

**FREEHOLD REGIONAL HIGH SCHOOL DISTRICT**

**OFFICE OF CURRICULUM AND INSTRUCTION**

**LAW ENFORCEMENT & PUBLIC SAFETY**

# **FORENSIC LAB SCIENCE**

Grade Level: 11

Credits: 5

**BOARD OF EDUCATION ADOPTION DATE:**

**AUGUST 25, 2014**

[SUPPORTING RESOURCES AVAILABLE IN DISTRICT RESOURCE SHARING](#)

APPENDIX A: ACCOMMODATIONS AND MODIFICATIONS

APPENDIX B: ASSESSMENT EVIDENCE

APPENDIX C: INTERDISCIPLINARY CONNECTIONS

# **FREEHOLD REGIONAL HIGH SCHOOL DISTRICT**

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## LEPS FORENSIC LAB SCIENCE

### COURSE PHILOSOPHY

The *LEPS Forensic Lab Science* course is designed to expose LEPS students to the types of evidence that can be found once a crime scene is secured, and the integral role that evidence plays in finding and proving the innocence or guilt of suspects. This course will build upon the declarative and procedural knowledge from *LEPS I* and *II*, and will be supported by *Honors LEPS III* and the Structured Learning Experience.

### COURSE DESCRIPTION

Students enrolled in the *LEPS Forensic Science* course will extend their knowledge of criminology by engaging in scientific investigations requiring forensic analysis of collected evidence in laboratory settings. Forensic analysis will require an understanding of physical, biological and chemical sciences.

## COURSE SUMMARY

### COURSE GOAL

Students will be able to transfer their understanding of the many aspects of forensic lab science in relation to criminology so that on their own, they will be able to apply the concepts and applications from biology, chemistry, physics, and geology to analyze and evaluate evidence discovered in a criminal investigation.

### COURSE ENDURING UNDERSTANDINGS

Forensic science requires the interaction of concepts and applications from the areas of biology, chemistry, physics, and geology to analyze and investigate evidence that may be discovered in a criminal investigation.

### COURSE ESSENTIAL QUESTIONS

How do criminal investigators use all of the sciences together in order to solve a crime?

## UNIT GOALS & PACING

UNIT TITLE	UNIT GOALS	RECOMMENDED DURATION
<a href="#">Unit 1: Introduction to Forensic Lab Science</a>	Students will understand the development of forensic science so that on their own, they will be able to cite evidence of how forensic science has advanced lock step with new discoveries and technologies in all of the scientific disciplines and describe how forensic science relates to the application of law in our criminal justice system.	2 weeks
<a href="#">Unit 2: Evidence &amp; the Crime Scene</a>	Students will be able to transfer their understanding of evidence in relation to forensic science so that on their own, they will be able to evaluate evidence to determine the proper collection techniques and analyze said evidence in order to explain its relevance to the investigation.	2 weeks
<a href="#">Unit 3: Impression Analysis &amp; Fingerprints</a>	Students will be able to transfer their understanding of impression analysis so that on their own, they will be able to differentiate between objects having individual and class physical characteristics that can be analyzed in order to be identified and compared.  Students will be able to transfer their understanding of dactylography so that on their own, they will be able to cite evidence of how to identify and analyze the three general fingerprint patterns, and assess the minutiae found in fingerprints in order to prove a positive match.	4 weeks

## UNIT GOALS & PACING

UNIT TITLE	UNIT GOALS	RECOMMENDED DURATION
<a href="#">Unit 4: Trace Evidence</a>	Students will be able to transfer their understanding of trace evidence so that on their own, they will be able to connect the usefulness between different types of trace evidence to a criminal investigation and apply the proper methods for collection and analysis.	3-4 weeks
<a href="#">Unit 5: Document Analysis</a>	Students will be able to transfer their understanding of handwriting and document analysis so that on their own, they will be able to connect the distinguishing points of similarity and difference existing in unknown documents to known documents in order to prove their relevance to a criminal investigation.	4 weeks
<a href="#">Unit 6: Digital Forensics</a>	Students will be able to transfer their understanding of digital forensics so that on their own, they will be able to draw conclusions to the processes involved in preserving, acquiring, extracting, analyzing, and interpreting computer data to solve cyber and/or physical crimes.	2 weeks
<a href="#">Unit 7: Ballistics</a>	Students will be able to transfer their understanding of ballistics so that on their own, they will be able to connect different types of firearms with their unique characteristics in order to cite evidence to their forensic significance.	2 weeks
<a href="#">Unit 8: Fire &amp; Explosion Investigation</a>	Students will be able to transfer their understanding of combustion and fire investigative techniques so that on their own, they will be able to draw conclusions to the initiation of fires and determine what types of incendiary devices were used based on available evidence.	2 weeks
<a href="#">Unit 9: DNA</a>	Students will understand the use of DNA evidence so that on their own, they will be able to cite evidence of how DNA can be used as a means of evidence and how far DNA technology has come in the last twenty years of forensic science.	3 weeks
<a href="#">Unit 10: Serology &amp; Blood Spatter Analysis</a>	Students will be able to transfer their understanding of serology and blood spatter so that on their own, they will be able to analyze all facets of blood evidence in order to prove its worth to a criminal investigation.	3 weeks
<a href="#">Unit 11: Forensic Pathology</a>	Students will be able to transfer their understanding of the most important piece of evidence (the victim) so that on their own, they will be able to determine the manner, mechanism, and time of death by applying the most appropriate forensic techniques.	3 weeks
<a href="#">Unit 12: Crime Scene Investigation: Bringing It All Together</a>	Students will be able to transfer their understanding of forensic science so that on their own, they will properly formulate the initial investigation of a crime scene and collect and analyze any evidence in a methodical and procedural manner.	2-3 weeks

**LEPS FORENSIC LAB SCIENCE****UNIT 1: INTRODUCTION TO FORENSIC LAB SCIENCE****SUGGESTED DURATION: 2 WEEKS****UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will understand the development of forensic science so that on their own, they will be able to cite evidence of how forensic science has advanced lock step with new discoveries and technologies in all of the scientific disciplines and describe how forensic science relates to the application of law in our criminal justice system.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can hypothesize possible future technologies in forensic science and predict how forensics may evolve in relation to changing societal ideals.
3	The student will: <ul style="list-style-type: none"> <li>• cite evidence of the development of scientific technology in the advancement of forensic science;</li> <li>• draw conclusions as to how forensic science relates to the application of law in our criminal justice system;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: expert witness, analytical skills, deductive reasoning, eyewitness, fact, forensic, logical, observation, opinion, perception.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student always needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: Forensic science is the application of varied scientific disciplines to the solving of legal and criminal investigations.

EU2: Many careers have been generated from the increased use of forensic science in investigations.

**ESSENTIAL QUESTIONS**

EQ1a: How are the sciences applied to legal and criminal investigations?  
EQ1b: How are biology, chemistry, physics, geology, etc. relevant to forensics?

EQ2: Based on improvements in technology, careers are continuously evolving in the field of forensic science; what new jobs do you predict will emerge?

**NJCCCS & COMMON CORE STANDARDS**

5.1.12.B.1 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

5.1.12.B.2 Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.

9.4.12.L.66 Identify and explore careers in one or more career pathways to build an understanding of the opportunities available in the cluster.

9.4.12.L.68 Research professional development opportunities needed to keep current on relevant trends and information within the cluster.

9.4.12.L.72 Compare and evaluate career pathways within this cluster to build understandings of the requirements across multiple pathways.

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.



SL.11-12.1 Come to discussions prepared, having read and researched materials under study; explicitly draw on that preparation by referring to evidence from texts and

other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1, EU2 5.1.12.B.1,2 9.4.12.L.66, 68, 72 ELA.RST.11-12.1, SL.11-12.1 DOK3	Students will research a given branch of forensic science or forensic science career to discover definitions of terms, importance in forensic science, tools/instruments used in the area, one important case, sample careers in the field, etc. Students will be prepared to present this information to the rest of the class and also be prepared for a question-and-answer session between the student and the rest of the class and the instructor.

### SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
Students will participate in labs involving observational skills such as studying photos of crime scenes for several seconds and then answering questions about details from the photo in order to describe some problems in making good observations and assess the validity of eyewitness accounts.   For students having difficulty with this activity, a definition of terms and examples of prior cases involving faulty eyewitness accounts will be provided.	Eyewitness Fact Observation Opinion Perception  DOK 1	<ul style="list-style-type: none"> <li>Summarize some of the problems in making good observations</li> <li>Assess the validity of eyewitness accounts based on lab results</li> <li>Critique their own powers of observation</li> </ul> DOK 3
Students will complete the “Deadly Picnic” lab on deductive reasoning, which involves combing over details of a crime in order to understand the process a forensic scientist uses in solving investigations.   For students having difficulty with this activity, a lab with partially completed data tables will be provided.	Analytical skills Deductive reasoning Forensic  DOK 1, 2	Apply the concepts of deductive reasoning to utilize logical and critical-thinking skills to solve a crime  DOK 3

**LEPS FORENSIC LAB SCIENCE**  
**UNIT 2: EVIDENCE & THE CRIME SCENE**

**SUGGESTED DURATION: 2 WEEKS**

**UNIT OVERVIEW**

**UNIT LEARNING GOALS**

Students will be able to transfer their understanding of evidence within a crime scene in relation to forensic science so that on their own, they will be able to evaluate the crime scene to determine the proper collection techniques and analysis of the evidence in order to explain its relevance to an investigation.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can apply concepts learned in order to differentiate the classification and evidentiary value of various items found at a crime scene.
3	The student will: <ul style="list-style-type: none"> <li>• evaluate evidence to determine the proper collection techniques;</li> <li>• analyze evidence and explain its relevance to a forensic investigation;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: chain of custody, circumstantial evidence, class evidence, crime scene investigation, crime scene reconstruction, direct evidence, first responder, individual evidence, Locard’s Exchange Principle, paper bindle, primary crime scene, secondary crime scene.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student always needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: Evidence is present at all crime scenes and must be located, collected, and analyzed properly.

EU2: Evidence can be classified as: individual or class; reconstructive or associative; and direct or circumstantial.

EU3: The crime scene must be analyzed in a methodical and procedural manner in order to maintain the evidentiary value of items found.

**ESSENTIAL QUESTIONS**

EQ1: How do forensic scientists locate, collect, and analyze various types of evidence?

EQ2: What aspects of evidence determine its classification?

EQ3a: How do forensic scientists approach the initial investigation of a crime scene?

EQ3b: How do forensic scientists proceed once the initial investigation has been established?

## NJCCCS & COMMON CORE STANDARDS


- 5.1.12.A.2 Use outcomes of investigations to build and refine questions, models, and explanations.
- 5.1.12.B.1 Observe, question, predict, and investigate materials, objects, and phenomena (e.g., using simple tools to crack a nut and look inside) during indoor and outdoor classroom activities and during any longer-term investigations.
- 5.1.12.B.3 Identify and use basic tools and technology to extend exploration in conjunction with science investigations.
- 5.1.12.C.1 Revise predictions or explanations on the basis of learning new information.
- 9.4.12.L.2 Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
- 9.4.12.L.5 Demonstrate mathematics knowledge and skills, including industry-specific applications, to enable pursuit of the full range of postsecondary education and career opportunities associated with the cluster.
- 9.4.12.L6 Demonstrate science knowledge and skills, including industry-specific applications, to enable pursuit of a full range of postsecondary education and career opportunities associate with the cluster.
- 9.4.12.L18 Employ critical thinking skills independently and in teams to solve problems and make decisions.
- 9.4.12.L.21 Conduct technical research to gather information necessary for decision making.
- 9.4.12.L.37 Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.
- 9.4.12.L.40 Identify response techniques to create a disaster and/or emergency response plan.
- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics
- RST.11-12.8 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
- WHST.11-12.1.B Develop claims and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values and possible bias.
- WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.



**COMMON ASSESSMENT**

ALIGNMENT	DESCRIPTION
LG1 EU1-3 5.1.12.A.1-3 RST.11-12.1, 2, 8 WHST.11-12.1., 9 9.4.12.L.2, 5, 6, 18, 21, 37, 40 DOK 1-3	Students will critique an actual criminal investigation for the purpose of summarizing Locard's Exchange Principle, identifying examples of evidence, summarizing and explaining the seven steps of a crime scene investigation and its importance to securing the crime scene, and assessing the techniques used to collect and analyze the evidence as it pertains to the given case.  Suggested Case Study: O.J. Simpson criminal investigation

**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will participate in class discussions on various case studies, such as the Enrique Camarena case and the JonBenet Ramsey case in order to discover challenges facing investigators collecting evidence and securing crime scenes.</p> <p> For students who have difficulty reading primary source materials, teachers will provide an annotated version of the document.</p>	Locard's Exchange Principle Chain of custody Circumstantial evidence Crime scene investigation Crime scene reconstruction Primary crime scene Secondary crime scene Class evidence Individual evidence  DOK 1	Analyze case studies in order to determine key aspects and their effect on the investigation  DOK 3

**UNIT OVERVIEW****UNIT LEARNING GOALS**

LG1: Students will be able to transfer their understanding of impression analysis so that on their own, they will be able to differentiate between objects having individual and class physical characteristics that can be analyzed in order to be identified and compared.

LG2: Students will be able to transfer their understanding of dactylography so that on their own, they will be able to cite evidence of how to identify and analyze the three general fingerprint patterns, and assess the minutiae found in fingerprints in order to prove a positive match.

**UNIT LEARNING SCALE - LG1**

4	In addition to score 3 performances, the student can, given an object, hypothesize as to the impression that would be left at the crime scene.
3	The student will: <ul style="list-style-type: none"> <li>analyze impression evidence to determine its importance to a criminal investigation;</li> <li>connect impressions left at a crime scene to the object that created the impression;</li> <li>recognize or recall specific vocabulary, such as but not limited to: abrasion mark, cutting mark, indentation mark, latent impressions, patent impressions, plastic impressions, sole, tire groove, tire rib, tire ridge, tool mark, track width, tread pattern, turning diameter, wheelbase.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student always needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding.

**UNIT LEARNING SCALE – LG2**



4	In addition to score 3 performances, the student can make in-depth inferences and applications that go beyond fingerprint analysis and recognition.
3	The student will: <ul style="list-style-type: none"> <li>identify and analyze patterns and minutiae;</li> <li>apply concepts of dactylography in order to prove a positive fingerprint match;</li> <li>recognize or recall specific vocabulary, such as but not limited to: arch, core, delta, digital imaging, fingerprint, fluoresce, iodine fuming, latent fingerprint, livescan, loop, ninhydrin, minutiae, patent fingerprint, Physical Developer, plastic fingerprint, ridge pattern, sublimation, Super Glue fuming, ten card, whorl.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student always needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: Many objects leave impressions that can be used as trace evidence.	EQ1a: How do objects that were used at a crime scene, but are no longer there, provide evidence?
EU2: Fingerprints are an important part of criminal investigations due to their ability to identify specific individuals.	EQ2a: Why are fingerprints important evidence? EQ2b: How are fingerprints collected and analyzed in order to identify an individual?
NJCCCS & COMMON CORE STANDARDS	
<p>5.1.12.B.2 Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.</p> <p>5.1.12.B.3 Revise predictions and explanations using evidence, and connect explanations /arguments to established scientific knowledge, models and theories.</p> <p>5.1.12.B.4 Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.</p> <p>5.1.12.C.1 Reflect on and revise understandings as new evidence emerges. C2: Use data representations and new models to revise predictions and explanations.</p> <p>5.1.12.C.2 Use data representations and new models to revise predictions and explanations.</p> <p>5.1.12.C.3 Consider alternative theories to interpret and evaluate evidence based arguments.</p> <p>9.4.12.L.3 Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.</p> <p>9.4.12.L.6 Demonstrate science knowledge and skills, including industry-specific applications, to enable pursuit of a full range of postsecondary education and career opportunities associate with the cluster.</p> <p>9.4.12.L.18 Employ critical thinking skills independently and in teams to solve problems and make decisions.</p> <p>9.4.12.L(4).25 Examine and summarize procedures for properly processing crime scenes for fingerprint evidence.</p> <p>9.4.12.L(4).26 Examine and summarize strategies to properly protect, document and process crime scenes and all related evidence.</p> <p>RST11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.</p> <p>RST11-12.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.</p> <p>RST11-12.8 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</p> <p>RST11-12.9 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.</p> <p>WHST11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.</p>	

## COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1-2 EU1-2 5.1.12.B.1 WHST.11-12.1 9.4.12.L.3, 6, 18 9.4.12.L(4).25, 26 DOK 3	Students will collect and analyze suspect fingerprints for pattern and minutiae in order to match one of them to a crime scene-recovered latent print. In writing, students prepare for a jury their justification for the match by identifying the pattern matching of at least twelve (12) minutiae points, as well as explaining if this evidence is categorized as class or individual evidence.

## SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will conduct a lab creating dental impressions in order to match bite marks from a suspect to bite marks found on a victim.</p> <p> Students having difficulty will be given samples of dental impressions with dentition patterns clearly explained.</p>	Odontology Dentition pattern  DOK 1	<ul style="list-style-type: none"> <li>• Create dental impressions</li> <li>• Compare and match bite marks from a victim to those from a suspect</li> </ul> DOK 2
<p>Students will conduct a lab on lifting and analyzing latent fingerprints in order investigate proper lifting procedure and identification of fingerprint patterns and minutiae.</p> <p> Students having difficulty lifting latent fingerprints will have an opportunity to identify and collect visible prints.</p>	Arch Loop Whorl Delta Latent print Minutiae Ridge pattern  DOK 1	<ul style="list-style-type: none"> <li>• Compare the three fingerprint patterns</li> <li>• Use the concepts of fingerprint collection in order to identify and collect latent prints</li> <li>• Analyze collected latent prints for pattern and ridge characteristics</li> </ul> DOK 2, 3

**UNIT OVERVIEW**

**UNIT LEARNING GOALS**

Students will be able to transfer their understanding of trace evidence so that on their own, they will be able to connect the usefulness of different types of trace evidence to a criminal investigation and apply the proper methods for collection and analysis.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can develop a logical argument in regards to the importance of various pieces of trace evidence.
3	The student will: <ul style="list-style-type: none"> <li>• identify the various types of trace evidence;</li> <li>• apply the proper methods for collection and analysis;</li> <li>• connect the usefulness of trace evidence to criminal investigations;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: amorphous, anagen phase, catagen phase, comparison microscope, cortex, crystalline, cuticle, direct transfer, fiber, follicular tag, hair follicle, keratin, manufactured fibers, medulla, melanin granules, mineral fiber, mitochondrial DNA, monomer, natural fibers, neutron activation analysis, nuclear DNA, polymer, secondary transfer, synthetic fiber, textile, trace evidence, telogen phase, yarn.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student always needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

**ESSENTIAL QUESTIONS**

EU1: Trace evidence is transferred when objects contact, and can include a wide variety of materials.	EQ1: What special considerations need to be taken into account when searching for and collecting trace evidence?
EU2: The morphology of hair allows it to be classified as individual or class evidence based on method of removal and stage in the growth cycle.	EQ2a: Why is hair such an important piece of evidence? EQ2b: What characteristics of hair allow it to be used as evidence?
EU3: The production method of different textiles imparts properties to fibers that can be used in forensic comparisons.	EQ3: What characteristics of fibers allow them to be used as evidence?
EU4: All manner of trace evidence must be collected and analyzed properly based on type.	EQ4: What other examples of trace evidence (besides hair and fiber) might be found at a crime scene, and what methods would you use to collect and analyze them?

### NJCCCS & COMMON CORE STANDARDS

5.1.12.A.1-3 1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. 2: Develop and use mathematical, physical and computational tools to build evidence based models and to pose theories. 3: Use scientific principles and theories to build and refine standards for data collection, posing controls and presenting evidence.

9.4.12.L.5-6 Demonstrate mathematics knowledge and skills, including industry-specific applications, to enable pursuit of the full range of postsecondary education and career opportunities associated with the cluster. 6: Demonstrate science knowledge and skills, including industry-specific applications, to enable pursuit of a full range of postsecondary and career opportunities associated with the cluster.

9.4.12.L.10 Evaluate and use information resources to accomplish specific occupational tasks.

9.4.12.L.18-21 Conduct technical research to gather information necessary for decision making.

9.4.12.L.24 Employ technological tools to expedite workflow.

9.4.12.L.37 Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements or performing technical tasks; analyze the specific results based on explanations in the text.

RST.11-12.4 Determine the meaning of symbols, key terms and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.



RST.11-12.8 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.11-12.9 Synthesize information from a range of sources into a coherent understanding of a process, phenomenon or concept, resolving conflicting information when possible.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-4 5.1.12.B.1-4 5.5.12.D.1-3 9.4.12.L.5-6, 18-21 11-12.RST.3, 5, 8, 9 11-12.W.2 DOK 3, 4	Students will conduct a lab using concepts from Locard's Exchange Principle in order to demonstrate how transfer of trace evidence occurs, and identify a possible crime scene location based on examination of the evidence collected. The students will use the skills and knowledge learned in this unit to properly collect and categorize any trace evidence found, and be able to justify its importance to the criminal investigation.

## SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will conduct a lab analyzing samples of their own hair for color, medulla types, cuticle types, thickness, and length in order to match it to a “suspect” and “victim.”</p> <p> Students having difficulty with this activity will be given prepared slides with morphology clearly labeled.</p>	<p>Trace evidence Cortex Cuticle Medulla Follicular tag</p> <p>DOK 1</p>	<ul style="list-style-type: none"><li>• Compare the morphology of hair</li><li>• Prove the “suspect” sample hair matches the “victim” sample hair</li></ul> <p>DOK 2, 3</p>
<p>Students will conduct a lab analyzing fibers by using the burn test and a dichotomous key in order to determine their composition and match the suspect threads to the crime scene.</p> <p> Students having difficulty with this lab activity will be given an alternate lab assignment involving textile identification.</p>	<p>Direct transfer Secondary transfer Natural fiber Synthetic fiber Textile Yarn</p> <p>DOK 1</p>	<ul style="list-style-type: none"><li>• Analyze fibers using a burn test in order to identify their composition</li><li>• Prove a positive match to fibers discovered at a crime scene and those found in a suspect’s environment</li></ul> <p>DOK 3</p>

**UNIT OVERVIEW**

**UNIT LEARNING GOALS**

Students will be able to transfer their understanding of handwriting and document analysis so that on their own, they will be able to connect the distinguishing points of similarity and difference existing in unknown documents to known documents in order to prove their relevance to a criminal investigation.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can analyze handwriting and document techniques for possible flaws and predict future counterfeiting techniques.
3	<p>The student will:</p> <ul style="list-style-type: none"> <li>• analyze handwriting and document samples in order to prove their worth to criminal investigations;</li> <li>• describe and demonstrate an example of each of the 12 exemplars of handwriting traits;</li> <li>• cite evidence to explain the goals of handwriting analysis;</li> <li>• differentiate among the various anti-counterfeiting features found in paper currency;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: counterfeiting, charred document, document analysis, document expert, erasure, exemplar, indented writings, infrared luminescence, forgery, fraudulence, natural variations, obliteration, questioned document.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.
ENDURING UNDERSTANDINGS	
ESSENTIAL QUESTIONS	
<p>EU1: Every method of document creation leaves specific identifying characteristics that can be used to determine the source of synthesis.</p>	<p>EQ1a: Can you name samples of documents that may be relevant in criminal investigations?</p> <p>EQ1b: What are the distinguishing points of similarity and difference that can be used to identify handwriting samples?</p>



**NJCCCS & COMMON CORE STANDARDS**

5.1.12.A.1, 3 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. 3: Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.  
 5.1.12.B.2-3 Build, refine and represent evidence-based models using mathematical, physical and computational tools. B3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models and theories.  
 5.1.12.C.3 Consider alternative theories to interpret and evaluate evidence based arguments.  
 9.4.12.L.9 Locate, organize and reference written information from various sources to communicate with others.



RST11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements or performing technical tasks; analyze the specific results based on explanations in the text.

RST11-12.9 Synthesize information from a range of sources into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

**COMMON ASSESSMENT**

ALIGNMENT	DESCRIPTION
LG1 EU1 5.1.12.A.1, 3 5.1.12.B.2,3 5.1.12.C.3 9.4.12.L.9 RST.11-12.3 WHST.11-12.9 DOK 3, 4	Students will take part in a “real life” ransom note scenario in which handwriting analysis of a document is crucial. Students will act as expert handwriting witnesses requested to testify that at least one the suspect’s handwriting samples matches the handwriting sample found in the ransom note. They will then write up their conclusions in a report that will be submitted to the jury before their testimony at the trial.

**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will complete a handwriting activity analyzing their own and a classmate's handwriting sample in order to differentiate between the 12 different handwriting characteristics.</p> <p> Students having difficulties will be given handwriting samples with exemplars clearly labeled.</p>	<p>Document analysis Document expert Exemplar Forgery Questioned document</p> <p>DOK 1</p>	<p>Analyze handwriting samples in order to compare and contrast the 12 handwriting exemplars</p> <p>DOK 3</p>
<p>Students will examine U.S. currency in order to identify the various security features found in paper money and to determine if samples are real or forgeries.</p> <p> Students having difficulties will be provided with specific resources or websites to use.</p>	<p>Counterfeiting Fraudulence</p> <p>DOK 1</p>	<ul style="list-style-type: none"><li>• Compare and contrast the various anti-counterfeiting measures used in paper money</li><li>• Design an original anti-counterfeiting measure currently not used</li></ul> <p>DOK 3, 4</p>

**UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will be able to transfer their understanding of digital forensics so that on their own, they will be able to draw conclusions to the processes involved in preserving, acquiring, extracting, analyzing, and interpreting computer data to solve cyber and/or physical crimes.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can hypothesize as to new and unique digital security features.
3	The student will: <ul style="list-style-type: none"> <li>differentiate components of computers including various forms of memory and data;</li> <li>formulate a plan for proper procedure in preserving and collecting computer evidence at a crime scene;</li> <li>compare the difficulties of finding various computer activities can be investigated in cybercrimes;</li> <li>recognize or recall specific vocabulary, such as but not limited to: bit, browser, byte, cookies, CPU, cluster, domain, file slack, firewall, HDD, hacking, hypertext, internet cache, internet history, internet protocol, internet service provider (ISP), latent data, MD5/SHA, motherboard, OS, partition, RAM slack, RAM, sector, software, swap file, temporary files, unallocated space, uniform resource locator (URL), visible data, VoIP (Voice over Internet Protocol), wi-fi.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS****ESSENTIAL QUESTIONS**

EU1: Computer evidence can be grouped under two major subheadings: visible and latent.	EQ1: What characteristics determine how computer evidence is grouped?
EU2: There are proper procedures for preserving computer evidence at a crime scene.	EQ2: How would a digital forensic scientist secure and collect evidence at a crime scene?
EU3: Internet activities can be traced and recovered.	EQ3: How are computer activities traced and recovered?

## NJCCCS & COMMON CORE STANDARDS

5.1.12.B.1 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships and anomalous data.

9.4.12.L.34-36 34: Demonstrate the effective use of computer based equipment to control electromechanical devices commonly used in this cluster. 35: Describe the nature and types of business organizations to build an understanding of the scope of organizations. 36: Describe and use quality control systems and practices to ensure quality products and services.

9.4.12.L(4)7 Demonstrate understanding of the role computer forensics plays in identifying patterns and solving crimes in order to convey understanding of how computers influence the resolution of crimes.

RST11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.


RST11-12.9 Synthesize information from a range of sources into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

WHST11-12.1B Develop claim(s) and counterclaims fairly 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.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-3 5.1.12.B.1 9.4.12.L(4)7 11-12.RST.7, 9 11-12.WHST.B DOK 3, 4	Students will assume the role of a computer investigator and analyze the evidence from two actual forensic cases in order to determine what evidence is pertinent to the cases and conclude guilt, providing evidence to support their claim.

### SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
Students will conduct research to determine the proper procedures and steps in preserving, acquiring, extracting, analyzing, and interpreting computer data that is essential to many modern criminal investigations.	Latent data Motherboard Hardware Software Visible data	Demonstrate the proper procedure for analyzing and preserving computer evidence during a criminal investigation
 Students with difficulty will be provided with specific resources or websites and texts to use.	DOK 1	DOK 3

**UNIT OVERVIEW**

**UNIT LEARNING GOALS**

Students will be able to transfer their understanding of ballistics so that on their own, they will be able to connect different types of firearms with their unique characteristics in order to cite evidence to their forensic significance.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can develop a logical argument as to why bullet evidence may not always match a firearm.
3	The student will: <ul style="list-style-type: none"> <li>• cite evidence of how bullets are test-fired and matched;</li> <li>• discuss the role of ballistics recovery and examination at the crime scene;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: ballistics, barrel, bore, breechblock, bullet, caliber, choke, distance determination, ejector, extractor, firearm, fully automatic, gauge, Greiss test, gunshot residue (GSR), lands and grooves, muzzle, pistol, revolver, rifle, rifling, semiautomatic, shell casing, trajectory.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

- EU1: Different types of firearms have unique characteristics.
- EU2: Spent cartridges and bullets can be matched with specific firearms used in crimes.
- EU3: There are procedures that can determine if an individual fired a weapon.

**ESSENTIAL QUESTIONS**

- EQ1: How are the unique characteristics of firearms important to criminal investigations?
- EQ2: What evidence do firearms provide?
- EQ3: What allows investigators to determine if someone fired a weapon?

### NJCCCS & COMMON CORE STANDARDS

- 5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.
- 5.1.12.A.2 Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.
- 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.
- 5.1.12.B.4 Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
- 9.4.12.L.18 Employ critical thinking skills independently and in teams to solve problems and make decisions.
- 9.4.12.L.21 Conduct technical research to gather information necessary for decision-making.


WHST.11-12.1.C Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

WHST.11-12.1.D Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-3 5.1.12.A.1 9.4.12.L.15, 18, 21 WHST.11-12.1.C, D DOK 3	Students will compare several different shell casings of varying calibers in order to recognize striation marks caused by the ejection of the casing after it is fired. Students will then match the test-fired casing from a suspect gun to the casings found at a "crime scene." They will have to justify the match by showing how the striations match up.

### SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
Students will conduct a lab comparing firing pin impressions from different sources in order to positively match a suspect shell casing to a crime scene casing.   Students having difficulty identifying impressions will be provided with a detailed example.	Ballistics Breech Caliber Cartridge Shell casing  DOK 1	<ul style="list-style-type: none"> <li>• Interpret markings on shell casings associated with caliber, headstamp, location, of firing pin strike, and firing pin markings</li> <li>• Cite evidence in order to prove a match between crime scene casings and suspect casings</li> </ul> DOK 3

**UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will be able to transfer their understanding of combustion and fire investigative techniques so that on their own, they will be able to draw conclusions to the initiation of fires and determine what types of incendiary devices were used based on available evidence.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can recognize and employ the proper laboratory techniques to analyze arson evidence.
3	The student will: <ul style="list-style-type: none"> <li>differentiate between how fires are initiated and how they are sustained;</li> <li>cite the telltale signs of an accelerant-initiated fire and understand how to analyze evidence at the arson scene and back at the lab;</li> <li>differentiate between explosions and more common forms of combustion;</li> <li>recognize or recall specific vocabulary, such as but not limited to: accelerant, black powder, combustion, deflagration, detonating cord, detonation, endothermic reaction, energy, exothermic reaction, explosion, flammable range, flash point, glowing combustion, heat of combustion, high explosive, hydrocarbon, ignition temperature, low explosive, modus operandi, oxidation, oxidizing agent, primary explosive, pyrolysis, safety fuse, secondary explosive, smokeless powder (double-base or single-base), spontaneous combustion, X-ray diffraction.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.
ENDURING UNDERSTANDINGS	
ESSENTIAL QUESTIONS	
EU1: Certain conditions are necessary to initiate and sustain combustion.	EQ1: How are fires started and how does heat transfer?
EU2: Collecting physical evidence at arson investigations differs from most other forensic investigations.	EQ2: What possible challenges does an arson scene present to forensic investigators?
EU3: There are specific laboratory techniques designed to detect and identify hydrocarbons from arson cases.	EQ3: What laboratory equipment and techniques are used in arson cases?
EU4: Explosions are a very specific type of combustion and present unique challenges to the forensic investigator.	EQ4a: How do explosions differ from fire? EQ4b: What are the challenges to a forensic scientist investigating a bombing?

## NJCCCS & COMMON CORE STANDARDS

5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.

5.1.12.B.1 Design investigations, collect evidence, analyze data and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

9.4.12.L.(2).1 Speak and write using communications equipment and platforms common to fire and emergency management services in order to communicate effectively and professionally while executing work duties.

9.4.12.L.(2).3 Describe how to use first-responder and other emergency response skills to manage an incident scene in order to conduct and manage on-scene accident activities until relieved by a superior officer.

9.4.12.L.(2).5 Model behaviors, strategies, and protocols that demonstrate an understanding of the objectives of, and a commitment to the mission of, fire and emergency management operations in order to carry out duties while responding to a range of incidents.

9.4.12.L.(2).9 Compare and contrast relevant aspects of careers in fire and emergency management services in order to demonstrate an understanding of opportunities available in the field.

9.4.12.L.(2).12 Examine equipment and summarize the range of applications for its use in fire and emergency management incidents in order to demonstrate the ability to use the equipment when needed.

9.4.12.L.(2).14 Demonstrate understanding of common codes and symbols used to identify materials as hazardous in order to properly handle potentially hazardous material in fire and emergency management environments

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

RST.11-12.8 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.


WHST.11-12.2.B Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

## COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-4 5.1.12.A.1 5.1.12.B.1 5.1.12.C.1 9.14.12.L (2)3, 5, 12, 14 11-12.RST.1, 8 WHST.11-12.2.B DOK 3	Students will critique an actual arson investigation for the purpose of summarizing the three factors that make investigating arson particularly hard, why it is important to begin the investigation as soon as the fire is extinguished, the primary focus of a fire-search, and what evidence at a fire site may indicate the possibility of arson.



**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will analyze various case studies in order to compare and contrast the evidence present at naturally occurring fires and those that are arson.</p> <p> Students who have difficulty will be given case studies with detailed descriptions of the photos and evidence.</p>	<p>Accelerant Hydrocarbon Modus operandi Spontaneous combustion “Streamers”</p> <p>DOK 1</p>	<p>Compare and contrast fire scene photos to decipher what evidence can determine arson</p> <p>DOK 3</p>

**UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will understand the use of DNA evidence so that on their own, they will be able to cite evidence of how DNA can be used as a means of evidence and how far DNA technology has come in the last twenty years of forensic science.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can assess DNA evidence for possible issues arising from partial matches.
3	The student will: <ul style="list-style-type: none"> <li>• identify the structure and function of DNA;</li> <li>• recognize where DNA originates and in what biological fluids it can be found;</li> <li>• explain how DNA is collected, analyzed, and presented as evidence;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: acid phosphatase, allele, chromosome, DNA fingerprint, DNA probe, deoxyribonucleic acid (DNA), egg, electrophoresis, gene, genotype, heterozygous, homozygous, PCR, phenotype, restriction enzyme, STR, VNTR, X chromosome, Y chromosome, zygote.</li> </ul>
2	The student can complete all score 3 performances with minor errors.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: DNA is found in all biological material to varying degrees and is the ultimate piece of individual evidence.

EU2: DNA must be collected and analyzed in very specific ways in order to maintain its evidentiary value.

**ESSENTIAL QUESTIONS**

EQ1: Where is DNA found and how has it revolutionized criminal investigations?

EQ2: What methods give an investigator the best chance of maintaining DNA's evidentiary value?

### NJCCCS & COMMON CORE STANDARDS

5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.

5.1.12.B.1 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

5.1.12.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.

9.4.12.L.6 Demonstrate science knowledge and skills, including industry-specific applications, to enable pursuit of a full range of postsecondary education and career opportunities associated with the cluster.

9.4.12.L.10 Evaluate and use information resources to accomplish specific occupational tasks.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

RST.11-12.9 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.

WHST.11-12.1.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.



WHST.11-12.1.E Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-2 5.1.12.B.1, 4 5.1.12.D.1 9.4.12.L.6, 10 RST.11-12.2, 4, 9 WHST.11-12.1.A, E; 7 DOK 3	Students will conduct research on gel electrophoresis in order to connect the processing and visualization of DNA evidence to the analytical comparisons that allow an investigator to positively match unknown samples of DNA to suspects. This research will also provide the student with insight into the advancements of DNA technology.

**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will interpret DNA profiles in order to establish or exclude paternity of a particular child to an alleged father.</p> <p> Students having difficulty interpreting DNA profiles will be provided with probes that are already colored coded.</p>	<p>DNA fingerprint DNA probe Electrophoresis Paternity</p> <p>DOK 1</p>	<p>Draw conclusions as to who the father is based on matching DNA probes</p> <p>DOK 3</p>
<p>Students will compare DNA profiles of crime scene evidence with that taken from suspects in order to identify the perpetrator.</p> <p> Students having difficulty interpreting DNA profiles will be provided with probes already colored coded.</p>	<p>DNA tissue matching PCR (polymerase chain reaction)</p> <p>DOK 1</p>	<ul style="list-style-type: none"><li>• Develop a logical argument justifying how DNA fingerprinting can be used to identify a suspect</li><li>• Assess whether the suspect's DNA matches the DNA found at the crime scene</li></ul> <p>DOK 3</p>

**UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will be able to transfer their understanding of serology and blood spatter so that on their own, they will be able to analyze all facets of blood evidence in order to prove its worth to a criminal investigation.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can identify the value of various aspects of blood evidence.
3	The student will: <ul style="list-style-type: none"> <li>• identify blood types by various methods;</li> <li>• draw conclusions to the events of a crime based on blood spatter evidence;</li> <li>• recognize other bodily fluids besides blood and determine their importance as evidence;</li> <li>• recognize or recall specific vocabulary, such as but not limited to: agglutination, antibodies, antigen-antibody response, cell-surface protein, hemoglobin, lines of convergence, luminol, plasma, point of origin, precipitin, red blood cells, satellite drop of blood, serology, serum, white blood cells.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: Blood contains several components that allow it to be used in criminal investigations.

EU2: Due to the aqueous nature of blood, the laws of physics determine how blood spatters during a violent crime.

**ESSENTIAL QUESTIONS**

EQ1: What about blood makes it so important in criminal investigations?

EQ2: Based on your own observations of how fluids act, how can blood spatter evidence determine direction and type of object used to commit a violent crime?

**NJCCCS & COMMON CORE STANDARDS**

5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.

5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.

5.1.12.B.3 Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.

5.1.12.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.

9.4.12.L.18 Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.

9.4.12.L.21 Conduct technical research to gather information necessary for decision-making.

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.



RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.

RST.11-12.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

## COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1-2 5.1.12.A.1 5.1.12.B.3 5.1.12.C.2 5.1.12.D.1 9.4.12.L.5-6, 10, 18, 21 11-12.RST.4, 8 11-12.WHST.1 DOK 3, 4	Students will distinguish between blood spatter droplets and blood spatter satellites to determine the point of origin based on lines of convergence within several case studies, including different scenarios with photos of spatter evidence, in order to establish where the victims were located when the bleeding first occurred. Students will need to provide evidence in order to justify their ideas of how the crime transpired.

## SUGGESTED STRATEGIES

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will perform simulated blood tests and compare the results to determine if an individual is linked to a crime scene based on blood evidence.</p> <p> Students having difficulty performing the blood tests will be given materials with fixed results.</p>	<p>Agglutination Antigen-antibody response</p> <p>DOK 1</p>	<ul style="list-style-type: none"> <li>• Apply proper procedures for testing blood</li> <li>• Analyze blood test results in order to prove a suspect's blood matches blood found at a crime scene</li> </ul> <p>DOK 3</p>
<p>Students will predict what the blood spatter patterns would look like under certain circumstances, which can include:</p> <ol style="list-style-type: none"> <li>1. While slicing onions, the knife slips and cuts a woman's finger. Describe the blood spatter pattern left as she walks to the bathroom.</li> <li>2. Right before the opposing team hit a fly ball, an outfielder's nose starts to bleed. Describe the blood spatter patterns left as he runs to catch the ball.</li> </ol> <p> Students having difficulty with this lab will be given data sheets with examples of blood spatter patterns based on different scenarios.</p>	<p>Lines of convergence Point of origin Satellite drop of blood</p> <p>DOK 1</p>	<ul style="list-style-type: none"> <li>• Create lines of convergence in order to establish a point of origin</li> <li>• Analyze the blood spatter evidence to establish where bleeding first occurred</li> </ul> <p>DOK 3</p>

**UNIT OVERVIEW**

**UNIT LEARNING GOALS**

Students will be able to transfer their understanding of the most important piece of evidence (the victim) so that on their own, they will be able to determine the manner, mechanism, and time of death by applying the most appropriate forensic techniques.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can connect how various environmental factors influence the estimated time of death.
3	<p>The student will:</p> <ul style="list-style-type: none"> <li>• apply concepts of the manner, mechanism, and time of death to a victim's a body and determine its relevance to the investigation.</li> <li>• summarize the roles of medical examiner, forensic anthropologist, and forensic entomologist in examining a corpse involved in a criminal investigation.</li> <li>• recognize or recall specific vocabulary, such as but not limited to: algor mortis, autolysis, autopsy, cause of death, death, decomposition, forensic entomology, instar, larva, livor mortis, manner of death, mechanism of death, pupa, rigor mortis.</li> </ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: The most important piece of evidence at a murder scene is the victim's body; great care must be taken to process it properly.

**ESSENTIAL QUESTIONS**

EQ1a: If you were a forensic scientist and needed to catch a murderer, would you prefer a body and no crime scene, or a crime scene and no body?  
 EQ1b: What evidence is available to the forensic investigator when examining a corpse?

### NJCCCS & COMMON CORE STANDARDS



- 5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations.
- 5.1.12.A.2 Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.
- 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.
- 5.1.12.B.1 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.
- 5.1.12.B.2 Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.
- 5.1.12.B.3 Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.
- 5.1.12.B.4 Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
- 9.4.12.L.3 Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
- 9.4.12.L.6 Demonstrate science knowledge and skills, including industry-specific applications, to enable pursuit of a full range of postsecondary education and career opportunities associated with the cluster.
- 9.4.12.L.18 Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.
- 9.4.12.L.72 Compare and evaluate career pathways within this cluster to build understanding of the requirements across multiple pathways.
- RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.
- RST.11-12.8 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.

### COMMON ASSESSMENT

ALIGNMENT	DESCRIPTION
LG1 EU1 5.1.12.A.1-3 5.1.12.B.1-4 5.1.12.C.3 9.4.12.L.3, 6, 18 11-12.RST.3, 4, 8 DOK 3	Students will determine time of death based on insect, algor, livor, and rigor mortis evidence in various scenarios. Students will need to remember to base time of death solely on temperature change (algor mortis) and then factor in the other variables. Students will compare and contrast the roles of the medical examiner, forensic anthropologist and forensic entomologist and determine when and how each contributes to assisting a criminal investigation.



**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
<p>Students will analyze scenarios in which they must estimate the time of death based on rigor mortis evidence.</p> <p> Students having difficulty estimating time of death using rigor mortis will be given tables and charts further explaining stiffening.</p>	<p>Death Rigor mortis Livor mortis</p> <p>DOK 1</p>	<p>Assess the available evidence to establish a time of death</p> <p>DOK 3</p>
<p>Students will calculate the time of death using algor mortis measurements.</p> <p> Students having difficulty will be given equations in order to clear up any confusion.</p>	<p>Decomposition Algor mortis</p> <p>DOK 1</p>	<p>Prove time of death using algor mortis calculations</p> <p>DOK 3</p>

**LEPS FORENSIC LAB SCIENCE****UNIT 12: CRIME SCENE INVESTIGATION: PULLING IT ALL TOGETHER****SUGGESTED DURATION: 2-3 WEEKS****UNIT OVERVIEW****UNIT LEARNING GOALS**

Students will be able to transfer their understanding of forensic science so that on their own, they will properly formulate the initial investigation of a crime scene and collect and analyze any evidence in a methodical and procedural manner.

**UNIT LEARNING SCALE**

4	In addition to score 3 performances, the student can identify possible points of contamination and disturbances in the investigation of crime scenes and how this affects criminal cases.
3	The student will: <ul style="list-style-type: none"><li>• construct the initial investigation of a crime scene;</li><li>• analyze various types of evidence found in a crime scene;</li><li>• identify, preserve, and document evidence;</li><li>• recognize or recall vocabulary from all units.</li></ul>
2	The student can complete all score 3 performances with minor mistakes.
1	The student needs assistance in order to reach the learning goal.
0	Even with help, the student does not exhibit understanding of performances listed in score 3.

**ENDURING UNDERSTANDINGS**

EU1: A crime scene is a complex environment that needs to be properly investigated.

**ESSENTIAL QUESTIONS**

EQ1: What must the forensic investigator be aware of when investigating a crime scene?

## NJCCCS & COMMON CORE STANDARDS

5.1.12.A.1-3 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.

5.1.12.B.1-4 Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.

5.1.12.C.1-3 Reflect on and revise understandings as new evidence emerges. Use data representations and new models to revise predictions and explanations. Consider alternative theories to interpret and evaluate evidence-based arguments.

5.1.12.D.1-3 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.

9.4.12.L.1-10 Identify and analyze customer software needs and requirements to guide programming and software development. Create and use information technology strategies and project plans when solving specific problems to deliver a product that meets customer specifications. Identify and analyze system and software requirements to ensure maximum operating efficiency. Demonstrate the effective use of software development tools to develop software applications. Use the software development process to design a software application and deliver it to the customer. Produce a computer application, in code, to demonstrate proficiency in developing an application using the appropriate programming language. Implement software testing procedures to ensure quality products. Perform maintenance and customer support functions to maintain software applications. Develop and maintain a database to store information.

9.4.12.L.14 Apply active listening skills to obtain and clarify information.

9.4.12.L.18-23 Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions. Employ critical thinking and interpersonal skills to resolve conflicts. Identify, write, and monitor performance goals to guide progress in assigned areas of responsibility and accountability. Conduct technical research to gather information necessary for decision-making. Formulate ideas, proposals, and solutions to address problems common to this cluster to ensure effective and efficient delivery of safety and/or security services to targeted consumers. Apply critical thinking strategies to facilitate team discussions about solutions to problems common to this cluster to contribute to the formulation of effective solutions.

9.4.12.L.36 Describe and use quality control systems and practices to ensure quality products and services.

RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.


RST11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.

WHST.11-12.2 Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

**COMMON ASSESSMENT**

ALIGNMENT	DESCRIPTION
LG1 EU1 5.1.12.A.1-3 5.1.12.B.1-4 5.1.12.C.1-3 5.1.12.D.1-3 9.4.12.L.1-10, 14, 18-23, 36 11-12.RST.3, 7 11-12.WHST.7,9 DOK 4	Students will use the knowledge gained throughout this course to secure and examine a simulated crime scene and properly collect and analyze evidence in the attempt to solve a fictional crime. Students will work in teams of six, with each student assigned a specific role. Each crime scene team will complete and turn in an investigation log, checklists, two sketches, photographs, and bagged evidence. Teams will then examine the evidence and determine the events of the crime.

**SUGGESTED STRATEGIES**

ACTIVITIES	DECLARATIVE KNOWLEDGE	PROCEDURAL KNOWLEDGE
Students will summarize the various types of evidence discussed throughout the course and review the proper collection and analysis techniques for each unit.   Students having difficulty will be given review material covering the units in question.	All course vocabulary  DOK 1	Develop an anticipatory plan of investigation for the crime scene reenactment  DOK 3