic, you can add some hair and black fabric threads taken from the materials in the upcoming lessons. Let the class look at the recreated "crime scene" for a few minutes and then see what they can recall later.

2. Developing our powers of observation often starts with improving our memories. Here's an old parlor game that's still played today:

   Memory Story
   Gather together 15 or 20 items from around the house, the classroom, or the supply box. A pencil, key, comb, spoon or cup could be among these. The 15 items should be random. Put these items together on a tray and cover them. Then gather in small groups around the tray. Remove the cover for 30 seconds and ask each member in the group to try to commit to memory all of the items. After 30 seconds, cover the items, and ask each person to write down as many items as they can remember.

   ➔ Some won't remember every item, and some will. Ask the people with the best memories how they remembered the items - often you'll discover that they've constructed a "memory story" to help them remember what they've seen.

➔ For example, Karen told the following story: "I just put it together like this when I saw the items: I thought to myself, I need a key (key) to open the door to the kitchen, where I would go to the drawer and get a spoon (spoon) to stir my coffee (cup); as I drink my coffee, I often make a list of the things I need to do (pencil) which include combing my hair (comb), etc."

3. And try these observational skills tests on the Internet:

- Here's some fun: can you find nine people in this picture? https://www.orderofthewhitelion.com/observation-powers/

4. Do your students think they can forge a note? Have every student in the class write a simple note using a pencil, such as "Please excuse Johnny from school today. He has the flu!" and sign it. With students in groups of five, have them pass the notes to the person on their right and try to copy one another's handwriting and signature. Do this until each person in the group has had a turn. Mix up the notes – can they find their own original handwriting?

5. Not everyone thinks handwriting analysis is a legitimate science. Read more about it at https://www.straightdope.com/columns/read/2447/is-handwriting-analysis-legit-science/

6. The most infamous forger of the early 20th century was Joseph Cosey. He specialized in copying the handwriting and signatures of many historical figures, including US presidents. See his work at: https://www.forbes.com/sites/booked/2011/02/13/historical-autographs-forgery-lincoln-franklin-washington/

You can find more resources and the most up-to-the-minute links by visiting our website at CommLearning.com and clicking on The Cookie Jar Mystery course kit.

NOTES

Activity 1: Practice Pictures

Picture #1

Look at the first picture for 20 seconds and then answer the following questions:

1. What did you see in the picture?_____

_____

_____

_____

2. How many cars are in the picture? _____

3. How many trucks are in the picture? _____

4. How many people are in the picture? _____

5. Was anyone in danger?_____

_____

_____

_____

_____

Lesson 1

Activity 1: Practice Pictures

Picture #2

Look at the second picture for 20 seconds and then answer the following questions:

1. What is happening in this picture? _____

_____

_____

2. Where is it taking place? _____

3. How many vehicles are in the picture? _____

4. What was the person wearing? _____

_____

Enlarged photo of Cookie Jar Crime Scene

1. List as many details as you can recall from the photograph of the scene. _____

_____

_____

2. Circle the details that you think may be important to remember in this case.

3. Compare your list to a partner's list. What details did you each recall? Which ones did each of you miss? Are there any details you both missed? _____

_____

_____

Activity 2: Comparison of Handwriting Samples

There are 12 characteristics that document examiners use to study handwriting. Read below to learn more about them. We will be using some of them, but not all, during our investigation of the *Cookie Jar Mystery*.

1. **Line quality**: Do the letters flow neatly or is the handwriting shaky?

2. **Spacing**: Are letters equally spaced or crowded? Are the margins even?

3. **Size consistency**: Is the height and/or width of the letters consistent?

4. **Continuous**: Is writing continuous, or does the writer lift the pen or pencil between letters of a word?

5. **Connecting letters**: Are capitals and lower-case letters connected?

6. **Lettering complete**: Does the letter begin and end on the page?

7. **Unusual letter formations**: Is there a mix of printed and cursive letters?

8. **Pen pressure**: Is pressure (how hard one presses with the writing tool) equal when applied to upward and downward strokes? Is the pressure light, medium, or heavy?

9. **Slant**: Do the letters lean to the left, right or both?

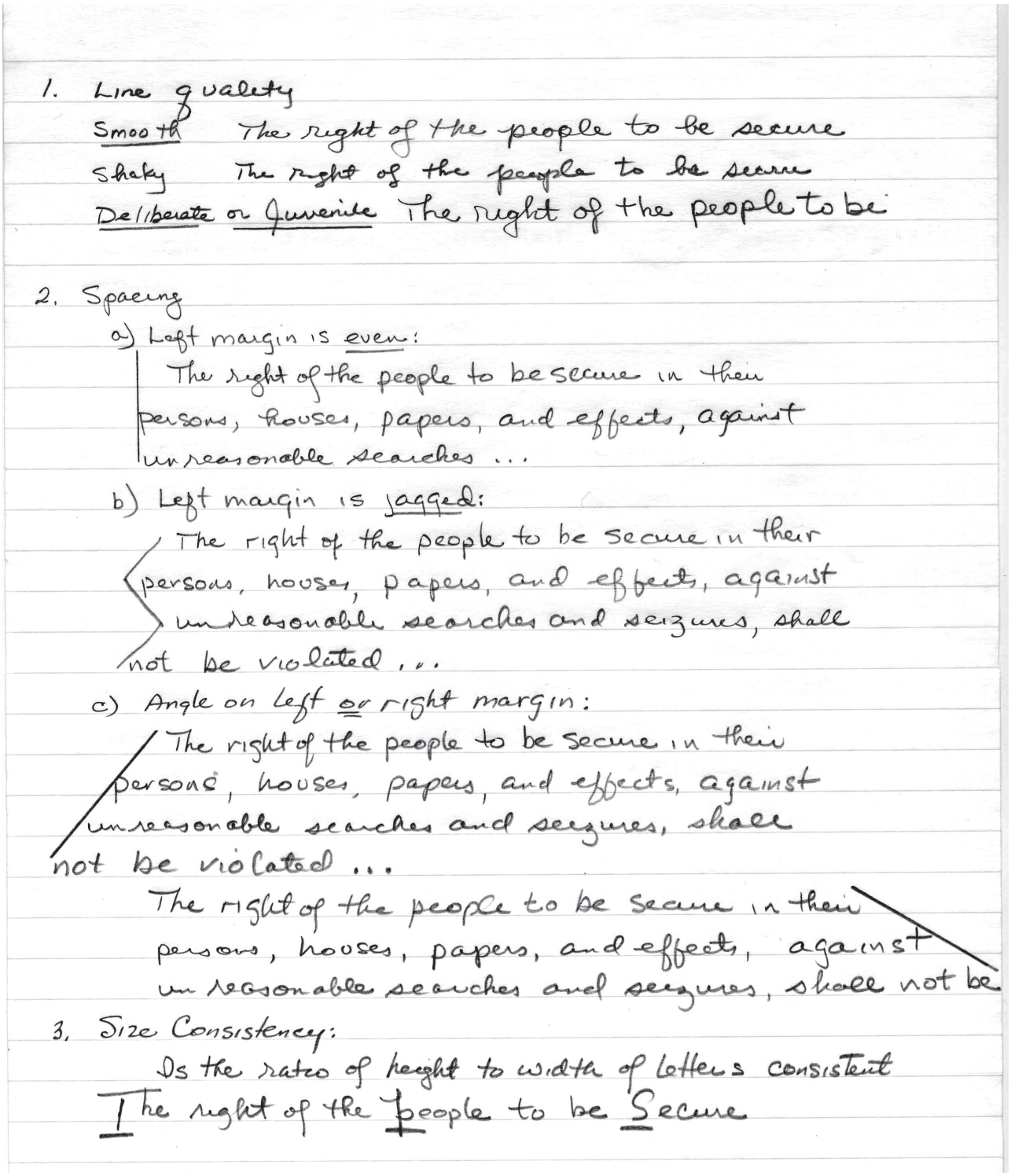
10. **Baseline habits**: Is the text on the line, above the line, or below the line?

11. **Fancy curls or loops**: Have either of these been used?

12. **Placement of crosses on "t's" and dots on "i's"**: Have these crosses and dots been properly placed?

See *Handwriting Exemplars* on the next page.

Activity 2: Handwriting Exemplars



Activity 2: Handwriting Exemplars

4. Continuous or Interrupted writing of words:
   Continuous: The right of the people to be secure ...
   Interrupted: The right of the people to be S ecure
5. Connecting letters: Are capital and lowercase letters connected
   John F. Kennedy W. C. Fields
6. Lettering Complete: Does the letter begin and end on the page
   The right of the people (incomplete)
7. Unusual Letter Formation: Mixed printed & cursive
   The right of the people to be secure in their
   persons, houses, papers, and effects ...
8. Pen or pencil pressure:
   Light: The right of the people to be secure ...
   Medium: The right of the people to be secure ...
   Heavy: The right of the people to be secure ...
9. Slant: To the left, right or mixed
   Right: The right of the people
   Left: The right of the people
   Variable: The right of the people to be Secure
10. Text on line: Is the writing on the line, above the line, or below the line?
11. Fancy curls or Loops:
    Fancy Curls Loops D's or Special letters
12. Placement of crosses on t's and dots on i's:
    The right of the people to be secure ...
    The right of the people to be secure ...

Activity 2: Suspect Handwriting Samples

EXHIBIT B

Suspect #1	Im Sorry about the jar The cookies were delicious
Suspect #2	I'm sorry about the jar. The cookies were delicious.
Suspect #3	I'm sorry about the jar the cookies more delicious
Suspect #4	I'm Dany abut the jar the cokies mere delicias

Lesson 1

Activity 2: Handwriting Analysis Summary

EXHIBIT B

Determine whether or not the following characteristics are present for each sample of handwriting provided.

Characteristic	Sample #1	Sample #2	Sample #3	Sample #4	Crime Scene Note
Are letters neat or shaky?	neat	neat	neat	neat	neat
Is left margin even?	no	yes	no	yes	yes
Are capital and lower-case letters connected?	yes	yes	yes	yes	yes
Are letters of each word continuous?	yes	yes	yes	no	no
Is there a mix of printed letters and cursive letters?	no	no	no	yes	yes
Do all letters slant to the right?	no	yes	no	no	no
Is writing on the line?	yes	no	yes	yes	yes
Do letters have fancy curls or loops?	no	no	no	yes	yes
Is the crossing of "t's" and dotting of "i's" correct?	yes	no	yes	yes	yes

1. Which writing sample shows the most similarities to the questioned document (the note found at the crime scene)? #4

2. Are there any other samples that are somewhat similar? Yes

Copy of the Crime Scene Note

I'm sorry about your
the cookies were delicious

Student Book 8

Lesson 1

Wrap-up Activity: Student Handwriting Samples

1. Examine your own handwriting by copying the following sentence: "Have members of your group copy this sentence and then trade papers with a partner to analyze each other's handwriting."

2. Exchange activity books with your partner.

3. On the chart below, determine which characteristics are present.

Answer the following:

Are letters neat or shaky?	
Is the left margin even?	
Are capital and lower-case letters connected?	
Are letters of each word continuous?	
Is there a mix of printed and cursive letters?	
Do all letters slant to the right?	
Is the writing on the line?	
Do letters have fancy curls or loops?	
Is the crossing of "t's" and dotting of "i's" correct?	

THE WHITE STUFF

Lesson 3

The White Stuff: White Substances and Toxicology

Objectives

Students will:

- Be introduced to the field of toxicology and its role in forensic science
- View, describe and analyze unknown substances
- Compare and contrast the characteristics of unknown substances in order to match like substances

Materials

Instructor:

- 1 bottle of iodine solution & dropper
- 1 bottle of vinegar
- 1 permanent marker
- 20 dropper bottles for filling
- 1 large container of water
- 5 plastic bags filled with white powders

Students (per group of three):

- Student Book pages (on Resource CD)
- 5 pieces of black paper
- 1 foam plate
- 1 hand lens
- 5 portion cups
- 1 permanent marker
- 1 dropper bottle of water
- 1 dropper bottle of vinegar
- 5 wooden splints
- 3 pencils

Preparation

1. Fill 10 dropper bottles with water. Label these bottles with "W."
2. Fill 10 dropper bottles with vinegar. Label these bottles with "V."
3. Assemble supplies for each group.
4. Set up a chemical distribution center. This will be a space where all five white powders are stored in plastic bags. Students will need to visit the chemical distribution center to retrieve their samples.

Material Use and Safety

Instructor should handle iodine solution very carefully. It can stain skin and clothing. If spilled, rinse quickly with water. Store iodine upright with lid sealed.

Do not contaminate or mix powders during the lab. This will nullify your results. To prevent contamination, be sure to use a clean splint in each bag. Do not cross splints from one bag to another.

Notes for the Instructor

A **toxicologist** is a scientist who studies the effects of chemicals in living things. Toxicologists will be called into an investigation if a victim is found injured or dead and alcohol, drugs or poisons are suspected. Toxicologists will also assist during investigations where unknown substances are found at the crime scene – for example, in medicine bottles or any loose powders at the scene. Toxicologists must identify the substances found, determine how much of the substance is present, and explain what effect(s) the substances may have on a person or its relationship, if any, to the crime.

When someone is suspected of being poisoned with an unknown substance, the toxicologist will begin by recording physical symptoms of the person. Are they conscious? Groggy? Extremely agitated? These symptoms are clues that will help identify the substance.

Next, toxicologists can test the person's body to learn more about the unknown substances. Alcohol, drugs and poisons can be detected in the blood or urine of a person. Urine samples are preferred because drugs show up at higher levels and last longer in urine than they do in blood. Additionally, hair can tell the story of drugs or poisons. Chemicals in the bloodstream can be transferred to growing hair.

Toxicologists can look for substances in living or dead people. However, samples taken from a living person are more difficult to interpret than samples taken from a deceased individual. This is because a living person's drug levels drop rapidly as the drug or poison is processed in their body and eliminated. In contrast, drug and poison levels do not change much after death since the body systems are no longer working.

In this activity, students will analyze the chemical characteristics of four unknown white powders. Although all of these substances are non-toxic, household items, this is a great time to teach your students lab safety.

1. Never eat anything you are using in a science lab.
2. Follow procedures exactly to ensure results.
3. Properly dispose of all materials at the end of the lab.

Students will be analyzing the unknown white substance found at the cookie jar crime scene. They will also analyze four samples connected to the suspects. Through observation, comparing and contrasting, students will attempt to match one of these substances found at the crime scene to a suspect.

Again, this is an example of class evidence, or evidence that can help narrow down the field of suspects, but cannot pinpoint a specific individual. The white powder is also what is known as **trace evidence**. Trace evidence is any small amount of hair, skin, fabric or other material that may link a suspect to a crime scene.

The activities in this lesson address Next Generation Science Standards practices of Planning and Carrying Out Investigations and Analyzing and Interpreting Data. In addition, they address Common Core Learning Standards. See the appendix on page 105 for more details.

Notes for the Students

Hello investigators! You have successfully analyzed the crime scene note for any insight it might provide our case. Today we focus our efforts on a mysterious white substance that was found at the cookie jar crime scene. Amidst all of the things Mrs. Randall swept off the floor that day is a white powder. As soon as Mrs. Randall realized what she was looking at, she made sure to collect the powder for your examination. Investigators also found different types of white powders in connection to each of the four suspects.

This white powder is **trace evidence**. Trace evidence is any small amount of hair, skin, fabric, or any other material, which may link a suspect to the crime scene. Keep in mind that when any unknown substance is found, it has the potential to be dangerous. Forensic scientists must work carefully to determine what type of material has been found.

Toxicology is the study of how different substances affect living things. In forensics, many of the substances you will deal with are **poisons**, meaning they can injure or even kill a person. Rest assured that all of the substances you work with today are harmless, however, it is important that you maintain strict lab safety rules:

1. Never eat anything you are using in a science lab.
2. Follow procedures exactly to ensure results.
3. Properly dispose of all materials at the end of the lab.

Drug identification is a very important part of forensic science. Fatal (also called lethal) doses of drugs have been studied since ancient Greece when Socrates drank an extract of hemlock, which led to his death. Various types of death by poisoning are studied by a forensic chemist called a **toxicologist**. Drugs may not always be the cause of a death but they may be a contributing factor in a death.

One of the jobs of toxicologists today is to analyze a victim's body to determine if a poison was present in large enough amounts to cause death. To find **toxins**,

the toxicologist examines human body tissue. The liver, the liquid inside the eyeball, fingernails and even hair can show the presence of different toxins.

If a person who is being tested for toxins is alive, blood and urine samples are most often used. Our bodies process drugs and poisons rather quickly, and we continually eliminate toxins; therefore, there is only so much time available to test for these. If the person being tested has died, time is not as much of a concern. Drug and poison levels do not change much in a dead person.

Substance identification is also important in the analysis of a crime scene. In 1775, Karl Scheele discovered a way to test for the presence of arsenic, a deadly poison. This was the first time a chemical test was used to determine if death was caused by a toxin (poison) entering the body of the victim.

As we have said, a white powder was found at the cookie jar crime scene. A similar powder was collected from the clothing of one of our suspects. Your role as a toxicologist today will be to perform several chemical tests to help identify the white powder found at the scene. Is this the same powder as found on any of the suspects? Can the powder be matched through chemical testing? Let's get started so we can find out.

Vocabulary

Chemical indicator: a chemical that changes color showing the presence of some unknown material

Crystal: a natural formation of a chemical. This could be a small cube like an individual piece of sugar or salt

Poison: a substance that can injure or kill a living thing

Toxicology: the study of substances and their effects on living things

Toxicologist: a scientist that studies substances and their effect on living things

Toxin: a poisonous substance that is a specific product of the metabolic activities of a living organism

Trace evidence: any small amount of hair, skin, fabric or any other material that may link a suspect to a crime scene

Activity 1: Chemical Summary

40 minutes

1. Read "Notes for the Students" section to class.
2. Divide students into groups of three. Hand out one set of materials per group.
3. Ask students to use the permanent marker to label the five portion cups as follows: S#1 (Sample #1), S#2 (Sample #2), S#3 (Sample #3), S#4 (Sample #4), C.S. (Crime Scene Sample).
4. Invite one group at a time to the chemical distribution center. Groups should bring a foam plate to carry the five empty labeled cups and five wooden splints. Using a clean wooden splint each time, students should scoop a small amount (pea size) of each sample from its container and place it in the corresponding portion cup. *It is very important that students use a clean splint for each chemical.*
5. After students return to their seats, they should place one portion cup at the top edge of each of the five pieces of black paper.
6. Next, students should scoop a very small amount from each portion cup onto the sheet of black paper. They should examine each sample with the hand lens.
7. On the *Activity 1: Powder Samples* Chart on Student Book page 20 have students fill in the top two rows for each sample by describing the substance's appearance and completing a sketch.
8. Have students add five drops of water to each sample in its cup and stir using the wooden splint. Does the sample dissolve (seem to

disappear)? Students should record the results on the chart. Be sure not to let the water dropper touch the samples.

9. Have students add two drops of vinegar to each sample in its cup. Do any bubbles form? In which sample(s)? Students should record the results on the chart.

10. Instructors should walk around to each group and add two drops of iodine to each sample in the cup. Does the brown color remain or does it change to blue-black? Record the results on the chart.

Wrap-up
10 minutes

1. Refer students to the activity sheet. Do any of the four powders match the one found at the crime scene?

2. We are treating these white powders as if they were toxic substances. Discuss some of the things a scientist should not do when testing substances. (A scientist should never sniff, touch, taste, or look too closely at a suspicious substance. Discuss why.)

3. We have been officially informed that the substance found on the suspect is not poisonous or harmful in anyway. What might it be? How did it get on the suspect's clothing? Hint: students in Mrs. Randall's school take a series of classes called "Home and Careers."

4. Is the evidence today an example of class evidence or evidence that can point to a specific individual? Discuss your ideas.

Clean-up
10 minutes

- Cups, black papers, and remaining white substances can be safely thrown in the trash.
- Have students return all reusable materials to the kit (foam plates must be wiped clean and reused).
- Make sure to store iodine upright and with the lid sealed.
- Wipe down any surfaces used in this lesson.

Other Directions, Discussions and Destinations

1. Chemical indicators help us to identify the presence or absence of certain chemicals. A diabetic uses an indicator to check for the presence of sugar in his/her urine or blood. Interview a pharmacist or research online to find out about glucose test strips.

2. Swimming pools are tested with chemical indicators. Is there a pool in your community? Students could ask the individual in charge or a lifeguard how and why the water is tested.

3. Toxicologists often encounter poisons during their work. What do you know about poisons? Check out https://www.poison.org/poison-prevention-by-substances.

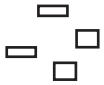
4. You can learn a poison prevention song (a "jingle") in English or Spanish by visiting www.poison.org/jingle/.

5. Learn all about a career in toxicology (and check out the other science career links) on this USDA page http://www.agriculture.purdue.edu/USDA/careers/toxicologist.html.

You can find more resources and the most up-to-the-minute links by visiting our website at CommLearning.com and clicking on The Cookie Jar Mystery course kit.

Activity 1: Powder Samples

Use the chart below to compare the five white powders associated with the crime scene.

	Sample #1	Sample #2	Sample #3	Sample #4	Crime Scene Sample
Appearance of sample (powder or crystals)	*crystals*	*crystals*	*powder*	*powder*	*powder*
Sketch what you see					
Dissolves in water (yes or no)	*yes*	*yes*	*no*	*no*	*no*
Reaction with vinegar forms bubbles (yes or no)	*no*	*no*	*no*	*yes*	*no*
Color after iodine added (brown or blue-black)	*brown*	*brown*	*blue-black*	*brown*	*blue-black*

1. Which powder(s) is similar in appearance to the one found at the crime scene? What properties do they share?

#3- They are both powders. They do not dissolve in water. They do not react with vinegar. They turn blue-black when iodine is added.

2. Which powder(s) reacted the same way as the crime scene sample to the chemical test with water?

#3 and #4

3. Which powder(s) reacted the same way as the crime scene sample to the chemical test with vinegar?

#1, #2 and #3

4. Which powder(s) reacted the same way as the crime scene sample to the chemical test with iodine?

#3

5. Which powder do you think is most like the powder found at the crime scene?

#3