Forensic Science
High School Elective

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<th>Course Description</th>
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<td>Forensic Science is a one semester high school level course that satisfies a CUSD200 graduation requirement in the area of science. Successful completion of Biology, Chemistry, and Physics are prerequisites for this course. Forensic Science is the application of scientific methods using principles from Biology, Chemistry and Physics in crime investigations. This course is lab-based and may include the following themes of study: crime scene evidence, forensic anthropology, toxicology, trace evidence, DNA, fingerprints, impression evidence, analysis of glass, serology, and questionable documents. Forensic Science provides basic knowledge of proper crime scene procedures and evidence processing that includes proper collection, documentation and preservation of physical evidence. Students engage in investigations to understand and explain a variety of scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.</td>
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<th>Transfer</th>
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<td>Students will be able to independently use their learning to…</td>
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| 1. Know, use, and interpret scientific explanations of the natural world.  
2. Generate and evaluate scientific evidence and explanations.  
3. Understand the nature and development of scientific knowledge.  
4. Participate productively in scientific practices and discourse. |


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<th>Science Inquiry and Application</th>
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<td>Students will use the following scientific and engineering practices$^1$ with appropriate laboratory safety$^2$ techniques to construct their knowledge and understanding in all science content areas:</td>
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| 1. Asking questions (for science) and defining problems (for engineering)  
2. Developing and using models  
3. Planning and carrying out investigations  
4. Analyzing and interpreting data  
5. Using mathematics and computational thinking  
6. Constructing explanations (for science) and designing solutions (for engineering) |
## Acquisition: Knowledge

*Students will know and be able to…*

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<tr>
<th>Topics</th>
<th>Frameworks</th>
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| Introduction    | • Explain the role and responsibilities of the expert witness  
• Recognize the major contributors to the development of forensic science  
• Describe the services of a typical comprehensive crime laboratory in the criminal justice system |
| Crime Scene     | • Demonstrate the steps to be taken to thoroughly record the crime scene  
• Model proper procedures for conducting a systematic search of a crime scene for physical evidence  
• Role play proper techniques for packaging common types of physical evidence  
• Define and understand the concept of chain of custody |
| Evidence        | • Distinguish between the identification and comparison of physical evidence  
• Use national data bases that are available to forensic science  
• Describe the proper procedure for preserving computer evidence at a crime scene  
• State the difference between and location of visible and latent data  
• Create a plan to view areas of the computer that will be examined to retrieve forensic data  
• Evaluate how e-mails, chat and instant messages from the Internet can be traced and recovered  
• Assess the reliability and validity of information on the Internet |
| Analysis of Glass | • Display an understanding of the properties of density and refractive index  
• Design a lab that creates a dispersion of light through a prism  
• Produce a list of forensic methods for comparing glass fragments  
• Evaluate glass fractures to determine the direction of impact for a projectile |
| Drugs | ● Perform laboratory tests normally used to analyze and identify drugs  
  ● Describe, explain and perform the process of chromatography  
  ● Implement proper collection and preservation of drug evidence  
  ● Execute a forensic toxicology scenario to isolate and identify drugs and poisons.  
  ● Appreciate the significance of finding a drug in human tissues and organs to assessing impairment |
| --- | --- |
| Forensic Serology | ● Interpret surface texture and bloodstain’s shape, size and location when determining the direction, dropping distance and angle of impact of a bloodstain.  
  ● Reconstruct events using the location, distribution and appearance of bloodstains and spatters.  
  ● Understand and describe how blood is typed and the genetic precursors for each type  
  ● Perform a blood spatter analysis to determine angle and trajectory of impact  
  ● Perform common field reagent testing used to enhance blood transfers |
| DNA | ● Model the necessary procedures for proper preservation of biological evidence for laboratory DNA analysis  
  ● Employ the technology of polymerase chain reaction (PCR) and how it applies to forensic DNA typing  
  ● Compare and contrast nuclear and mitochondrial DNA  
  ● Deduce the paternity of an individual using gel electrophoresis techniques |
| Trace Evidence I (Hair, Fibers, Tool Marks, Odontology) | ● Demonstrate a knowledge of cuticle, cortex and medulla areas of hair  
  ● Consider the properties of fibers and hairs that are most useful for forensic comparisons  
  ● Analyze tool marks and footwear for use as evidence  
  ● Compare and contrast dental records to identify a perpetrator |
| Trace Evidence II (Automobiles, Metals, Paints, Soils) | ● Categorize individual characteristics of tire impressions.  
  ● Evaluate the force, velocity and energy transfer of a car accident using physics formulas  
  ● Apply proper collection techniques for soil evidence and classify the important forensic properties of soils  
  ● Interpret tread patterns to determine the path of a vehicle  
  ● Determine the most useful examination for performing a forensic comparison of paint and metal |
| **Fingerprints** | • Know the common ridge characteristics of a fingerprint  
• List the three major fingerprint patterns and their respective subclasses  
• Distinguish between visible, plastic, and latent fingerprints  
• Implement a fingerprint identification using an automated system (IAFIS)  
• Develop latent fingerprints on porous and nonporous objects using a variety of techniques  
• Summarize the proper procedures for preserving a developed latent fingerprint |
| **Documentation** | • Recognize the difference between the collected and requested handwriting sample  
• Know the common individual characteristics associated with handwriting  
• Compare the individual type character’s style, shape and size to a complete reference collection of past and present typefaces  
• Determine a document’s author using ink chromatography  
• Survey techniques document examiners use to uncover alterations, erasures, obliterations and variations in engraving |
| **Forensic Anthropology** | • Determine stature, gender, race and physical disability through examination of skeletal remains  
• Measure a human forearm to determine the dominate hand  
• Determine the height of a corpse using humerus dimensions |
| **Careers** | • Survey current job trends, markets, and education needed for forensic related careers |
### Acquisition: Skills

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<th>Cognitive Demand</th>
<th>Description</th>
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<td><strong>Designing</strong></td>
<td>Requires students to solve science-based engineering or technological problems through application of scientific inquiry. Within given scientific constraints, propose or critique solutions, analyze and interpret technological and engineering problems, use science principles to anticipate effects of technological or engineering design, find solutions using science and engineering or technology, consider consequences and alternatives and/or integrate and synthesize scientific information.</td>
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<td><strong>Demonstrating Science Knowledge</strong></td>
<td>Requires students to use scientific inquiry and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and techniques to gather and organize data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments. <strong>Note:</strong> Procedural knowledge (knowing how) is included in Recalling/Identifying Accurate Science.</td>
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<td><strong>Interpreting and Communicating Science Concepts</strong></td>
<td>Requires students to use subject-specific conceptual knowledge to interpret and explain events, phenomena, concepts and experiences using grade-appropriate scientific terminology, technological knowledge and mathematical knowledge. Communicate with clarity, focus and organization using rich, investigative scenarios, real-world data and valid scientific information.</td>
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<td><strong>Recalling Accurate Science</strong></td>
<td>Requires students to provide accurate statements about scientifically valid facts, concepts and relationships. Recall only requires students to provide a rote response, declarative knowledge or perform routine mathematical task. This cognitive demand refers to students’ knowledge of science fact, information, concepts, tools, procedures and basic principles.</td>
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**Established Goals:** *Ohio Revised Science Standards and Model Curriculum, High School (adapted from National Science Education Standards)*
**Stage 2 – Assessment Evidence**

**Transfer Task(s) / Evaluative Criteria**

*(What do you expect student to do)* –

1. Ask questions (for science) and define problems (for engineering)

2. Develop and use models
   - Identify strengths and weaknesses in one or more models
   - Identify similarities and differences between models

3. Plan and carry out investigations
   - Understand the methods and tools used in a complex experiment
   - Predict the results of an additional trial or measure in an experiment
   - Determine the experimental conditions that would produce specified results

4. Analyze and interpret data
   - Compare or combine data from one or more simple or complex data presentations
   - Analyze given information when presented with new, simple information

5. Use mathematics and computational thinking
   - Determine how the value of one variable changes as the value of another variable changes in a complex data presentation
   - Identify and/or use a simple (e.g. linear) mathematical relationship between data

6. Construct explanations (for science) and design solutions (for engineering)
   - Select a simple hypothesis, prediction, or conclusion that is supported by one or more data presentations or models

7. Engage in argument from evidence
   - Determine whether given information supports or contradicts a simple hypothesis or conclusion, and why
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<th>8. Obtain, evaluate, and communicate information</th>
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<td>• Determine which model(s) is(are) supported or weakened by new information and present findings¹</td>
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<tr>
<td>• Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion and communicate results¹</td>
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Established Goals: 1. *ACT College Readiness Standards - Science*