

La Cañada High School

Proposed Course Outline – Forensics

I. Course Title – ‘Forensic Science ’

II. Grade Level(s) – 9-12th grade

III. Length/Credit – 1 Year - 10.0 units Satisfies One Year of Interdisciplinary Lab Science for Graduation Credit

IV. Preparations – None

V. Course Description:

Forensics is the interdisciplinary application of science to investigate and establish how historical events have occurred for the purposes of providing evidence to resolve criminal, legal, and investigative issues. This course utilizes skills and concepts from multiple disciplines, such as physics, chemistry, biology, anthropology, psychology, and statistics to accomplish its goals.. Laboratory practice will make up at least 25% of this course in order to explore topics such as DNA fingerprinting, blood analysis, toxicology, crime scene investigations, counterfeiting, and rate of decay.

This course requires that significant instructional time be spent in hands-on laboratory work, with an emphasis on inquiry-based investigations that provide students with opportunities to demonstrate the foundational biological principles and apply all the attributes of the NGSS 3D instructional model and the seven science practices to their learning. This course is proposed as a UC Certified Lab Science.

VI. Standards/ESLRs Addressed

This course is designed to address a wide breadth of NGSS performance expectations from the four core science disciplines of earth science, physics, chemistry, and biology. Each instructional segment will include multiple PE’s across disciplines in order to facilitate student development, and mastery of, the 3 dimensions of NGSS and to prepare students for future core NGSS courses. As students achieve the performance expectations (PEs) within each instructional segment, they uncover disciplinary core ideas (DCIs) from Life Science, Physical Science, Earth and space science, and engineering. Students also focus on one or more crosscutting concepts (CCC) as tools to make sense of their observations and investigations; the CCCs are ongoing themes in all disciplines of science and engineering and help tie these seemingly disparate fields together. In addition to the exploration of phenomena through DCIs and CCCs, this course is organized based upon eight science and engineering practices (SEPs) which articulate the behaviors in which students need to engage in order to achieve conceptual understanding in the course. The science and engineering practices enable students to establish lines of evidence and use them to develop and refine testable explanations and predictions of natural phenomena. Because content, inquiry, and reasoning are equally important in Forensics, the learning objectives of the course described in the content outline combines content with inquiry and reasoning skills described in the science practices stated below.

VII. Brief Course Outline

CP Forensic Science Unit 1: History (5 Instructional Days)

Unit Rationale: Forensic Science combines the diverse fields of physical and biological sciences to recreate the events surrounding a crime. In this unit students will examine a timeline that details the major contributions to the development of the field of forensic science. Describe the basic as well as specialized services offered by forensic laboratories. This unit is designed to address the fundamental aspects of forensic science. Students will explore the major disciplines within forensic science and the development of the field of forensic science over time. Students will also be able to relate how major scientific advances have contributed to the evolution of the field of forensic science, discuss the role of crime laboratories and the services they provide and have the opportunity to use general forensics websites to explore advancements in the field of forensic science.

Overarching Essential Questions	Overarching Enduring Understandings	
<ul style="list-style-type: none"> ● What is the role of forensic science in modern society? ● How has the field of forensic science evolved over the past hundred years? ● How have scientific advancements contributed to the evolution of forensic science? ● How is the depiction of forensic science in popular culture misleading? 	<ul style="list-style-type: none"> ● The principles of scientific method are required in ALL forensic scientific analysis. ● Forensic science utilizes concepts from all scientific disciplines. ● Locard’s exchange principal ● Comprehensive crime laboratories provide a variety of services including, but not limited to, a physical science unit, biology unit, firearms unit, document examination unit, photography unit, toxicology, fingerprint analysis, polygraph administration, voiceprint analysis, and crime-scene investigation. 	
Student Learning Objectives		
<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>	
Define forensic science and list the major disciplines it encompasses.	HS-ETS1-1	
Identify the major contributors to the development of forensic science and explain how scientific advancements account for the rapid growth of forensic laboratories in the past 40 years.	HS-ETS1-1 HS-LS1-2	
Describe Locard’s Exchange principle.	HS-LS1-2	
Compare and contrast Frye and Daubert decisions relating the admissibility of scientific evidence in the courtroom and explain the role and responsibilities of the expert witness.	HS-ETS1-1 HS-LS1-2	
Analyze how scientific advancements have contributed to the more effective use of forensic science in solving crimes	HS-ETS1-1 HS-LS1-2	

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models: Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)</p> <p>Asking Questions and Defining Problems: Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)</p> <p>Engaging in Argument from Evidence: Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)</p>	<p>Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)</p>	<ul style="list-style-type: none"> • Patterns <ul style="list-style-type: none"> ○ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. • Cause and effect <ul style="list-style-type: none"> ○ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • Structure and function <ul style="list-style-type: none"> ○ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. <p>Connections to Nature of Science</p> <p>Science is a human endeavor</p> <ul style="list-style-type: none"> • Technological advances have influenced the progress of science and science has influenced advances in technology. <p>Science and engineering are influenced by society and society is influenced by science and engineering.</p>

Embedded English Language Arts/Literacy and Mathematics

English Language Arts/Literacy –

English Language Arts/Literacy –

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.11-12.4. 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.

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.

Mathematics –

4.5 B. Communication

1. Use communication to organize and clarify their mathematical thinking

4.5 D Reasoning

4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.

4.5 C Connections

3. Recognize that mathematics is used in a variety of contexts outside of mathematics.

Three-Dimensional Teaching and Learning

Students will understand how scientific advancements have contributed to the development and evolution of forensic science and will be able to analyze two cases and the forensic investigation techniques used in each as it relates to the development of forensic science

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

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

Forensic science is an ever developing field that depends on knowledge of biology, chemistry, and physics to draw conclusions from physical evidence.

Prior Learning

- Branches of science evolved over time through experimentation
- Significance of Supreme Court decisions
- Scientific method

Part A:

Concepts	Formative Assessment
Many scientists were crucial in the development of the field of forensic science by implementing principles and techniques that could be used to examine physical evidence.	<i>Students who understand the concepts are able to:</i> <ul style="list-style-type: none">• Students will describe major contributors to their respective branches of forensic science• Students will have the opportunity to use general forensics websites to explore advancements in the field of forensic science

Part B:

Concepts	Formative Assessment
<ul style="list-style-type: none">• Describe Locard's Exchange principle	<i>Students who understand the concepts are able to:</i> <ul style="list-style-type: none">• Students will explain the concept of Locard's exchange principle and significance to the field of forensic science

Part C:

Concepts	Formative Assessment
Explain the criteria of admissibility of evidence and the scientific advancements that resulted on the rapid growth of forensic laboratories	<i>Students who understand the concepts are able to:</i> <ul style="list-style-type: none">• Students will describe the Supreme Court decisions that specify admissibility rules for evidence• They will describe what the rules are and reference the cases• Students will explain the factors that lead to the advent of the numerous crime labs present today

Samples of Open Education Resources for this unit:

The Science Spot <http://sciencespot.net/Pages/classforsci.html>

History of Forensic Science: www.crimezzz.net/forensic_history

Criminal Fact Investigation Index: www.tncrimlaw.com/forensic/fsbindx

Forensic History Timeline: <http://forensicsciencecentral.co.uk>

History timeline CBS TV: www.cbsnews.com/htdocs/forensics/timeline

Crime scene investigation protocol: www.nij.gov/topics/law-enforcement/investigations/crime-scene

CP Forensic Science Unit 2 Physical Evidence:(10 Instructional Days)

Unit Rationale: Forensic science utilizes all levels of scientific inquiry, specifically chemistry and physics, to analyze physical evidence with the ultimate goal of recreating the events of the crime for a jury in a court of law. Students will also identify and compare various types of physical evidence and compare their values to forensic investigation. Students will address the fundamental aspects of crime scene investigation and the identification and comparison of physical evidence. Students will be able to define physical evidence and describe how it is collected and packaged as well as identify and compare various types of physical evidence and compare their values to forensic investigation. Understand the importance of following the principals of scientific method and the need for collecting control samples at every crime scene.

Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> ● Why is it important to collect evidence in a procedural manner? ● What is the difference between the identification and comparison of physical evidence? ● Why is it important that physical evidence collected from a crime scene is shared on national databases? 	<ul style="list-style-type: none"> ● Physical evidence is crucial in linking victims and suspects to a crime scene. ● Physical evidence must be collected in a specific and strategic manner, as well as systematically documented, in order to ensure that no tampering or contamination occurs. ● Physical evidence can link specific persons or objects to a crime scene, or may contain class characteristics linking a type of object to a crime scene. ● Physical evidence collected from crime scenes (i.e. fingerprints and DNA) are shared on national databases. This dramatically enhances the role of forensic science in criminal investigation.

Student Learning Objectives	
<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>
Identify the common types of physical evidence encountered at crime scenes and describe proper techniques for packaging common types of physical evidence.	HS-LS1-2 HS-LS2-7
Explain the difference between the identification and comparison of physical evidence.	HS-LS1-2 HS-LS2-7
Define and contrast individual and class characteristics of physical evidence.	HS-LS1-2 HS-LS2-7
Assess the value of class characteristics to crime scene investigation.	HS-PS4-1

The Student Learning Objectives above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models: Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)</p> <p>Constructing Explanations and Designing Solutions: Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.</p> <p>ETS1.B: Developing Possible Solutions: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a</p>	<p>Systems and System Models: Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2)</p> <p>Cause and Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8),(HS-LS4-6)</p> <p>Scale, Proportion, and Quantity: The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)</p>

<p>Using Mathematics and Computational Thinking:</p> <p>Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HLSL2-1) ☐</p> <p>Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)</p> <p>Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)</p> <p>Engaging in Argument from Evidence:</p> <p>Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)</p> <p>Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8)</p> <p>Analyzing and Interpreting Data:</p> <p>Apply concepts of statistics and probability to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3)</p>	<p>problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)</p> <p>ETS1.C: Optimizing the Design Solution:</p> <p>Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HSETS1-2)</p>	<p>Patterns:</p> <p>Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HLSL4-1),(HS-LS4-3)</p> <p>Science is a Human Endeavor:</p> <p>Technological advances have influenced the progress of science and science has influenced advances in technology. (HSL3-3)</p> <p>Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)</p>
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English Language Arts/Literacy –

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.11-12.7 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.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 (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Mathematics –

4.5 A. Problem Solving

3. Select and apply a variety of appropriate problem-solving strategies to solve problems.

4.5 B. Communication

1. Use communication to organize and clarify their mathematical thinking
2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.
3. Analyze and evaluate the mathematical thinking and strategies of others.

4.5 C Connections

2. Use connections among mathematical ideas to explain concepts.
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.
4. Apply mathematics in practical situations and in other disciplines.

4.5 D Reasoning

4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.
5. Make and investigate mathematical conjectures

4.5 E Representations

1. Create and use representations to organize, record, and communicate mathematical ideas as pictorial or symbolic.

2. Select, apply, and translate among mathematical representations to solve problems.

4.5 F. Technology

6. Use computer-based laboratory technology for mathematical applications in the sciences.

Three-Dimensional Teaching and Learning

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.

Students will understand the importance of identifying and comparing physical evidence and sharing this information on national databases

Prior Learning

- Students will be required to understand Locard's exchange principal
- Lab safety SOPs

• Part A:

Concepts

Students will understand the importance of following procedures and documentation in evidence collection and will be able to properly collect physical evidence

Formative Assessment

Students who understand the concepts are able to:

Students will demonstrate and explain how and why different types of physical evidence should be packaged

Part B:

Concepts

Formative Assessment

Students will be able to classify types of physical evidence and explain their significance in forensic investigation.	<i>Students who understand the concepts are able to:</i> Distinguish between individual and class evidence given hypothetical and actual examples to observe and analyze and justify their hypotheses
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Part C:	
Concepts	Formative Assessment
<ul style="list-style-type: none"> Students will understand the importance of identifying and comparing physical evidence and sharing this information on national databases 	<i>Students who understand the concepts are able to:</i> Students will identify the relevant databases and what evidence can be input as well as the importance of communication amongst law enforcement agencies nationally

Samples of Open Education Resources for this unit:
<p>The Science Spot http://sciencespot.net/Pages/classforsci.html</p> <p>OREGON STATE POLICE FORENSIC SERVICES DIVISION - http://www.crime-scene-investigator.net/Phys_Evid_Manual_OR.pdf</p> <p>World of Forensic Science - http://www.encyclopedia.com/doc/1G2-3448300449.html</p> <p>BSAPP Forensics - http://www.bsapp.com/forensics_illustrated/forensic_text_adobe/text_unit_2_physical_evidence.pdf</p>

CP Forensics Unit 3: The Crime Scene (15 Instructional Days)	
<p>Unit Rationale: Forensic Science combines the diverse fields of physical and biological sciences to recreate the events surrounding a crime. In this unit students will examine a timeline that details the major contributions to the development of the field of forensic science. Describe the basic as well as specialized services offered by forensic laboratories. Explain proper crime scene procedure and understand the necessity for establishing a chain of custody. Detail the role that evidence plays in recreating the events of a crime. Describe the two types of evidence that can be found at a crime scene and differentiate between class and individual evidence. Understand the importance of following the principals of scientific method and the need for collecting control samples at every crime scene. Define proper evidence collection procedure. It is assumed students have working knowledge of a compound light microscope but a review during this unit is advisable.</p>	
Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> How can physical evidence be used to reconstruct a crime scene? What are the proper techniques in order to properly process evidence? 	<ul style="list-style-type: none"> Forensic science utilizes concepts from all scientific disciplines.

<ul style="list-style-type: none"> • What information can be gained from the proper processing of evidence at a crime scene? 	<ul style="list-style-type: none"> • The principles of scientific method are required in ALL forensic scientific analysis. • Physical evidence is indispensable in crime scene recreation.
Student Learning Objectives	
Define the crime scene and identify the steps followed in crime scene investigation.	HS-PS1-1 HS-PS1-2
Describe the use and information obtained from physical evidence found at the crime scene.	HS-PS1-1 HS-PS1-2
Demonstrate proper documentation of the crime scene, various techniques used to effectively search a crime scene and proper techniques used to collect, package, and preserve physical evidence at a crime scene.	HS-PS1-1 HS-PS1-2 HS-PS1-5
Summarize and present crime scene reports including sketches, photographs, notes and lab analysis results	HS-PS1-1 HS-PS1-2 HS-PS1-3 HS-PS1-5

CP Forensic Science Unit 4: Fingerprinting (15 Instructional Days)	
Unit Rationale: 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.	
Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> • How can the various methods for processing, classifying, and identifying fingerprints aid in a criminal investigation? • How can fingerprints identify a criminal with absolute certainty? 	<ul style="list-style-type: none"> • Explain the history and development of fingerprints as identifying features for civil and law enforcement agencies. • Fingerprints are unique to individuals and can be used as evidence in arguing which individuals were present at a crime scene
Student Learning Objectives	

<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>
Analyze the common ridge characteristics of a fingerprint.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2
Identify and compare the three major fingerprint patterns and their respective subclasses.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2
Distinguish between visible, plastic and latent fingerprints	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2
Describe the concept of an automated fingerprint identification system (AFIS) and its importance to forensic investigation.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2
List and demonstrate the techniques for developing latent fingerprints on porous and nonporous objects.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2
Describe and demonstrate the proper procedures for preserving a developed latent fingerprint.	HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-LS1-1 HS-LS1-2

CP Forensic Science Unit 5: Blood Evidence (20 Instructional Days)

Unit Rationale: Blood is among the most common forms of evidence found at scenes of violent and brutal crimes. All suspected blood—liquid or dried, animal or human—present suggests a relationship to the offense or persons involved in a crime. Blood may be found in trace amounts, puddles, spatters, smears, or droplets. Blood samples may be collected from suspects and victims for examination and comparison. Blood evidence can help narrow a group of suspects, support identification of a suspect, and even guide the reconstruction of a crime.

Overarching Essential Questions	Overarching Enduring Understandings	
<ul style="list-style-type: none"> ● How is blood analyzed by forensic investigators? ● How can information be inferred based on blood spatter patterns? ● How can crime scene reconstruction assist forensic scientists in solving crimes? 	<ul style="list-style-type: none"> ● Serology involves a broad scope of laboratory tests that use specific antigen and serum antibody reactions. ● Blood type is an inherited trait that is a permanent feature of a person’s biological makeup. ● Blood may link criminal to crime. ● Individual blood stains can convey the directionality and of impact of the blood when it struck a surface. ● Crime scene reconstruction helps to sort out the events surrounding the occurrence of a crime. 	
Student Learning Objectives		
<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>	
Explain the composition of blood	HS-LS1-1 HS-LS1-2 HS-LS3-2	
Describe the function of blood cells	HS-LS1-1 HS-LS1-2 HS-LS3-2	
Describe the history of the use of blood and blood-spatter analysis in forensic science	HS-PS1-2 HS-ETS1-1 HS-ETS1-2	
Describe how to determine blood type, given a sample	HS-LS1-1 HS-LS1-2 HS-LS3-2	
Describe how to screen for the presence of human blood	HS-LS1-1 HS-LS1-2	

	HS-LS3-2
Calculate the probability of certain blood types with in a population	HS-LS1-1 HS-LS1-2 HS-LS3-2
Conduct a blood spatter analysis	HS-PS1-2 HS-ETS1-1 HS-ETS1-2
Use blood spatter evidence to recreate the events of a crime scene	HS-PS1-2 HS-ETS1-1 HS-ETS1-2

<p>CP Forensics Unit 6: DNA Evidence (15 Instructional Days)</p> <p>Unit Rationale: This unit is designed to allow students the opportunity to investigate how DNA has become an “indispensable forensic science tool.” Students will understand basic concepts of DNA including its structure, function, and uniqueness to each individual. Students will compare and model various types of DNA typing. Students will also explore several case studies involving DNA evidence and cite the importance of properly handling and preserving physical evidence (especially DNA evidence) in forensic investigations. Students will discuss how mishandling of DNA evidence can severely diminish its value in the courtroom. Students will discuss DNA databases and their use in solving crimes, new and old. In this unit, students will compare case studies in which the limitations of DNA evidence are discussed.</p>	
Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> • How is DNA and how is unique to each individual? • What is the significance or value of DNA evidence to forensic investigation? • How has DNA profiling contributed to the development of the field of forensic science? • What DNA technologies have been developed that can be used to isolate and identify evidence? 	<ul style="list-style-type: none"> • Apply the principles of DNA as a means to identifying one person with a reasonable certainty. • Describe the differences in nuclear DNA, mitochondrial DNA • DNA evidence is highly important as, upon proper handling, it can directly link an individual to a crime scene. • Understand the significance of the development of DNA technology to forensic science and will be able to compare segments of DNA and describe the use of DNA profiling in the CODIS database.
Student Learning Objectives	
<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>

Identify the parts of a nucleotide and explain how nucleotides are linked to form DNA and explain the concept of base pairing as it relates to the double-helix structure of DNA.	HS-LS1-1 HS-LS3-1 HS-LS3-2 HS-LS3-3
Describe how the newest DNA typing techniques, like short tandem repeats (STRs) and polymerase chain reaction (PCR) are applied to forensic DNA typing and how CODIS is used to compare DNA samples	HS-LS1-1 HS-LS3-1 HS-LS3-2 HS-LS3-3
Describe the difference between nuclear and mitochondrial DNA.	HS-LS1-1 HS-LS3-1 HS-LS3-2 HS-LS3-3
List the necessary procedures for proper preservation of biological evidence for laboratory DNA analysis.	HS-LS1-1 HS-LS3-1 HS-LS3-2 HS-LS3-3

CP Forensics Unit 7: Questioned Document (20 Instructional Days)

Unit Rationale: This unit is designed to address the fundamental aspects of document examination as it applies to forensic science. Students will explore handwriting analysis as well as some guidelines for collecting known writings for comparison to a questioned document. Students will also discuss some of the class and individual characteristics of printers, photocopiers, inks. Students will use document examination techniques to uncover alterations, erasures, obliterations, and variations in pen inks. Students will familiarize themselves with US currency security features and identify counterfeit currency.

Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> ● How can handwriting be used as individual evidence? ● How can the forensic scientist detect forgeries or counterfeits? 	<ul style="list-style-type: none"> ● Handwriting becomes personalized almost as soon as students begin learning it.

<ul style="list-style-type: none"> • What are the important guidelines necessary to collection of handwriting exemplars? • What is a “questioned document” and what is the value of a questioned document in forensic investigation? 	<ul style="list-style-type: none"> • Questioned documents and other collected documents can be analyzed for handwriting comparisons to determine if the author of each is the same. • Inks (printer, pen, and photocopier) can be compared to determine if they share a common source. • Questioned documents may be analyzed for alterations, obliterations, erasures, or variations in pen inks.
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Student Learning Objectives

<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>
Define questioned document, explain some of the techniques document examiners use to uncover alterations, erasures, obliterations, and variations in pen inks	HS-LS1-2 HS-LS1-3 HS-LS1-5 HS-LS1-6
Identify what common characteristics are associated with handwriting and list important guidelines for collecting known writings for comparison to a questioned document.	HS-LS1-2 HS-LS1-3 HS-LS1-5 HS-LS1-6
Describe Anti-counterfeiting features on US currency	HS-LS1-2 HS-LS1-3 HS-LS1-5 HS-LS1-6

CP Forensic Science Unit 8: Toxicology(10 Instructional Days)

Unit Rationale: Forensic science utilizes all levels of scientific inquiry, specifically chemistry, human physiology and biochemistry, to analyze physical evidence with the ultimate goal of recreating the events of the crime for a jury in a court of law. This unit focuses on drugs, toxicology and the chemistry of alcohol, physical evidence collection and analysis using technology that incorporates core principles from chemistry, physics, biochemistry and human physiology.

Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> • What laboratory tests do forensic scientists rely on to identify unknown chemicals? 	<ul style="list-style-type: none"> • Chemical compounds are classified in the Controlled Substances Act are regulated by the United States government.

<ul style="list-style-type: none"> • How does chromatography work and how can it be modified to accomplish a specific chemical identification? • What methods are available to determine the level of sobriety in a suspected impaired driver? • How is toxicity determined? 	<ul style="list-style-type: none"> • Understand the significance of drug analysis and toxicology to forensic investigations and will be able to identify various drugs and describe methods drug analysts and toxicologists use in identifying substances. • Toxicology has a long historical presence and many applications in assessing possible cause of death. • Describe techniques that forensic toxicologists use to isolate and identify drugs and poisons. • How alcohol is absorbed and processing in a living system
Student Learning Objectives	
Identify unknown substances by utilizing a series of chemical tests of the chemical and physical properties of substances	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3
Explain what LD50 is and how it is determined for different substances and use it to classify how toxic a substance is	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3
Human metabolism of alcohol and calculation of blood alcohol content	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3

CP Forensic Science Unit 9: Anthropology (20 Instructional Days)	
Unit Rationale: To understand the composition, development and structure of bones to recognize the wealth of post mortem information made available	

Overarching Essential Questions	Overarching Enduring Understandings	
<ul style="list-style-type: none"> • How can the structure and function of bone help forensic investigators? • How can the knowledge of human anatomy, specifically the skeletal system, help forensic scientists? • How can bones be used to build a description of the person? 	<ul style="list-style-type: none"> • Forensic anthropologists identify and examine human skeletal remains to gain insight into a crime. • Bones reveal key information about the age, race, sex, health, and lifestyle of the person 	
Student Learning Objectives		
<i>What students should be able to do after instruction.</i>		<i>Evidence Statements</i>
Describe how bone is formed	HS-LS1-6 HS-LS1-7	
Distinguish between male and female skeletal remains based on skull, jaw, brow ridge, pelvis and femur	HS-LS1-6 HS-LS1-7	
Describe how bones contain a record of disease and injury	HS-LS1-6 HS-LS1-7	
Describe how age determination may be based upon an analysis of bone	HS-LS1-6 HS-LS1-7	
Explain human facial structure differences based upon race	HS-LS1-6 HS-LS1-7	
Describe the role of mitochondrial DNA in bone identification	HS-LS1-6 HS-LS1-7	

<p align="center">CP Forensic Science Unit 10: Autopsies and Entomology (20 Instructional Days)</p> <p align="center">Unit Rationale: To recognize cause and effect of death on the human body, the chronological chains of events, related biological and chemical changes, the connections between humans and other living things, and understand the potential data made available by concurrent events.</p>		
Overarching Essential Questions	Overarching Enduring Understandings	
<ul style="list-style-type: none"> • How is death defined? • How can an autopsy help to solve a crime? 	<ul style="list-style-type: none"> • There are several definitions of death, including the cessation of the heartbeat and brain function. 	

<ul style="list-style-type: none"> • Why is time of death important? • How can environmental factors influence the time estimate? 	<ul style="list-style-type: none"> • An autopsy is performed if a death is suspicious or unexplained. • A forensic entomologist studies the development of insect larvae in a body to estimate the time of death.
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Student Learning Objectives

<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>
Distinguish between four manners of death: natural, accidental, suicidal, homicidal	HS-LS1-1 HS-LS1-2
Distinguish between cause, manner, and mechanisms of death	HS-LS1-1 HS-LS1-2
Explain how the development of rigor, algor and livor mortis occur	HS-LS1-1 HS-LS1-2
Employ evidence of rigor, algor and livor mortis to calculate the approximate time of death	HS-LS1-1 HS-LS1-2
Describe the stages of decomposition in a corpse	HS-LS1-1 HS-LS1-2
Employ autopsy report regarding stomach contents to estimate time of death	HS-LS1-1 HS-LS1-2
Explain how time of death estimates may be linked to insect evidence	HS-LS1-1 HS-LS1-2
Provide an example of the succession of different types of insects that are found on a body as it decomposes	HS-LS1-1 HS-LS1-2
Estimate time of death given insect evidence, rigor, algor and livor mortis data	HS-LS1-1 HS-LS1-2
Describe how various environmental factors may influence the estimated time of death	HS-LS1-1 HS-LS1-2

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CP Forensic Science Unit 11: Hair and Fiber Analysis (20 Instructional Days)

Unit Rationale: Trace Evidence examination is often challenged in court for its uncertainty. Nonetheless, characterization of hair and fiber evidence has played an important role in providing investigative leads in many criminal cases. It is not to be replaced in its entirety by DNA analysis, but to be used complementarily with other disciplines and technology in forensic science.

Overarching Essential Questions		Overarching Enduring Understandings	
<ul style="list-style-type: none"> ● How is hair used in a criminal investigation? ● How can fibers be used as circumstantial evidence to provide links to the victim, suspect, and the crime scene? ● Why is fiber evidence not always conclusive with suspect identification? 		<ul style="list-style-type: none"> ● Human hair is a form of class evidence if no follicle is present. ● The follicle of a human hair contains DNA. ● The main function of hair is to help regulate body temperature. ● Fibers are classified as natural or synthetic. ● Textiles refer to the weaving patterns of fibers. 	
Student Learning Objectives			
<i>What students should be able to do after instruction.</i>			<i>Evidence Statements</i>
Identify the various parts of hair			HS-LS1-1 HS-LS1-2
Describe variations in the structure of the medulla, cortex, and cuticle			HS-LS1-1 HS-LS1-2
Distinguish between human and nonhuman animal hair			HS-LS1-1 HS-LS1-2
Explain how hair can be used in a forensic investigation.			HS-LS1-1 HS-LS1-2
Calculate the medullary index for a hair.			HS-LS1-1 HS-LS1-2

Distinguish hairs from individuals belonging to the broad racial categories	HS-LS1-1 HS-LS1-2
Determine if two examples of hair are likely to be from the same person.	HS-LS1-1 HS-LS1-2
Identify and describe common weave patterns of textile samples	HS-LS1-1 HS-LS1-2
Compare and contrast various types of fibers through physical and chemical analysis.	HS-LS1-1 HS-LS1-2
Describe principal characteristics of common fibers used in their identification.	HS-LS1-1 HS-LS1-2

CP Forensic Science Unit 12: Ballistics and Impression Evidence (25 Instructional Days)

Unit Rationale: Just as natural variations in skin ridge patterns and characteristics provide a key to human identification, minute random markings on surfaces can impart individuality to inanimate objects. Structural variations and irregularities caused by scratches, nicks, breaks, and wear permit the criminalist to relate a bullet to a gun; a scratch or abrasion mark to a single tool; or a tire track to a particular automobile. Individualization, so vigorously pursued in all other areas of Criminalistics, is frequently attainable in firearms and tool examination.

Overarching Essential Questions	Overarching Enduring Understandings
<ul style="list-style-type: none"> ● How can scientists tell that a specific tool created a mark, not one like it? ● How are different types of impressions used in forensic investigations? ● Although they might seem easy to cover up, why might foot prints, bite marks and tire tracks can be difficult to conceal? ● How are the unique characteristics of firearms important to criminal investigations? 	<ul style="list-style-type: none"> ● Many objects leave impressions that can be used as trace evidence ● Different types of firearms have unique characteristics. ● Spent cartridges and bullets can be matched with specific firearms used in crimes ● There are procedures that can determine if an individual fired a weapon.

Student Learning Objectives	
<i>What students should be able to do after instruction.</i>	<i>Evidence Statements</i>
Distinguish between latent, patent, and plastic impressions	HS-ETS1-2 HS-PS1-2
Explain how various types of impressions can be used as trace evidence	HS-ETS1-2 HS-PS1-2
Use track width and wheelbase information to identify a motor vehicle	HS-ETS1-2 HS-PS1-2
Discuss the significance of tool mark impressions in criminal investigations	HS-ETS1-2 HS-PS1-2
Describe three major types of tool mark impressions	HS-ETS1-2 HS-PS1-2
Describe variations in tool surface characteristics that are used to identify individual tools	HS-ETS1-2 HS-PS1-2
Match tool marks with the instrument used to create same	HS-ETS1-2 HS-PS1-2
Describe how tool mark evidence is collected, preserved and documented	HS-ETS1-2 HS-PS1-2
Describe rifling on a gun barrel and explain how it marks a bullet	HS-PS2-1 HS-PS2-2 HS-PS2-3
Explain barrel size and caliber	HS-PS2-1 HS-PS2-2 HS-PS2-3
Describe how bullets are test fired and matched	HS-PS2-1 HS-PS2-2 HS-PS2-3
Discuss the role of ballistics recovery and examination at a crime scene	HS-PS2-1 HS-PS2-2 HS-PS2-3
Determine the position of the shooter based on bullet trajectory	HS-PS2-1 HS-PS2-2 HS-PS2-3

VIII. Methods of Assessment

Grades and Class Participation:

All work will be assessed and the students will receive points. Overall grades in the class will be by total percentage:

A=90+ B=80-89 C=70-79 D=60-69

Grades will be based on daily class assignments, homework, notebook checks, projects, quizzes and tests. Class participation is essential to the learning process; therefore, daily student attendance is essential for course success.

Grades for this class will derive from the following sources:

Exams	50%	
Labs/Homework/Projects		50%

Attendance Policy: Attendance in this course will be treated the same way as it would be treated at a place of employment. If a student is absent, it is the student's responsibility to see the instructor to get "makeup" or "missed" information. Also, if a student is behind, he/she can set up appointment to use the computer lab before or after school, or during STEP, as is mutually agreeable to teacher and student.

Academic Honesty:

Students are expected to demonstrate honesty and integrity at all times. Each student is responsible for his or her own work, which includes test taking, homework, class assignments, individual contributions to group products, and the original creation of digital art, web pages, essays, compositions, and research papers. All work submitted by a student should be a true reflection of that student's knowledge, experience, effort and ability. It is unacceptable academic behavior to submit work that is not one's own. Refer to "Academic Honesty & Integrity" section in your student handbook. The consequences laid out in this section will be strictly adhered to in all incidents of cheating or plagiarism.

IX. Materials/Textbook(s) Bertino, Anthony J., and Patricia Nolan. Bertino. Forensic Science: Fundamentals & Investigations. Second edition. Mason, OH: South-Western Cengage Learning, 2016.

X. Seeking "a-f" Approval – Yes – Yes, this course will be submitted to the University of California for approval for the 2019-20 academic year in the subject domain "D" for Laboratory Science.

XI. Seeking AP Class Approval – No– This course does NOT seek AP approval.