FORENSIC SCIENCE I

Course Description:

Forensic Science is offered as a two-year course to students in grades 10 and 11 who are currently enrolled in The Public Safety Academy. Forensics I takes place in grade 10. It is an integral component of the Criminal Justice/Public Safety Curricula at this grade level. Law enforcement agencies have expanded their investigative functions, and rely on the advice and technical support from the scientific community. Forensic Science is the application of the science process and content knowledge to laws that are enforced by police departments and other law enforcement agencies.

This comprehensive program includes both theoretical and practical/hands-on instruction. Students receive challenging college preparatory level instruction, including: regular laboratory investigations, the daily infusion of technology, projects and activities, readings and discussions, guest presentations and demonstrations from industry personnel. In addition, students are exposed to career opportunities in the area of Criminalistics and Forensic Science.

Students apply the scientific method and employ related science disciplines to consider aspects of evidence relevant to crime scenes. Forensic Science is the application of Biology, Chemistry, Physical Science, Mathematics, Earth Science, Psychology and Technology to the analysis of criminal acts and law enforcement. This course focuses on the development of critical thinking skills and the examination of evidence as it relates to crimes and case studies. Instruction includes many of the most relevant tools, practices and techniques utilized today in the field of Forensic Science.

COURSE TOPIC OUTLINE:

I. Introduction to Forensic Science
   A. Observational Skills
      1. Observation Techniques and Activities
   B. Definition of Forensic Science
      1. Scope of Forensic Science
      2. History of Forensic Science
   C. Organization of a Crime Laboratory
      1. Services of a crime laboratory
         a. Physical science unit
         b. Biology unit
         c. Firearms unit
         d. Document examination unit
         e. Photography unit
         f. Toxicology unit
         g. Fingerprint unit
h. Polygraph unit
i. Voice print analysis unit
j. Evidence collection unit

2. Functions of a forensic scientist
   a. Analysis of physical evidence
   b. Expert testimony

D. Other Forensic Services
   1. Forensic Pathology
   2. Forensic Anthropology
   3. Forensic Entomology
   4. Forensic Psychiatry
   5. Forensic Odontology
   6. Forensic Engineering

E. Case Studies

II. Crime Scene Investigation
   A. Processing the Crime Scene
      1. Collecting and securing evidence
      2. Procedure/Protocol
      3. Safety at the crime scene
      4. Legal considerations
   B. Crime-Scene Reconstruction

III. Physical Evidence
   A. Common Types of Physical Evidence
      1. Significance of physical evidence
         a. Identification of evidence
         b. Comparison of evidence

IV. Fingerprinting
   A. History of Fingerprinting
   B. Classification of Fingerprints
      1. Characteristics
      2. Basic Types
   C. Methods of Detecting Fingerprints/Collection
      1. Preservation of developed prints
      2. Digital imaging for enhancement
      3. Superglue Fuming
   D. Fingerprint Identification Technology
      1. Automated Identification Systems

V. Document Examination
   A. History of Handwriting Analysis
   B. Handwriting Comparisons
      1. Collection of handwriting samples (exemplars)
      2. 12 Characteristics of Handwriting
C. Analysis of Samples
   1. Alterations, Erasures, and Obliterations
   2. Forgery
   3. Paper chromatography
D. Technology
   1. Computerized Analysis

VI. Forensic Serology: Introduction
   A. Introduction to Blood
      1. Blood Composition
      2. Blood Typing
      3. Forensic characterization of blood
         a. Blood enzymes and proteins

VII. DNA: Introduction
   A. DNA Structure
      1. Double helix
      2. Base-pairing
      3. Replication

VIII. Dental Impressions
   A. Bite Marks
   B. Structure and Development of Teeth
      1. Different tissue layers
      2. Primary/Permanent dentations
   C. Dental Patterns in Forensics

IX. The Microscope
   A. Types of scopes
      1. Compound Microscope
      2. Comparison Microscope
      3. Stereoscopic Microscope
      4. Electron Microscope

X. Hairs Analysis
   A. History
   B. Morphology of Hair
      1. Identification and comparison of hair
      2. Collection of hair evidence
   C. Human/Non-Human Hair Analysis
      1. Calculating Medullary Index

XI. Fiber and Textile Analysis
   A. Natural fibers/Man-made/Synthetic fibers
      1. Polymers
   B. Characteristics of fibers
C. Collection of fiber evidence
D. Physical and Chemical Analysis

XII. Soil Analysis
   A. History
   B. Types of soil and their formation
      1. Soil composition
   C. Soil profiles (horizons)
   D. Chemistry of soil
   E. Mineral composition of sand
   F. Soil collection and examination

XIII. Ballistics
   A. History of gunpowder and firearms
   B. Types of weapons
      1. Long guns vs. handguns
   C. Anatomy of a firearm
      1. Bullet and cartridge casing
      2. Rifling
   D. Test-firing
   E. Calculating the trajectory of a bullet

XIV. Glass Analysis
   A. History
   B. Physical Properties
      1. Temperature
      2. Mass and weight
      3. Density
      4. Refractive index
   C. Comparing Glass Fragments
   D. Glass Fractures
      1. Collecting glass evidence

OBJECTIVES:

I. Introduction to Forensic Science

The Student Will...

| Define observation and describe what changes occur in the brain. | 5.1.12.B.1; 5.1.12.B.4; 9.1.12.A.1 |
| Relate observational skills to their use in forensic science. | 5.1.12.B.1; 5.1.12.B.4; 9.1.12.A.1 |
| Practice and improve one’s own observational skills. | 5.1.12.B.1; 5.1.12.B.4; 9.1.12.A.1 |
| Define Forensic Science and identify the major disciplines it encompasses. | 9.3.12.C; 9.4.12O.1; 9.4.12O(2).1 |
| Recognize the major contributors to the | 9.3.12.C; 9.4.12O.1; 9.4.12O(2).1 |
development of forensic science.

| Describe the services of a typical crime laboratory and other forensic services. | 9.3.12.C; 9.4.12O.1; 9.4.12O(2).1 |
| Describe the roles and responsibilities of the forensic scientist | 9.3.12.C; 9.4.12O.1; 9.4.12O(2).1 |
| Explain the role and responsibilities of the expert witness | 5.1.12.D.2; 9.1.12.B.1 |

### II. Crime Scene Investigation

*The Student Will...*  
_NJCCCS_

| Discuss the responsibilities of the first police officer that arrives at a crime scene. | 5.1.12.B.1; 5.1.12.B.3; 5.1.12.D.2 |
| Explain the importance of securing the crime scene | 5.1.12.B.1 |
| Explain the steps taken to thoroughly record the crime scene. | 5.1.12.B.1 |
| Describe proper procedures for conducting a systematic search of a crime scene for evidence. | 5.1.12.B.1; 5.1.12.B.2 |
| Distinguish between direct and circumstantial evidence. | 5.1.12.B.1 |
| Identify trace evidence. | 5.1.12.B.1 |
| Summarize Locard’s exchange principle. | 5.1.12.B.1 |
| Define and understand the concept of chain of custody | 5.1.12.D.1; 5.1.12.B.2 |
| Identify the methods by which a crime scene is documented. | 5.1.12.D.2 |
| Demonstrate proper technique for collecting and packaging trace evidence. | 5.1.12.B.1 |
| Explain the importance of crime scene reconstruction. | 5.1.12.A.1; 5.1.12.B.1; 5.1.12.C.1; 5.1.12.D.1 |

### III. Physical Evidence:

*The Student Will...*  
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| Define physical evidence. | 5.1.12.B.1 |
| Review the common types of physical evidence encountered at a crime scene | 5.1.12.B.1 |
| Describe proper techniques for packaging common types of physical evidence | 5.1.12.B.1 |
| Define and contrast individual and class evidence | 5.1.12.B.1 |
| Distinguish between physical and biological evidence. | 5.1.12.B.1 |
### IV. Fingerprinting:

*The Student Will...*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Discuss the history of fingerprinting.</td>
<td>5.1.12.C.3</td>
</tr>
<tr>
<td>Describe the different layers of skin and the common ridge characteristics.</td>
<td>5.3.12.A.6</td>
</tr>
<tr>
<td>Identify the three major fingerprint patterns and their respective subclasses.</td>
<td>5.3.12.A.6</td>
</tr>
<tr>
<td>Distinguish between visible, plastic, and latent fingerprints</td>
<td>5.3.12.A.6</td>
</tr>
<tr>
<td>Explain how fingerprint evidence is collected.</td>
<td>5.1.12.C.3</td>
</tr>
<tr>
<td>Describe the latest identification technologies including the automated fingerprint identification system (AFIS).</td>
<td>5.1.12.B.1; 5.1.12.C.3; 5.1.12.D.3; 8.2.12.D</td>
</tr>
<tr>
<td>List the techniques for developing latent fingerprints from porous and nonporous objects.</td>
<td>5.1.12.B.1; 5.1.12.C.3; 5.1.12.D.3</td>
</tr>
<tr>
<td>Describe proper procedure for preserving a developed latent print.</td>
<td>5.1.12.C.3</td>
</tr>
</tbody>
</table>

### V. Document Examination:

*The Student Will...*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Define questioned document.</td>
<td>5.1.12.C.3</td>
</tr>
<tr>
<td>Know what common individual characteristics are associated with handwriting.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>List the important guidelines for collecting known writings for comparison to a questioned document.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>Describe some of the technology used in handwriting analysis.</td>
<td>5.1.12.C.3; 8.2.12.D</td>
</tr>
<tr>
<td>Distinguish between the terms forgery and fraudulence.</td>
<td>5.1.12.C.3</td>
</tr>
<tr>
<td>List some techniques document examiners use to uncover alterations, erasures, obliterations, and variations in pen inks.</td>
<td>5.1.12.C.3</td>
</tr>
</tbody>
</table>

### VI. Forensic Serology: An Introduction

*The Student Will...*

<table>
<thead>
<tr>
<th>Topic</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Explain the composition of blood.</td>
<td>5.3.12.A.1</td>
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<tr>
<td>Describe the function of blood cells.</td>
<td>5.3.12.A.1</td>
</tr>
<tr>
<td>List the A-B-O antigens and antibodies found in blood for each of the four blood types.</td>
<td>5.3.12.A.1</td>
</tr>
<tr>
<td>Understand and describe how to determine the blood type of a sample of blood.</td>
<td>5.3.12.A.1</td>
</tr>
<tr>
<td>Learn how the Punnett square is used to determine the genotypes and phenotypes of offspring’s blood type.</td>
<td>5.3.12.A.1; 5.3.12.D; 5.3.12.D.3</td>
</tr>
<tr>
<td>Describe how to screen for the presence of human blood</td>
<td>5.3.12.A.1</td>
</tr>
</tbody>
</table>

**VII. DNA: An Introduction**

*The Student Will...*

| Name the parts of a nucleotide and explain how they are linked to form the DNA molecule. | 5.3.12.D.1 |
| Understand the concept of base pairing as it relates to the double-helix structure of DNA. | 5.3.12.D.1 |
| Describe the process and importance of DNA replication. | 5.3.12.D.1 |

**VIII. Dental Impressions:***

*The Student Will...*  

| Identify the different types of tissues that compose teeth. | 5.3.12.A.1; 5.3.12.A.5; 5.3.12.A.6 |
| Describe the development of teeth from birth. | 5.3.12.A.1; 5.3.12.A.5; 5.3.12.A.6 |
| Explain how dental patterns are used in forensic investigations. | 5.1.12.C.3 |

**IX. The Microscope:**

*The Student Will...*  

| Identify the importance of this tool in forensic science. | 5.1.12.D.3; 8.2.12.D |
| List and understand the parts of the compound microscope. | 5.1.12.D.3; 8.2.12.D |
| Define magnification. | 5.1.12.D.3; 8.2.12.D |
| Contrast the comparison and compound microscope. | 5.1.12.D.3; 8.2.12.D |
| Understand the theory and utility of the stereoscopic microscope. | 5.1.12.D.3; 8.2.12.D |
| Outline some forensic applications of the scanning electron microscope. | 5.1.12.D.3; 8.2.12.D |
### X. Hair Analysis: Trace Evidence

**The Student Will...**

| Understand the importance of hair analysis as trace evidence in forensic investigations. | 5.3.12.A.1; 5.3.12.A.3; 5.3.12.A.5 |
| Identify the main parts of a hair. | 5.3.12.A.1; 5.3.12.A.3; 5.3.12.A.5 |
| Describe variations in the structure of the cuticle, cortex, and medulla. | 5.3.12.A.1; 5.3.12.A.3; 5.3.12.A.5 |
| List the three phases of hair growth. | 5.3.12.A.1; 5.3.12.A.3; 5.3.12.A.5 |
| Appreciate the distinctions between human and animal hair. | 5.3.12.A.1; 5.3.12.A.3; 5.3.12.A.5 |
| Calculate the medullary index for hair to determine if it is human. | 5.1.12.B.2 |
| Describe the role of DNA typing in hair comparisons. | 5.3.12.D.1 |
| Describe proper collection of forensic hair evidence. | 5.1.12.C.3 |

### XI. Fiber and Textile Analysis: Trace Evidence

**The Student Will...**

| Understand the difference between natural and manufactured fibers. | 5.3.12.A.1; 5.3.12.B.4 |
|List the properties of fibers (weave-patterns) that are most useful for forensic comparisons. | 5.3.12.A.1; 5.3.12.B.4 |
|Describe proper collection of fiber evidence. | 5.1.12.C.3 |
|Compare and contrast various types of fibers through physical and chemical analysis. | 5.2.12.B.2; 5.2.12.D.2 |

### XII. Soil Analysis: Trace Evidence

**The Student Will...**

| Describe how geology is used in the investigation of crime. | 5.4.12.C.1 |
|Recognize various soil types and describe methods for examining soil samples. | 5.4.12.C.1 |
|Identify the chemical composition of soil. | 5.4.12.C.1 |
|Distinguish sand samples by size, color and mineral composition. | 5.4.12.C.1 |
|Perform a soil analysis, including macroscopic and microscopic examination. | 5.4.12.C.1 |
|Explain how soil evidence is collected and used to link suspects to a crime. | 5.4.12.C.1 |
XIII. Ballistics:  
*The Student Will...*  
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<table>
<thead>
<tr>
<th>Task</th>
<th>NJCCCS</th>
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<tbody>
<tr>
<td>Define ballistics.</td>
<td>5.1.12.D.2</td>
</tr>
<tr>
<td>Identify how gunpowder and firearms originated.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>Discuss the difference between a handgun, a rifle, and a shotgun.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>Distinguish between a bullet and a cartridge.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>Discuss rifling on a gun barrel and how it affects the flight of the projectile.</td>
<td>5.2.12.E.1-4;</td>
</tr>
<tr>
<td>Explain the relationship between barrel size and caliber.</td>
<td>5.1.12.C.3; 5.1.12.D.2</td>
</tr>
<tr>
<td>Explain how bullets are test-fired and matched.</td>
<td>5.1.12.B.2; 5.2.12.E.1-4; 8.2.12.D</td>
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<tr>
<td>Discuss the role of ballistics recovery and examination at the crime scene.</td>
<td>5.1.12.C.3</td>
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<tr>
<td>Calculate the position of a shooter based on bullet trajectory.</td>
<td>5.1.12.A.1; 5.1.12.B.2; 4.2.12.A.1</td>
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</table>

XIV. Glass Analysis:  
*The Student Will...*  
NJCCCS

<table>
<thead>
<tr>
<th>Task</th>
<th>NJCCCS</th>
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<tbody>
<tr>
<td>Describe how glass is formed.</td>
<td>5.2.12.A.2</td>
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<tr>
<td>List some of the characteristics of glass and identify different types of glass.</td>
<td>5.2.12.A.2</td>
</tr>
<tr>
<td>Describe the physical properties of glass and calculate density.</td>
<td>5.1.12.A.1; 5.1.12.B.2</td>
</tr>
<tr>
<td>Use the refractive index to identify different types of glass.</td>
<td>5.1.12.A.1; 5.1.12.B.2</td>
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<tr>
<td>Describe how glass fractures.</td>
<td>5.1.12.D.2</td>
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<tr>
<td>Analyze glass fracture patterns to determine how glass was broken.</td>
<td>5.1.12.D.2</td>
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<tr>
<td>Explain how glass is used as evidence.</td>
<td>5.1.12.C.3</td>
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</table>

**INSTRUCTIONAL, RESOURCE & SOFTWARE MATERIALS:**

Textbooks:  
**Forensic Science: Fundamentals & Investigations**  
Anthony J. Bertino  
South-Western Cengage Learning, 2008  

**Forensic Science- An Introduction**  
Richard Saferstein  
Pearson Prentice Hall, 2008
Additional Resource Materials:

CD-ROM:  Forensic Science: Fundamentals & Investigations
         First Edition
         South-Western Cengage Learning, 2008

The Casebook of Forensic Detection
Colin Evans
John Wiley & Sons, Inc., 1996

DVD:  CSI: Crime Scene Investigation
      Seasons I-VIII

EVALUATION:

Assessment of student achievement each marking period will be determined by evaluations comprised of a combination of teacher-made examinations on major topics and quizzes, which will take forms to include oral, written, and/or demonstration. In addition, students will be graded on laboratory experiments, projects, critical thinking skills, and presentations.

Teacher observations and evaluations of classwork, homework, and class participation will be included. The course will have a final examination, which together with four marking periods will constitute a basis for the final course grade.

10%  Class Participation
20%  Lab/Project
10%  Notebook/Homework
20%  Quiz
40%  Test

MP I= 20%
MP II= 20%
MP III= 25%
MP IV= 25%
Final Exam= 10%
INSTRUCTIONAL STRATEGIES:

In order to meet the individual needs of our students, differentiated instruction is utilized in every class. This involves the use of a variety of instructional strategies, including but not necessarily limited to: readings and exercises from approved text(s) and related supplemental materials; individual and group research projects; cooperative group activities; teacher generated handouts; lecture in conjunction with class discussion and notes; role playing activities; hands-on lab activities; oral and written reports; simulations; the use of audio-visual materials; software, as well as the Internet; related field trips; guest presenters and demonstrations.

Scope and Sequence Chart:

*KEY*

I = Introduced    D = Developed in Depth    R = Reinforced

Forensic Science I

<table>
<thead>
<tr>
<th>Skill to be Learned</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tbody>
<tr>
<td>1. Explain the science of forensic investigation.</td>
<td>IDR</td>
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<tr>
<td>2. Use the instruments, apparatus, and technologies of forensic science correctly.</td>
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<td>3. Use the procedures of forensic science in a safe, prescribed manner.</td>
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<td>4. Use and apply observational and deductive reasoning skills properly.</td>
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<td>5. Explain the importance of securing and reporting a crime scene.</td>
<td>IDR</td>
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<td>6. Describe the proper steps taken for searching, recording, and reconstructing a crime scene.</td>
<td>IDR</td>
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<td>7. Describe proper techniques for securing and packaging all types of physical evidence.</td>
<td>IDR</td>
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<td>8. Explain how fingerprints are formed.</td>
<td>IDR</td>
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<tr>
<td>9. Identify the major fingerprint patterns and techniques for developing prints.</td>
<td>IDR</td>
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<td>10. Know the 12 characteristics used in handwriting analysis.</td>
<td>IDR</td>
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<td>11. List guidelines for comparing handwriting samples to questioned documents.</td>
<td>IDR</td>
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<td>12. Explain the techniques used to uncover forged documents.</td>
<td>IDR</td>
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<td>13. Understand the formation and typing of blood cells.</td>
<td>IDR</td>
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<tr>
<td>14. Describe the techniques used to screen for human blood.</td>
<td>IDR</td>
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<tr>
<td>15. Explain the structure and function of a DNA</td>
<td>IDR</td>
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<td>16.</td>
<td>Identify the composition of teeth and how they develop.</td>
<td>IDR</td>
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<td>17.</td>
<td>Describe how dental impressions are used in forensic investigations.</td>
<td>IDR</td>
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<tr>
<td>18.</td>
<td>Compare and contrast the different microscopes used in forensic investigations.</td>
<td>IDR</td>
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<tr>
<td>19.</td>
<td>Distinguish between the different types of trace evidence (hair, fibers, and soil) and the techniques used to identify each.</td>
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<td>20.</td>
<td>Explain the difference between handguns and long guns.</td>
<td>IDR</td>
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<tr>
<td>21.</td>
<td>Describe the anatomy of a firearm.</td>
<td>IDR</td>
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<tr>
<td>22.</td>
<td>Calculate the trajectory of a bullet.</td>
<td>IDR</td>
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<tr>
<td>23.</td>
<td>Describe the formation of glass and its physical properties.</td>
<td>IDR</td>
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<tr>
<td>24.</td>
<td>Use the refractive index to identify different types of glass.</td>
<td>IDR</td>
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<tr>
<td>25.</td>
<td>Analyze glass fracture patterns to determine how glass was broken.</td>
<td>IDR</td>
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FORENSIC SCIENCE I

COURSE DESCRIPTION:

Forensic Science is offered as a two-year course to students in grades 10 and 11 who are currently enrolled in The Public Safety Academy. Forensics I takes place in grade 10. It is an integral component of the Criminal Justice/Public Safety Curricula at this grade level. Law enforcement agencies have expanded their investigative functions, and rely on the advice and technical support from the scientific community. Forensic Science is the application of the science process and content knowledge to laws that are enforced by police departments and other law enforcement agencies.

STUDENT PROFICIENCIES:

Students will be required to demonstrate an understanding of the following topics at the conclusion of Forensics I: Observational Skills (forensic investigators must have the ability to observe, interpret, and report observations clearly); Crime-Scene Investigation and Evidence Collection (crime-scene investigators must be able to recognize, document, and collect evidence at a crime scene); Fingerprinting (CSI must be able to identify, collect, and process fingerprints); DNA Analysis (investigators must have a basic understanding of DNA found in our cells); Dental Impressions; Basic Blood Analysis; Handwriting Analysis (CSI must be able to identify forgers and counterfeiters; Soil Examination, Hair and Fiber Analysis (forensic investigators must be able to process trace evidence); Ballistics (CSI must be able to recover bullets and firearms); and Glass Evidence.

Throughout this course students will evaluate the importance of the science of forensic investigation and its application to law. In doing so, students will be asked to perform lab procedures and analyze a variety of case scenarios. This course will develop the ability to think analytically and draw reasonable conclusions. In addition, students will be able to clearly present and justify their findings orally and in writing.