iCEV Forensic Science

Knowledge and Skill Statement	Student Expectation	Breakout	iCEV Citation Narrative/Activity	Type of Citation (New Content/New Citation)	Lesson Title	New Location
(2) The Student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The Student is expected to	(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence	(i) collect quantitative data with accuracy using the International System of Units (SI)	Narrative	New Content	Conducting Lab and Field Investigations: Forensic Science	Student Handout-Data Collection Methods and Conversions
(2) The Student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The Student is expected to	(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence	(i) collect quantitative data with accuracy using the International System of Units (SI)	Activity	New Content	Blood Spatter	Project-Find the Origin
(2) The Student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The Student is expected to	(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence	(ii) collect quantitative data with precision using the International System of Units (SI)	Narrative	New Content	Conducting Lab and Field Investigations: Forensic Science	Student Handout-Data Collection Methods and Conversions
(2) The Student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The Student is expected to	(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence	(ii) collect quantitative data with precision using the International System of Units (SI)	Activity	New Content	Blood Spatter	Project-Find the Origin
(2) The Student, for at least 40% of instructional time, asks	(E) collect quantitative data with accuracy and	(iii) collect quantitative data with	Narrative	New Content	Conducting Lab and Field Investigations: Forensic	Student Handout-Data Collection Methods and
(2) The Student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The Student is expected to	(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence	(iii) collect quantitative data with accuracy using United States customary units	Activity	New Content	Blood Spatter	Project-Find the Origin
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(i) develop explanations supported by data and consistent with scientific ideas	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(ii) develop explanations supported by data and consistent with scientific principles	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(iii) develop explanations supported by data and consistent with scientific theories	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(viii) propose solutions supported by data and consistent with scientific principles	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(x) propose solutions supported by models and consistent with scientific ideas	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(xi) propose solutions supported by models and consistent with scientific principles	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
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(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(xii) propose solutions supported by models and consistent with scientific theories	Narrative	New Content	Communicating Findings in Forensic Science	Student Handout-Proposing Solutions and Developing Explanations
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories	(xii) propose solutions supported by models and consistent with scientific theories	Activity	New Content	Communicating Findings in Forensic Science	Activity - Designing Solutions

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Knowledge and Skill Statement	Student Expectation	Breakout	iCEV Citation Narrative/Activity	Type of Citation (New Content/New Citation)	Lesson Title	New Location
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	(i) engage respectfully in scientific argumentation using applied scientific explanations	Narrative	New Content	Communicating Findings in Forensic Science	Slides 7-8
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	(i) engage respectfully in scientific argumentation using applied scientific explanations	Activity	New Content	Communicating Findings in Forensic Science	Activity-Data to Communicate
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	(ii) engage respectfully in scientific argumentation using empirical evidence	Narrative	New Content	Communicating Findings in Forensic Science	Slides 7-8
(4) The Student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The Student is expected to	(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.	(ii) engage respectfully in scientific argumentation using empirical evidence	Activity	New Content	Communicating Findings in Forensic Science	Activity-Data to Communicate
(7) The Student analyzes legal aspects within forensic science. The Student is expected to	(C) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony	(i) identify terminology employed in the criminal justice system as [it pertains] to expert witness testimony	Activity	New Content	Ethics in Forensic Science	Project-Forensic Fued Instruction Sheet
(7) The Student analyzes legal aspects within forensic science. The Student is expected to	(C) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony	(ii) identify procedures employed in the criminal justice system as they pertain to expert witness testimony	Activity	New Content	Ethics in Forensic Science	Project-Forensic Fued Instruction Sheet
(7) The Student analyzes legal aspects within forensic science. The Student is expected to	(C) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony	(iii) explain knowledge of terminology employed in the criminal justice system as [it pertains] to expert witness testimony	Activity	New Content	Ethics in Forensic Science	Project-Forensic Fued Instruction Sheet
(7) The Student analyzes legal aspects within forensic science. The Student is expected to	(C) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony	(iv) explain knowledge of procedures employed in the criminal justice system as they pertain to expert witness testimony	Activity	New Content	Ethics in Forensic Science	Project-Forensic Fued Instruction Sheet
(8) The Student explores career options within forensic science. The Student is expected to	(C) differentiate the functions of various forensic science disciplines such as forensic biology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics, and questioned documents.	(i) differentiate the functions of various forensic science disciplines	Activity	New Content	STEM Careers: Forensic Science	Project-Career Research
(9) The Student recognizes the procedures of crime scene investigation while maintaining scene integrity. The Student is expected to	(C) discuss the elements of criminal law that guide search and seizure of persons, property, and evidence	(iii) discuss the elements of criminal law that guide search and seizure of evidence	Activity	New Content	Evidence Collection: Laws and Regulation	Activity- Search & Seizure Bell Ringer Activity
(10) The Student analyzes fingerprint evidence in forensic science. The Student is expected to	(E) perform procedures for developing latent prints using chemical processes on porous and adhesive surfaces with chemicals such as ninhydrin and crystal violet and documenting the results via photography	(i) perform procedures for developing latent prints using chemical processes on porous surfaces with chemicals	Activity	New Content	Fingerprint and Impression Analysis	Activity-Classroom Vandalism
(10) The Student analyzes fingerprint evidence in forensic science. The Student is expected to	(E) perform procedures for developing latent prints using chemical processes on porous and adhesive surfaces with chemicals such as ninhydrin and crystal violet and documenting the results via photography	(ii) perform procedures for developing latent prints using chemical processes on adhesive surfaces with chemicals	Narrative	New Content	Fingerprint and Impression Analysis	Student Handout-Collecting Fingerprints on Adhesive Surfaces
(10) The Student analyzes fingerprint evidence in forensic science. The Student is expected to	(E) perform procedures for developing latent prints using chemical processes on porous and adhesive surfaces with chemicals such as ninhydrin and crystal violet and documenting the results via photography	(ii) perform procedures for developing latent prints using chemical processes on adhesive surfaces with chemicals	Activity	New Content	Fingerprint and Impression Analysis	Activity-Classroom Vandalism
(11) The Student collects and analyzes impression evidence in forensic science. The Student is expected to	(A) analyze the class and individual characteristics of tool mark impressions and the recovery and documentation of surface characteristics such as wood or metal	(iii) analyze the recovery of surface characteristics [of toolmark impressions]	Activity	New Content	Tool Mark Analysis	Activity-Creating Tool Marks
(11) The Student collects and analyzes impression evidence in forensic science. The Student is expected to	(D) compare impression evidence collected at a simulated crime scene with the known impression.	(i) compare impression evidence collected at a simulated crime scene with the known impression.	Narrative	New Content	Tool Mark Analysis	Student Handout-Footwear and Tire Tread Impressions
(11) The Student collects and analyzes impression evidence in forensic science. The Student is expected to	(D) compare impression evidence collected at a simulated crime scene with the known impression.	(i) compare impression evidence collected at a simulated crime scene with the known impression.	Activity	New Content	Tool Mark Analysis	Activity-Impression Analysis Bell Ringer
(12) The Student recognizes the methods to process and analyze hair and fibers found in a crime scene. The Student is expected to	(B) perform the analysis of hair and fiber evidence using forensic science methods such as microscopy and flame testing	(ii) perform the analysis of fiber evidence using forensic science methods	Activity	New Content	Trace Evidence: Hair and Fiber	Activity-Fiber Analysis
(17) The Student explores toxicology in forensic science. The Student is expected to	(C) interpret results from presumptive and confirmatory laboratory procedures, including GC/MS and their implications	(i) interpret results from presumptive laboratory procedures, including GC/MS	Activity	New Content	Toxicology and Controlled Substances	Project- Explain Drug Tests
(17) The Student explores toxicology in forensic science. The Student is expected to	(C) interpret results from presumptive and confirmatory laboratory procedures, including GC/MS and their implications	(iii) interpret results from confirmatory laboratory procedures, including GC/MS	Activity	New Content	Toxicology and Controlled Substances	Project- Explain Drug Tests

iCEV Forensic Science

Knowledge and Skill Statement	Student Expectation	Breakout	iCEV Citation Narrative/Activity	Type of Citation (New Content/New Citation)	Lesson Title	New Location
(19) The Student analyzes the foundations and methodologies surrounding the processing of biological evidence for the purpose of identification. The Student is expected to	(D) explain the analytical procedure for generating a DNA profile, including extraction, quantification, amplification, and capillary electrophoresis	(ii) explain the analytical procedure for generating a DNA profile, including quantification	Activity	New Content	DNA Analysis	Activity-Strawberry Extraction
(19) The Student analyzes the foundations and methodologies surrounding the processing of biological evidence for the purpose of identification. The Student is expected to	(D) explain the analytical procedure for generating a DNA profile, including extraction, quantification, amplification, and capillary electrophoresis	(iii) explain the analytical procedure for generating a DNA profile, including amplification	Activity	New Content	DNA Analysis	Activity-Strawberry Extraction
(19) The Student analyzes the foundations and methodologies surrounding the processing of biological evidence for the purpose of identification. The Student is expected to	(D) explain the analytical procedure for generating a DNA profile, including extraction, quantification, amplification, and capillary electrophoresis	(iv) explain the analytical procedure for generating a DNA profile, including capillary electrophoresis	Activity	New Content	DNA Analysis	Activity-Strawberry Extraction

Data Collection Methods & Conversions

Qualitative data is descriptive while quantitative data is measurable. Many data collecting methods can be used for both quantitative and qualitative. The main difference is how the data is collected. For example, interviews provide a direct approach to gather data directly related to the research question. This method can be completed face-to-face or virtually. Interviews allow for flexibility, as the researcher and participant can guide the interview or a strict script of questions can be followed. When looking at qualitative data, the researcher will ask open-ended questions and review the answers. Whereas with quantitative data, the researcher might ask a group of people the same exact question and look at how many people answered the same way. Focus groups are similar to interviews but rather than the interaction being one-on-one, the scientist gathers data from a group of six to 12 people together in a single setting. Observations allow scientists to gather data by watching and taking notes over the subject. Surveys and questionnaires are generally the easiest and most effective way to collect quantitative data. They can also be used for both quantitative and qualitative data collection as they use open and close-ended questions through multiple choice, scales or yes-or-no questions.

Both qualitative and quantitative data can be collected and organized for use in many ways including:

- Lab reports
  - document experiments and their findings by including an introduction, procedure, results and conclusion
- Lab notebooks or journals
  - are a primary record of research which include documentation of observations, recorded steps of projects or experiments and data collection
  - include information, such as observations, literature review, experimental planning, raw data, procedures, data, observational images and references
- Labeled drawings
  - are visual representations of processes or items to identify various components
- Graphic organizers
  - are a visual way to organize a flow of information
- Summaries
  - are used to provide an overview of what methods were used in an experiment and how they led to the results
- Oral reports
  - are when researchers present their findings

Data Collection Methods & Conversions

- Technology-based reports
  - can vary, technology can be used for oral reports by using a voice over, traditional lab reports can be completed using various digital applications, or a presentation can be created using software to present findings
- Evidence
  - identifies objects, substances or other types of proof used to indicate alleged facts of a case

Regardless of the data collection method, data should be collected with accuracy and precision. Precision and accuracy in measurements reflect how closely the measurements are to the known accepted values of the object of measurement. Precision is how closely the individual measurements match and accuracy is how closely a measured value matches the actual value. Data or measurements may be collected using the International System of Units (SI) or the United States customary units. Measurements may include distance, speed and mass, and noting which unit is being used is important.

Conversions
Conversion occurs when measurements with many zeros or decimal places are simplified or when data is collected in different units of measurement.

SI Conversions
Converting units requires multiplication or division and knowledge of possible prefixes and their value.

To perform a conversion of units, use the conversion factor to multiply to the unit being changed. See the conversion factor for centimeters to meters below.

$$\frac{100\ cm}{1\ m} = \frac{1\ m}{1m} \rightarrow \frac{100\ cm}{1\ m} = 1$$

Data Collection Methods & Conversions

Prefix	Abbreviation	Multiplier	Exponential Factor
Giga-	G	1,000,000,000	10^{9}
Mega-	M	1,000,000	10^{6}
Kilo-	k	1,000	10^{6}
Hecto-	h	100	10^{6}
Deka-	da	10	10^{1}
Base Unit (meter, gram, second, ampere, candela, mole, liter, joule, etc.)			
Deci-	d	0.1	10^{-1}
Centi-	c	0.01	10^{-2}
Milli-	m	0.001	10^{-3}
Micro-	μ	0.000001	10^{-6}
Nano-	n	0.000000001	10^{-9}
Pico-	p	0.000000000001	10^{-12}

U.S. Customary Units
U.S. Customary Units, also known as The British Imperial, originally came from the British Empire. When the U.S. gained independence from Britain, the new U.S. government decided to keep these measurements. Currently, only the United States, Myanmar and Liberia use U.S. Customary Units. Cost and time are a few reasons the U.S. has not adopted the metric system.

Some basic units used in this type of measurement are inches, feet, yards, miles, ounces, pounds, tons, fluid ounces, cups, pints, quarts and gallons.

The following units of measure are used to measure length:

- Inches
  - for small objects
- Feet
  - for short distances or heights
- Yards
  - for medium objects
- Miles
  - for long distances

Data Collection Methods & Conversions

Conversion Table

Amount	Unit	Equals	Amount	Unit
1	Foot	=	12	Inches
1	Yard	=	3	Feet
1	Mile	=	5,280	Feet
1	Mile	=	1,760	Yards

The following units of measure are used to measure mass:

- Ounces
  - for light objects
- Pounds
  - for medium objects
- Tons
  - for heavy objects

Conversion Table

Amount	Unit	Equals	Amount	Unit
1	Pound	=	16	Ounces
1	Ton	=	2,000	Pounds

The following units of measure are used to measure volume:

- Fluid ounces
  - for small amounts of liquid
- Cups
  - for small amounts
- Pints
  - for medium amounts
- Quarts
  - for larger amounts
- Gallons
  - for very large amounts

Conversion Table

Amount	Unit	Equals	Amount	Unit
1	Cup	=	8	Fluid Ounces
1	Pint	=	2	Cups
1	Quart	=	2	Pints
1	Gallon	=	4	Quarts

Find the Origin

Project Overview:
In groups of three or four, you will work to determine the area of the origin. You will create fake blood and create impact spatter. You will then calculate the angle of impact of the bloodstain.

Directions:

1. Your instructor will divide the glass into groups of three or four and provide each group with the **Blood Recipe Student Handout**.

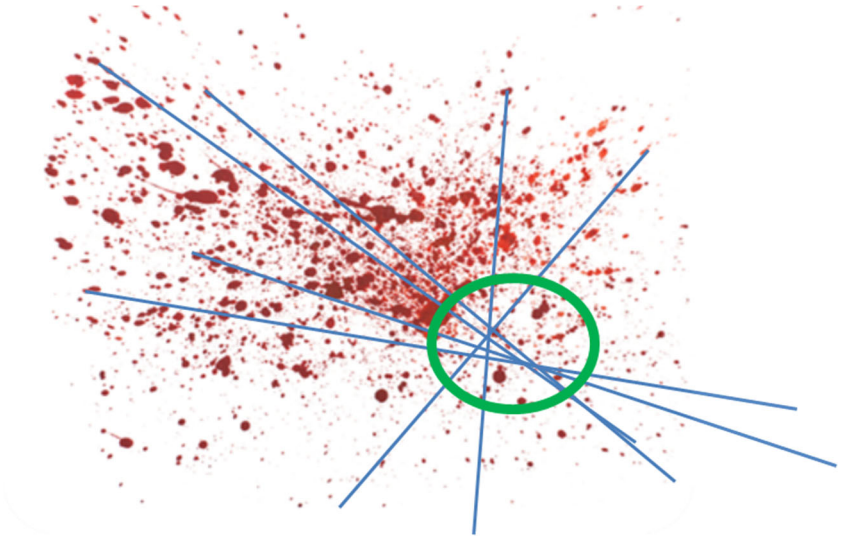
2. Mix up a batch of fake blood according to the **Blood Recipe Student Handout**.

3. Use a white sheet of paper or white bed sheets in order to create impact spatter. The paper or bed sheets may be taped to the floor or to the wall.

4. Create impact spatter by flinging the fake blood onto the paper or bed sheet and allow time for the fake blood to dry.

5. Using the dry impact spatter, determine the area of convergence for the stain pattern by drawing straight lines through the length of several individual bloodstains. The area of convergence will be where the lines of the group of stains intersect one another.

Example:



6. Record the length and width of multiple bloodstains in the table. Collect the data with accuracy and precision. For bloodstain measurements 1-5, use U.S. customary units, such as inches to measure and collect data. For bloodstain measurements 6-10, use SI units, such as millimeters and centimeters. Answer the reflection questions.

Find the Origin

7. Calculate the angle of impact of each individual bloodstain by measuring the length and width of multiple bloodstains, dividing the width by the length and determining the arcsin. You may use a calculator.

8. Place something sturdy, such as a member of the group holding a yardstick, at the area of convergence.

9. Attach one end of a string to each stain location at the point where the droplet contacted the surface.

10. Place a protractor next to each droplet and lift the string until it lines up with the determined angle of impact of the droplet and secure the string to the yardstick while keeping the string in line with the angle.

11. Repeat steps for multiple droplets. The area of origin should come into view where the strings appear to meet.

12. Once complete, submit your project according to your instructor's directions.

Find the Origin

Bloodstain #1	Bloodstain #2	Bloodstain #3	Bloodstain #4	Bloodstain #5
Bloodstain #6	**Bloodstain #7**	**Bloodstain #8**	**Bloodstain #9**	**Bloodstain #10**

When collecting data, which unit measurement was more accurate and precise?

Why is it important to collect data with accuracy and precision?

How did the different unit measurements change the angle of impact calculated?

Find the Origin

Rubric

Description	Possible Points	Your Score
Concept & Understanding: • Understanding of the concept is clearly evident • Effective strategies were used to achieve the end product • Logical thinking was utilized to arrive at the conclusion	50	
Creativity/Craftmanship: • End product is unique and reflects the student's or group's individuality • End product is clearly high quality	25	
Production/Effort: • Class time provided for the project was used efficiently • Time and effort are evident in the execution of the end product	25	
Total Points	100	

Additional Comments:

Proposing Solutions & Developing Explanations

Proposing Solutions

Proposing solutions to forensic science problems often involves analyzing and interpreting models and data collected from various sources. When proposing solutions supported by data and models, they should be consistent with scientific ideas, principles, and theories. A basic approach to utilizing data pr models to propose solutions can include the following processes:

Data Collection:
Gather relevant data from various sources such as research studies, crime scenes, and the Combined DNA Index System. The data may include information on trace evidence, DNA, trajectory, or ballistics.

Data Analysis:
Analyze the collected data using appropriate statistical and computational methods. This may involve identifying trends, patterns, associations, and correlations within the data. Use tools such as data visualization techniques, statistical tests, and modeling approaches to gain insights from the data.

Identify Patterns & Gaps:
Look for patterns or trends in the data that may provide insights into the underlying problem. Identify gaps in knowledge or areas where the data is insufficient to fully address the problem. For example, if looking at the trajectory of multiple gunshots, analyze the pattern of the gunshots, identify the locations of the gunshots, and assess factors contributing to the trajectory.

Identify Potential Solutions:
Based on data analysis, propose potential solutions to address the identified problem. Consider evidence-based interventions, strategies, or innovations aligning with the data findings, scientific ideas, principles and theories. For example, if data analysis reveals that hot temperature, for long period of time, at the crime scene contributes to the decay of human remains, propose an intervention like mobile refrigerator units.

Models can be used in different aspects of forensic science. For example, cadaver models are used to study the nature and timing of decomposition. Anatomical models help identify relationships between different organs, tissues, and systems. Ballistic specialist model the crime scene to replicate where the shooter was located and where the bullet ended up. Computational models can be used to provide tools for forensic scientists to better analyze evidence by overcoming the limitations of the human brain.

Incorporating models into solution design allows researchers to gain a better understanding of the intricate structures and functions of the human body. Additionally, models can be used to assess the performance and cost-effectiveness of different

Proposing Solutions & Developing Explanations

testing approaches. This information can guide decisions on test selection, screening procedures, and resource allocation. Proposed solutions should be evaluated and validated through real-world studies and trials as well as scientific ideas, principles and theories to ensure their effectiveness and feasibility.

Consider Multidisciplinary Approaches:
Problems related to forensic science often require multidisciplinary approaches. Collaborate with experts from various fields, such as law enforcement, biologists, toxicology, forensic anthropology, ballistic, or even forensic entomology, to develop comprehensive solutions. Incorporate diverse perspectives and expertise to ensure the proposed solutions are well-rounded and effective.

Evaluate Feasibility & Impact:
Assess the feasibility and potential impact of the proposed solutions. Consider factors such as cost, resources, scalability, ethical implications, and the potential for implementation in real-world settings. Conduct cost-effectiveness analyses or modeling studies to evaluate the potential impact of the proposed solutions on disease outcomes or public health.

Iterative Approach:
Proposing solutions based on data is a repetitive process. Continuously gather new data, update analyses, and refine solutions based on emerging evidence and feedback. The field of forensic science is dynamic, and new insights may lead to further modifications or alternative solutions over time.

Remember, proposing solutions to forensic science problems requires a rigorous and evidence-based approach. Data analysis plays a crucial role in understanding the problem, identifying potential solutions, and informing decision-making.

Developing Explanations

Developing an explanation for a forensic science issue can be done by asking a question, collecting background information, developing a hypothesis, testing a hypothesis, and analyzing the data to form a conclusion. A good scientific explanation is composed of a claim, evidence, and reasoning. The claim is a statement based on an experiment. For example, stating that oxygen affects the decomposition of human remains is a claim. Evidence is the data or model which supports the claim or hypothesis. Collecting data on the rate of decomposition of human remains in various levels of oxygen would be an example of evidence. Lastly, reasoning is the process of identifying the problem by observing the data or model. Looking at the evidence collected over oxygen and human remains decomposition, an individual can reason that higher oxygen levels lead to faster decomposition. Most of the time, an explanation will result in a proposed solution, but that is not always the case.

Proposing Solutions & Developing Explanations

Developing and communicating scientific explanations and solutions in a variety of formats is crucial for reaching diverse audiences and effectively conveying complex information. When developing scientific explanations, they should be supported by data and models consistent with scientific ideas, principles and theories. Some of the most common formats include:

Scientific Papers:
Publishing research findings and solutions in scientific journals allows for in-depth, peer-reviewed communication within the scientific community. This format typically follows a structured format, including an abstract, introduction, methods, results, discussion, and conclusion sections. Research is typically conducted by a team and requires collaboration and review throughout the initial writing of the paper and through the official peer-review process.

Presentations:
Oral presentations, such as talks at conferences or seminars, provide an opportunity to share scientific findings, explanations and solutions with a live audience. These presentations often use slides or visual aids to support the delivery of information and may include data, models, graphs and illustrations.

Posters:
Poster presentations are commonly used at conferences and scientific meetings. Posters allow for visual representation of scientific findings, explanations, and solutions through a combination of text, figures, and graphs. Posters are effective for summarizing research findings and facilitating discussions with peers.

Infographics:
Infographics are visual representations that use a combination of text, icons, images, and charts to convey scientific information in a concise and engaging manner. They are useful for simplifying complex concepts, presenting data, and highlighting key findings or solutions.

Scientific Reports & Summaries:
Creating reports or summaries targeted at policymakers, stakeholders, or the general public is an effective way to communicate scientific explanations and solutions in a clear and accessible manner. These documents should include an overview of the problem, the scientific basis, and evidence supporting the proposed solutions.

Websites & Blogs:
Developing websites or blogs dedicated to scientific explanations and solutions allows for the dissemination of information to a wider audience. These platforms can include articles, case studies, FAQs, and interactive content to engage readers and provide access to scientific resources.

Proposing Solutions & Developing Explanations

Videos & Animations:
Creating videos or animations can be an engaging way to communicate scientific explanations and solutions. These formats can combine visual elements, narration, and graphics to simplify complex concepts and enhance understanding.

Social Media & Podcasts:
Utilizing social media platforms and podcasts can help reach broader audiences and share scientific information in a more accessible and digestible format. These mediums allow for shorter, concise explanations, discussions, and interviews with experts.

Press Releases:
Developing press releases can effectively communicate scientific explanations and solutions to journalists and the media. These documents should highlight the significance of the research or proposed solutions and emphasize key findings in a language accessible to non-experts.

Public Talks & Outreach Events:
Engaging in public talks, workshops, or outreach events allows for direct interaction with the public and provides an opportunity to explain scientific concepts, present research findings, and discuss potential solutions to scientific problems. Often times these talks and events allow for individuals to communicate with a diverse audience and answer questions to further explain their findings, explanations and solutions.

Adapting scientific explanations and solutions to various formats ensures information is accessible, engaging, and relevant to different audiences, including scientists, policymakers, stakeholders, and the general public. It is important to tailor the content, language, and visuals to suit the specific format and target audience, promoting effective communication and understanding.

Models Explanation Infographic

Project Overview:
In groups, you will choose a forensic science topic and research models relevant to forensic science to help develop explanations of the topic based on scientific ideas, principles and theories.

Directions:

1. Your instructor will divide the class into groups of five.

2. In your group, select one of the topics from the following list:
    - Fingerprinting
    - DNA analysis
    - Crime scene sketching
    - Forensic anthropology and odontology
    - Ballistics
    - Trace evidence collection

3. Based on the topic selected, use the internet to research models which relate to the topic and how the model is supported by scientific ideas, principles and theories.

4. Develop an infographic which details your findings which can be printed or shared digitally to ensure it can be used in a variety of formats. The infographic should contain at least the following information:
    - Name of topic chosen
    - An explanation of the topic based on at least one model found relating to the topic
    - At least two supports of the model from either accepted scientific ideas, principles or theories

5. Turn in your completed activity according to your instructor's directions.

Models Explanation Infographic

Rubric

Description	Possible Points	Your Score
Research & Organization: • Proper research was conducted to complete the infographic • Sources were cited appropriately based on instructions provided • Information was presented in a logical organized manner	35	
Concept & Understanding: • Understanding of the models related to the topic is clearly evident • Effective strategies were used to achieve the end infographic • Logical thinking was utilized to arrive at the conclusion	35	
Creativity/Craftmanship: • Infographic is unique and reflects the student's or group's individuality • Infographic is clearly high quality	15	
Production/Effort: • Class time provided for the project was used efficiently • Time and effort are evident in the execution of the infographic	15	
Total Points	100	

Additional Comments:

Designing Solutions

Activity Overview:
You will consider a problem or issue in the field of food science in order to propose a solution.

Directions:

1. Use the internet and other resources to locate a problem or issue in the field of food science. Be sure to check in with your instructor to have your chosen issue approved and record the problem in the space provided.

2. Research and list, in the space provided, three possible solutions to the problem. Pay attention to solutions based on data, scientific ideas, principles or theories.

3. Choose one solution from the list and detail how the solution can be implemented. This could include sketches of models, detailed processes or precise procedures. Detail how the solution is supported by data, scientific ideas, principles or theories.

4. Write a description of your solution and propose how it will help solve the issue identified in step one.

5.Form small groups according to your instructor's directions, and share the identified problem and possible solution.

6. Turn in your completed activity as directed.

Proposed Problem:
Write out the problem you are choosing to address.

Designing Solutions

Possible Solutions:

1.

2.

3.

Proposed Solution Details:

Proposed Solution Explanation:

Communicating Results

- Should be discussed in a respectful way through scientific argumentation using applied scientific explanations and empirical evidence
  - argumentation may occur when others disagree with an experiment or its results

7

Communicating Results

- Through scientific argumentation includes four parts:
  - claim
    - statement based on the experiment or results
  - evidence
    - what is the factual evidence supporting the experiment or results
  - reasoning
    - statements to support the claim
  - rebuttal
    - provides additional scientific evidence to a response from the counterargument

8

Data to Communicate

Activity Overview:
In a group, you will perform a brief data collection and consider how the results could be shared with the world. Then you will respectfully engage in scientific argumentation using applied scientific explanations and empirical evidence.

Directions:

1. Your instructor will divide the class into groups of four.

2. Within your groups, make tally marks for which blood type each group member has using the table below.

3. Once everyone in your group has been marked, go around to other groups and ask each member their blood type. Continue collecting blood types until you have received answers from the entire class. Make sure to tally the answers from the other groups on the table below.

4. Consider how these results could be shared with the world. Write one to two sentences explaining your thoughts.

5. Pair up with another group to participate in a group scientific argumentation. In a respectful way discuss the reasoning a person may have a certain blood type. Be sure to use the four part of scientific argumentation:
    - Claim
    - Evidence
    - Reasoning
    - Rebuttal

6. Submit the completed activity according to your instructor's directions.

Data to Communicate

	# of Students
A+/A-	
B+/B-	
O+/O-	
AB+/AB-	
Not Sure	

Forensic Feud

Project Overview:
In groups, students will compete in a game show with your team covering topics from the presentation. Students will then write a reflection based on their experience.

Directions:

1. Divide the class into two groups.

2. One member of each team will compete in a face-off as the teacher reads the question.

3. The team to “buzz in” with a correct answer first will choose if they would like to continue the question or pass the question to the other team.

4. The team members will attempt to guess all remaining correct answers. If the team guesses two incorrect answers, the other team will receive the question.

5. The team now in control of the question will have the opportunity to give one answer. If the answer is correct, points will be added to the team’s score. If the answer is incorrect, points will be given to the initial team.

6. Points are collected as each team finds answers to the questions. The team with the most points wins. Points allotment is dependent upon the instructor.

7. After the game is completed, students will write a reflection on their experience.
    - Which questions did you find difficult to answer and why
    - Did the pressure of answering the question affect your answers, why or why not
    - What questions do you still have about the content
    - How did the game show prepare you for your final assessment

Forensic Feud

Questions:

1. Name the four important roles of ethical behavior in an investigation.
   Documenting the scene
   Searching the scene
   Collecting and securing evidence
   Analyzing evidence

2. Name the five ethical behaviors when documenting the scene.
   Avoiding touching or moving anything
   Photographing the scene and evidence
   Measuring precise locations of items
   Creating accurate scene sketches
   Keeping a record of all procedures completed

3. Name the four ethical behaviors when analyzing evidence.
   Identifying relevant and valid test methods
   Proper performing tests in a systematic, unbiased manner
   Documenting results of analysis accurately
   Refraining from drawing conclusions about the case

4. Name the four unethical & illegal behaviors which are never acceptable in forensic science.
   Manipulating evidence
   Manipulating documentation
   Manipulation analysis methods or results
   Failing to report witnessing unethical behavior

5. Name the five examples of ethical courtroom behavior.
   Being completely truthful
   Exhibiting neutrality, not advocacy
   Acknowledging the judge's authority
   Following ethical standards of conduct
   Displaying respect for the justice system and its rules and processes

6. Name the five misapplications of forensic science The Innocence Project covers.
   Invalid forensic disciplines
   Insufficient validation of methods
   Misleading testimony
   Mistakes
   Misconduct

Forensic Feud

7. Name which party can call upon an expert witness.
   Defense
   Prosecution

8. Define the difference between expert witnesses and lay witnesses.
   Expert witnesses are individuals called to testify because they have specialized knowledge or training about the subject matter which will be used to prove or disprove specific claims
   Lay witnesses are not considered experts

9. Define the difference between testimony, testifying and oath.
   Testimony is a statement provided as evidence by a witness under oath
   Testifying is the act of providing testimony
   Oath is a legal promise to tell the truth

10. Explain how testimony is used by forensic scientists for expert witness testimony.
   Forensic scientists must often explain forensic evidence and the methodology used to analyze it
   Forensic scientists must be able to communicate technical concepts in an understandable way while maintaining accuracy and remaining unbiased

11. Describe the process and guidelines for expert witness testimony.
   Experts should help the judge or jury better understand evidence or facts of the case
   Experts may testify about conclusions if analysis is conduced in a reliable manner and based on scientific principles
   Experts must prepare a summary of the analysis and conclusions to be included in the testimony, which are made available to all parties in the case

Forensic Feud

Rubric

Description	Possible Points	Your Score
Teamwork & Collaboration: • Participation in team discussion • Proactively contributes to their team by offering ideas	50	
Concept & Understanding: • Understanding of the concept is clearly evident • Effective strategies were used to achieve the end product • Logical thinking was utilized to arrive at the conclusion	25	
Production/Effort: • Class time provided for the project was used efficiently • Time and effort are evident in the execution of the end product	25	
Total Points	100	

Additional Comments:

Career Research

Project Overview:
You will select a project from the choices provided to demonstrate your knowledge of a career specific to forensic science.

Directions:

1. Select a career within the forensic science pathway which interests you. A list of possible careers is listed on the following page. Careers represent the various disciplines of forensic science including forensic biology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics and questioned documents.

2. Choose a project option from the following:
    - **Infographic**: graphic visual representation of information and knowledge using images, statistics and information
    - **Trading Card**: card which shows an image on one side and information on the other
    - **Poster**: use of both textual and graphic elements to promote an idea
    - **Podcast**: information shared via spoken word, interviews and discussions
    - **Newsletter**: printed or electronic report with news, information and activities
    - **Comic**: series of panels utilizing images and speech bubbles or narration to communicate ideas
    - **Board Game**: virtual or physical interactive game which incorporates elements of cards, role-playing or moving pieces

3. Notify your instructor of your selections to make sure no two students select the same career.

4. Using all available resources, explore sources including museums, professional organizations, online platforms, etc., gather the following information:
    - Occupation information (duties and responsibilities, location of work, work hours)
    - Education path (college major, degree(s) needed, good schools to attend)
    - Required certificates or licenses
    - Necessary skills and knowledge
    - Professional organizations which support the career
    - Projected job growth and demand
    - Average salary
    - Two similar alternative careers

5. Develop a citation sheet listing all sources used.

Career Research

6. Pair up with a partner who researched a different career or forensic science discipline. Discuss the functions of both careers and their respective discipline. Write a three to five sentence summary outlining any similarities or differences.

7. Submit your completed project to your instructor.

Career List:

Arson Investigator
Bloodstain Pattern Analyst
Computer Forensics Examiner
Crime Scene Investigator
Criminalist
Digital Forensics Expert
DNA Analyst
Evidence Technician
Fingerprint Analyst
Forensic Accountant
Forensic Anthropologist
Forensic Autopsy Technician
Forensic Ballistics Expert
Forensic Biologist
Forensic Chemist
Forensic Documents Examiner
Forensic DNA Analyst
Forensic Engineer
Forensic Entomologist
Forensic Investigator
Forensic Medical Examiner
Forensic Nurse
Forensic Nurse Examiner
Forensic Odontologist
Forensic Pathologist
Forensic Psychologist
Forensic Science Technician
Forensic Sketch Artist
Forensic Toxicologist
Legal Nurse Consultant
Polygraph Examiner

Career Research

Rubric

Description	Points	Your Score
Project includes thorough information about the occupation as indicated in the project.	20	
Project details a well thought out educational path.	20	
Project includes two alternative careers similar to the one chosen.	20	
Project utilizes color and graphics to enhance understanding of the career.	20	
Project demonstrates creativity.	20	
Total Points	100	

Additional Comments:

Search & Seizure Discussion Bell Ringer

Activity Overview:
You will participate in a class discussion about the laws which guide legal search and seizure of evidence.

Directions:

1. Consider the elements of criminal law that guide the search and seizure of evidence. Write two to three elements below.

2. For each identified element write a sentence or two about how it guides the search and seizure of evidence.

3. When prompted, participate in a class discussion about the importance of the criminal laws you identified.

4. Once completed, turn in the completed activity according to your instructor's directions

Classroom Vandalism

Activity Overview:
In groups, you will solve the mystery of who vandalized the classroom participate in a class discussion about the best evidence to collect.

Directions:

1. Your instructor will divide the class into groups of three or four. You will work as a group to figure out who vandalized the classroom.

2. Begin by looking through the classroom without collecting any evidence. Try to develop an image of what happened and create a list of evidence. You may be able to gather fingerprints.

3. Have a class discussion about the best evidence to collect and determine the best visualization technique for each piece of evidence. Use proper evidence collection techniques for any evidence which you must pick up from the crime scene.

4. Complete the following steps for each collection method and visualization technique listed below.

5. After completing steps, answer the reflection questions on the following pages.

6. Once complete, submit your activity according to your instructor's directions.

Oblique Lighting: Best for patent prints, particularly in substances where patent prints can be easily destroyed such as wet clay or paint

- Step 1: Shine a flashlight at a low angle to the print to best create shadows which make the ridges within the print most visible
- Step 2: Photograph the print as closely as possible from several angles

Classroom Vandalism

Super Glue Fuming: Best for latent prints on otherwise dry, smooth surfaces like glass

- Step 1: Set up your station within a fume hood because super glue fumes are very dangerous to inhale.
- Step 2: Create a small bowl using the aluminum foil. Add 10-15 drops of super glue.
- Step 3: Add the super glue to the bottom of an airtight jar or container. Place your evidence on top of the aluminum foil holding the super glue. Seal the jar or container.
- Step 4: Place the jar or container on top of a hot plate on a low heat setting. Allow the hot plate to heat the jar for 5-10 minutes until you see fingerprints begin to develop on your evidence.
- Step 5: Remove the jar or container from heat and allow to cool. Once cool, remove evidence by opening the jar toward the back of the hood. Be sure not to breathe in the fumes from the super glue, they are very toxic. Then remove the evidence using gloved hands being careful not to touch prints. Discard of the superglue and aluminum foil.
- Step 6: Photograph the prints as close as possible from several angles.

Crystal Violet Processing: Best for latent prints on adhesive surfaces, like tape or labels.

- Step 1: Set up your station within a fume hood to avoid inhaling crystal violet fumes.
- Step 2: Pour crystal violet solution into a processing tray.
- Step 3: Soak the adhesive material in the solution for approximately 1-2 minutes to dye the prints. Be careful not to transfer any of your own prints to the adhesive material.
- Step 4: Rinse the item with tap water to remove the excess chemicals and allow the adhesive to dry completely before analyzing the prints.
- Step 5: Photograph the prints as close as possible from several angles.

Ninhydrin Processing: Best for latent prints on porous surfaces, like paper or wood.

- Step 1: Set up your station within a fume hood, because ninhydrin is very toxic and dangerous to inhale.
- Step 2: Use PPE like gloves and a mask in addition to the fume hood to protect yourself from the chemical.
- Step 3: Spray or soak the porous material with ninhydrin for two minutes, depending on your instructor's directions.
- Step 4: Use indirect heat from an iron or blow dryer for one minute over the prints. The ninhydrin should turn purple under the heat.

Classroom Vandalism

- Step 5: After drying and heating, photograph any prints visible as close as possible and from several angles.

Dusting: Best for smooth surfaces

- Step 1: Cover your working surface with newspaper or a table cloth for easy clean up.
- Step 2: Put on gloves to handle the evidence.
- Step 3: Dip the fingerprint brush into the fingerprint powder. Brush the fingerprint powder over the surface of the evidence.
- Step 4: Photograph any prints visible on the surface of the evidence as close as possible from several angles.

Reflection Questions:

1. Explain which evidence you chose to use for each visualization technique and why.
   A. Oblique Lighting

   B. Superglue Fuming

   C. Crystal Violet Processing

   D. Ninhydrin Processing

   E. Dusting

Classroom Vandalism

2. Place all of the pictures you collected from the lab here. Label each one with the visualization method used.

Classroom Vandalism

3. Which method worked best and why?

4. What would you do to improve your results next time?

5. What prints are usable for print identification? Which ones are not usable for print identification? Why?

Classroom Vandalism

6. Select the best print to use for print identification. Blow up the image as large as possible.

Collecting Fingerprints on Adhesive Surfaces

The collection of fingerprints is a necessary step in any investigation providing information which may lead to solving a crime. Fingerprints are found on a variety of surface materials including adhesive. When prints are found on adhesive surfaces, chemical processes may be used to develop latent prints. When performing chemical processes, it is important to follow all safety regulations and proper disposal procedures.

Below are the steps for developing latent prints using the Sticky-Side Powder method, which is a common chemical process to develop latent prints on adhesive surfaces.

1. Wear proper PPE or protection to avoid contaminating the work area
2. Place the sticky-side powder solution on the adhesive surface with a brush
3. Let the solution set for 30 to 60 seconds
4. Rinse the solution with cold water
5. Allow the adhesive surface to dry
6. Repeat the process if necessary to develop a print
7. Use a type of vision enhancement, like a microscope or magnifying glass and inspect the adhesive surface for the print components
8. Identify the print with the necessary information and prepare for storage

The following are additional examples which can be used to reveal latent prints on adhesive surfaces using chemical processes.

- Gentian Violet
  - a sample is placed in the gentian violet solution for one to two minutes and then rinsed with cold water
- Alternative Black Powder
  - a solution is placed on the adhesive surface, sets for 30 to 60 seconds and rinsed off with cold water
  - after drying, the procedure may be repeated if necessary
- Ash Gray Powder
  - is typically used more with darker colored tape
  - an ash gray powder is placed in a petri dish, solution is then added to the powder and mixed until achieving the desired consistency
  - the solution is placed on the adhesive surface, sets for 30 to 60 seconds and rinsed off with cold water
  - after drying, the procedure may be repeated if necessary

Creating Tool Marks

Activity Overview:
In a group, you will create tool marks using the tools provided and record your findings.

Directions:

1. Your instructor will divide the class into five groups.

2. Each group will be provided with different types of tools and Play-Doh®.

3. Using the Play-Doh® and tools, create a tool mark for each of the tools provided.

4. On a separate sheet of paper, note the following for each tool:
    - Name of the tool
    - What category would the tool be classified as
    - What type of impression was created
    - What class of tool mark impression was created
    - Was the impression difficult to create
    - Was the recovery of surface characteristics difficult to create
    - Where would the impression typically be found at a crime scene
    - Where there any individual characteristics shown on the impression

5. Consider how the tool markings can be recovered, including imaging, lighting, chemical enhancement and 3D scanning. Write three to five sentences describing the process you would use to recover one of the markings.

6. Perform the tool marking recovery you described on one of your tool markings.

7. Note the striations, notches and unique patterns resulting from your recovery and compare them to the initial marking.

8. Be prepared to participate in a class discussion to share the success of your recovery process.

9. Once complete, submit your activity according to your instructor's directions.

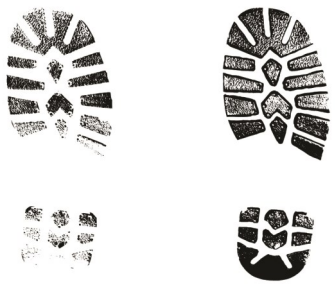
Footwear & Tire Tread Impressions

Footwear Impressions
Class characteristics of footwear impressions include design features which are repeated during the manufacturing process. This can include characteristics such as the company logo, brand name and tread pattern. Other class characteristics could include size and mold characteristics. Each size and mold piece can contain different characteristics leading to the manufacturer and location sold.

Individual characteristics of footwear impressions include unique characteristics resulting from use or wear. This could be a cut, gouge or crack in the sole, or an alteration to the shoe such as a tear, stitch or rock stuck in the tread. These individual characteristics can lead to the exact suspect, as the characteristic could be unique to one pair of shoes.

The most popular footwear impression is collected using a casting. This method uses a powdered stone material mixed with water and poured into the impression. After the material is dried, a three-dimensional model of the impression will be present.

Footwear impressions are documented by photographing, lifting or casting an impression of the footprint. This allows forensic analysts to review the impression and compare to other shoe prints and samples. A side-by-side comparison can be done by directly comparing features in the impression to a known footwear item. Another way to compare the impression is called superimposition. This involves placing a test impression, created from a known piece of footwear, over the footwear impression from the crime scene. Examiners may use both side-by-side and superimposition comparisons to compare class and individual characteristics and narrow down potential footwear sources.



Footwear & Tire Tread Impressions

Tire Tread Impressions
Class characteristics of tire tread impressions can include everything from physical shape and size, tread design and wear positions. Physical shape and size can lead to the specific vehicle driven due to vehicles requiring different size tires to match the size of the vehicle. Tread designs can also be different based on the brand. These characteristics are all repeated during the manufacturing process.

Individual characteristics of tire tread impressions can include typical wear and tear or incidental cuts, holes or patches. These characteristics may be present in impressions based on the surface. Each individual impression will only have certain surfaces the impression will be uncovered on.

Tire tread impressions can be collected by photographing, casting or lifting the impression from the surface. Tire tracks can be found in sand, dirt, mud, snow, or even on a victim at a crime scene. These impressions can be collected and compared in a database to determine the make and model of the tire. Specific features from a crime scene's tire impression can be directly compared to a known tire in a side-by-side comparison. Another method called superimposition involves a test impression of a known tire being placed over the impression from the crime scene. In both side-by-side and superimposition comparisons, class and individual characteristics are able to be compared to allow an examiner to narrow down potential sources.

Impression Analysis Bell Ringer

Activity Overview:
You will review the impressions and answer the reflection questions.

Directions:

1. Your instructor will divide the class into groups of three or four.

2. Your group will be responsible for analyzing the footwear and tire tread impressions.

3. You will complete the reflection questions after analyzing the impressions.

4. Turn in the activity according to your instructor's directions.

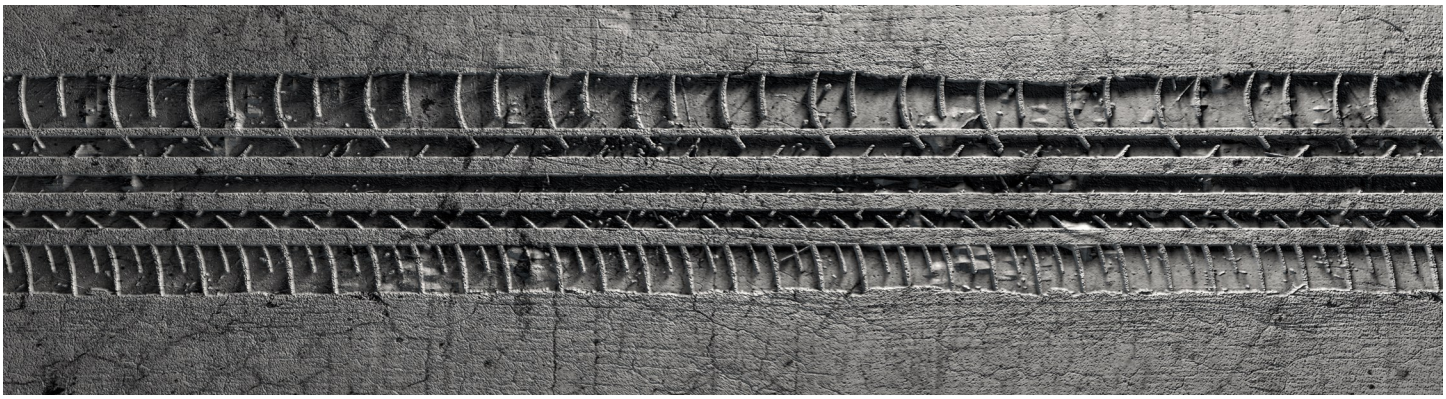
Footwear Impressions:
How would you analyze the class of footwear impressions?

How would you analyze the individual characteristics of footwear impressions?

How would you analyze the recovery and documentation of footwear impressions?

Compare the impression to the reference impression of a known footwear. Describe why or why not the impressions come from the same shoe.

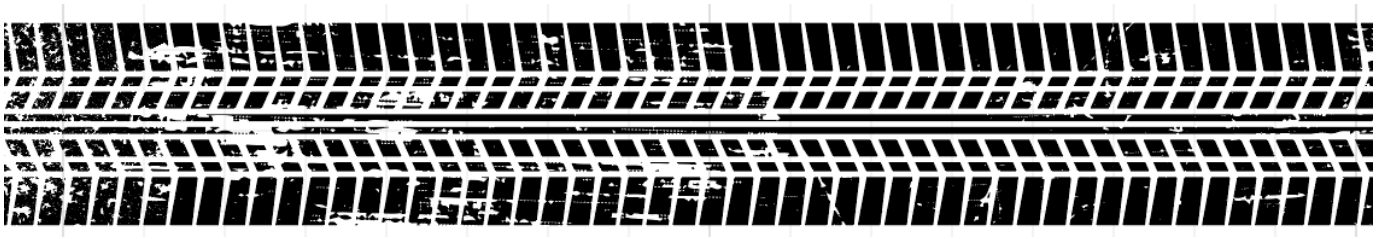
Impression Analysis Bell Ringer



Tire Tread Impressions:
How would you analyze the class of tire tread impressions?

How would you analyze the individual characteristics of tire tread impressions?

How would you analyze the recovery and documentation of tire tread impressions?



Compare the impression to the reference impression of a known tire. Describe why or why not the impressions come from the same tire.

Fiber Analysis

Activity Overview:
You will observe the characteristics of a provided fiber sample using a microscope and compare it to known samples.

Directions:

1. Identify a partner to work with according to your instructor's directions.

2. Obtain a plastic slide with a mounted fiber sample from your instructor.

3. Using a microscope, focus the fiber using 100x magnification.

4. Where provided, note the following characteristics which help determine the type of fiber and its possible origin:
    - Color
    - Texture (smooth, rough, etc.)
    - Cross-sectional shape (if visible)
    - Diameter
    - Any other observable characteristics

5. Create an illustration of the fiber's characteristics in the space provided.

6. Compare your description to the fiber examples on the following page and identify which fiber example best matches your slide.

7. Write three to five sentences identifying the fiber sample with justification.

8. Once complete, submit your activity according to your instructor's directions.

Fiber Analysis

Fiber Characteristics:

1. Color:

2. Texture:

3. Cross-sectional shape:

4. Diameter:

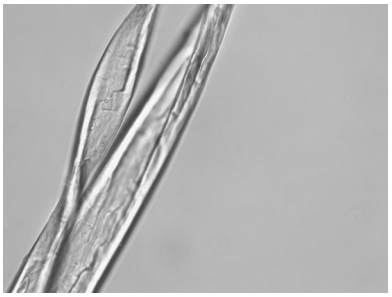
5. Other characteristics:

Fiber Characteristics Illustration

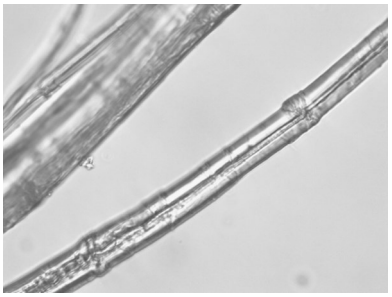
Fiber Analysis

Examples (for comparison):

- Cotton

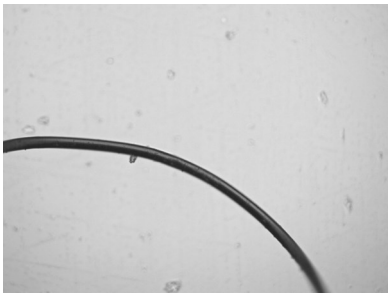


- Linen

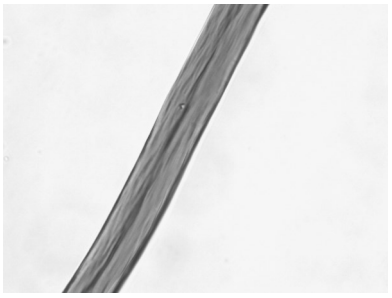


- Wool

- Nylon



- Acrylic



Explain Drug Tests

Project Overview:
You will conduct research about the different types of drug tests.

Directions:

1. Use the internet, library or any other available resources to answer the questions about the different types of drug tests.

2. Turn in your answers according to your instructor's directions.

Gas Chromatography
How does the test work?

How is the test used to identify controlled substances or toxins?

Thin-Layer Chromatography
How does the test work?

Explain Drug Tests

How is the test used to identify controlled substances or toxins?

Mass Spectrometry
How does the test work?

How is the test used to identify controlled substances or toxins?

Ultraviolet Spectrometry
How does the test work?

How is the test used to identify controlled substances or toxins?

Explain Drug Tests

Infrared Spectrometry
How does the test work?

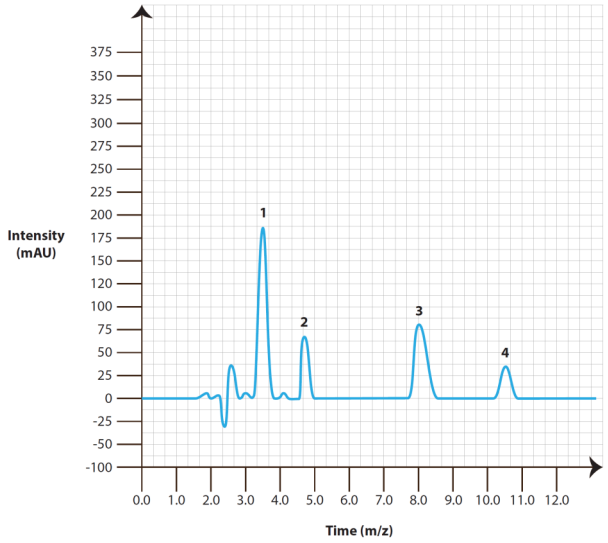
How is the test used to identify controlled substances or toxins?

Gas Chromatography/Mass Spectrometry (GC/MS)
How does the test work?

How is the test used to identify controlled substances or toxins?

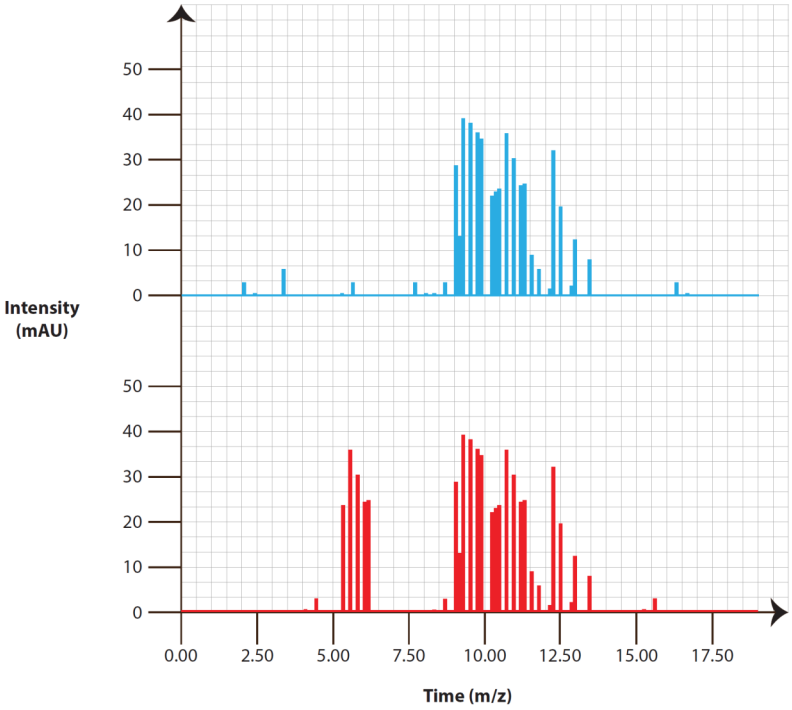
Explain Drug Tests

The graph and table below details a presumptive GC/MS result from a victim's blood sample. Interpret and describe the results in three to four sentences.



	Peak name	Ret. Time (min)	Area (mAU/min)	Height (mAU)	Amount (mg/L)
1	Caffeine	3.560	26.5392	181.738	22.461
2	Aspartame	4.787	10.0363	67.9074	51.107
3	Diphenhydramine	8.053	12.8521	70.4162	5.053
4	Pentobarbital	10.511	10.1438	37.9963	4.915

This graph details a confirmatory GC/MS result for one of the compounds found in the victim's blood sample. Interpret and describe the results in three to four sentences.



Explain Drug Tests

Rubric

Description	Possible Points	Your Score
Research & Organization: • Proper research was conducted to complete the assignment • Sources were cited appropriately based on instructions provided • Information was presented in a logical organized manner	35	
Concept & Understanding: • Understanding of the concept is clearly evident • Effective strategies were used to achieve the end product • Logical thinking was utilized to arrive at the conclusion	35	
Creativity/Craftmanship: • End product is unique and reflects the student's or group's individuality • End product is clearly high quality	15	
Production/Effort: • Class time provided for the project was used efficiently • Time and effort are evident in the execution of the end product	15	
Total Points	100	

Additional Comments:

Strawberry Extraction

Activity Overview:
In groups, you will be extracting DNA from a strawberry using the materials provided.

Directions:

1. Your instructor will divide the class into group of four.

2. Gather the following materials:
    - Rubbing alcohol
    - Cheese cloth
    - One strawberry
    - Plastic bag
    - Funnel
    - Test tube
    - Measuring cylinder
    - Scale
    - Wooden skewer
    - Salt
    - Water
    - Liquid dish soap

3. Create your extraction buffer by adding 5 mL of liquid dish soap, 0.75 g of salt and 45 mL water into a measuring cylinder. Mix well.

4. Rinse the strawberry and remove the leaves. Then place the strawberry into a plastic bag and seal shut.

5. Add 10 mL of extraction buffer to the bag. Crush the strawberry with your fingers for one minute.

6. Using a cheese cloth, layer it over the funnel. Place the funnel into the test tube. Pour the material from the plastic bag into the cheese cloth. Squeeze the liquid components of the strawberry into the test tube through the cheese cloth so it will catch the solid components of the strawberry.

7. Add an equal volume of rubbing alcohol to the test tube.

8. At this point, you should observe a layer of gooey clear, stringy material in the test tube. Swirl the wooden skewer through the test tube to collect the gooey material. This is the DNA from the strawberry.

9. Once complete, submit your activity according to your instructor's directions.

Strawberry Extraction

Reflection Questions

1. Explain the analytical procedure for generating a DNA profile, including qualification, amplification and capillary electrophoresis.

2. Explain extraction pertaining to generating a DNA profile.

3. Explain quantification pertaining to generating a DNA profile.

4. Explain amplification pertaining to generating a DNA profile.

5. Explain capillary electrophoresis pertaining to generating a DNA profile.

6. How do these match the strawberry extraction lab?