

CURRICULUM

FOR

FORENSICS

GRADES 11 - 12

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Dr. Susan Dube, Program Supervisor of Science and Technology Education

The Board acknowledges the following who contributed to the preparation of this curriculum.

Rima Patel

Dr. Tiffany A. Beer, Director of Curriculum and Instruction

Subject/Course Title:
Forensics
Grades 11 - 12

Date of Board Adoption:
September 21, 2021

RAHWAY PUBLIC SCHOOLS CURRICULUM

Forensic Science – Grades 11 & 12

PACING GUIDE

Unit	Title	Pacing
1	Introduction to Forensic Science & the Law	2.5 weeks
2	Evidence Collection & Crime Scene Investigation	2 weeks
3	Forensic Anthropology & Odontology	1.5 weeks
4	Hair & Fiber Analysis	1 week
5	Serology (Blood & Blood Spatter)	2 weeks
6	DNA Analysis & Profiling	2 weeks
7	Firearms, Tool Marks, & Ballistics	2 weeks
8	Document & Handwriting Analysis	2 weeks
9	Drugs & Drug Analysis	2 weeks
10	Fingerprints	3 weeks

ACCOMMODATIONS

<p>504 Accommodations:</p> <ul style="list-style-type: none"> ● Provide scaffolded vocabulary and vocabulary lists. ● Provide extra visual and verbal cues and prompts. ● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. ● Provide links to audio files and utilize video clips. ● Provide graphic organizers and/or checklists. ● Provide modified rubrics. ● Provide a copy of teaching notes, especially any key terms, in advance. ● Allow additional time to complete assignments and/or assessments. ● Provide shorter writing assignments. ● Provide sentence starters. ● Utilize small group instruction. ● Utilize Think-Pair-Share structure. ● Check for understanding frequently. ● Have student restate information. ● Support auditory presentations with visuals. ● Weekly home-school communication tools (notebook, daily log, phone calls or email messages). ● Provide study sheets and teacher outlines prior to assessments. ● Quiet corner or room to calm down and relax when anxious. ● Reduction of distractions. ● Permit answers to be dictated. ● Hands-on activities. ● Use of manipulatives. ● Assign preferential seating. ● No penalty for spelling errors or sloppy handwriting. ● Follow a routine/schedule. ● Provide student with rest breaks. ● Use verbal and visual cues regarding directions and staying on task. ● Assist in maintaining agenda book. 	<p>IEP Accommodations:</p> <ul style="list-style-type: none"> ● Provide scaffolded vocabulary and vocabulary lists. ● Differentiate reading levels of texts (e.g., Newsela). ● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. ● Provide extra visual and verbal cues and prompts. ● Provide links to audio files and utilize video clips. ● Provide graphic organizers and/or checklists. ● Provide modified rubrics. ● Provide a copy of teaching notes, especially any key terms, in advance. ● Provide students with additional information to supplement notes. ● Modify questioning techniques and provide a reduced number of questions or items on tests. ● Allow additional time to complete assignments and/or assessments. ● Provide shorter writing assignments. ● Provide sentence starters. ● Utilize small group instruction. ● Utilize Think-Pair-Share structure. ● Check for understanding frequently. ● Have student restate information. ● Support auditory presentations with visuals. ● Provide study sheets and teacher outlines prior to assessments. ● Use of manipulatives. ● Have students work with partners or in groups for reading, presentations, assignments, and analyses. ● Assign appropriate roles in collaborative work. ● Assign preferential seating. ● Follow a routine/schedule.
<p>Gifted and Talented Accommodations:</p> <ul style="list-style-type: none"> ● Differentiate reading levels of texts (e.g., Newsela). ● Offer students additional texts with higher lexile levels. ● Provide more challenging and/or more supplemental readings and/or activities to deepen understanding. ● Allow for independent reading, research, and projects. ● Accelerate or compact the curriculum. ● Offer higher-level thinking questions for deeper analysis. ● Offer more rigorous materials/tasks/prompts. ● Increase number and complexity of sources. ● Assign group research and presentations to teach the class. 	<p>ELL Accommodations:</p> <ul style="list-style-type: none"> ● Provide extended time. ● Assign preferential seating. ● Assign peer buddy who the student can work with. ● Check for understanding frequently. ● Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc...). ● Have student repeat directions. ● Make vocabulary words available during classwork and exams. ● Use study guides/checklists to organize information. ● Repeat directions. ● Increase one-on-one conferencing. ● Allow student to listen to an audio version of the text. ● Give directions in small, distinct steps.

<ul style="list-style-type: none"> ● Assign/allow for leadership roles during collaborative work and in other learning activities. 	<ul style="list-style-type: none"> ● Allow copying from paper/book. ● Give student a copy of the class notes. ● Provide written and oral instructions. ● Differentiate reading levels of texts (e.g., Newsela). ● Shorten assignments. ● Read directions aloud to student. ● Give oral clues or prompts. ● Record or type assignments. ● Adapt worksheets/packets. ● Create alternate assignments. ● Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. ● Allow student to resubmit assignments. ● Use small group instruction. ● Simplify language. ● Provide scaffolded vocabulary and vocabulary lists. ● Demonstrate concepts possibly through the use of visuals. ● Use manipulatives. ● Emphasize critical information by highlighting it for the student. ● Use graphic organizers. ● Pre-teach or pre-view vocabulary. ● Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. ● Provide audio versions of the textbooks. ● Highlight textbooks/study guides. ● Use supplementary materials. ● Give assistance in note taking ● Use adapted/modified textbooks. ● Allow use of computer/word processor. ● Allow student to answer orally, give extended time (time-and-a-half). ● Allow tests to be given in a separate location (with the ESL teacher). ● Allow additional time to complete assignments and/or assessments. ● Read question to student to clarify. ● Provide a definition or synonym for words on a test that do not impact the validity of the exam. ● Modify the format of assessments. ● Shorten test length or require only selected test items. ● Create alternative assessments. ● On an exam other than a spelling test, don't take points off for spelling errors.
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UNIT OVERVIEW

Content Area: Forensic Science

Unit Title: Introduction to Forensic Science and the Law

Target Course/Grade Level: 11 / 12

Unit Summary: In this unit, forensic science is introduced, along with some of the fundamental concepts of criminalistics. A broad overview of the forensic sciences, including a discussion of the relationship of forensic science to science as an enterprise, a brief history of the origins of forensic science, and the basic ideas of criminalistics will be covered. The way in which scientific examinations relate to the justice system and the law is also presented.

Approximate Length of Unit: 2.5 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HSETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **HSETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Science and Engineering Practices

Asking Questions and Defining Problems. ...
Developing and Using Models. ...
Planning and Carrying Out Investigations. ...
Analyzing and Interpreting Data. ...
Using Mathematics and Computational Thinking. ...
Constructing Explanations and Designing Solutions. ...
Engaging in Argument from Evidence.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- Everyone will analyze things differently even when presented with the same situation.
- Define observation, and describe what changes occur in the brain while observing.
- Describe examples of factors influencing eyewitness testimony of events.
- How crime labs in the United States are organized and what services they provide.
- The growth and development of forensic science through history.
- Basic types of law in the criminal justice system.

Unit Essential Questions:

- How is forensic science used in prosecuting/convicting criminals?
- Why are the principles of forensic science necessary in investigating and solving crimes?
- What are observations and how are they used in forensics?
- Why would two people perceive a crime scene in different ways?

Knowledge and Skills:

Students will know...

- Key definitions: analytical skills, deductive reasoning, eyewitness, fact, criminalistics, evidence, ballistics, odontology, pathology, entomology, common law, civil law, criminal law, misdemeanor, felony, probable cause, violation, infraction, and Miranda rights
- What factors influence eyewitness accounts for testimonies?
- How to practice and improve personal observation skills.
- History of how forensic science developed

Students will be able to...

- Describe how the scientific method is used to solve forensic problems.
- Describe different jobs done by forensic scientists and the experts they consult.
- Students will understand basic types of law in the criminal justice system.

- Students will analyze and examine the trial case of O.J. Simpson. They will research the case and come to conclusions about the trial.
- Describe what changes occur in the brain while observing.
- Describe examples of factors influencing eyewitness accounts of events.
- Compare the reliability of eyewitness testimony to what actually happened.
- Students will understand the growth and development of forensic science through history.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- “Forensics Timeline Poster”. Each group will choose a significant historical figure and his/her contribution to forensics and research that person and then students will present their findings.
- Students will analyze the forensic evidence from a trial and draw conclusions supported by the evidence.
- Use FACES in the computer lab to recreate victim images based on observations.
- Complete a formative assessment on vocabulary words from the chapter

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Introduction to Forensic Science and the Law PowerPoint presentation
- Role playing victim vs. suspect with classmates as judges
- Metric Measurement Lab - Bertillonage measurements
- How an Autopsy Works WebQuest (<http://science.howstuffworks.com/autopsy.htm>)
- Observation activity – observe an image for a period of time and answer questions based on the image
- FACES Computer Lab Recreation
- Case study on Carlo Ferrier & OJ Simpson
- EdPuzzle on Autopsies

RESOURCES

Teacher Resources:

- Criminalistics – An Introduction to Forensic Science
- Google Classroom

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Computer Lab access with FACES program

UNIT OVERVIEW

Content Area: Forensic Science

Unit Title: Evidence Collection & Crime Scene Investigation

Target Course/Grade Level: 11/12

Unit Summary: How is it possible to identify the person who committed a crime? A single hair or clothing fiber can allow a crime to be reconstructed and lead police to the responsible person. The goal of a crime-scene investigation is to recognize, document, and collect evidence at the scene of a crime. Solving the crime will then depend on piecing together the evidence to form a picture of what happened at the crime scene. Forensic science begins at the crime scene, which can provide useful information that must be carefully, systematically, scientifically, and legally collected. If the crime scene is not treated carefully, it can make vital information not only useless, but even deceptive, pointing an investigation in the wrong direction. The main reason to carefully gather and analyze the crime scene is to learn what happened and to gather evidence that can be used to identify and, ultimately, convict the people responsible.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HSETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **HSETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- **HSETS1-4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **HSETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and

propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

Unit Understandings:

Students will understand that...

- All evidence no matter how big or small can still be useful in recreating a crime scene
- Each crime scene will look different but still must be processed in a similar manner
- The difference between direct and circumstantial evidence
- The value of direct and indirect evidence in a court of law.
- The eyewitness accounts have limitations.
- What physical evidence can and cannot prove in court.
- What Locard's principle of exchange is
- The steps to take when processing a crime scene.
- What type of evidence determines what packaging should be used
- Chain of custody must be preserved in order to maintain communication of evidence

Unit Essential Questions:

- Why is testimonial or direct evidence valuable?
- Why must a crime scene be secured and processed in a specific way?
- How is the location and handling of evidence essential to crime scene investigation?
- How is a crime scene processed?
- How is physical evidence classified?
- Why is physical evidence valuable and how is it classified?
- What is trace evidence?

Knowledge and Skills:

Students will know...

- Key definitions: chain of custody, circumstantial evidence, class evidence, first responder, primary crime scene vs secondary crime scene, trace evidence, testimonial evidence, physical evidence, indirect evidence, circumstantial evidence, questioned sample, known sample, control sample, individual evidence, crime scene, modus operandi, and chain of custody.

Students will be able to...

- Explain the difference between indirect and direct evidence.
- Identify four examples of trace evidence.
- Summarize the seven steps of a crime scene investigation.
- Identify the methods by which a crime scene is documented.

- Demonstrate proper technique in collecting and packaging trace evidence.
- Explain what it means to map a crime scene.
- Describe what is meant by physical evidence and give examples.
- Distinguish individual evidence from class evidence.
- Determine the significance of class evidence.
- Isolate, record, and search for evidence at a mock crime scene.
- Collect and package evidence at a mock crime scene using proper forensic procedures.
- Students will understand how crime labs in the United States are organized and what services they provide

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment: Crime Scene Skits:** Students will break up into groups and create and perform a crime skit. The skits should be 5 minutes long and include a crime, a setting, a victim, a perpetrator, and dialogue. Two to three class periods may be spent writing the skits, assigning roles, gathering props and rehearsing and timing the skits.
- Students in class watching will be asked to answer the following questions about each skit:
 - 1. Where did the crime take place? (Describe the imaginary setting)
 - 2. Describe the victim. What was he or she wearing?
 - 3. Describe the perpetrator. What was he or she wearing?
 - 4. Re-create any dialogue you might remember.
 - 5. Describe any other participants.
 - 6. Give any other information related to the crime.
- A class discussion will follow, noting which scenes were most memorable and why. If a weapon was involved, did it influence the witness? If some groups had more participants was it easier or harder to remember details?
- Students will complete a comprehensive exam on the unit, which will be composed of multiple choice, true/false, fill in the blank, short answer, essay and lab practical questions.
- Students will conduct research on their local and state crime labs. In the form of an essay. Students will address the following: 1. Location of the labs 2. Number of people employed in the labs 3. Services provided 4. Number of cases processed per year 5. The most common types of evidence analyzed

Crime Scene Observation and Sketch Activity

- Students will analyze the classroom as a crime scene and will sketch it from a bird's eye point of view. Teacher will set up a fake victim station and students will record that in their drawing. All drawings must be to scale and must include a compass and a legend.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Types of Evidence PowerPoint presentation
- Can this evidence be individualized? Lab
- Research how thermal imaging helped to locate the alleged Boston Marathon bomber
- Create crime scene sketches (rough and final draft)

- Students will find and research a case where the crime scene was compromised. A one page report should provide a synopsis of the crime, the case and how it was botched.
- Students will be given three crime scenarios to read and review. They will then consider how each of the crime scenes was handled and write a brief review of each account noting mistakes made and how proper crime scene processing should have been applied.
- Lillian Oetting Case Study
- Innocence Project

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Sketching material

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Forensic Anthropology & Odontology

Target Course/Grade Level: 11/12

Unit Summary: Anthropology is the study of humankind including anatomy, variability, evolution, and culture. Forensic anthropology is a type of applied physical anthropology that specializes in the human skeletal system and its changes and variations, for purposes of legal inquiry and ultimately for presentation in the courts of law. A forensic anthropologist can use knowledge of the skeletal system to identify crime victims and sometimes to determine the cause or circumstances of death. The forensic anthropologist can apply information learned from modern forensic cases to the study of skeletons that are hundreds or even thousands of years old.

Approximate Length of Unit: 1.5 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-LS1- 1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- **HS-LS1- 2.** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

Unit Understandings:

Students will understand that...

- A child's skeleton and an adult skeleton are very different in terms of composition, number of bones, stature marks, and growth plates.
- Anthropologists can use bones to determine whether remains are human; to determine the sex, age, and sometimes race of individual; to estimate height; and to determine when the death may have occurred.
- Various methods are used to analyze skeletal remains, including radiology, computer imaging, DNA technology, video or photographic superimposition, and craniofacial reconstruction.
- Different types of skeletal trauma exist due to disease, injuries, occupation, or environmental factors that can provide clues to the identification of skeletal remains.
- What type of evidence do bite marks provide

Unit Essential Questions:

- How can forensic anthropologists use skeletal remains to determine the cause, time and identity of an individual?
- How is the location and handling of evidence essential to crime scene investigation? How is evidence used to determine whether a crime has been committed? How are various types of evidence tested and analyzed?

Knowledge and Skills:

Students will know...

- Key definitions: odontology, forensic anthropology, osteology, osteoporosis, scoliosis, femur, tibia, humerus, radius, joints, ventral arc, epiphyses, diaphysis, iliac crest, sutures, symphysis, Caucasoid, negroid, mongoloid, Ted Bundy.
- What the functions of a skeletal system are.

Students will be able to...

- Describe how bone is formed.
- Distinguish between male and female skeletal remains based on the structure, size and shape of the skull, the pelvis, and the long bones.
- Describe how bones contain a record of injuries and disease.
- Describe how a person's approximate age could be determined by examining his or her bones.
- Explain the differences in facial structures among different races.
- Describe the role of mitochondrial DNA in bone identification.
- Summarize the information a forensic anthropologist derives from skeletal remains to construct a biological profile.

- Apply knowledge of bone growth to estimate the age of the deceased at the time of death based on skeletal remains.
- Apply appropriate formulas to estimate the height of a person based on individual bone length.
- Learn to analyze bite mark

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment:**
 - Students will use bone growth to estimate the time of death on skeletal remains.
 - Students will use formulas to estimate the height of a person based on individual bone growth.
 - Students will be given a blank diagram of the human skeleton and asked to identify as many bones as possible.
 - Students will complete a comprehensive exam on the unit, which will be composed of multiple choice, true/false, fill in the blank, short answer, essay and lab practical questions.
 - Students will make bite mark impressions using paper plates and orange candy peanuts. Students will then compare individual peanuts to different plates and try to match up the teeth of various students.
 - Recreation of the skeletal system, students will be given a long sheet of white paper in which they will work together to create a life size image of all the bones.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Forensic Anthropology PowerPoint presentation
- Height Estimation Lab
- Determining Sex – Skull and Pubis Examination Lab
- Determination of Race – Skull Analysis Lab
- Missing Persons Bone Lab
- Ted Bundy Case Study
- Bite Mark Analysis Lab
- Anthropology EdPuzzle
- Bone Lab on GIZMO

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Skulls & Bones

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Hair & Fiber Analysis

Target Course/Grade Level: 11/12

Unit Summary: Investigators often find hair at the crime scene. Hair is considered class evidence and is useful in backing up other circumstantial evidence. The physical characteristics of hair can offer clues to the broad racial background of an individual. It can also adhere to clothes, carpets, and be transferred to other locations. Secondary transfer is particularly common with animal hair. Chemical tests can provide a history of the use of drugs and other toxins, indicate the presence of heavy metals, and provide an assessment of nutritional deficiencies. When the follicle of the hair is present, DNA evidence may be obtained. Fibers are everywhere. Because textiles are mass produced, it is difficult to trace a fiber back to a specific source, but fiber evidence is valuable because it creates links among victims, suspects, and places. Investigators identify and compare fibers physically, using microscopy, as well as chemically.

Approximate Length of Unit: 1 week

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-LS1- 1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- **HS-LS1- 2.** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **HS-LS3- 2.** Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

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9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the

data.

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Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

Unit Understandings:

Students will understand that...

- Hair is class evidence.
- Hair can be used to back up circumstantial evidence.
- Hair absorbs substances both from within the body and the external environment.
- The functions of hair as well the structure of hair.
- Why fibers are class evidence.
- How fibers can be used as circumstantial evidence to link the victim, suspect, and crime scene.
- Why statistics are important in determining the value of evidence.

Unit Essential Questions:

- How can hair be used as evidence in a crime investigation?
- How can fiber be used as evidence in a crime investigation?

Knowledge and Skills:

Students will know...

- Key definitions: Comparison microscope, hair follicle, hair shaft, keratin, nuclear DNA, morphology, cuticle, cortex, medulla, anagen phase, catagen phase, telogen phase, melanin.
- Key definitions: fibers, textiles, generic, fabric, filaments, inorganic, yarn, warp, weft, blend, helix, direct transfer, monomer, polymer, natural fiber, synthetic fiber, textile.

Students will be able to...

- Successfully use a compound microscope.
- Describe variations in the structure of the medulla, cortex, and cuticle.
- Tell the difference between human and animal hair.
- Tell which characteristics of hair are important for forensic analysis.
- Assess the probative value of hair samples.
- Identify questions and ideas that guide scientific investigations.

- Describe variations in the structure of the medulla, cortex, and cuticle.
- Determine if two examples of hair are likely to be from the same person.
- Distinguish and identify different types of fibers.
- Identify and describe common weave patterns of textile samples.
- Compare and contrast various types of fibers through physical and chemical analysis.
- Apply forensic science techniques to analyze fibers .

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

End of Unit Assessment:

- Hair Lab (students will study their own hair under a microscope)
- Hair testimony essay
- Sketching human hair and animal hair from under a microscope
- Analyzing various fabrics from students closets
- Matching Fibers Activity
- Sketching different fibers lab
- Atlanta murderer Wayne Williams case study
- End of unit quiz

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Hair PowerPoint presentation
- Microscopic Analysis of Hair Lab
- Animal Hair Lab
- Biology of hair (how is hair made video)
- How it’s made – Fibers <http://www.youtube.com/watch?v=YYWlevX7Kw0>
- Fiber Analysis – reading and comprehension questions
- Fiber Comparison Lab
- Fiber Identification Lab
- Wayne Williams Case Study & Questions
- Hair EdPuzzle

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Compound Microscope
- Hair & Fiber microscope slides

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Serology (Blood & Blood Spatter)

Target Course/Grade Level: 11/12

Unit Summary: Blood left at a crime scene can be analyzed in several ways by a criminal investigator. Blood typing may provide class evidence because more than one person has the same blood type. Because white blood cells contain DNA, it is possible to determine with a high degree of certainty using DNA profiling whether evidence of blood left at a crime scene matches the blood of a suspect or victim. Blood spatter evidence can also be used to help recreate a crime scene to validate the information provided by a witness or suspect. By using blood spatter, it is possible to discern the direction from which the blood originated, the angle of impact, and the point of origin of the blood. Further examination of the blood drops might indicate if the blood spatter resulted from a high or low velocity impact, indicating the type of weapon used to cause the injury.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-PS1-5.** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- **HS-PS2-3.** Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
- **HS-LS1-1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.

9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- That an antibody and an antigen of different types will agglutinate, or clump, when mixed together.
- That blood evidence's significance depends on a characteristic's relative occurrence in the population.
- Describe the forensic significance of different types of blood cells.
- The history of the use of blood and blood spatter analysis in forensics.
- How to screen for the presence of human blood.

Unit Essential Questions:

- How is blood evidence properly collected, preserved and packaged?
- How is blood identified and used as evidence at a crime scene?

Knowledge and Skills:

Students will know...

- Key definitions: hemoglobin, area or origin, passive drop, satellite, spine, swipe, wipe, serum, antigens, agglutinate, antiserum, serology, plasma, leukocytes, ABO, Rh factor, blood factors, secretors, area of convergence, impact angle.

Students will be able to...

- Explain the composition of blood.
- Describe the functions of blood cells.
- Explain how to determine whether a stain is blood.
- Calculate the probability of a person having a specific blood type, using data from population studies.
- Describe the proper procedures for handling blood evidence.
- Describe how different types of blood spatter patterns are formed.
- Explain how to determine the blood type of a simulated bloodstain using the ABO/Rh system.
- Explore bloodstain patterns as a function of velocity, direction, and height of fall.
- Use blood-spatter evidence to recreate the events at a crime scene.

<i>EVIDENCE OF LEARNING</i>

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

End of Unit Assessment:

- Blood spatter Chart
- Multiple Alleles in Blood Group worksheets
- Students will complete a comprehensive exam on the unit, which will be composed of multiple choice, true/false, fill in the blank, short answer, essay and lab practical questions.
- Functions of blood reading and questions
- Calculating angle of impact using math
- Vertical Drip Pattern Activity
- Blood spatter on various surfaces lab

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Serology and Blood Spatter PowerPoint presentations
- Animal Blood Lab
- Blood spatter Video
- Bloodstain Diameter, Surface and Distance Lab
- Blood Drop Volume Lab
- Angle of Impact Lab
- Blood Drop on Various Surfaces Lab
- Punnett Squares for blood typing activity
- Blood Identification GIZMO
- Blood Spatter Analysis: Effect of Height on Blood Drops
- Case Study - Jeffrey Dahmer

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Compound Microscope with blood slides
- Simulated Drip Blood
- Blue light

UNIT OVERVIEW

Content Area: Forensics

Unit Title: DNA Analysis & Profiling

Target Course/Grade Level: 11/12

Unit Summary: Except for identical twins, no two people have the same DNA. Advances in DNA technology have allowed criminal cases to be solved that previously were thought unsolvable. Since the 1980's, DNA evidence has been used to investigate crimes, establish paternity, and identify victims of war and large scale disasters. Because each human is unique, DNA evidence from a crime scene or from an unidentified body can be traced back to one and only one person. DNA evidence can be used to link a suspect to a crime or to eliminate a suspect. It can also be used to identify a victim, even when nobody can be found.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-LS1-1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- **HS-LS3-1.** Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- **HS-LS3-3.** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- **HS-LS3-2.** Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
- **HS-LS4-1.** Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

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9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

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NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

Unit Understandings:

Students will understand that...

- That DNA is a long-chain polymer found in nucleated cells, which contain genetic information.
- That DNA can be used to identify or clear potential suspects in crimes.
- How DNA is extracted and characterized.
- Uses of DNA evidence for matching
- The process of gel electrophoresis.
- The process of PCR (polymerase chain reaction) for replication and analysis of DNA

Unit Essential Questions:

- How is DNA analyzed and used as evidence at a crime scene?
- Why is DNA the most useful in forensics?

Knowledge and Skills:

Students will know...

- Key definitions: allele, karyotype, chromosomes, DNA, genes, proteins, hydrogen bonds, helix, amino acids, enzymes, restriction, enzymes, electrophoresis, mitochondrial DNA

Students will be able to...

- Compare DNA fingerprints for matching.
- Explain how DNA can be important to criminal investigations.
- Explain how crime-scene evidence is collected from DNA analysis.
- Explain how law-enforcement agencies compare new DNA evidence to existing DNA evidence.
- Compare and contrast a gene and a chromosome, and an intron and an exon.

- Use a DNA fingerprint to determine if specimens come from related or unrelated individuals.
- Use a DNA fingerprint to identify DNA from a parent, child, or relative of another person.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

End of Unit Assessment:

- Students will explain the role of DNA in criminal investigations
- DNA analysis GIZMO
- Students will explain how crime scene evidence is collected for DNA analysis and how law enforcement agencies compare new DNA to database DNA.
- **Paper:** Both Sides of the Issue; Establishment of a DNA Databank: Students will write a paper analyzing the arguments for and against the establishment of a DNA databank to gain an understanding of both sides of the issue, and to get experience identifying and defending the side of the issue you disagree with.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- DNA PowerPoint Presentation
- DNA Fingerprinting WebQuest
- DNA GIZMO
- Case Study - Colin Pitchfork, Tommie Lee Andrews, and Ian Simms
- Punnett Squares activity
- Students will research different victims who have been freed from a crime due to DNA evidence (Innocence project website from chapter 1)
- Cheek Swab Lab - Simple DNA Extraction
- STR Identification of a September 11 Victim

RESOURCES

Teacher Resources:

- Google Classroom
- Criminialistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Lab materials for cheek swab lab (cotton swabs, slides, etc.)
- Compound Microscope

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Firearms, Tool Marks, & Ballistics

Target Course/Grade Level: 11/12

Unit Summary: People, vehicles, and objects leave evidence of their presence at the crime scene in the form of a mark or an imprint. Impressions fall into three basic categories: patent, latent, and plastic. A tool mark is any impression, scratch or abrasion made when contact occurs between a tool and an object. The impressions made by these tools' could link the tool to a crime scene and ultimately to the tools owner. A significant part of studying firearms involves examining used bullets and their spent cartridge casings for individualizing markings left on them by the firearm that shot them.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force of a macroscopic object, its mass, and its acceleration.
- **HS-PS2-2.** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- **HS-PS2-3.** Apply scientific and engineering ideas to design, evaluate and refine a device minimizes the force on a macroscopic object during a collision.
- **HS-PS2-4.** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.

9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for

accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- How various types of impressions can be used as trace evidence?
- How to use track width and wheelbase information to identify vehicles.
- How tool mark evidence is collected, preserved, and documented.
- Role of ballistics recovery and examination at the crime scene.
- The sequence of events that occur once a trigger is pulled.

Unit Essential Questions:

- How are impressions made?
- How are tool marks analyzed and used as evidence at a crime scene?
- How is tool mark evidence collected, preserved and documented?
- What use do bullets serve at a crime scene?
- Why are bullets analyzed and used as evidence at a crime scene?

Knowledge and Skills:

Students will know...

- The composition of a gun.

- Key definitions: caliber, gauge, shot, slug, grains, rifled, lands, grooves, striations, extractor, ejector, magazine, chamber, cartridge, firearm, gunshot residue, pistol, revolver, rifle, and trajectory.
- Types of guns and bullets.

Students will be able to...

- Compare and contrast the different types of firearms, including: handguns, rifles, and shotguns.
- Estimate the trajectory of a projectile.
- Process and/or analyze a crime scene for firearm and ballistics evidence.
- Understand the role of ballistics recovery and examination
- Discuss how technology has improved the ability to obtain, compare, analyze, store, and retrieve firearm and ballistics evidence.
- Measure individual features of bullets and cartridge cases.
- Describe how a handgun works.
- Explain how bullets are test fired and matched.
- Distinguish between latent, patent, and plastic impressions.
- Explain how various types of impressions can be used as trace evidence.
- Describe how to make food, shoe, and tire impressions.
- Summarize steps of tool mark examinations and analysis.
- Match tool marks with the instrument that produced them.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

End of Unit Assessment: (brief description of assessment)

- **PAPER:** Both Sides of the Issue; Gun Control
 - Students will write a paper analyzing the arguments for and against the establishment of stricter gun control laws in the United States. Write one or two paragraphs briefly explaining the current gun control laws in the United States and the controversy surrounding the issue. Write a short statement of why there should or should not be stricter gun control laws. Write at least three paragraphs supporting the statement, using different sources.
- Students will explain how bullets are test fired and matched.
- Students will distinguish between latent, patent, and plastic impressions.
- Students will explain how various types of impressions can be used as trace evidence

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Firearms, Tool marks and Impressions PowerPoint Presentation
- Characterization of Bullets and Cartridge Casings Lab
- “Who Killed Lincoln” Movie and Questions
- Firearms Lab: Measuring and weighing bullets
- The Science of Firearms – reading and comprehension questions
- Firemarks, Tool marks and other impressions – reading and comprehension questions.
- How it’s made Bullets Video

- Case Study - Richard Crafts & Credit Union Break-in (New York state 2011)
- Bullet Trajectory Lab
- Case Study - Lee Harvey Oswald

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Lab materials - bullets, scale, ruler, etc.

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Document & Handwriting Analysis

Target Course/Grade Level: 11/12

Unit Summary: The examination of questioned documents covers many areas of investigation, including verifying handwriting and signatures; authenticating documents; characterizing papers, pigments, and inks used in writing instruments and copying machines; restoring erased and obliterated writing; and determining the relative age of documents and inks. Handwriting's individuality makes this type of physical evidence, like fingerprints, one of the few definitive tools available to the investigator.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-ETS1-1.**Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HSETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

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9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

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NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- That an expert analyst can individualize handwriting to a particular person.
- What types of evidence are submitted to the document analyst?
- Three types of forgery.
- How to characterize different types of paper.
- Different types of handwriting characteristics
- The types and impact of computer crime.

Unit Essential Questions:

- How are different types of evidence used in document analysis?
- Why are points of analysis used in handwriting analysis and comparison?
- How is forgery detected and prevented?

Knowledge and Skills:

Students will know...

- Key definitions: counterfeiting, currency, document expert, forgery, blind forgery, writing, watermark, chromatography, solute, solvent, computer forensics

Students will be able to...

- Characterize their own handwriting using 12 points of analysis.

- Detect deliberately disguised handwriting.
- List safeguards against the counterfeiting of the U.S. currency.
- Explain how a sample of handwriting evidence is compared with an exemplar using both qualitative and quantitative characteristics.
- Describe some limitations of handwriting analysis.
- Identify historical cases of document fraud and explain how the fraudulent document(s) were created.
- List and describe several ways in which businesses prevent check forgery.
- Compare and contrast older paper currencies with new currencies
- Recognize some of the methods of Internet fraud.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment:**

- **Handwriting Analysis Activity**

- Students will copy the Fourth Amendment in their own handwriting. They will then use the twelve points of comparison to analyze their own handwriting. Students will then exchange handwriting samples and complete a twelve point analysis of their partner's writing.

- **Fraudulent Document Activity**

- Students will be given a document that has been altered, their job will be to use what they have learned to determine and prove what parts of the document are fraudulent. Students will have to explain what methods they used to detect the forgery.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Simulated Forgery Lab
- Detecting Deliberately Disguised Handwriting Activity
- Analysis of Paper Activity
- Catch Me If You Can Movie Clip & Questions
- Ink Comparison Using Chromatography Paper Lab
- DB Cooper Case Study
- Examination of U.S. Currency Lab
- Case study - the Hitler Diaries (1981)
- Analyze your own handwriting with the 12 point system

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Lab materials - ink paper

UNIT OVERVIEW

Content Area: Forensics

Unit Title: Drugs & Drug Analysis

Target Course/Grade Level: 11/12

Unit Summary: The drug analysis section is the largest section in the majority of forensic laboratories in the United States. A drug is a natural or synthetic substance designed to affect humans (or other animals) psychologically or physiologically. A drug can affect the function or structure of living tissue through various chemical reactions. In the United States, all drugs covered by law that are somehow restricted are called “controlled substances”. They are listed in a part of the Federal Code called the Controlled Substances Act (Act 21 U.S.C. 812). Students will understand the importance of Drug analysis when it comes to solving case studies.

Approximate Length of Unit: 2 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-LS1- 1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- **HS-LS1- 3.** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- **HS-PS1-3.** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **HS-PS1-4.** Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- **HS-PS1-5.** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.

9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Interdisciplinary Connections and Standards:

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

RST.9-10.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.9-10.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.9-10.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

NJSLSA.W6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- How to apply deductive reasoning to a series of analytical data.
- The limitations of presumptive (screening) tests.
- The relationship between the electromagnetic spectrum and spectroscopic analysis.
- The difference between qualitative and quantitative analysis.
- The dangers of using prescription drugs, controlled substances, over-the-counter medications, and alcohol.

Unit Essential Questions:

- What are the major classes of drugs?
- What are the controlled substance laws in the U.S.?
- What are the federal penalties for possession and use of controlled substances?
- What is bioterrorism? What kind of substances can be used in such attacks?

- How are controlled substances analyzed in the forensic laboratory?

Knowledge and Skills:

Students will know...

- Key definitions: Addiction, controlled substances act, dependency, depressant, hallucinogen, illegal drugs, narcotics, poison, stimulant, tolerance, toxicity, toxicology, toxin, controlled drugs.

Students will be able to...

- Classify the types of illicit drugs and their negative effects.
- Discuss the federal penalties for possession and use of controlled substances.
- Provide examples of drugs, poisons, and toxins.
- List factors that affect drug toxicity.
- Describe the role of a toxicologist in analyzing substance evidence.
- Describe how people get exposed to environmental toxins (pesticides, carbon monoxide), and describe their effects on the body.
- Relate the signs and symptoms of overdose with a specific substance.
- Explain the need for confirmatory tests.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment:**
- **Project: Both Sides of the Issue; Legalization of Drugs**
 - Write a paper analyzing the arguments about legalizing drugs in the United States. Billions of dollars have been spent on the “war on drugs”. Seventy five percent of people in prison are there on drug or drug related crime charges. Do we need more severe drug laws? Would legalization benefit society? Which drugs should be legal? How would the cost of drugs be affected? How would the cost of drugs affect violent crimes? Should the state protect people from harm to themselves? What has history taught us about government control? Can the success or failure of drug laws in other countries help us decide?
- Students will describe the role of a toxicologist in analyzing substance evidence.
- Students will explain how people get exposed to environmental toxins and the effects on the body.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Drug Analysis PowerPoint presentation
- Should Medical Marijuana be Legalized - Class Debate
- Drug Analysis EdPuzzle
- Drug Analysis Reading and Checkpoint Questions
- Drug Analysis webquest
- Should Medical Marijuana Be Legalized Group Debate.
- DEA: Federal Trafficking Policies – Reading and Comprehension Questions.
- Case studies on various celebrities involved in drugs scandals
- Tylenol Tampering Case study of 1982

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Drug analysis lab materials

UNIT OVERVIEW

Unit Title: Fingerprints

Target Course/Grade Level: 11/12

Unit Summary: Fingerprints are among the oldest and most important kinds of evidence used for human identification. A convincing fingerprint match is universally accepted as certain evidence that identifies a particular person. Fingerprints are often residue prints, but they can be plastic or impression prints. Three features of fingerprints underlie their use as a means of personal identification. In this unit students will collect fingerprints from various sources and learn how to differentiate between them.

Approximate Length of Unit: 3 weeks

LEARNING TARGETS

NJ Student Learning Standards:

- **HS-LS1- 1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- **HS-LS1- 2.** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- **HS-LS3- 2.** Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Career Readiness, Life Literacies, and Key Skills:

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

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Interdisciplinary Connections and Standards:

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NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

WHST.9-10.1. Write arguments focused on discipline-specific content.

A. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B. Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

Unit Understandings:

Students will understand that...

- Fingerprints are unique to each individual regardless of DNA
- Why fingerprints are individual evidence.
- Why there may be no fingerprint evidence at a crime scene
- When and where fingerprints are formed
- The purpose of having fingerprints
- How computers have made personal identification easier

Unit Essential Questions:

- How do friction skin ridges make up a fingerprint?
- How are fingerprints classified?
- What service do fingerprints provide on crime scenes?
- Why can no two people have the same prints?
- Why are established procedures used for collecting, preserving and visualizing prints?

Knowledge and Skills:

Students will know...

- Key definitions: fingerprint, dactyloscopy, anthropometry, loop, delta, core, whorl, arch, minutiae, plastic print, visible print, latent print, ridge count, ridge pattern, bifurcation.
- The history of fingerprinting.

- The characteristics of fingerprints
- Basic types of fingerprints

Students will be able to...

- Define the three basic properties that allow individual identification by fingerprints.
- Obtain an inked, readable fingerprint for each finger.
- Recognize and classify the three general ridge patterns (loops, whorls, and arches)
- Identify and compare friction ridge characteristics and compare two fingerprints with at least ten points of identification.
- Tell the differences among latent, plastic, and visible fingerprints.
- Lift latent prints.
- Create and analyze lip prints.
- Create and analyze shoe prints.
- Describe how criminals try to alter their fingerprints.
- Develop latent prints using physical and chemical methods.
- Identify questions and concepts that guide scientific investigations.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- **End of Unit Assessment:**

Fingerprint Portfolio: Students will create a fingerprint portfolio which will include:

- Title page
- Table of contents
- Background information on fingerprints
- Three fingerprint cards of individuals outside the classroom that they must obtain
- Their fingerprint card
- Class data table and graph (dispersion of prints)
- Background information on fingerprint ridge characteristics
- Right thumb enlargement labeled with various ridges
- Background information on latent prints
- Latent prints from three various surfaces (dark table, glass, and tile)
- Lip prints (5) labeled
- Shoe prints (5) labeled
- Reference Page

Students will complete a comprehensive exam on the unit, which will be composed of multiple choice, true/false, fill in the blank, short answer, essay and lab practical questions.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Fingerprints PowerPoint presentation
- Fingerprint Identification GIZMO
- Minutiae and Characteristics of Fingerprints Activity
- Right Thumb Enlargement Lab
- Dusting for Fingerprints Lab

- Video on creation of prints
- Shoe Prints Lab
- Fingerprint Portfolio
- Balloon activity for ridges
- Lip Prints Lab

RESOURCES

Teacher Resources:

- Google Classroom
- Criminalistics – An Introduction to Forensic Science

Equipment Needed:

- Overhead projector and laptop connections for presentations.
- Lab materials - ink pads, latent print dust & brushes, shoe print ink, etc.