

PUBLIC SCHOOLS OF EDISON TOWNSHIP  
OFFICE OF CURRICULUM AND INSTRUCTION



Forensics

Length of Course:	Semester
Elective/Required:	Elective
Schools:	High Schools
Eligibility:	Grade 11-12
Credit Value:	2.5 Credits
Date Approved:	November 24, 2020

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**Modifications will be made to accommodate IEP mandates for classified students.**

## STATEMENT OF PURPOSE

Forensics is a new course offering in the Edison Public School district for the 2012-13 school year. The course is being offered as a semester elective to seniors who want to take an introductory course in Forensics. Forensics is multifaceted and designed so students can apply scientific principles and concepts to solve crime-related problems. By studying different scenarios and applying their scientific knowledge, students will understand the relationship of science and problem solving to real-life situations.

Teachers completed work on this guide by identifying the units of study and delineating the expectations of student skills as well as appropriate instructional teacher actions that will help to insure proper and consistent delivery of the curriculum across the district.

In the Fall of 2020, the guide was updated to align to and reflect the current NJSL-S/NGSS Science Standards.

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### Unit of Study 1: Introduction and History of Forensic Science

Time: 1 Week

#### Targeted Standards:

HS- ETS1-1, HS- LS1-2

#### Unit Objectives/Conceptual Understandings:

Be exposed to the basics and history of forensic science to prepare them for deeper understanding of specific topics in the following units.

Realize that Science can be applied to solving crimes

Understand that physical evidence is the basis for building a criminal case against a suspect

#### Essential Questions:

Is science applicable to solving crimes?

Is all evidence found at a crime scene significant?

Has technology revolutionized forensic science and in what ways is technology used to solves crimes?

#### Unit Assessment:

Formal Summative Assessment

Cumulative Progress Indicators	Core Content Objectives		Instructional Actions	
	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS- ETS1-1, HS- LS1-2	The definition of forensic science.  The history of Bertillion, Orfila, Galton, Goddard, McCrone and Foresics Locard.	Demonstrate how to properly use the light microscope	Teacher Powerpoint on the History of Forensic Science  Sherlock Holmes? Who is He? Why is he so important? (Research	Quizzes Tests Labs and Write Ups Class Discussions Worksheets Teacher Feedback Homework

	<p>That there are several branches of forensic science: Physical science unit, biology unit, firearms unit, document examination unit, photography unit, toxicology unit, latent fingerprint unit, polygraph unit, voiceprint analysis unit, and evidence collection unit.</p> <p>The set-up of the forensic science lab. The methods used to process crime scenes</p> <p>The importance of the microscope to forensic analysis.</p> <p>The types/categories of physical evidence How data and information can be extracted from physical evidence.</p>		<p>activity) Modern Marvels: Inside a Forensics Lab</p>	<p>Online Activities BRAG Sheet</p>
<p><b>Resources:</b> Bertino Forensics Science Book Computer Programs, PowerPoints, Study Guides, Video Segments from various crime tv shows (CSI, Forensic Files, etc.)</p>			<p><b>Instructional Adjustments:</b> Modifications, student difficulties, possible misunderstandings</p>	

**Unit of Study 2: Observation Skill and Crime Scene Analysis**  
**Time: 3 Weeks**

**Targeted Standards:**

HS- ETS1-1, HS- LS1-2

**Unit Objectives/Conceptual Understandings:**

Practice and improve their powers of observation

Relate observation skills to their use in forensic science

Differentiate between the seven steps involved in processing and evaluating evidence at a crime scene.

Realize that physical evidence is the basis for building a criminal case against a suspect.

Understand that physical evidence can be used in a variety of ways and be tested in several ways to produce results that can be used to solve the crime.

Appreciate that documenting the crime scene is just as important as collecting evidence.

**Essential Questions:**

Is all evidence found at a crime scene significant?

Is Locard's Exchange Principle always applicable in the collection, preservation and analysis of evidence?

Is it possible to commit the perfect crime?

Does human activity have an impact on the collection and evaluation of evidence?

Has technology revolutionized forensic science and in what ways is technology used to solve crimes?

**Unit Assessment:**

Various Formal and Summative Assessments on Observation skills and their importance (Both in lab and out of lab activities)

Cumulative Progress Indicators	Core Content Objectives		Instructional Actions	
	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS- ETS1-1, HS- LS1-2	The methods used to process crime scenes	Demonstrate how to properly use the light microscope	Teacher Led Powerpoints Observation Activity Bedroom Sketch / Intro To	Quizzes Tests Labs and Write Ups

	<p>The importance of the microscope to forensic analysis.</p> <p>The types/categories of physical evidence.</p> <p>How data and information can be extracted from physical evidence.</p>	<p>Develop a sketch of a suspect based on on eyewitness testimony</p> <p>Demonstrate the securing of a crime scene</p> <p>Search a crime scene for evidence</p> <p>Use the correct method for Sketching a crime scene</p>	<p>Crime Scene Sketch Suspect Sketching Locards Principle Activity Crime Scène Investigation/Chain of Custody</p>	<p>Class Discussions Worksheets Teacher Feedback Homework Online Activities BRAG Sheet</p>
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<p><b>Resources:</b> Bertino Forensics Science Book Computer Programs, PowerPoints, Study Guides, Video Segments from various crime tv shows (CSI, Forensic Files, etc.)</p>	<p><b>Instructional Adjustments:</b> Modifications, student difficulties, possible misunderstandings</p>
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**Unit of Study 3: Hair and Fiber Analysis**  
**Time: 2 Weeks**

**Targeted Standards:**

HS- LS1-1, HS-LS1-2, HS-LS3-3, HS-LS4-1

**Unit Objectives/Conceptual Understandings:**

The learner will learn the variety of scientific analysis that can be used to evaluate hair and fiber evidence by:  
 Demonstrate how to package and process hair and fiber evidence  
 Demonstrate how to use a microscope to evaluate hair and fiber evidence  
 Identify human and animal hairs  
 Differentiate between natural and synthetic fibers

**Essential Questions:**

Has computer technology changed the science of analyzing trace evidence for the better?  
 Is hair evidence just as useful in identifying a suspect as DNA?  
 Is there value in fiber evidence when trying to identify a suspect?

**Unit Assessment:**

Investigatory Lab analyzing and identifying various hair and fiber samples.

Cumulative Progress Indicators	Core Content Objectives		Instructional Actions	
	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS- LS1-1 HS-LS1-2 HS-LS3-3 HS-LS4-1	How to evaluate hair and fiber evidence.  How to determine the source of a strand of hair.	Demonstrate how to package and process hair and fiber evidence  Demonstrate how to use a microscope to	<i>Reading “ Job of a CSI”</i> Critical Thinking Activity: US v. Mincey Students will be asked about the validity of fiber and hair evidence based on how	Quizzes Tests Labs and Write Ups Class Discussions Worksheets Teacher Feedback



	<p>How to extract DNA from hair.</p>	<p>evaluate hair and fiber evidence Identify human and animal hairs</p> <p>Differentiate between natural and synthetic fibers</p>	<p>the evidence was obtained</p> <p>“Can this evidence be individualized?” Lab: Students will be given a variety of evidence to evaluate and determine whether it is class or individual.</p>	<p>Homework Online Activities</p>
<p><b>Resources:</b> Bertino Forensics Science Book, Computer Programs, PowerPoints, Study Guides, Video Segments from various crime tv shows (CSI, Forensic Files, etc.) Slides Clear nail polish Reference slides (both hair and fiber) Computer microscope Cloth samples Hair samples from animal and human sources</p>			<p><b>Instructional Adjustments:</b> Modifications, student difficulties, possible misunderstandings</p>	

**Unit of Study 4: Fingerprint Analysis**  
**Time: 3 Weeks**

**Targeted Standards:**

HS-ETS1-1, HS-ETS1-2, HS-ETS1-33, HS-LS1-1, HS-LS1-2, HS-LS3-1, HS-LS4-1

**Unit Objectives/Conceptual Understandings:**

Distinguish between the combination of pattern type and minutiae that make each person's fingerprints unique.

Recognize that there are three basic fingerprint patterns: loops, arches and whorls and 12 basic minutiae that make up each individual's prints.

Identify the three basic types of fingerprints that can be lifted from a crime scene: latent, visible and plastic.

Correctly identify the best method to lift a print based upon the type of print and the surface it is found on.

Explain how the FBI developed database of fingerprints (CODIS) is used by police agencies around the world to help identify prints that have been lifted from a crime scene.

**Essential Questions:**

Can two people have the same fingerprint?

Are the three basic patterns and 12 minutiae the only way to individualize fingerprint evidence? Has computer technology changed the science of fingerprinting for the better?

**Unit Assessment:**

Investigatory Lab analyzing and identifying various fingerprints

Cumulative Progress Indicators	Core Content Objectives		Instructional Actions	
	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS-ETS1-1, HS-ETS1-2, HS-ETS1-33, HS-LS1-1, HS-LS1-2, HS-LS3-1, HS-LS4-1	The historical development of fingerprints as a science.	Identify fingerprints Compare fingerprints Lift fingerprints	Case studies that deal with fingerprints	Tests and quizzes Lab on lifting and preserving fingerprints

	<p>Fingerprints have three basic patterns: arches, loops and whorls</p> <p>The 12 minutiae that combine to form a unique set of fingerprints for each individual</p> <p>How CODIS is used to identify fingerprints</p>		<p>Lifting and preserving fingerprints lab: Student will use powders, tape and fuming box to lift prints from a variety of surfaces</p> <p>Fingerprint Comparison Lab: Students will compare unknown prints to known prints</p> <p>Crazy Glue Lab: students will bring in pieces of evidence to lift prints from them using crazy glue in a fuming box</p>	<p>Lab on comparing fingerprints</p> <p>Crazy glue fuming Lab</p>
<p><b>Resources:</b> Essential Materials, Supplementary Materials, Links to Best Practices</p> <ul style="list-style-type: none"> <li>• Fingerprinting kits</li> <li>• Fuming Box for crazy glue fuming</li> <li>• Fingerprinting powders</li> <li>• Dif tape</li> <li>• <u>Forensic Science: Fundamentals &amp; Investigations</u>; Student Edition</li> </ul>			<p><b>Instructional Adjustments:</b> Modifications, student difficulties, possible misunderstandings</p>	

**Unit of Study 5: Serology****Time: 4 Weeks****Targeted Standards:**

HS-LS1-1, HS-LS1-2, HS-LS3-2, HS-PS1-2, HS-ETS1-1, HS-ETS1-2

**Unit Objectives/Conceptual Understandings:**

Identify DNA as the structural unit of heredity made up of long chains of repeating units called nucleotides.

Recognize that there is a difference between nuclear and mitochondrial DNA and therefore they must be processed differently

Explain how PCR can be used to amplify minute amounts of DNA found at a crime scene

Identify the proper way to collect and store DNA from a crime scene to prevent degradation.

Analyze blood splatter evidence to help reconstruct a crime scene.

Describe how to screen for the presence of human blood.

Describe how to determine the blood type of a sample.

Interpret toxicology tests performed on DNA and Blood evidence.

**Essential Questions:**

What is the basic structure and function of DNA?

Is all DNA the same?

How does DNA fingerprinting and PCR work?

How does gel electrophoresis work?

Explain how crime-scene evidence is collected for DNA analysis?

Explain how crime scene evidence is processed to obtain DNA evidence in criminal cases?

Does blood evidence have value in criminal investigation?

Does the duality of blood as class and individual evidence make it one of the better tools in a forensic scientist's arsenal?

**Unit Assessment:**

Investigatory Lab analyzing and identifying various blood and DNA sample

	Core Content Objectives		Instructional Actions	
Cumulative Progress Indicators	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS-LS1-1 HS-LS1-2 HS-LS3-2 HS-PS1-2 HS-ETS1-1, HS-ETS1-2	<p>DNA is a biological molecule made up of a combination of nucleotides that are unique to each individual</p> <p>The unique nature of DNA makes it the definitive form of personal identification</p> <p>There are a variety of different sources for DNA</p> <p>The difference between nuclear DNA and mitochondrial DNA</p> <p>That PCR is used to amplify small amounts of DNA How DNA evidence is collected at a crime scene</p> <p>The identity of each of the four ABO blood groups can be established by testing the blood with anti-A and anti-B sera</p> <p>The Kastle-Meyer test is used to determine if a stain is blood</p>	<p>Demonstrate how to collect evidence at a crime scene to protect the fragile DNA samples that may exist</p> <p>Explain the differences between nuclear and mitochondrial DNA and the processing and uses for each in a criminal investigation.</p> <p>Perform the processes of gel electrophoresis, PCR and DNA fingerprinting</p> <p>Analyze DNA fingerprints for similarities</p> <p>Type blood</p> <p>Perform the Kastle-Meyer test</p> <p>Analyze bullets and trajectory angles</p> <p>Analyze convergence patterns</p>	<p>Case studies</p> <p>Powerpoint presentation and notes</p> <p>DNA Fingerprinting Simulation activity</p> <p>Where is the CAT? Simulation activity: students will analyze simulated DNA fingerprints to identify a suspect.</p> <p>Who is the Parent Critical Thinking activity: students are presented with a southern blot to Process and analyze</p> <p>Romanov Murders Internet Activity; Students will follow a webquest to use DNA technology to identify the remains of the Romanov family</p> <p>Blood Typing Lab: Students will learn how to perform a test</p>	<p>activity</p> <p>Presumptive Blood Test</p> <p>Blood Typing Lab Blood Spatter Analysis lab</p> <p>Crime Scene Investigation: A Critical Thinking Activity</p>

	<p>Luminol can be used to search out trace amounts of blood located at a crime scene</p> <p>The effect of height and surface angel on blood drops</p> <p>How to interpret blow back Toxicology reports can give us insight into contributing factors in death and accident investigations.</p>	<p>Analyze blood spatter for height, surface angle, angle of convergence and point of origin</p> <p>Interpret toxicology reports</p> <p>Test for the presence of various classes of controlled substances.</p>	<p>to determine the blood type of a blood sample</p> <p>Presumptive Blood Test activity: students will use the Kastle-Meyer test to test a variety of "blood" samples to determine their authenticity.</p> <p>Blood Splatter Analysis Lab: Students will analyze the effect of height, impact angle, area of convergence and point of origin</p> <p>Crime Scene Investigation: A Critical Thinking Activity: Students will use information collected from a crime scene and their knowledge of blood spatter analysis to develop a hypothesis to describe events that occurred at a crime scene</p> <p>Drug analysis and Identification Labs: Students will test for the presence of various drugs in an unknown sample to determine the sample's composition.</p>	
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**Resources:** Essential Materials, Supplementary Materials, Links to Best Practices

Gel electrophoresis kit

DNA samples

Website: [www.dnai.org/d/index.html](http://www.dnai.org/d/index.html)

- Fake blood
- Butcher paper
- Ant-A and Anti-B solutions
- Luminol
- Blue light
- Plastic ballistics set
- Trajectory rods
- String
- Bullet angle templates
- Toothbrush

**Instructional Adjustments:** Modifications, student difficulties, possible misunderstandings

**Unit of Study 6: Impressions****Time: 3 Weeks****Targeted Standards:**

HS-ETS1-2, HS-PS1-2

**Unit Objectives/Conceptual Understandings:**

Study, identify and analyze various bite marks, tool marks, tire and footwear impressions by demonstrating:

How to collect bite mark impressions

How to collect tool mark, tire and footwear impression evidence at a crime scene

How to analyze and compare bite marks, tool marks, tire impressions and footwear impressions

The value of the tire and footwear databases developed by the FBI

**Essential Questions:**

Has computer technology changed the science of analyzing trace evidence for the better?

How are impressions useful in recreating a crime scene? (class evidence and individual evidence) Have tire and footwear databases changed the landscape of impressions evidence?

Can individualizing tool-mark impressions, tire impressions and footwear impressions make them more useful as evidence in a criminal investigation?

**Unit Assessment:**

Investigatory Lab analyzing and identifying various impression prints.

Cumulative Progress Indicators	Core Content Objectives		Instructional Actions	
	Concepts <i>What students will know.</i>	Skills <i>What students will be able to do.</i>	Activities/Strategies Technology Implementation/ Interdisciplinary Connections	Assessment Check Points
HS- ETS1-1, HS- LS1-2	Impression evidence can be made from bites, tools, tires and shoes	Take bite mark impressions and evaluate them as	Bite mark analysis lab: Students will examine and document each	Quizzes Tests Labs and Write Ups Class



	<p>Collecting the impressions using the correct medium is of utmost importance</p> <p>Structural variations made by scratches, nicks, gouges, breaks and wear are what individualize tool and tire marks and footwear impressions</p>	<p>evidence</p> <p>Analyze tool marks</p> <p>Determine tire size</p> <p>Take tire impressions and compare them</p> <p>Take footwear casts and compare them</p>	<p>other's teeth on a dental chart and then make bite mark impressions in wax and try to match them as unknown to the known dental charts</p> <p>Tool mark analysis lab: Students will make castings of a variety of screw drivers to identify the unknown casting</p> <p>Tire impressions lab: Students will learn how to make tire mark impressions using an automobile. They will then take these impressions back to the classroom to learn how to identify tire impressions by make, model and size. They will also learn how to identify minor imperfections that are unique to each vehicle.</p> <p>Toy car tire impression activity: Students will be given a set of unknown toy tire mark impressions and a set of cars. They will match the tire impressions to the specific car that made them.</p> <p>Footwear impression lab: Students will make castings of their footwear.</p>	<p>Discussions Worksheets Teacher Feedback Homework Online Activities</p>
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			<p>They will then be presented with a set of pre-made impressions that they must match up to a variety of footwear presented as examples.</p>	
<p><b>Resources:</b>                  Bertino Forensics Science Book, Computer Programs, PowerPoints, Study Guides, Video Segments from various crime tv shows (CSI, Forensic Files, etc.)</p> <ul style="list-style-type: none"> <li>• Casting medium</li> <li>• Impression setting solution</li> <li>• Paint</li> <li>• Butcher paper</li> <li>• Car (to make tire impressions)</li> <li>• Variety of footwear</li> <li>• Footwear Impression cards</li> <li>• Footwear impression casts (for comparison)</li> <li>• Clay</li> <li>• Old keys</li> <li>• Variety of screw drivers</li> <li>• Impression foam</li> </ul>			<p><b>Instructional Adjustments:</b> Modifications, student difficulties, possible misunderstandings</p>	

## Disciplinary Core Ideas

### Disciplinary Core Ideas in Physical Science

#### PS1: Matter and Its Interactions

- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions
- PS1.C: Nuclear Processes

#### PS2: Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions
- PS2.C: Stability and Instability in Physical Systems

#### PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces
- PS3.D: Energy in Chemical Processes and Everyday Life

#### PS4: Waves and Their Applications in Technologies for Information Transfer

- PS4.A: Wave Properties
- PS4.B: Electromagnetic Radiation
- PS4.C: Information Technologies and Instrumentation

### Disciplinary Core Ideas in Life Science

#### LS1: From Molecules to Organisms: Structures and Processes

- LS1.A: Structure and Function
- LS1.B: Growth and Development of Organisms
- LS1.C: Organization for Matter and Energy Flow in Organisms
- LS1.D: Information Processing

#### LS2: Ecosystems: Interactions, Energy, and Dynamics

- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- LS2.D: Social Interactions and Group Behavior

#### LS3: Heredity: Inheritance and Variation of Traits

- LS3.A: Inheritance of Traits
- LS3.B: Variation of Traits

#### LS4: Biological Evolution: Unity and Diversity

- LS4.A: Evidence of Common Ancestry and Diversity
- LS4.B: Natural Selection
- LS4.C: Adaptation
- LS4.D: Biodiversity and Humans

## **Disciplinary Core Ideas in Earth and Space Science**

### **ESS1: Earth's Place in the Universe**

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of Planet Earth

### **ESS2: Earth's Systems**

- ESS2.A: Earth Materials and Systems
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.C: The Roles of Water in Earth's Surface Processes
- ESS2.D: Weather and Climate
- ESS2.E: Biogeology

### **ESS3: Earth and Human Activity**

- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth Systems
- ESS3.D: Global Climate Change

## **Disciplinary Core Ideas in Engineering, Technology, and the Application of Science**

### **ETS1: Engineering Design**

- ETS1.A: Defining and Delimiting an Engineering Problem
- ETS1.B: Developing Possible Solutions
- ETS1.C: Optimizing the Design Solution

### **ETS2: Links Among Engineering, Technology, Science, and Society**

- ETS2.A: Interdependence of Science, Engineering, and Technology
- ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World