CSI   **Designed by: Cindy Klein**

Unit of Study: Processing the Crime Scene

Brief Summary of Unit:

PRE-REQUISITE SKILLS: Basic graphing skills (X & Y axis and plot 2 variables) and general laboratory skills (measurement and utilization of basic science equipment), basic navigation on the internet for gathering research materials. Students should have basic knowledge of conventions (grammar) when writing or speaking. Students must exercise good safety habits, specifically in laboratory sessions. Students must be able to work both independently and in group settings from written directions. Students must be able to write a basic laboratory report with hypothesis, materials, procedure, data, and conclusions. Basic photography skills for zoom, micro, and wide pan images.

The primary focus of this unit is to understand the processes of the properly collecting and "bagging" evidence that could be admissible in court. Identify evidence as "class" or "individualistic." They must properly document the chain of evidence for each piece of evidence.

 The processes include:
Analyze the impact of modern technology on the study of forensics and its place in the real world application.

BELOW LEVEL ACTIVITIES: If students are struggling with this material, differentiation of instruction could include use of: online powerpoint notes packet, small group laboratory sessions, chunked content with notes outline; a simplified, graphic organizer for key concepts.

EXTENSION ACTIVITIES for advanced learners could include real data that would require more complex graphical representation and breakdown of data; more complex examples; more complex activities; and additional article research via scientific online resources.

Materials and Resources

- South-Western Cengage Learning – Forensic Science: Fundamentals & Investigations (Bertino & Bertino) - South-Western Cengage Learing – Forensic Science – Advanced Investigations (Brown & Davenport) - Prentice Hall – Criminalistics: An introduction to forensic science (Saferstein) - Law Tech Custom Publishing – Forensic Studies: CSI for the Nonscientist from Crime Scene to Crime Lab (Bucholtz & Davis) - Law Tech Custom Publishing – Biological Evidence (Bucholtz & Lewis) - The Center for Applied Research in Education – Crime Scene Investigations: Real-life science labs for grades 6-12. - Bureau of Education & Research – Strengthening Your Science instruction Using NEW and innovative forensic science strategies Resource Handbook - grades 7-12 (Butler) - American Academy of Forensic Sciences – Eighth Forensic Science Education Conference (2005) Reference Guide (Cedar Crest College) - Facts on File, Inc. – Forensic Science Experiments on File Reproducible Handouts - NeoSCI Corporation - New Ideas for teaching science – Detective's Casebook Reproducible Handouts - Ward's Natural Science (2004) – Forensic Detective Lab Activity (36W 6150) - Mulberry House Publishing – Understanding Firearm Ballistics: Basic to advanced ballistics, simplified, illustrated, and explained. (Rinker) - Ward's Natural Science – The Science Behind Ballistics and Firearms Lab Activity (36W 6239) - Ward's Natural Science – Forensic Glass Analysis Lab Activity (36W6240)	Materials necessary to complete the performance tasks. - Unbreakable holiday ornaments - Measuring devices (tape measures, rulers, volume, mass) - Digital camera with zoom capabilities - ID number markers - Evidence tags - Evidence bags – paper, plastic, containers - Templates for sketches - Graph paper - Faces 4.0 CD ROM - Photographic rulers (white & black and "L" shaped) - Forceps / tweezers - Latex (or non-latex) gloves - Teacher Made Crime Scene Scenarios: Jose` Gonzales & Miley Cyrus story lines - Inflatable Manikins & props

ELIGIBLE CONTENT   S11.A.1 **Reasoning and Analysis**

Students will be able to use their learning independently to:
- **S11.A.1.1** - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
- **S11.A.1.2** - Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
- **S11.A.1.3** - Describe and interpret patterns of change in natural and human-made systems.

Understandings	**Essential Questions**
- Types of evidence - Search Methods - Responders' roles - Primary Vs secondary scenes - Proper techniques for evidence collection - Proper documentation for evidence seals to custody - Observations & eyewitnesses - Fact vs opinion - Sketches - Basics of Police Reports - Utilization of faces 4.0 for facial reconstruction	- How do you classify evidence? - When is appropriate to utilize specific search methods? - What constitutes a primary vs secondary crime scene? - Who does what at a crime scene? - What methods are utilized to collect & record evidence? - What are the basic components of a police report? - When are eye witnesses important? - How do you sketch the crime scene with scale? - How do you utilize faces 4.0 to provide facial reconstruction? - How do you interpret a mock crime scene?
Knowledge	**Skills**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	- Utilize faces 4.0 for facial reconstruction - Collect & bag and document evidence properly - Write a police report with proper components - Classify evidence - Designate responsibilities at crime scene - Utilize proper search methods - Sketch the crime scene

ELIGIBLE CONTENT S11.A.2 **Processes, Procedures, and Tools of Scientific Investigations**

Students will be able to use their learning independently to:
- **S11.A.2.1** - Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.
- **S11.A.2.2** - Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide

Understandings	Essential Questions
- Types of evidence - Search Methods - Responders' roles - Primary Vs secondary scenes - Proper techniques for evidence collection - Proper documentation for evidence seals to custody - Observations & eyewitnesses - Fact vs opinion - Sketches - Basics of Police Reports - Utilization of faces 4.0 for facial reconstruction	- How do you evaluate a mock crime scene? - How do you classify evidence? - When is appropriate to utilize specific search methods? - What constitutes a primary vs secondary crime scene? - Who does what at a crime scene? - What methods are utilized to collect & record evidence? - What are the basic components of a police report? - When are eye witnesses important? - How do you sketch the crime scene? - How do you utilize faces 4.0 to provide facial reconstruction?
Knowledge	**Skills**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	- Utilize faces 4.0 for facial reconstruction - Collect & bag and document evidence properly - Write a police report with proper components - Classify evidence - Designate responsibilities at crime scene - Utilize proper search methods - Sketch the crime scene

ELIGIBLE CONTENT S11.A.3 **Systems, Models, and Patterns**

Students will be able to use their learning independently to:
- **S11.A.3.1** - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
- **S11.A.3.2** - Compare observations of the real world to observations of a constructed model.
- **S11.A.3.3** - Compare and analyze repeated processes or recurring elements in patterns.

Understandings	Essential Questions
- Types of evidence - Search Methods - Responders' roles - Primary Vs secondary scenes - Proper techniques for evidence collection - Proper documentation for evidence seals to custody - Observations & eyewitnesses - Fact vs opinion - Sketches - Basics of Police Reports - Utilization of faces 4.0 for facial reconstruction	- How do you analyze a mock crime scene? - How do you classify evidence? - When is appropriate to utilize specific search methods? - What constitutes a primary vs secondary crime scene? - Who does what at a crime scene? - What methods are utilized to collect & record evidence? - What are the basic components of a police report? - When are eye witnesses important? - How do you sketch the crime scene? - How do you utilize faces 4.0 to provide facial reconstruction?
Knowledge	**Skills**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	- Utilize faces 4.0 for facial reconstruction - Collect & bag and document evidence properly - Write a police report with proper components - Classify evidence - Designate responsibilities at crime scene - Utilize proper search methods - Sketch the crime scene - Analyze a Mock Crime Scene

ELIGIBLE CONTENT	S11.C.3	**Principles of Motion and Force**

Students will be able to use their learning independently to:
- **S11.C.3.1** - Use the principles of motion and force to solve real-world challenges.

Understandings	Essential Questions
- Types of evidence - Search Methods - Responders' roles - Primary Vs secondary scenes - Proper techniques for evidence collection - Proper documentation for evidence seals to custody - Observations & eyewitnesses - Fact vs opinion - Sketches - Basics of Police Reports - Utilization of faces 4.0 for facial reconstruction	- How do you analyze a mock crime scene? - How do you classify evidence? - When is appropriate to utilize specific search methods? - What constitutes a primary vs secondary crime scene? - Who does what at a crime scene? - What methods are utilized to collect & record evidence? - What are the basic components of a police report? - When are eye witnesses important? - How do you sketch the crime scene? - How do you utilize faces 4.0 to provide facial reconstruction?
Knowledge	**Skills**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	- Utilize faces 4.0 for facial reconstruction - Collect & bag and document evidence properly - Write a police report with proper components - Classify evidence - Designate responsibilities at crime scene - Utilize proper search methods - Sketch the crime scene - Analyze a Mock Crime Scene

ELIGIBLE CONTENT   MATH RELATED STANDARDS Grade 11

2.1: Numbers, Number Systems and Number Relationships

2.1.11.D: Use exponential, scientific, and calculator notation to represent any rational number.
2.1.11.F: Understand the concepts of exponential and logarithmic forms and use the inverse relationships between exponential and logarithmic expression to determine unknown quantities in equations.

2.2: Computation and Estimation

2.2.11.C: Evaluate numerical expressions that include the four basic operations and operations of powers and roots, reciprocals, opposites, and absolute values.

2.3: Measurement and Estimation

2.3.11.C: Use properties of geometric figures and measurement formulas to solve for a missing quantity (e.g., the measure of a specific angle created by parallel lines and a transversal).
2.3.11.E: Describe how a change in the value of one variable in a formula affects the value of the measurement.

2.5: Mathematical Problem Solving and Communication

2.5.11.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
2.5.11.B: Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results.

2.6: Statistics and Data Analysis

2.6.11.A: Design and conduct an experiment using random sampling.
2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7: Probability and Predictions

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.
2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

2.8: Algebra and Functions

2.8.11.B: Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities.
2.8.11.F: Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situation that motivated the model.

2.9: Geometry

2.9.11.A: Create justifications for arguments related to geometric relations.

2.10: Trigonometry

2.10.11.A: Identify, create, and solve practical problems involving right triangles using the trigonometric functions and the Pythagorean Theorem.

2.11: Concepts of Calculus

2.11.11.A: Determine and interpret maximum and minimum values of a function over a specified interval.
2.11.11.B: Analyze and interpret rates of growth/decay

Students will be able to use their learning independently to:
        See the information above for related math standards

Understandings	Essential Questions
- Types of evidence - Search Methods - Responders' roles - Primary Vs secondary scenes - Proper techniques for evidence collection - Proper documentation for evidence seals to custody - Observations & eyewitnesses - Fact vs opinion - Sketches - Basics of Police Reports - Utilization of faces 4.0 for facial reconstruction	- How do you determine scale for a crime scene? - How do you apply proper scale & dimension to facial drawings? - How do you determine the placement of evidence? - How do you measure at a crime scene? - How do you apply trajectory principles for blood spatter & projectiles at a crime scene? - How do you analyze the data collected at a crime scene? - How do you calculate time of death? - How do you analyze impression evidence at a crime scene?
Knowledge (Related Math Standards) for Processing the Crime Scene	**Skills (Related Math Standards) for Processing the Crime Scene**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	- Sketch the crime scene - Utilize faces 4.0 for facial reconstruction - Collect & bag and document evidence properly - Write a police report with proper components - Classify evidence - Designate responsibilities at crime scene - Utilize proper search methods - Analyze a Mock Crime Scene

ELIGIBLE CONTENT RELATED READING, WRITING, SPEAKING & LISTENING STANDARDS

Reading Standards:

R11.A.2 **Understand nonfiction appropriate to grade level.**

 R11.A.2.1 - Identify and apply the meaning of vocabulary in nonfiction.

 R11.A.2.4 - Identify and explain main ideas and relevant details.

 R11.A.2.5 - Summarize a nonfictional text as a whole.

 R11.A.2.6 - Identify, describe, and analyze genre of text.

R11.B.3 **Understand concepts and organization of nonfictional text.**

 R11.B.3.1 - Interpret, describe, and analyze the characteristics and uses of facts and opinions in nonfictional text.

 R11.B.3.2 - Distinguish between essential and nonessential information within or between texts.

 R11.B.3.3 - Identify, compare, explain, interpret, describe, and analyze how text organization clarifies meaning of nonfictional text.

Writing Standards:

 1.4.11.A: Write poems, **short stories**, and plays.

- Apply various organizational methods.
- Include literary elements and devices.
- Construct a strong story line with illustrative details.
- Include elements of style in writing to develop a personal style

1.4.11.B: Write complex informational pieces (e.g. research papers, literary analytical essays, evaluations)

- Create an organizing structure appropriate to purpose, audience, and context.
- Use precise language and specific detail.
- Use relevant graphics (e.g. maps, charts, graphs, table illustrations, photographs)• Include accurate information from primary and secondary sources and exclude extraneous information.

1.5.11.A: Write with a clear **focus**, identifying topic, task, and audience.

1.5.11.B: Develop content appropriate for the topic.

- Gather, organize, and determine validity and reliability of information.
- Employ the most effective format for purpose and audience.
- Write fully developed paragraphs that have details and information specific to the topic and relevant to the **focus.**

1.5.11.C: Write with controlled and/or subtle organization.

- Establish coherence within and among paragraphs through effective transitions, parallel structures, and similar writing techniques.

1.5.11.D: Write with an understanding of **style** using a variety of sentence structures and descriptive word choices. Create **tone** and **voice** through the use of precise language.

1.5.11.E: Revise writing to improve style, word choice, sentence variety, and subtlety of meaning after rethinking how questions of purpose, audience, and **genre** have been addressed.

1.5.11.F: Use grade appropriate **conventions of language** when writing and editing.

- Spell all words correctly.
- Use capital letters correctly.
- Punctuate correctly.
- Use correct grammar and sentence formation.

 Speaking and Listening Standards:

1.6.11.A: Listen critically and respond to others in small and large group situations.

- Respond with grade level appropriate questions, ideas, information or opinions.

1.6.11.B: Demonstrate awareness of audience using appropriate volume and clarity in formal speaking presentations.

Students will be able to use their learning independently to:

- See the information above for the related Reading, Writing, Speaking & Listening Standards

Understandings	Essential Questions
• Types of evidence • Search Methods • Responders' roles • Primary Vs secondary scenes • Proper techniques for evidence collection • Proper documentation for evidence seals to custody • Observations & eyewitnesses • Fact vs opinion • Sketches • Basics of Police Reports • Utilization of faces 4.0 for facial reconstruction • English conventions for writing • reading, writing, speaking& listening	• How do you gain knowledge of new terminology through written word? • How do you gain content knowledge from laboratory session materials? • How do you respond to laboratory sessions with written summaries? • How do you creatively reflect your new knowledge in a written mock crime scene? • How do you write a police report to reflect facts? • How do you create a presentation to encompass the content learned? • How do you conduct yourself during a presentation? • How do you determine your audience for the presentation?
Knowledge	**Skills**
Vocabulary: Circumstantial evidence, direct evidence, class evidence, individualistic evidence, physical evidence, biological evidence, sketch, first responder, search patterns: grid, linear, zone (quadrant), spiral, primary crime scene, secondary crime scene, chain of custody log, evidence log, fact, opinion, perception, eyewitness, evidence, coroner, medical examiner, exemplar, forensics, deductive reasoning, analytical skills, observation.	• Reading trade materials for laboratory sessions • Reading manuals for equipment usage • Writing a Police report in a real life application format • Write a Mock crime scene utilizing newly gained processing the crime scene knowledge • Present information in a formal speech • Analyze laboratory sessions and write written summaries with detailed persuasive content of facts. • Utilize faces 4.0 for facial reconstruction • Collect & bag and document evidence properly • Classify evidence • Designate responsibilities at crime scene • Utilize proper search methods • Sketch the crime scene • Analyze a Mock Crime Scene

Evidence of Understanding

Performance Tasks
Created models of: Crime Scenes utilizing impressions, physical evidence, document analysis,   Laboratory sessions: • Christmas ornament evidence (search methods & scaled sketches)   • Photography using lighting, angles, & scale   • Mock crime scene analysis (José Gondolas or Miley Cyrus teacher written storylines)   • Scale factors   • Bag & Tag evidence   • Follow the chain of evidence   Web OR Technology based simulations: Faces 4.0 facial reconstruction CD ROM   Research projects / Presentations: Culminating activity for groups to present content knowledge

Other Evidence of Understanding*

Assessment Measures	Assessment Tasks
• Bellringers • Correct/Incorrect model. • Laboratory reports • Simulation summaries. • Presentations	• Written assessments: Lab reports, police report of mock crime scene, presentations • Illustrations of: scaled sketches of crime scenes • Laboratory sessions on: search methods, scale, photography, collecting & papertrail of evidence • Internet simulations: Faces 4.0 • Build models of: Mock Crime Scene

*can be embedded into formative and summative assessments.

Integration of ELA Common Core Standards *(The tasks below are meant to serve as sample activities regarding the integration of the standard listed. Related up-to-date material can be substituted)*

Reading/Writing in Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- Students will read and analyze an article from an online science journal, regarding human activity that is thought to affect climate change. Students will write a one-two paragraph summary of the article, focusing only on two of the specific examples of evidence involving human activity and climate change.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

- Students will read and analyze an article from an online science journal, regarding the dangers of introducing nonnative species into an ecosystem. Students will write a one page summary of the article, explaining what a nonnative species is and the effects they have on ecosystems when introduced.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 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 9–10 texts and topics*.

- In an effort to further stress the difference between biotic and abiotic factors, students will complete an activity in which students, given a list of living and nonliving factors, will write a narrative explanation as to why each factor should be classified and "biotic" or "abiotic."

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-Literacy.RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.WHST.9-10.1 Write arguments focused on *discipline-specific content*.

CCSS.ELA-Literacy.WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

CCSS.ELA-Literacy.WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.

CCSS.ELA-Literacy.WHST.9-10.1c Use words, phrases, and clauses 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.

CCSS.ELA-Literacy.WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

CCSS.ELA-Literacy.WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

CCSS.ELA-Literacy.WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

CCSS.ELA-Literacy.WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

CCSS.ELA-Literacy.WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

CCSS.ELA-Literacy.WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the

significance of the topic).

CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-Literacy.WHST.9-10.7 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.

CCSS.ELA-Literacy.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS.ELA-Literacy.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

CSI   **Designed by: Cindy Klein**

Unit of Study: Document Analysis (Forgery, Handwriting, Ink, Paper & Anti-counterfeiting Techniques)

Brief Summary of Unit:

PRE-REQUISITE SKILLS: Basic graphing skills (X & Y axis and plot 2 variables) and general laboratory skills (measurement and utilization of basic science equipment), basic navigation on the internet for gathering research materials. Students should have basic knowledge of conventions (grammar) when writing or speaking. Students must exercise good safety habits, specifically in laboratory sessions. Students must be able to work both independently and in group settings from written directions. Students must be able to write a basic laboratory report with hypothesis, materials, procedure, data, and conclusions. Basic photography skills for zoom, micro, and wide pan images.

The primary focus of this unit is to understand the concepts of comparing questioned documents with known, authentic ones. Various techniques will be covered, including but not limited to: Handwriting analysis (graphology); document analysis for forgery – obliterations, alterations; paper analysis; ink analysis; check forgery prevention; anti-counterfeiting methods by the US Treasury &Bureau of Engraving and potentially art forgery techniques.

 The processes include:
Analyze the impact of modern technology on the study of forensics and its place in the real world application.

BELOW LEVEL ACTIVITIES: If students are struggling with this material, differentiation of instruction could include use of: online powerpoint notes packet, small group laboratory sessions, chunked content with notes outline; a simplified, graphic organizer for key concepts.

EXTENSION ACTIVITIES for advanced learners could include real data that would require more complex graphical representation and breakdown of data; more complex examples; more complex activities; and additional article research via scientific online resources.

Materials and Resources

• South-Western Cengage Learning – Forensic Science: Fundamentals & Investigations (Bertino & Bertino) • South-Western Cengage Learing – Forensic Science – Advanced Investigations (Brown & Davenport) • Prentice Hall – Criminalistics: An introduction to forensic science (Saferstein) • Law Tech Custom Publishing – Forensic Studies: CSI for the Nonscientist from Crime Scene to Crime Lab (Bucholtz & Davis) • Law Tech Custom Publishing – Biological Evidence (Bucholtz & Lewis) • The Center for Applied Research in Education – Crime Scene Investigations: Real-life science labs for grades 6-12. • Bureau of Education & Research – Strengthening Your Science instruction Using NEW and innovative forensic science strategies Resource Handbook - grades 7-12 (Butler) • American Academy of Forensic Sciences – Eighth Forensic Science Education Conference (2005) Reference Guide (Cedar Crest College) • Facts on File, Inc. – Forensic Science Experiments on File Reproducible Handouts • NeoSCI Corporation - New Ideas for teaching science – Detective's Casebook Reproducible Handouts • Ward's Natural Science (2004) – Forensic Detective Lab Activity (36W 6150) • Mulberry House Publishing – Understanding Firearm Ballistics: Basic to advanced ballistics, simplified, illustrated, and explained. (Rinker)	Materials necessary to complete the performance tasks. • Sample art works – typically impressionism art • Water colors, cups, brushes & paper • Various paper types including ones with watermarks & colors – UV light, stereomicroscope, water & eye dropper, scissors. • Alteration tools – knives, white out, erasers, tape, scissors • Check writing lab - handouts for writing checks to prevent alterations • Ink Identification lab – various black markers both water soluble & permanent ink, beakers, water, acetone or fingernail polish, chromatography paper, typewriter and/or photocopier comparisons • Compare various denominations of US currency for historical/ patriotic features; ink patterns including micro-printing, patterns, and color; and security features • Analyze handwriting for specific patterns in: slant, pressure, size, spacing, zones, margins, etc.

- Ward's Natural Science – The Science Behind Ballistics and Firearms Lab Activity (36W 6239) - Handwriting analysis textbooks: - Ward's Natural Science – Forensic Glass Analysis Lab Activity (36W6240)	

ELIGIBLE CONTENT   S11.A.1   Reasoning and Analysis

Students will be able to use their learning independently to:
- **S11.A.1.1** - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
- **S11.A.1.2** - Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
- **S11.A.1.3** - Describe and interpret patterns of change in natural and human-made systems.

Understandings	Essential Questions
- Basics of Police Reports - Comparison of Inks via chromatography - Comparison of Papers via texture, color, watermark & microscopic fibers - Comparison of US currency for counterfeit detection - Comparison of documents for alterations and/or obliterations - Explore check writing methods for preventing alterations/ forgeries - Analyze handwriting for various writing techniques - Investigations into Literary Forgery / Art Forgery	- What are the basic components of a police report? - What are scientific methods to compare ink? - What are scientific methods to compare paper? - How does the US Treasury & Bureau of Engraving prevent counterfeiting? - How can an individual prevent fraudulent acts on a check? - How do you properly write a check? - How can you analytically compare handwriting? - What are scientific methods to analyze for document alterations? - What are methods of document alterations / obliterations? - How are art forgeries / literary forgeries detected? - What are various methods of art / literary forgery?
Knowledge	**Skills**
<u>Vocabulary:</u> Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	- Write a police report with proper components - Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. - Analyze ink via chromatography methodologies - Write a check with anti-forgery techniques - Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. - Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. - Attempt "exact replica" form of art forgery - Analyze documents for fraudulence such as obliterations and alterations.

ELIGIBLE CONTENT S11.A.2 **Processes, Procedures, and Tools of Scientific Investigations**

Students will be able to use their learning independently to:
- **S11.A.2.1** - Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.
- **S11.A.2.2** - Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide

Understandings	Essential Questions
- Basics of Police Reports - Comparison of Inks via chromatography - Comparison of Papers via texture, color, watermark & microscopic fibers - Comparison of US currency for counterfeit detection - Comparison of documents for alterations and/or obliterations - Explore check writing methods for preventing alterations/ forgeries - Analyze handwriting for various writing techniques - Investigations into Literary Forgery / Art Forgery	- What are the basic components of a police report? - What are scientific methods to compare ink? - What are scientific methods to compare paper? - How does the US Treasury & Bureau of Engraving prevent counterfeiting? - How can an individual prevent fraudulent acts on a check? - How do you properly write a check? - How can you analytically compare handwriting? - What are scientific methods to analyze for document alterations? - What are methods of document alterations / obliterations? - How are art forgeries / literary forgeries detected? - What are various methods of art / literary forgery?
Knowledge	**Skills**
<u>Vocabulary:</u> Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	- Write a police report with proper components - Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. - Analyze ink via chromatography methodologies - Write a check with anti-forgery techniques - Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. - Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. - Attempt "exact replica" form of art forgery - Analyze documents for fraudulence such as obliterations and alterations.

ELIGIBLE CONTENT S11.A.3 Systems, Models, and Patterns

Students will be able to use their learning independently to:
- **S11.A.3.1** - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
- **S11.A.3.2** - Compare observations of the real world to observations of a constructed model.
- **S11.A.3.3** - Compare and analyze repeated processes or recurring elements in patterns.

Understandings	Essential Questions
 • Basics of Police Reports • Comparison of Inks via chromatography • Comparison of Papers via texture, color, watermark & microscopic fibers • Comparison of US currency for counterfeit detection • Comparison of documents for alterations and/or obliterations • Explore check writing methods for preventing alterations/ forgeries • Analyze handwriting for various writing techniques • Investigations into Literary Forgery / Art Forgery	 • What are the basic components of a police report? • What are scientific methods to compare ink? • What are scientific methods to compare paper? • How does the US Treasury & Bureau of Engraving prevent counterfeiting? • How can an individual prevent fraudulent acts on a check? • How do you properly write a check? • How can you analytically compare handwriting? • What are scientific methods to analyze for document alterations? • What are methods of document alterations / obliterations? • How are art forgeries / literary forgeries detected? • What are various methods of art / literary forgery?
Knowledge	**Skills**
Vocabulary: Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	 • Write a police report with proper components • Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. • Analyze ink via chromatography methodologies • Write a check with anti-forgery techniques • Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. • Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. • Attempt "exact replica" form of art forgery • Analyze documents for fraudulence such as obliterations and alterations.

Students will be able to use their learning independently to:
- **S11.C.3.1** - Use the principles of motion and force to solve real-world challenges.

Understandings	Essential Questions
- Basics of Police Reports - Comparison of Inks via chromatography - Comparison of Papers via texture, color, watermark & microscopic fibers - Comparison of US currency for counterfeit detection - Comparison of documents for alterations and/or obliterations - Explore check writing methods for preventing alterations/ forgeries - Analyze handwriting for various writing techniques - Investigations into Literary Forgery / Art Forgery	- What are the basic components of a police report? - What are scientific methods to compare ink? - What are scientific methods to compare paper? - How does the US Treasury & Bureau of Engraving prevent counterfeiting? - How can an individual prevent fraudulent acts on a check? - How do you properly write a check? - How can you analytically compare handwriting? - What are scientific methods to analyze for document alterations? - What are methods of document alterations / obliterations? - How are art forgeries / literary forgeries detected? - What are various methods of art / literary forgery?
Knowledge	**Skills**
Vocabulary: Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	- Write a police report with proper components - Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. - Analyze ink via chromatography methodologies - Write a check with anti-forgery techniques - Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. - Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. - Attempt "exact replica" form of art forgery - Analyze documents for fraudulence such as obliterations and alterations.

ELIGIBLE CONTENT MATH RELATED STANDARDS Grade 11

2.3: Measurement and Estimation

2.3.11.C: Use properties of geometric figures and measurement formulas to solve for a missing quantity (e.g., the measure of a specific angle created by parallel lines and a transversal).

2.3.11.E: Describe how a change in the value of one variable in a formula affects the value of the measurement.

2.5: Mathematical Problem Solving and Communication

2.5.11.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.

2.5.11.B: Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results.

2.6: Statistics and Data Analysis

2.6.11.A: Design and conduct an experiment using random sampling.

2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7: Probability and Predictions

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.

2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

2.8: Algebra and Functions

2.8.11.B: Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities.

2.8.11.F: Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situation that motivated the model.

2.9: Geometry

2.9.11.A: Create justifications for arguments related to geometric relations.

2.11: Concepts of Calculus

2.11.11.A: Determine and interpret maximum and minimum values of a function over a specified interval.

2.11.11.B: Analyze and interpret rates of growth/decay

Students will be able to use their learning independently to:
    See the information above for related math standards

Understandings	Essential Questions
• Comparison of Inks via chromatography • Comparison of Papers via texture, color, watermark & microscopic fibers • Comparison of US currency for counterfeit detection • Comparison of documents for alterations and/or obliterations • Explore check writing methods for preventing alterations/ forgeries • Analyze handwriting for various writing techniques • Investigations into Literary Forgery / Art Forgery	• What are scientific / mathematical methods to compare ink? • What are scientific / mathematical methods to compare paper? • How does the US Treasury & Bureau of Engraving prevent counterfeiting? • How can you mathematically & analytically compare handwriting? • What are scientific / mathematical methods to analyze for document alterations? • How are art forgeries /literary forgeries detected utilizing machines?
Knowledge (Related Math Standards) for Processing the Crime Scene	**Skills (Related Math Standards) for Processing the Crime Scene**
Vocabulary: Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	• Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. • Analyze ink via chromatography methodologies • Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. • Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. • Analyze documents for fraudulence such as obliterations and alterations.

ELIGIBLE CONTENT RELATED READING, WRITING, SPEAKING & LISTENING STANDARDS

Reading Standards:

R11.A.2 **Understand nonfiction appropriate to grade level.**

- **R11.A.2.1** - Identify and apply the meaning of vocabulary in nonfiction.
- **R11.A.2.4** - Identify and explain main ideas and relevant details.
- **R11.A.2.5** - Summarize a nonfictional text as a whole.
- **R11.A.2.6** - Identify, describe, and analyze genre of text.

R11.B.3 **Understand concepts and organization of nonfictional text.**

- **R11.B.3.1** - Interpret, describe, and analyze the characteristics and uses of facts and opinions in nonfictional text.
- **R11.B.3.2** - Distinguish between essential and nonessential information within or between texts.
- **R11.B.3.3** - Identify, compare, explain, interpret, describe, and analyze how text organization clarifies meaning of nonfictional text.

Writing Standards:

 1.4.11.A: Write poems, **short stories**, and plays.

- Apply various organizational methods.
- Include literary elements and devices.
- Construct a strong story line with illustrative details.
- Include elements of style in writing to develop a personal style

1.4.11.B: Write complex informational pieces (e.g. research papers, literary analytical essays, evaluations)

- Create an organizing structure appropriate to purpose, audience, and context.
- Use precise language and specific detail.
- Use relevant graphics (e.g. maps, charts, graphs, table illustrations, photographs)• Include accurate information from primary and secondary sources and exclude extraneous information.

1.5.11.A: Write with a clear **focus**, identifying topic, task, and audience.

1.5.11.B: Develop content appropriate for the topic.

- Gather, organize, and determine validity and reliability of information.
- Employ the most effective format for purpose and audience.
- Write fully developed paragraphs that have details and information specific to the topic and relevant to the **focus.**

1.5.11.C: Write with controlled and/or subtle organization.

- Establish coherence within and among paragraphs through effective transitions, parallel structures, and similar writing techniques.

1.5.11.D: Write with an understanding of **style** using a variety of sentence structures and descriptive word choice. Create **tone** and **voice** through the use of precise language.

1.5.11.E: Revise writing to improve style, word choice, sentence variety, and subtlety of meaning after rethinking how questions of purpose, audience, and **genre** have been addressed.

1.5.11.F: Use grade appropriate **conventions of language** when writing and editing.

- Spell all words correctly.
- Use capital letters correctly.
- Punctuate correctly.
- Use correct grammar and sentence formation.
- **Speaking and Listening Standards:**

1.6.11.A: Listen critically and respond to others in small and large group situations.

- Respond with grade level appropriate questions, ideas, information or opinions.

1.6.11.B: Demonstrate awareness of audience using appropriate volume and clarity in formal speaking presentations.

Students will be able to use their learning independently to:
- See the information above for the related Reading, Writing, Speaking & Listening Standards

Understandings	Essential Questions
- Basics of Police Reports - English conventions for writing - reading, writing, speaking& listening - Comparison of Inks via chromatography - Comparison of Papers via texture, color, watermark & microscopic fibers - Comparison of US currency for counterfeit detection - Comparison of documents for alterations and/or obliterations - Explore check writing methods for preventing alterations/ forgeries - Analyze handwriting for various writing techniques - Investigations into Literary Forgery / Art Forgery	- What are the basic components of a police report? - How can a crime scene scenario be written to reflect document analysis information? - What are scientific methods to compare ink? - What are scientific methods to compare paper? - How does the US Treasury & Bureau of Engraving prevent counterfeiting? - How can an individual prevent fraudulent acts on a check? - How do you properly write a check? - How can you analytically compare handwriting? - What are scientific methods to analyze for document alterations? - What are methods of document alterations / obliterations? - How are art forgeries / literary forgeries detected? - What are various methods of art / literary forgery?
Knowledge	**Skills**
Vocabulary: Exemplars, counterfeiting, document analysis, document expert, forgery, fraudulence, questioned documents, ink chromatography, alterations, obliterations, slant, pressure, spacing, size, flow, zones, watermark, water soluble, permanent, checks, currency, denominations, literary forgery, micro printing, color-shifting ink, vignette, portrait, security features.	- Write a police report with proper components - Write crime scene scenario utilizing document analysis as the main piece of evidence in the crime - Analyze various papers for texture, watermark, fiber patterns, tear patterns, water solubility, color, etc. - Analyze ink via chromatography methodologies - Write a check with anti-forgery techniques - Compare denominations of US currency for security features, historical / patriotic patterns, ink patterns and colors. - Analyze a personal exemplar for handwriting patterns such as slant, pressure, spacing, size, flow, zones. - Attempt "exact replica" form of art forgery - Analyze documents for fraudulence such as obliterations and alterations.

Evidence of Understanding

Performance Tasks
Created models of: writing checks, art masterpieces, Laboratory sessions: • Ink Chromatography • Paper comparisons • Making paper • Currency comparisons • Potato stamping for engraving techniques • Analyze personal samples of hadwriting • Create exact replicas of impressionism art • Obliterations & alterations & erasures for forgeries   Web OR Technology based simulations: www.handwritingwizard.com Research projects / Presentations: • Currency essay • Culminating activity for groups to present content knowledge

Other Evidence of Understanding*

Assessment Measures	Assessment Tasks
• Bellringers • Correct/Incorrect model. • Laboratory reports • Simulation summaries. • Presentations • Written reports	• Written assessments: Lab reports, police report of mock crime scene, presentations, written reports • Illustrations of: art forgeries • Laboratory sessions on: ink, paper, currency comparisons, obliterations/alterations/erasures • Internet simulations: www.handwritingwizard.com • Build models of: making paper from recycled materials

*can be embedded into formative and summative assessments.

Integration of ELA Common Core Standards *(The tasks below are meant to serve as sample activities regarding the integration of the standard listed. Related up-to-date material can be substituted)*

Reading/Writing in Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Students will read and analyze an article from an online science journal, regarding human activity that is thought to affect climate change. Students will write a one-two paragraph summary of the article, focusing only on two of the specific examples of evidence involving human activity and climate change.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- Students will read and analyze an article from an online science journal, regarding the dangers of introducing nonnative species into an ecosystem. Students will write a one page summary of the article, explaining what a nonnative species is and the effects they have on ecosystems when introduced.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 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 9–10 texts and topics*.
- In an effort to further stress the difference between biotic and abiotic factors, students will complete an activity in which students, given a list of living and nonliving factors, will write a narrative explanation as to why each factor should be classified and "biotic" or "abiotic."

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-Literacy.RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.WHST.9-10.1 Write arguments focused on *discipline-specific content*.
  CCSS.ELA-Literacy.WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
  CCSS.ELA-Literacy.WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
  CCSS.ELA-Literacy.WHST.9-10.1c Use words, phrases, and clauses 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.
  CCSS.ELA-Literacy.WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
  CCSS.ELA-Literacy.WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
  CCSS.ELA-Literacy.WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
  CCSS.ELA-Literacy.WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
  CCSS.ELA-Literacy.WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

CCSS.ELA-Literacy.WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

CCSS.ELA-Literacy.WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-Literacy.WHST.9-10.7 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.

CCSS.ELA-Literacy.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS.ELA-Literacy.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

CSI   **Designed by: Cindy Klein**

Unit of Study: HAIR, FIBERS & BONES

Brief Summary of Unit:

PRE-REQUISITE SKILLS: Basic graphing skills (X & Y axis and plot 2 variables) and general laboratory skills (measurement and utilization of basic science equipment), basic navigation on the internet for gathering research materials. Students should have basic knowledge of conventions (grammar) when writing or speaking. Students must exercise good safety habits, specifically in laboratory sessions. Students must be able to work both independently and in group settings from written directions. Students must be able to write a basic laboratory report with hypothesis, materials, procedure, data, and conclusions. Basic photography skills for zoom, micro, and wide pan images.

The primary focus of this unit is to understand the processes:
- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair
- Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns
- Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race

 The processes include:
Analyze the impact of modern technology on the study of forensics and its place in the real world application.

BELOW LEVEL ACTIVITIES: If students are struggling with this material, differentiation of instruction could include use of: online powerpoint notes packet, small group laboratory sessions, chunked content with notes outline; a simplified, graphic organizer for key concepts.

EXTENSION ACTIVITIES for advanced learners could include real data that would require more complex graphical representation and breakdown of data; more complex examples; more complex activities; and additional article research via scientific online resources.

Materials and Resources

- South-Western Cengage Learning – Forensic Science: Fundamentals & Investigations (Bertino & Bertino) - South-Western Cengage Learing – Forensic Science – Advanced Investigations (Brown & Davenport) - Prentice Hall – Criminalistics: An introduction to forensic science (Saferstein) - Law Tech Custom Publishing – Forensic Studies: CSI for the Nonscientist from Crime Scene to Crime Lab (Bucholtz & Davis) - Law Tech Custom Publishing – Biological Evidence (Bucholtz & Lewis) - The Center for Applied Research in Education – Crime Scene Investigations: Real-life science labs for grades 6-12. - Bureau of Education & Research – Strengthening Your Science instruction Using NEW and innovative forensic science strategies Resource Handbook - grades 7-12 (Butler) - American Academy of Forensic Sciences – Eighth Forensic Science Education Conference (2005) Reference Guide (Cedar Crest College) - Facts on File, Inc. – Forensic Science Experiments on File Reproducible Handouts - NeoSCI Corporation - New Ideas for teaching science – Detective's Casebook Reproducible Handouts - Ward's Natural Science (2004) – Forensic Detective Lab Activity (36W 6150) - Wards Natural Science – Sherlock Bones (Africoid female & Caucasoid male) - Metro Books, New York – Everyday Knots for Fishermen, Boaters, Climbers, Crafters, and Household Use (Budworth, Geoffrey)	Materials necessary to complete the performance tasks. - Safety glasses and other safety equipment - Wards Natural Science – Sherlock Bones – Africoid female & Caucasoid male sets - Wards Natural Science CD ROM – A guide to Sherlock Bones Vernier Calipers, meter sticks, rulers, diagrams of bones w/ labels - Wards Natural Science - The investigation of Hair - Wards Natural Science – The investigation of Fibers - Teacher created – Seeds as Fibers lab exercise - Various seeds - Stereomicroscopes - Petri dishes - Various samples of white cloth – both natural & synthetic - Rit Dye - Alcohol burners, metal forceps, tinfoil - Rope (for knot tying)

ELIGIBLE CONTENT   S11.A.1 Reasoning and Analysis

Students will be able to use their learning independently to:
- **S11.A.1.1** - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
- **S11.A.1.2** - Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
- **S11.A.1.3** - Describe and interpret patterns of change in natural and human-made systems.

Understandings	Essential Questions
- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences - Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns - Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race - Basic construction of household knots	- How are human and animal hairs similar & different? - How can you analytically compare human hair? - How can you analytically compare natural vs dyed hair? - How are hairs from various locations of the body different? - How are hairs from various racial backgrounds different? - How can fibers be classified? - What general properties distinguish synthetics from natural fibers? - What properties of fibers can be revealed by burning them? - How can seeds be compared and act as fibers? - How does a weave pattern help with strength of a fabric? - How do fabrics differ in their ability to accept dye? - How can Bones be compared for human to animal? - What is the function of the human skeletal system? What types of joints? - How can a bone or set of bones help to determine height, gender or race? - How can fibers such as ropes leave evidence at a crime scene? - How would different knots be utilized in a crime? - What are some basic knot constructions?
Knowledge	**Skills**
<u>Vocabulary:</u> Compound microscope, stereomicroscope, dissecting microscope, cortex, cuticle, hair, pubic hair, body hair, head hair, medulla, medullar index, melanin, keratin, hair follicle, nucleic DNA, mitochondrial DNA, epidermis, hair shaft, dermis, sub-cutaneous tissue, sebaceous gland, imbricated, coronal, spinous, fiber, natural, synthetic, cellulose, Locards Principle, textile, yarn, seeds, weave pattern, plain, satin, twill, anthropology, bones, femur, tibia, fibula, phalanges, metatarsals, metacarpals, skull, vertebrae, pelvis, cartilage, ligaments, facial reconstruction, epiphysis, ossification, blunt force trauma	- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences - Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns - Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race - Basic construction of household knots

ELIGIBLE CONTENT S11.A.2 Processes, Procedures, and Tools of Scientific Investigations

Students will be able to use their learning independently to:
- **S11.A.2.1** - Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.
- **S11.A.2.2** - Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide

Understandings	Essential Questions
• Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences • Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns • Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race • Basic construction of household knots	• How are human and animal hairs similar & different? • How can you analytically compare human hair? • How can you analytically compare natural vs dyed hair? • How are hairs from various locations of the body different? • How are hairs from various racial backgrounds different? • How can fibers be classified? • What general properties distinguish synthetics from natural fibers? • What properties of fibers can be revealed by burning them? • How can seeds be compared and act as fibers? • How does a weave pattern help with strength of a fabric? • How do fabrics differ in their ability to accept dye? • How can Bones be compared for human to animal? • What is the function of the human skeletal system? What types of joints? • How can a bone or set of bones help to determine height, gender or race? • How can fibers such as ropes leave evidence at a crime scene? • How would different knots be utilized in a crime? • What are some basic knot constructions? •
Knowledge	**Skills**
<u>Vocabulary:</u> Compound microscope, stereomicroscope, dissecting microscope, cortex, cuticle, hair, pubic hair, body hair, head hair, medulla, medullary index, melanin, keratin, hair follicle, nucleic DNA, mitochondrial DNA, epidermis, hair shaft, dermis, sub-cutaneous tissue, sebaceous gland, imbricated, coronal, spinous, fiber, natural, synthetic, cellulose, Locards Principle, textile, yarn, seeds, weave pattern, plain, satin, twill, anthropology, bones, femur, tibia, fibula, phalanges, metatarsals, metacarpals, skull, vertebrae, pelvis, cartilage, ligaments, facial reconstructioin, epiphysis, ossification, blunt force trauma	• Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences • Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns • Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race • Basic construction of household knots •

ELIGIBLE CONTENT S11.A.3 **Systems, Models, and Patterns**

Students will be able to use their learning independently to:
- **S11.A.3.1** - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
- **S11.A.3.2** - Compare observations of the real world to observations of a constructed model.
- **S11.A.3.3** - Compare and analyze repeated processes or recurring elements in patterns.

Understandings	Essential Questions
• Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences • Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns • Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race • Basic construction of household knots	• How are human and animal hairs similar & different? • How can you analytically compare human hair? • How can you analytically compare natural vs dyed hair? • How are hairs from various locations of the body different? • How are hairs from various racial backgrounds different? • How can fibers be classified? • What general properties distinguish synthetics from natural fibers? • What properties of fibers can be revealed by burning them? • How can seeds be compared and act as fibers? • How does a weave pattern help with strength of a fabric? • How do fabrics differ in their ability to accept dye? • How can Bones be compared for human to animal? • What is the function of the human skeletal system? What types of joints? • How can a bone or set of bones help to determine height, gender or race? • How can fibers such as ropes leave evidence at a crime scene? • How would different knots be utilized in a crime? • What are some basic knot constructions?
Knowledge	**Skills**
<u>Vocabulary:</u> Compound microscope, stereomicroscope, dissecting microscope, cortex, cuticle, hair, pubic hair, body hair, head hair, medulla, medullary index, melanin, keratin, hair follicle, nucleic DNA, mitochondrial DNA, epidermis, hair shaft, dermis, sub-cutaneous tissue, sebaceous gland, imbricated, coronal, spinous, fiber, natural, synthetic, cellulose, Locards Principle, textile, yarn, seeds, weave pattern, plain, satin, twill, anthropology, bones, femur, tibia, fibula, phalanges, metatarsals, metacarpals, skull, vertebrae, pelvis, cartilage, ligaments, facial reconstructioin, epiphysis, ossification, blunt force trauma	• Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences • Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns • Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race • Basic construction of household knots

ELIGIBLE CONTENT   BIOLOGY RELATED STANDARDS GRADE 11

BIO.B.1.2: Explain how genetic information is inherited.

BIO.B.1.2.1: Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
BIO.B.1.2.2: Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.

BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.

BIO.B.2.1.1: Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).
BIO.B.2.1.2: Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).

BIO.B.2.3: Explain how genetic information is expressed.

BIO.B.2.3.1: Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).

BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.

BIO.B.2.4.1: Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).

Students will be able to use their learning independently to:
- BIO.B.1.2: Explain how genetic information is inherited.

- BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
- BIO.B.2.3: Explain how genetic information is expressed.
- BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.

Understandings	Essential Questions
- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences - Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns - Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race - Basic construction of household knots	- How are human and animal hairs similar & different? - How can you analytically compare human hair? - How can you analytically compare natural vs dyed hair? - How are hairs from various locations of the body different? - How are hairs from various racial backgrounds different? - How can fibers be classified? - What general properties distinguish synthetics from natural fibers? - What properties of fibers can be revealed by burning them? - How can seeds be compared and act as fibers? - How does a weave pattern help with strength of a fabric? - How do fabrics differ in their ability to accept dye? - How can Bones be compared for human to animal? - What is the function of the human skeletal system? What types of joints? - How can a bone or set of bones help to determine height, gender or race? - How can fibers such as ropes leave evidence at a crime scene? - How would different knots be utilized in a crime? - What are some basic knot constructions?
Knowledge	**Skills**
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ELIGIBLE CONTENT   MATH RELATED STANDARDS Grade 11

2.1: Numbers, Number Systems and Number Relationships

2.1.11.D: Use exponential, scientific, and calculator notation to represent any rational number.
2.1.11.F: Understand the concepts of exponential and logarithmic forms and use the inverse relationships between exponential and logarithmic expression to determine unknown quantities in equations.

2.2: Computation and Estimation

2.2.11.C: Evaluate numerical expressions that include the four basic operations and operations of powers and roots, reciprocals, opposites, and absolute values.

2.3: Measurement and Estimation

2.3.11.C: Use properties of geometric figures and measurement formulas to solve for a missing quantity (e.g., the measure of a specific angle created by parallel lines and a transversal).
2.3.11.E: Describe how a change in the value of one variable in a formula affects the value of the measurement.

2.5: Mathematical Problem Solving and Communication

2.5.11.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
2.5.11.B: Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results.

2.6: Statistics and Data Analysis

2.6.11.A: Design and conduct an experiment using random sampling.
2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7: Probability and Predictions

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.
2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

2.8: Algebra and Functions

2.8.11.B: Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities.
2.8.11.F: Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situation that motivated the model.

2.9: Geometry

2.9.11.A: Create justifications for arguments related to geometric relations.

2.10: Trigonometry

2.10.11.A: Identify, create, and solve practical problems involving right triangles using the trigonometric functions and the Pythagorean Theorem.

2.11: Concepts of Calculus

2.11.11.A: Determine and interpret maximum and minimum values of a function over a specified interval.
2.11.11.B: Analyze and interpret rates of growth/decay

Students will be able to use their learning independently to:
See the information above for related math standards

Understandings	Essential Questions
- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences - Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns - Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race - Basic construction of household knots	- How are human and animal hairs similar & different? - How can you analytically compare human hair? - How can you analytically compare natural vs dyed hair? - How are hairs from various locations of the body different? - How are hairs from various racial backgrounds different? - How can fibers be classified? - What general properties distinguish synthetics from natural fibers? - What properties of fibers can be revealed by burning them? - How can seeds be compared and act as fibers? - How does a weave pattern help with strength of a fabric? - How do fabrics differ in their ability to accept dye? - How can Bones be compared for human to animal? - What is the function of the human skeletal system? What types of joints? - How can a bone or set of bones help to determine height, gender or race? - How can fibers such as ropes leave evidence at a crime scene? - How would different knots be utilized in a crime? - What are some basic knot constructions?
Knowledge (Related Math Standards) for Processing the Crime Scene	**Skills (Related Math Standards) for Processing the Crime Scene**
- Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences - Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns - Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race - Basic construction of household knots	- How are human and animal hairs similar & different? - How can you analytically compare human hair? - How can you analytically compare natural vs dyed hair? - How are hairs from various locations of the body different? - How are hairs from various racial backgrounds different? - How can fibers be classified? - What general properties distinguish synthetics from natural fibers? - What properties of fibers can be revealed by burning them? - How can seeds be compared and act as fibers? - How does a weave pattern help with strength of a fabric? - How do fabrics differ in their ability to accept dye? - How can Bones be compared for human to animal? - What is the function of the human skeletal system? What types of joints? - How can a bone or set of bones help to determine height, gender or race? - How can fibers such as ropes leave evidence at a crime scene? - How would different knots be utilized in a crime? - What are some basic knot constructions?

ELIGIBLE CONTENT RELATED READING, WRITING, SPEAKING & LISTENING STANDARDS

Reading Standards:

R11.A.2 **Understand nonfiction appropriate to grade level.**

R11.A.2.1 - Identify and apply the meaning of vocabulary in nonfiction.

R11.A.2.4 - Identify and explain main ideas and relevant details.

R11.A.2.5 - Summarize a nonfictional text as a whole.

R11.A.2.6 - Identify, describe, and analyze genre of text.

R11.B.3 **Understand concepts and organization of nonfictional text.**

R11.B.3.1 - Interpret, describe, and analyze the characteristics and uses of facts and opinions in nonfictional text.

R11.B.3.2 - Distinguish between essential and nonessential information within or between texts.

R11.B.3.3 - Identify, compare, explain, interpret, describe, and analyze how text organization clarifies meaning of nonfictional text.

Writing Standards:

1.4.11.A: Write poems, **short stories**, and plays.
- Apply various organizational methods.
- Include literary elements and devices.
- Construct a strong story line with illustrative details.
- Include elements of style in writing to develop a personal style

1.4.11.B: Write complex informational pieces (e.g. research papers, literary analytical essays, evaluations)
- Create an organizing structure appropriate to purpose, audience, and context.
- Use precise language and specific detail.
- Use relevant graphics (e.g. maps, charts, graphs, table illustrations, photographs)• Include accurate information from primary and secondary sources and exclude extraneous information.

1.5.11.A: Write with a clear **focus**, identifying topic, task, and audience.

1.5.11.B: Develop content appropriate for the topic.
- Gather, organize, and determine validity and reliability of information.
- Employ the most effective format for purpose and audience.
- Write fully developed paragraphs that have details and information specific to the topic and relevant to the **focus.**

1.5.11.C: Write with controlled and/or subtle organization.
- Establish coherence within and among paragraphs through effective transitions, parallel structures, and similar writing techniques.

1.5.11.D: Write with an understanding of **style** using a variety of sentence structures and descriptive word choices.Create **tone** and **voice** through the use of precise language.

1.5.11.E: Revise writing to improve style, word choice, sentence variety, and subtlety of meaning after rethinking how questions of purpose, audience, and **genre** have been addressed.

1.5.11.F: Use grade appropriate **conventions of language** when writing and editing.
- Spell all words correctly.
- Use capital letters correctly.
- Punctuate correctly.
- Use correct grammar and sentence formation.

Speaking and Listening Standards:

1.6.11.A: Listen critically and respond to others in small and large group situations.
- Respond with grade level appropriate questions, ideas, information or opinions.

1.6.11.B: Demonstrate awareness of audience using appropriate volume and clarity in formal speaking presentations.

Students will be able to use their learning independently to:

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Knowledge	**Skills**
• Comparing HAIR for the following properties: human VS animal hair, types of human hair, dyed vs natural colored hair, racial differences, body location differences • Comparing FIBERS for the following properties: natural vs synthetic, burning fibers, seeds as fibers, fiber weave patterns • Comparing BONES for the following properties: human vs animal, basic skeletal bones of human body, ratio of certain bones for height, gender, race • Basic construction of household knots	• How are human and animal hairs similar & different? • How can you analytically compare human hair? • How can you analytically compare natural vs dyed hair? • How are hairs from various locations of the body different? • How are hairs from various racial backgrounds different? • How can fibers be classified? • What general properties distinguish synthetics from natural fibers? • What properties of fibers can be revealed by burning them? • How can seeds be compared and act as fibers? • How does a weave pattern help with strength of a fabric? • How do fabrics differ in their ability to accept dye? • How can Bones be compared for human to animal? • What is the function of the human skeletal system? What types of joints? • How can a bone or set of bones help to determine height, gender or race? • How can fibers such as ropes leave evidence at a crime scene? • How would different knots be utilized in a crime? • What are some basic knot constructions?

Evidence of Understanding

Performance Tasks
Created models of: Diagrams of Hair, comparative drawings of natural vs synthetic fibers, Diagrams of Human skeleton, Laboratory sessions: • Hair – microscopic --medullar index, dyed vs. natural, cortex patterns, medullar patterns • Fibers – microscopic – natural vs. synthetic, weave patterns of fibers and burning of fibers • Bones – "Candy bones, diagram labeling, assemble human skeleton, "Who Owns These bones?" Lab, General skeletal system for humans & function of bones, differences for gender(pelvis & skull), differences for racial profiles (skull) Age differences of skeletal systems - Sherlock Bones Lab Activity   Web OR Technology based simulations: Research projects / Presentations: Culminating activity for groups to present content knowledge

Other Evidence of Understanding*

Assessment Measures	Assessment Tasks
• Bellringers • Correct/Incorrect model. • Laboratory reports • Simulation summaries. • Presentations	• Written assessments: Lab reports, police report of mock crime scene, presentations • Illustrations of: Hair, Fibers & bones • Laboratory sessions on: Hair, Fibers & Bones • Internet simulations: Bones • Build models of: Bones

*can be embedded into formative and summative assessments.

Integration of ELA Common Core Standards *(The tasks below are meant to serve as sample activities regarding the integration of the standard listed. Related up-to-date material can be substituted)*

Reading/Writing in Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Students will read and analyze an article from an online science journal, regarding human activity that is thought to affect climate change. Students will write a one-two paragraph summary of the article, focusing only on two of the specific examples of evidence involving human activity and climate change.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- Students will read and analyze an article from an online science journal, regarding the dangers of introducing nonnative species into an ecosystem. Students will write a one page summary of the article, explaining what a nonnative species is and the effects they have on ecosystems when introduced.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 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 9–10 texts and topics*.
- In an effort to further stress the difference between biotic and abiotic factors, students will complete an activity in which students, given a list of living and nonliving factors, will write a narrative explanation as to why each factor should be classified and "biotic" or "abiotic."

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-Literacy.RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.WHST.9-10.1 Write arguments focused on *discipline-specific content*.

    CCSS.ELA-Literacy.WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

    CCSS.ELA-Literacy.WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.

    CCSS.ELA-Literacy.WHST.9-10.1c Use words, phrases, and clauses 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.

    CCSS.ELA-Literacy.WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

    CCSS.ELA-Literacy.WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

    CCSS.ELA-Literacy.WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

    CCSS.ELA-Literacy.WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

    CCSS.ELA-Literacy.WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

    CCSS.ELA-Literacy.WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the

discipline and context as well as to the expertise of likely readers.

CCSS.ELA-Literacy.WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-Literacy.WHST.9-10.7 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.

CCSS.ELA-Literacy.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS.ELA-Literacy.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

CSI   **Designed by: Cindy Klein**

Unit of Study: Impressions (foot, tire, tool, teeth, Bullet & Fingerprints)

Brief Summary of Unit:

PRE-REQUISITE SKILLS: Basic graphing skills (X & Y axis and plot 2 variables) and general laboratory skills (measurement and utilization of basic science equipment), basic navigation on the internet for gathering research materials. Students should have basic knowledge of conventions (grammar) when writing or speaking. Students must exercise good safety habits, specifically in laboratory sessions. Students must be able to work both independently and in group settings from written directions. Students must be able to write a basic laboratory report with hypothesis, materials, procedure, data, and conclusions. Basic photography skills for zoom, micro, and wide pan images.

The primary focus of this unit is to understand the processes of the collecting impressions made from footprints, tire prints, tool marks, teeth impressions, bullet striations, and fingerprints.

 The processes include:
Analyze the impact of modern technology on the study of forensics and its place in the real world application. Students will create molds and casts of foot & tire impressions, diagram tool individualistic characteristics, teeth impressions and dental numbering, bullet striations for "L or R twist, lands & groove markings, types of guns / ammunition, and comparison of fingerprint types (loop, arch or whorl) plus the minutiae.

BELOW LEVEL ACTIVITIES: If students are struggling with this material, differentiation of instruction could include use of: online powerpoint notes packet, small group laboratory sessions, chunked content with notes outline; a simplified, graphic organizer for key concepts.

EXTENSION ACTIVITIES for advanced learners could include real data that would require more complex graphical representation and breakdown of data; more complex examples; more complex activities; and additional article research via scientific online resources.

Materials and Resources

• South-Western Cengage Learning – Forensic Science: Fundamentals & Investigations (Bertino & Bertino) • South-Western Cengage Learing – Forensic Science – Advanced Investigations (Brown & Davenport) • Prentice Hall – Criminalistics: An introduction to forensic science (Saferstein) • Law Tech Custom Publishing – Forensic Studies: CSI for the Nonscientist from Crime Scene to Crime Lab (Bucholtz & Davis) • Law Tech Custom Publishing – Biological Evidence (Bucholtz & Lewis) • The Center for Applied Research in Education – Crime Scene Investigations: Real-life science labs for grades 6-12. • Bureau of Education & Research – Strengthening Your Science instruction Using NEW and innovative forensic science strategies Resource Handbook - grades 7-12 (Butler) • American Academy of Forensic Sciences – Eighth Forensic Science Education Conference (2005) Reference Guide (Cedar Crest College) • Facts on File, Inc. – Forensic Science Experiments on File Reproducible Handouts • NeoSCI Corporation - New Ideas for teaching science – Detective's Casebook Reproducible Handouts • Ward's Natural Science (2004) – Forensic Detective Lab Activity (36W 6150) • Mulberry House Publishing – Understanding Firearm Ballistics: Basic to advanced ballistics, simplified, illustrated, and explained. (Rinker) • Ward's Natural Science – The Science Behind Ballistics and Firearms Lab Activity (36W 6239) • Ward's Natural Science – Forensic Glass Analysis Lab Activity (36W6240)	Materials necessary to complete the performance tasks. • Measuring devices (tape measures, rulers, volume, mass) • Digital camera with zoom capabilities • Graph paper • Photographic rulers (white & black and "L" shaped) • Forceps / tweezers • Plaster Paris • Clay • Ink blotters / inkless fingerprinting strips • Tire tread data base • Poster of Fingerprint patterns • Wards: One bite out of crime Activity & dental pattern worksheets • Ballistics Lab – Wards scientific • Older, worn tools with individualistic patterns • Tires (from Kost tire – contact is Mr. Stackhouse) • Diagrams of fingerprint minutiae • Ballistics powerpoint with hunter safety course references

ELIGIBLE CONTENT S11.A.1 **Reasoning and Analysis**

Students will be able to use their learning independently to:
- **S11.A.1.1** - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
- **S11.A.1.2** - Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
- **S11.A.1.3** - Describe and interpret patterns of change in natural and human-made systems.

Understandings	**Essential Questions**
- Types of impressions - Proper mold / cast techniques for foot/shoe & tire impressions - Comparison of dental records - Tools & classes of levers - Casts for dental impressions - Individualistic vs class evidence of impressions - Proper microscopic comparison for individualistic marks - Sketches - Compare fingerprints for loop, whorl, arch patterns - Locate & identify minutiae patterns - Ballistics – compare types of guns & ammunition - Ballistics – determine best trajectory based on angle & projectile motion laws - Lands / Grooves / Twist in rifle barrels & striation marks as a result - Firing pin patterns	- How do you classify evidence as individualistic vs class? - What is the difference between 2D & 3D impressions? - What is the difference between positive & negative impressions? - When is appropriate to utilize different fingerprint dusting methods? - What is the difference between a visible & latent fingerprint? - What methods are utilized to develop latent prints? - What wear patterns? - How do up properly photograph & collect impressions evidence? - How do you sketch the microscopic tool marks with scale? - How do you compare fingerprints for individualistic characteristics? - How do you compare dental records for age? - How do you cast a dental mold? - How can you compare tools based on their class of lever classification? - How do you compare firearms & the ammunition? - How are striations of a bullet created? - What is projectile motion and how does it apply to ballistics & trajectory? - How does a gun fire & how does it leave class or individualistic markings?
Knowledge	**Skills**

<u>Vocabulary:</u>
Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel, breech, bullet, caliber,
	- Compare & contrast individualistic VS Class characteristics of:
	  - Tire / Shoe impressions
	  - Tool / teeth impressions
	  - Fingerprint impressions
	  - Ballistics evidence
	- Compare dental records for age using a dental chart
	- Compare tools by classes of levers for use of tool & expected impressions
	- Sketch microscopic view of tools & tool impressions

cartridge, firearm, GSR (gunshot residue), lands, grooves, muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern, gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, , delta, core, ending ridge, fork, dot, bridge, eye,	- Properly document, photograph & collect impression evidence - Develop latent prints: dusting, super-glue, iodine crystals - Identify patterns (loop,whorl & arch) plus minutiae of fingerprints - Determine best range of a nerf gun based on projectile motion & trajectory - Compare firing pin patterns & bullet striations from lands/grooves - Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle)

ELIGIBLE CONTENT S11.A.2 **Processes, Procedures, and Tools of Scientific Investigations**

Students will be able to use their learning independently to:
- **S11.A.2.1** - Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.
- **S11.A.2.2** - Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide

Understandings	Essential Questions
- Types of impressions - Proper mold / cast techniques for foot/shoe & tire impressions - Comparison of dental records - Tools & classes of levers - Casts for dental impressions - Individualistic vs class evidence of impressions - Proper microscopic comparison for individualistic marks - Sketches - Compare fingerprints for loop, whorl, arch patterns - Locate & identify minutiae patterns - Ballistics – compare types of guns & ammunition - Ballistics – determine best trajectory based on angle & projectile motion laws - Lands / Grooves / Twist in rifle barrels & striation marks as a result - Firing pin patterns	- How do you classify evidence as individualistic vs class? - What is the difference between 2D & 3D impressions? - What is the difference between positive & negative impressions? - When is appropriate to utilize different fingerprint dusting methods? - What is the difference between a visible & latent fingerprint? - What methods are utilized to develop latent prints? - What wear patterns? - How do up properly photograph & collect impressions evidence? - How do you sketch the microscopic tool marks with scale? - How do you compare fingerprints for individualistic characteristics? - How do you compare dental records for age? - How do you cast a dental mold? - How can you compare tools based on their class of lever classification? - How do you compare firearms & the ammunition? - How are striations of a bullet created? - What is projectile motion and how does it apply to ballistics & trajectory? - How does a gun fire & how does it leave class or individualistic markings?
Knowledge	**Skills**
Vocabulary: Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel, breech, bullet, caliber, cartridge, firearm, GSR (gunshot residue), lands, grooves,	- Compare & contrast individualistic VS Class characteristics of: - Tire / Shoe impressions - Tool / teeth impressions - Fingerprint impressions - Ballistics evidence - Compare dental records for age using a dental chart - Compare tools by classes of levers for use of tool & expected impressions - Sketch microscopic view of tools & tool impressions - Properly document, photograph & collect impression evidence

| muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern, gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, , delta, core, ending ridge, fork, dot, bridge, eye, | Develop latent prints: dusting, super-glue, iodine crystals Identify patterns (loop,whorl & arch) plus minutiae of fingerprints Determine best range of a nerf gun based on projectile motion & trajectory Compare firing pin patterns & bullet striations from lands/grooves Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle) |

ELIGIBLE CONTENT S11.A.3 **Systems, Models, and Patterns**

Students will be able to use their learning independently to:
- **S11.A.3.1** - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
- **S11.A.3.2** - Compare observations of the real world to observations of a constructed model.
- **S11.A.3.3** - Compare and analyze repeated processes or recurring elements in patterns.

Understandings	Essential Questions
- Types of impressions - Proper mold / cast techniques for foot/shoe & tire impressions - Comparison of dental records - Tools & classes of levers - Casts for dental impressions - Individualistic vs class evidence of impressions - Proper microscopic comparison for individualistic marks - Sketches - Compare fingerprints for loop, whorl, arch patterns - Locate & identify minutiae patterns - Ballistics – compare types of guns & ammunition - Ballistics – determine best trajectory based on angle & projectile motion laws - Lands / Grooves / Twist in rifle barrels & striation marks as a result - Firing pin patterns	- How do you classify evidence as individualistic vs class? - What is the difference between 2D & 3D impressions? - What is the difference between positive & negative impressions? - When is appropriate to utilize different fingerprint dusting methods? - What is the difference between a visible & latent fingerprint? - What methods are utilized to develop latent prints? - What wear patterns? - How do up properly photograph & collect impressions evidence? - How do you sketch the microscopic tool marks with scale? - How do you compare fingerprints for individualistic characteristics? - How do you compare dental records for age? - How do you cast a dental mold? - How can you compare tools based on their class of lever classification? - How do you compare firearms & the ammunition? - How are striations of a bullet created? - What is projectile motion and how does it apply to ballistics & trajectory? - How does a gun fire & how does it leave class or individualistic markings?
Knowledge	**Skills**
Vocabulary: Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel,	- Compare & contrast individualistic VS Class characteristics of: - Tire / Shoe impressions - Tool / teeth impressions - Fingerprint impressions - Ballistics evidence - Compare dental records for age using a dental chart - Compare tools by classes of levers for use of tool & expected impressions - Sketch microscopic view of tools & tool impressions

breech, bullet, caliber, cartridge, firearm, GSR (gunshot residue), lands, grooves, muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern, gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, delta, core, ending ridge, fork, dot, bridge, eye,	- Properly document, photograph & collect impression evidence - Develop latent prints: dusting, super-glue, iodine crystals - Identify patterns (loop,whorl & arch) plus minutiae of fingerprints - Determine best range of a nerf gun based on projectile motion & trajectory - Compare firing pin patterns & bullet striations from lands/grooves - Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle)

ELIGIBLE CONTENT S11.C.3 Principles of Motion and Force

Students will be able to use their learning independently to:
- **S11.C.3.1** - Use the principles of motion and force to solve real-world challenges.

Understandings	Essential Questions
• Types of impressions • Proper mold / cast techniques for foot/shoe & tire impressions • Comparison of dental records • Tools & classes of levers • Casts for dental impressions • Individualistic vs class evidence of impressions • Proper microscopic comparison for individualistic marks • Sketches • Compare fingerprints for loop, whorl, arch patterns • Locate & identify minutiae patterns • Ballistics – compare types of guns & ammunition • Ballistics – determine best trajectory based on angle & projectile motion laws • Lands / Grooves / Twist in rifle barrels & striation marks as a result • Firing pin patterns	• How do you classify evidence as individualistic vs class? • What is the difference between 2D & 3D impressions? • What is the difference between positive & negative impressions? • When is appropriate to utilize different fingerprint dusting methods? • What is the difference between a visible & latent fingerprint? • What methods are utilized to develop latent prints? • What wear patterns? • How do up properly photograph & collect impressions evidence? • How do you sketch the microscopic tool marks with scale? • How do you compare fingerprints for individualistic characteristics? • How do you compare dental records for age? • How do you cast a dental mold? • How can you compare tools based on their class of lever classification? • How do you compare firearms & the ammunition? • How are striations of a bullet created? • What is projectile motion and how does it apply to ballistics & trajectory? • How does a gun fire & how does it leave class or individualistic markings?
Knowledge	**Skills**
Vocabulary: Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel, breech, bullet, caliber, cartridge, firearm, GSR (gunshot residue), lands, grooves, muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern,	• Compare & contrast individualistic VS Class characteristics of: o Tire / Shoe impressions o Tool / teeth impressions o Fingerprint impressions o Ballistics evidence • Compare dental records for age using a dental chart • Compare tools by classes of levers for use of tool & expected impressions • Sketch microscopic view of tools & tool impressions • Properly document, photograph & collect impression evidence • Develop latent prints: dusting, super-glue, iodine crystals

gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, , delta, core, ending ridge, fork, dot, bridge, eye,	• Identify patterns (loop,whorl & arch) plus minutiae of fingerprints • Determine best range of a nerf gun based on projectile motion & trajectory • Compare firing pin patterns & bullet striations from lands/grooves • Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle)

ELIGIBLE CONTENT   MATH RELATED STANDARDS Grade 11

2.3: Measurement and Estimation
2.3.11.C: Use properties of geometric figures and measurement formulas to solve for a missing quantity (e.g., the measure of a specific angle created by parallel lines and a transversal).
2.3.11.E: Describe how a change in the value of one variable in a formula affects the value of the measurement.

2.5: Mathematical Problem Solving and Communication

2.5.11.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
2.5.11.B: Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results.

2.6: Statistics and Data Analysis

2.6.11.A: Design and conduct an experiment using random sampling.
2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7: Probability and Predictions

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.
2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

2.8: Algebra and Functions

2.8.11.B: Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities.
2.8.11.F: Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situation that motivated the model.

2.9: Geometry

2.9.11.A: Create justifications for arguments related to geometric relations.

2.10: Trigonometry

2.10.11.A: Identify, create, and solve practical problems involving right triangles using the trigonometric functions and the Pythagorean Theorem.

2.11: Concepts of Calculus

2.11.11.A: Determine and interpret maximum and minimum values of a function over a specified interval.

Students will be able to use their learning independently to:
      See the above Math standards for related materials

Understandings	Essential Questions
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Knowledge	**Skills**
<u>Vocabulary:</u> Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel, breech, bullet, caliber, cartridge, firearm, GSR (gunshot residue), lands, grooves, muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern, gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, , delta, core, ending ridge, fork, dot, bridge, eye,	- Compare & contrast individualistic VS Class characteristics of: - Tire / Shoe impressions - Tool / teeth impressions - Fingerprint impressions - Ballistics evidence - Compare dental records for age using a dental chart - Compare tools by classes of levers for use of tool & expected impressions - Sketch microscopic view of tools & tool impressions - Properly document, photograph & collect impression evidence - Develop latent prints: dusting, super-glue, iodine crystals - Identify patterns (loop, whorl & arch) plus minutiae of fingerprints - Determine best range of a nerf gun based on projectile motion & trajectory - Compare firing pin patterns & bullet striations from lands/grooves - Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle)

ELIGIBLE CONTENT   BIOLOGY RELATED STANDARDS GRADE 11

BIO.B.1.2: Explain how genetic information is inherited.

BIO.B.1.2.1: Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
BIO.B.1.2.2: Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.

BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.

BIO.B.2.1.1: Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).
BIO.B.2.1.2: Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).

BIO.B.2.3: Explain how genetic information is expressed.

BIO.B.2.3.1: Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).

BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.
BIO.B.2.4.1: Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).

Students will be able to use their learning independently to:
- BIO.B.1.2: Explain how genetic information is inherited.

- BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
- BIO.B.2.3: Explain how genetic information is expressed.
- BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.

Understandings	Essential Questions
- Types of impressions - Proper mold / cast techniques for foot/shoe & tire impressions - Comparison of dental records - Tools & classes of levers - Casts for dental impressions - Individualistic vs class evidence of impressions - Proper microscopic comparison for individualistic marks - Sketches - Compare fingerprints for loop, whorl, arch patterns - Locate & identify minutiae patterns - Ballistics – compare types of guns & ammunition - Ballistics – determine best trajectory based on angle & projectile motion laws - Lands / Grooves / Twist in rifle barrels & striation marks as a result - Firing pin patterns	- How do you classify evidence as individualistic vs class? - What is the difference between 2D & 3D impressions? - What is the difference between positive & negative impressions? - When is appropriate to utilize different fingerprint dusting methods? - What is the difference between a visible & latent fingerprint? - What methods are utilized to develop latent prints? - What wear patterns? - How do up properly photograph & collect impressions evidence? - How do you sketch the microscopic tool marks with scale? - How do you compare fingerprints for individualistic characteristics? - How do you compare dental records for age? - How do you cast a dental mold? - How can you compare tools based on their class of lever classification? - How do you compare firearms & the ammunition? - How are striations of a bullet created? - What is projectile motion and how does it apply to ballistics & trajectory? - How does a gun fire & how does it leave class or individualistic markings?
Knowledge	**Skills**
Vocabulary: Latent impressions, visible impressions, two-dimensional impressions, three-dimensional impressions, positive impression, negative impression, tire tread patterns, tire sidewall, turning radius, accident reconstruction, shoe tread patterns, sole, class characteristics, individual characteristics, wear pattern, classes of levers, first class lever, second class lever, third class lever, mold, cast, dental record, dental impression, primary teeth, secondary teeth, incisors, cuspids, pre-molar, molar, abrasion marks, cutting marks, indentation marks, tool mark, ballistics, barrel, breech, bullet, caliber, cartridge, firearm, GSR (gunshot residue), lands, grooves, muzzle, pistol, revolver, rifle, rifling, shell casing, trajectory, projectile, twist, striations, firing pin pattern, gravity, entrance & exit wounds, loop, whorl, arch, minutiae, latent, visible, plastic, ridge pattern, , delta, core, ending ridge, fork, dot, bridgeeye,	- Compare & contrast individualistic VS Class characteristics of: - Tire / Shoe impressions - Tool / teeth impressions - Fingerprint impressions - Ballistics evidence - Compare dental records for age using a dental chart - Compare tools by classes of levers for use of tool & expected impressions - Sketch microscopic view of tools & tool impressions - Properly document, photograph & collect impression evidence - Develop latent prints: dusting, super-glue, iodine crystals - Identify patterns (loop,whorl & arch) plus minutiae of fingerprints - Determine best range of a nerf gun based on projectile motion & trajectory - Compare firing pin patterns & bullet striations from lands/grooves - Compare types of ammunition to types of guns to fire (shotgun, revolver, rifle)

Evidence of Understanding

Performance Tasks
Created models of: shoe impressions, tire impressions, teeth impressions, tool impressions, dental molds, dental records (adult vs child) Laboratory sessions: Ballistics –Nerf trajectory, comparison of mock ballistic evidence, microscopic sketches of tool striations, matchbox cars & tire tread patterns, fingerprints - latent development & visible prints comparison, crayon rubbings of shoes & tires Web based simulations: projectile motion Research projects: Fingerprint crime scene report, and Oral presentations: Culminating activity for groups to present content knowledge

Other Evidence of Understanding*

Assessment Measures	Assessment Tasks
- Bellringers - Correct/Incorrect model. - Laboratory reports - Simulation summaries.	- Written assessments: laboratory reports, fingerprint crime scene report - Illustrations of: sketches for impressions - Laboratory sessions on: tools, teeth, tires, shoes, ballistics, & fingerprints - Internet simulations: projectile motion - Build models of: impressions

*can be embedded into formative and summative assessments.

Integration of ELA Common Core Standards *(The tasks below are meant to serve as sample activities regarding the integration of the standard listed. Related up-to-date material can be substituted)*

Reading/Writing in Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Students will read and analyze an article from an online science journal, regarding human activity that is thought to affect climate change. Students will write a one-two paragraph summary of the article, focusing only on two of the specific examples of evidence involving human activity and climate change.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- Students will read and analyze an article from an online science journal, regarding the dangers of introducing nonnative species into an ecosystem. Students will write a one page summary of the article, explaining what a nonnative species is and the effects they have on ecosystems when introduced.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 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 9–10 texts and topics*.
- In an effort to further stress the difference between biotic and abiotic factors, students will complete an activity in which students, given a list of living and nonliving factors, will write a narrative explanation as to why each factor should be classified and "biotic" or "abiotic."

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-Literacy.RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.WHST.9-10.1 Write arguments focused on *discipline-specific content*.

    CCSS.ELA-Literacy.WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.

    CCSS.ELA-Literacy.WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.

    CCSS.ELA-Literacy.WHST.9-10.1c Use words, phrases, and clauses 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.

    CCSS.ELA-Literacy.WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

    CCSS.ELA-Literacy.WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

    CCSS.ELA-Literacy.WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

    CCSS.ELA-Literacy.WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

    CCSS.ELA-Literacy.WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

CCSS.ELA-Literacy.WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

CCSS.ELA-Literacy.WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-Literacy.WHST.9-10.7 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.

CCSS.ELA-Literacy.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS.ELA-Literacy.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

CSI   **Designed by: Cindy Klein**

<center>**Unit of Study: Physical / Trace Evidence (Glass, Unknown Powders (drugs), Blood & DNA)**</center>

Brief Summary of Unit:

PRE-REQUISITE SKILLS: Basic graphing skills (X & Y axis and plot 2 variables) and general laboratory skills (measurement and utilization of basic science equipment), basic navigation on the internet for gathering research materials. Students should have basic knowledge of conventions (grammar) when writing or speaking. Students must exercise good safety habits, specifically in laboratory sessions. Students must be able to work both independently and in group settings from written directions. Students must be able to write a basic laboratory report with hypothesis, materials, procedure, data, and conclusions. Basic photography skills for zoom, micro, and wide pan images.

The primary focus of this unit is to understand the processes:
- Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density
- Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances.
- Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -)
- Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns
- Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

The processes include:
- Analyze the impact of modern technology on the study of forensics and its place in the real world application.

BELOW LEVEL ACTIVITIES: If students are struggling with this material, differentiation of instruction could include use of: online powerpoint notes packet, small group laboratory sessions, chunked content with notes outline; a simplified, graphic organizer for key concepts.

EXTENSION ACTIVITIES for advanced learners could include real data that would require more complex graphical representation and breakdown of data; more complex examples; more complex activities; and additional article research via scientific online resources.

Materials and Resources

- South-Western Cengage Learning – Forensic Science: Fundamentals & Investigations (Bertino & Bertino)
- South-Western Cengage Learing – Forensic Science – Advanced Investigations (Brown & Davenport)
- Prentice Hall – Criminalistics: An introduction to forensic science (Saferstein)
- Law Tech Custom Publishing – Forensic Studies: CSI for the Nonscientist from Crime Scene to Crime Lab (Bucholtz & Davis)
- Law Tech Custom Publishing – Biological Evidence (Bucholtz & Lewis)
- The Center for Applied Research in Education – Crime Scene Investigations: Real-life science labs for grades 6-12.
- Bureau of Education & Research – Strengthening Your Science instruction Using NEW and innovative forensic science strategies Resource Handbook - grades 7-12 (Butler)
- American Academy of Forensic Sciences – Eighth Forensic Science Education Conference (2005) Reference Guide (Cedar Crest College)
- Facts on File, Inc. – Forensic Science Experiments on File Reproducible Handouts
- NeoSCI Corporation -   New Ideas for teaching science – Detective's Casebook Reproducible Handouts
- Ward's Natural Science (2004) – Forensic Detective Lab Activity (36W 6150)

- Materials necessary to complete the performance tasks.
  - Safety equipment for labs including glasses, gloves & aprons
  - Hammers, sponges, tyvex suits, face shields, hair shower caps, string, protractor, laser, tape, plastic drop cloth, white roll paper, ring stands, meter stick, vernier calipers, simulated blood (simulated "bottle of blood" from party city).
  - Electrophoresis gel well & electrical sources with chemicals
  - Wards: DNA detectives Lab Activity
  - Wards: DNA fingerprint Lab Activity
  - Wards: Usage of restriction enzymes in DNA fingerprinting Analysis
  - Wards: Simulated Blood Typing "whodunit" lab activity
  - Wards: Introduction to Blood spatter Analysis Lab Activity
  - Wards: Forensic science wound simulation kit
  - Wards: Genes in a Bottle lab activity
  - Wards: Effects of drugs on Elodea
  - Wards: Mystery Powders Forensic Identification Lab
  - Wards: Introduction to toxicology lab
  - Wards: Narc Lab
  - Wards: Electrophoresis Gel Lab – includes perishable digested DNA sample

	● Wards: Forensic Analysis of Glass

ELIGIBLE CONTENT S11.A.1 **Reasoning and Analysis**

Students will be able to use their learning independently to:
- **S11.A.1.1** - Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.
- **S11.A.1.2** - Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.
- **S11.A.1.3** - Describe and interpret patterns of change in natural and human-made systems.

Understandings	Essential Questions
• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	• How can glass fracture patterns be interpreted for sequence? • How can glass be analyzed by density, refractive index, becke line & color for identification? • How can presumptive test narrow down the type of unknown substances you have? • How can a mass spectrometer individually identify the unknown substance? • How can the effects of drugs (and alcohol) affect a living organism? • How can you determine if it is blood? Human or non-human? • What are they types of blood (rh factor) and who can donate blood to whom? • How can you analyze blood spatter to determine the point of origin? • How do height, velocity & angle affect the spatter pattern of blood? • What are different patterns caused by blood at a crime scene (drip, castoff, spatter). • What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? • How do you collect buccal cells and utilize the DNA material? • How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? • What are DNA markers?
Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT S11.A.2   Processes, Procedures, and Tools of Scientific Investigations

Understandings	Essential Questions
- Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density - Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. - Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) - Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns - Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	- How can glass fracture patterns be interpreted for sequence? - How can glass be analyzed by density, refractive index, becke line & color for identification? - How can presumptive test narrow down the type of unknown substances you have? - How can a mass spectrometer individually identify the unknown substance? - How can the effects of drugs (and alcohol) affect a living organism? - How can you determine if it is blood? Human or non-human? - What are they types of blood (rh factor) and who can donate blood to whom? - How can you analyze blood spatter to determine the point of origin? - How do height, velocity & angle affect the spatter pattern of blood? - What are different patterns caused by blood at a crime scene (drip, castoff, spatter). - What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? - How do you collect buccal cells and utilize the DNA material? - How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? - What are DNA markers?
Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens,	- Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density - Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. - Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -)

erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT S11.A.3 Systems, Models, and Patterns

Students will be able to use their learning independently to:
- **S11.A.3.1** - Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.
- **S11.A.3.2** - Compare observations of the real world to observations of a constructed model.
- **S11.A.3.3** - Compare and analyze repeated processes or recurring elements in patterns.

Understandings	Essential Questions
- Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density - Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. - Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) - Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns - Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	- How can glass fracture patterns be interpreted for sequence? - How can glass be analyzed by density, refractive index, becke line & color for identification? - How can presumptive test narrow down the type of unknown substances you have? - How can a mass spectrometer individually identify the unknown substance? - How can the effects of drugs (and alcohol) affect a living organism? - How can you determine if it is blood? Human or non-human? - What are they types of blood (rh factor) and who can donate blood to whom? - How can you analyze blood spatter to determine the point of origin? - How do height, velocity & angle affect the spatter pattern of blood? - What are different patterns caused by blood at a crime scene (drip, castoff, spatter). - What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? - How do you collect buccal cells and utilize the DNA material? - How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? - What are DNA markers?
Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin,	- Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density - Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. - Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -)

blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT S11.C.3 **Principles of Motion and Force**

Understandings	Essential Questions
• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	• How can glass fracture patterns be interpreted for sequence? • How can glass be analyzed by density, refractive index, becke line & color for identification? • How can presumptive test narrow down the type of unknown substances you have? • How can a mass spectrometer individually identify the unknown substance? • How can the effects of drugs (and alcohol) affect a living organism? • How can you determine if it is blood? Human or non-human? • What are they types of blood (rh factor) and who can donate blood to whom? • How can you analyze blood spatter to determine the point of origin? • How do height, velocity & angle affect the spatter pattern of blood? • What are different patterns caused by blood at a crime scene (drip, castoff, spatter). • What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? • How do you collect buccal cells and utilize the DNA material? • How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? • What are DNA markers?
Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT   Course - 3.2.C.A: CHEMISTRY

Assessment Anchor - CHEM.A.1: Properties and Classification of Matter
CHEM.A.1.1: Identify and describe how observable and measurable properties can be used to classify and describe matter and energy.

CHEM.A.1.1.1: Classify physical or chemical changes within a system in terms of matter and/or energy.
CHEM.A.1.1.2: Classify observations as qualitative and/or quantitative.

CHEM.A.1.2: Compare the properties of mixtures.

CHEM.A.1.2.1: Compare properties of solutions containing ionic or molecular solutes (e.g., dissolving, dissociating).

CHEM.B.2.1: Predict what happens during a chemical reaction.

CHEM.B.2.1.1: Describe the roles of limiting and excess reactants in chemical reactions.
CHEM.B.2.1.4: Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion).

Students will be able to use their learning independently to:
        See the information above relating to the chemistry standards.

Understandings	Essential Questions
• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	• How can glass fracture patterns be interpreted for sequence? • How can glass be analyzed by density, refractive index, becke line & color for identification? • How can presumptive test narrow down the type of unknown substances you have? • How can a mass spectrometer individually identify the unknown substance? • How can the effects of drugs (and alcohol) affect a living organism? • How can you determine if it is blood? Human or non-human? • What are they types of blood (rh factor) and who can donate blood to whom? • How can you analyze blood spatter to determine the point of origin? • How do height, velocity & angle affect the spatter pattern of blood? • What are different patterns caused by blood at a crime scene (drip, castoff, spatter). • What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? • How do you collect buccal cells and utilize the DNA material? • How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? • What are DNA markers?
Knowledge	**Skills**
<u>Vocabulary:</u> DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter,

| of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology | height & angle patterns, velocity patterns
• Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles. |

ELIGIBLE CONTENT   RELATED READING, WRITING, SPEAKING & LISTENING STANDARDS

Reading Standards:

R11.A.2 **Understand nonfiction appropriate to grade level.**

<u>R11.A.2.1</u> - Identify and apply the meaning of vocabulary in nonfiction.

<u>R11.A.2.4</u> - Identify and explain main ideas and relevant details.

<u>R11.A.2.5</u> - Summarize a nonfictional text as a whole.

<u>R11.A.2.6</u> - Identify, describe, and analyze genre of text.

R11.B.3 **Understand concepts and organization of nonfictional text.**

<u>R11.B.3.1</u> - Interpret, describe, and analyze the characteristics and uses of facts and opinions in nonfictional text.

<u>R11.B.3.2</u> - Distinguish between essential and nonessential information within or between texts.

<u>R11.B.3.3</u> - Identify, compare, explain, interpret, describe, and analyze how text organization clarifies meaning of nonfictional text.

Writing Standards:

1.4.11.A: Write poems, **short stories**, and plays.

- Apply various organizational methods.
- Include literary elements and devices.
- Construct a strong story line with illustrative details.
- Include elements of style in writing to develop a personal style

1.4.11.B: Write complex informational pieces (e.g. research papers, literary analytical essays, evaluations)

- Create an organizing structure appropriate to purpose, audience, and context.
- Use precise language and specific detail.
- Use relevant graphics (e.g. maps, charts, graphs, table illustrations, photographs)• Include accurate information from primary and secondary sources and exclude extraneous information.

1.5.11.A: Write with a clear **focus**, identifying topic, task, and audience.

1.5.11.B: Develop content appropriate for the topic.

- Gather, organize, and determine validity and reliability of information.
- Employ the most effective format for purpose and audience.
- Write fully developed paragraphs that have details and information specific to the topic and relevant to the **focus.**

1.5.11.C: Write with controlled and/or subtle organization.

- Establish coherence within and among paragraphs through effective transitions, parallel structures, and similar writing techniques.

1.5.11.D: Write with an understanding of **style** using a variety of sentence structures and descriptive word choices.

- Create **tone** and **voice** through the use of precise language.

1.5.11.E: Revise writing to improve style, word choice, sentence variety, and subtlety of meaning after rethinking how questions of purpose, audience, and **genre** have been addressed.

1.5.11.F: Use grade appropriate **conventions of language** when writing and editing.

- Spell all words correctly.
- Use capital letters correctly.
- Punctuate correctly.
- Use correct grammar and sentence formation.

Speaking and Listening Standards:

1.6.11.A: Listen critically and respond to others in small and large group situations.

- Respond with grade level appropriate questions, ideas, information or opinions.

1.6.11.B: Demonstrate awareness of audience using appropriate volume and clarity in formal speaking presentations.

Students will be able to use their learning independently to:

- See the information above for the related Reading, Writing, Speaking & Listening Standards

Understandings	Essential Questions
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Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT BIOLOGY RELATED STANDARDS GRADE 11

BIO.B.1.2: Explain how genetic information is inherited.
BIO.B.1.2.1: Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.
BIO.B.1.2.2: Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance.
BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
BIO.B.2.1.1: Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).
BIO.B.2.1.2: Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).
BIO.B.2.3: Explain how genetic information is expressed.
BIO.B.2.3.1: Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).
BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.
BIO.B.2.4.1: Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).

Students will be able to use their learning independently to:
- BIO.B.1.2: Explain how genetic information is inherited.

- BIO.B.2.1: Compare and contrast Mendelian and non-Mendelian patterns of inheritance.
- BIO.B.2.3: Explain how genetic information is expressed.
- BIO.B.2.4: Apply scientific thinking, processes, tools, and technologies in the study of genetics.

Understandings	Essential Questions
• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	• How can glass fracture patterns be interpreted for sequence? • How can glass be analyzed by density, refractive index, becke line & color for identification? • How can presumptive test narrow down the type of unknown substances you have? • How can a mass spectrometer individually identify the unknown substance? • How can the effects of drugs (and alcohol) affect a living organism? • How can you determine if it is blood? Human or non-human? • What are they types of blood (rh factor) and who can donate blood to whom? • How can you analyze blood spatter to determine the point of origin? • How do height, velocity & angle affect the spatter pattern of blood? • What are different patterns caused by blood at a crime scene (drip, castoff, spatter). • What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? • How do you collect buccal cells and utilize the DNA material? • How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? • What are DNA markers?
Knowledge	**Skills**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

ELIGIBLE CONTENT   MATH RELATED STANDARDS Grade 11

2.1: Numbers, Number Systems and Number Relationships
2.1.11.D: Use exponential, scientific, and calculator notation to represent any rational number.
2.1.11.F: Understand the concepts of exponential and logarithmic forms and use the inverse relationships between exponential and logarithmic expression to determine unknown quantities in equations.
2.2: Computation and Estimation
2.2.11.C: Evaluate numerical expressions that include the four basic operations and operations of powers and roots, reciprocals, opposites, and absolute values.
2.3: Measurement and Estimation
2.3.11.C: Use properties of geometric figures and measurement formulas to solve for a missing quantity (e.g., the measure of a specific angle created by parallel lines and a transversal).
2.3.11.E: Describe how a change in the value of one variable in a formula affects the value of the measurement.
2.5: Mathematical Problem Solving and Communication
2.5.11.A: Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense, and explain how the problem was solved in grade appropriate contexts.
2.5.11.B: Use symbols, mathematical terminology, standard notation, mathematical rules, graphing and other types of mathematical representations to communicate observations, predictions, concepts, procedures, generalizations, ideas, and results.
2.6: Statistics and Data Analysis
2.6.11.A: Design and conduct an experiment using random sampling.
2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.
2.7: Probability and Predictions
2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.
2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.
2.8: Algebra and Functions
2.8.11.B: Evaluate and simplify algebraic expressions and solve and graph linear, quadratic, exponential, and logarithmic equations and inequalities, and solve and graph systems of equations and inequalities.
2.8.11.F: Interpret the results of solving equations, inequalities, systems of equations, and inequalities in the context of the situation that motivated the model.
2.9: Geometry
2.9.11.A: Create justifications for arguments related to geometric relations.
2.10: Trigonometry
2.10.11.A: Identify, create, and solve practical problems involving right triangles using the trigonometric functions and the Pythagorean Theorem.
2.11: Concepts of Calculus
2.11.11.A: Determine and interpret maximum and minimum values of a function over a specified interval.
2.11.11.B: Analyze and interpret rates of growth/decay

Students will be able to use their learning independently to:
See the information above for related math standards

Understandings	Essential Questions
• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.	• How can glass fracture patterns be interpreted for sequence? • How can glass be analyzed by density, refractive index, becke line & color for identification? • How can presumptive test narrow down the type of unknown substances you have? • How can a mass spectrometer individually identify the unknown substance? • How can the effects of drugs (and alcohol) affect a living organism? • How can you determine if it is blood? Human or non-human? • What are they types of blood (rh factor) and who can donate blood to whom? • How can you analyze blood spatter to determine the point of origin? • How do height, velocity & angle affect the spatter pattern of blood? • What are different patterns caused by blood at a crime scene (drip, castoff, spatter). • What types of DNA (mitochondrial vs. nucleic) can be used forensically? Where are they found? • How do you collect buccal cells and utilize the DNA material? • How do you utilize electrophoresis gel technology to read a DNA fingerprint profile? • What are DNA markers?
Knowledge (Related Math Standards) for Processing the Crime Scene	**Skills (Related Math Standards) for Processing the Crime Scene**
Vocabulary: DNA (deoxyribonucleic acid), DNA fingerprinting, electrophoresis, gene, PCR (polymerase chain reaction), restrictive enzyme, replication, double-helix, bases - cytosine, guanine, thymine & adenine, base pairs, hydrogen bonds, paternity, DNA markers, DNA standards, blood, blood typing, agglutination, antibodies, antigens, erythrocytes, leucocytes, platelets, Rh factor, lines of convergence, point of origin, blood spatter, trajectory, cast off, rays, satellites, tail, directionality, medium & high velocity, presumptive test, impact angle, Law of Tangents (Tan = opposite / adjacent), glass, amorphous, becke line, density, lead glass, pyrex, refractive index, normal line, refraction, silica, Snell's Law, fracture pattern, radial, concentric, tempered glass, backscatter, impact, controlled substance, drug, narcotic, poison, toxicity, toxin, overdose, depressants, stimulants, hallucinogenic, anabolic steroids, alcohol, blood alcohol levels, urine, field sobriety test, toxicology	• Comparing Glass evidence for: fracture patterns, glass samples for types of glass, glass refractive index, becke line for glass density • Comparing Unknown powders (drugs) for: chemical "footprint" of mass-spectrometer, simulated presumptive chemical testing of unknown powders, effects of controlled substances. • Comparing Blood evidence for: Blood type (A,B, AB, O) and RH factor (+ or -) • Compare Blood spatter evidence for: spatter patterns & points of convergence, drip vs spatter, height & angle patterns, velocity patterns • Compare DNA evidence for: Electrophoresis gel plate patterns for DNA markers, location of mitochondrial vs. nucleic DNA, Measure DNA markers for comparison of profiles.

Evidence of Understanding

Performance Tasks
Created models of: DNA models (Double Helix), Blood Spatter Crime Scene to interpret point of origin. Laboratory sessions: DNA detectives Lab Activity, DNA fingerprint Lab Activity, Usage of restriction enzymes in DNA fingerprinting Analysis, Simulated Blood Typing "whodunit" lab activity, Introduction to Blood spatter Analysis Lab Activity, Genes in a Bottle lab activity, Effects of drugs on Elodea,   Mystery Powders Forensic Identification Lab, Introduction to toxicology lab, Narc Lab, Electrophoresis Gel Lab – includes perishable digested DNA sample , Forensic Analysis of Glass Web based simulations: Blood transfusions simulation game Research projects: Blood related diseases

Other Evidence of Understanding*

Assessment Measures	Assessment Tasks
- Bellringers - Correct/Incorrect model. - Laboratory reports - Simulation summaries. - Research projects	- Written assessments: Research on Blood Related diseases - Illustrations of: DNA models, Blood Spatter Patterns - Laboratory sessions on: Glass, DNA, Drugs, Unknown Powders, - Internet simulations: Blood transfusions - Build models of: DNA molecules, Blood spatter crime scene – point of origin - Guest speaker Interactions: Cammie Anderson (drug & alcohol prevention counselor)

*can be embedded into formative and summative assessments.

Integration of ELA Common Core Standards *(The tasks below are meant to serve as sample activities regarding the integration of the standard listed. Related up-to-date material can be substituted)*

Reading/Writing in Science and Technical Subjects

CCSS.ELA-Literacy.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- Students will read and analyze an article from an online science journal, regarding human activity that is thought to affect climate change. Students will write a one-two paragraph summary of the article, focusing only on two of the specific examples of evidence involving human activity and climate change.

CCSS.ELA-Literacy.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- Students will read and analyze an article from an online science journal, regarding the dangers of introducing nonnative species into an ecosystem. Students will write a one page summary of the article, explaining what a nonnative species is and the effects they have on ecosystems when introduced.

CCSS.ELA-Literacy.RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CCSS.ELA-Literacy.RST.9-10.4 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 9–10 texts and topics*.
- In an effort to further stress the difference between biotic and abiotic factors, students will complete an activity in which students, given a list of living and nonliving factors, will write a narrative explanation as to why each factor should be classified and "biotic" or "abiotic."

CCSS.ELA-Literacy.RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

CCSS.ELA-Literacy.RST.9-10.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-Literacy.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-Literacy.RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CCSS.ELA-Literacy.RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

CCSS.ELA-Literacy.WHST.9-10.1 Write arguments focused on *discipline-specific content*.
   CCSS.ELA-Literacy.WHST.9-10.1a Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
   CCSS.ELA-Literacy.WHST.9-10.1b Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
   CCSS.ELA-Literacy.WHST.9-10.1c Use words, phrases, and clauses 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.
   CCSS.ELA-Literacy.WHST.9-10.1d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
   CCSS.ELA-Literacy.WHST.9-10.1e Provide a concluding statement or section that follows from or supports the argument presented.

CCSS.ELA-Literacy.WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
   CCSS.ELA-Literacy.WHST.9-10.2a Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
   CCSS.ELA-Literacy.WHST.9-10.2b Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
   CCSS.ELA-Literacy.WHST.9-10.2c Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

CCSS.ELA-Literacy.WHST.9-10.2d Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

CCSS.ELA-Literacy.WHST.9-10.2e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

CCSS.ELA-Literacy.WHST.9-10.2f Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

CCSS.ELA-Literacy.WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.WHST.9-10.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

CCSS.ELA-Literacy.WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CCSS.ELA-Literacy.WHST.9-10.7 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.

CCSS.ELA-Literacy.WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

CCSS.ELA-Literacy.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.