

Wallingford Public Schools - HIGH SCHOOL COURSE OUTLINE

Course Title: Forensic Science	Course Number:
Department: Science	Grade(s): 11-12
Level(s): General	Credit: 1/2
Course Description This course focuses on the collection, identification and analysis of crime scene evidence. Emphasis will be placed on the methods that link suspect, victim, and crime scene. Laboratory exercises will include finger printing, handwriting analysis, ballistics, blood typing, hair and fiber examination, and DNA analysis. Case studies and current events will be explored.	
Required Instructional Materials <ul style="list-style-type: none"> • <i>Crime Scene: The Ultimate Guide to Forensic Science</i>, Platt, 2003. • Current and sufficient laboratory materials and equipment for each of the learning strands • Appropriate safety equipment – goggles, aprons, eyewash, safety shower, etc. • Information technologies – internet and library resources 	Completion/Revision Date Approved by Curriculum Council October 26, 2004 Adopted by Board of Education November 15, 2004

Mission Statement of the Curriculum Management Team
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The mission statement of the Science Curriculum Management Team is to promote scientific literacy emphasizing the process, content, and interdisciplinary nature of science.

Enduring Understandings for the Course

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| <ul style="list-style-type: none"> • Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems. |
| <ul style="list-style-type: none"> • Science is the method of observation and investigation used to understand our world. |
| <ul style="list-style-type: none"> • Biological evidence contains discrete pieces of information that makes every organism unique. |
| <ul style="list-style-type: none"> • Science ideas evolve as new information is uncovered. |
| <ul style="list-style-type: none"> • Matter, including forensic evidence, can be described, organized, classified, and analyzed and can be used to identify individual suspects. |
| <ul style="list-style-type: none"> • Evidence can be analyzed for its chemical components to uncover characteristics that are not always directly observable and thus can give insight into a crime. |
| <ul style="list-style-type: none"> • Laws, including due process, are designed to protect the rights of all citizens. |

LEARNING STRAND

1.0 Scientific Reasoning and Communication Skills

NOTE: This learning strand should be taught through the integration of the other learning strands. This learning strand is not meant to be taught in isolation as a separate unit.

ENDURING UNDERSTANDING(S)

- Inquiry is the integration of process skills, the application of scientific content and critical thinking to solve problems.
- Science is the method of observation and investigation used to understand our world.

LEARNING OBJECTIVES The student will:

- 1.1 Apply appropriate instruments needed to collect data precisely.
- 1.2 Analyze experimental design and data so as to question validity, identify variables, and improve experimental design.
- 1.3 Develop conclusions based on critical data analysis identifying further investigations and/or questions based on the results.
- 1.4 Organize data in tables and graphs.
- 1.5 Utilize data in order to determine patterns and make predictions.
- 1.6 Apply computer-based tools to present and research information.
- 1.7 Gather information using a variety of print and non-print sources.
- 1.8 Support scientific arguments using a variety of print and non-print sources.
- 1.9 Present scientific information orally.
- 1.10 Present scientific information in an expository format so that it adheres to standard forms of grammar, spelling and mechanics.

INSTRUCTIONAL SUPPORT MATERIALS

- Sufficient laboratory instrumentation

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Open-ended labs
- Inquiry
- Modeling
- Hands-on, minds-on lab activities
- Computer created spreadsheets and graphs
- See other learning strands for integration
- Analyze experimental design, data validity, and conclusion(s) for a given experiment

SUGGESTED ASSESSMENT METHODS

- Lab reports
- Open-ended questions
- Teacher observations
- Essays and/or compositions
- Excel spreadsheets and graphs
- Research based projects
- Computer created spreadsheets and graphs
- Critique experimental design, data validity, and conclusion(s) for a given experiment
- See other learning strands for integration

LEARNING STRAND

2.0 Biological Evidence

ENDURING UNDERSTANDING(S)

- Biological evidence contains discrete pieces of information that makes every organism unique.
- Science ideas evolve as new information is uncovered.
- Matter, including forensic evidence, can be described, organized, classified, and analyzed and can be used to identify individual suspects.

LEARNING OBJECTIVES – The student will:

- 2.1 Classify hair samples (human and animal) according to their microscopic structure.
- 2.2 Describe the structure of DNA.
- 2.3 Describe what makes each person's DNA unique.
- 2.4 Describe how and why DNA controls inherited traits.
- 2.5 Identify the characteristics of different blood types.
- 2.6 Describe how biological evidence is collected, identified and analyzed. (blood testing, DNA, fingerprinting, hair, etc.)
- 2.7 Evaluate biological evidence collected at a crime scene (blood testing, DNA fingerprinting, hair, etc.)
- 2.8 Examine the limitations of biological evidence when identifying suspects.

INSTRUCTIONAL SUPPORT MATERIALS

- Prepared hair samples
- Microscopes
- Blood type prepared slides
- Simulated blood sample kit
- Sample DNA fingerprints (karyotypes, autorad, and DNA sequences)
- DNA model
- DNA fingerprinting kit
- Web sites: courttv.com, crimescene.com

SUGGESTED INSTRUCTIONAL STRATEGIES

- Graphic organizers
- Group discussions
- Directed reading
- Modeling
- Jig-saw activities to share information
- Research on marine organisms, chemical, physical, or biological factor.
- Performance tasks
- Demonstrations
- Suggested labs or inquiry investigations:
 - View hair samples under microscope and diagram structure and compare to a key
 - Identify sex of a body with karyotyping
 - Paternity testing
 - Collect, organize and analyze DNA using a paper model of DNA sequences
 - DNA fingerprinting investigation (Ward's)
 - DNA electrophoresis using dyes
 - Inheritance of blood type / parental testing
 - Interpreting autorads in relation to various types of cases
- Analysis of case studies (i.e. Colin Pitchfork, O.J. Simpson, Tommy Lee

	<p>Andrews, Kirk Bloodsworth, Central Park Jogger, Vollman, etc.)</p> <ul style="list-style-type: none"> • Videos on case studies and DNA analysis • Research current case studies • Community speaker – forensic scientist, detective • Construct a 3D model of DNA • Analyze experimental design, data validity, and conclusion(s) for a given experiment <p><u>SUGGESTED ASSESSMENT METHODS</u></p> <ul style="list-style-type: none"> • Crime analysis (organize data collected, analyze data, offer possible solution to case, and identify weaknesses in data) • Tests and quizzes • Lab reports and summary questions (blood typing, hair classification, DNA fingerprinting, etc.) • Research and present a current case that highlights biologic evidence • DNA model with labels
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LEARNING STRAND

3.0 Physical Evidence

ENDURING UNDERSTANDING(S)

- Matter, including forensic evidence, can be described, organized, classified and analyzed to identify individual suspects.
- Science ideas evolve as new information is uncovered.

LEARNING OBJECTIVES – The student will:

- 3.1 Classify prints (finger, lip, foot, etc.) and fibers according to their structure.
- 3.2 Compare and contrast the characteristics of different handwriting samples. (slant, dotting of i, pressure, spacing, ink, etc.)
- 3.3 Describe how marks on the bullet can be traced back to a specific firearm.
- 3.4 Describe how ballistic information can be used to identify distance, angle, firearm source, number of firearms, etc.
- 3.5 Apply the transformation and conservation of kinetic and potential energy to solve ballistic case studies.
- 3.6 Describe how physical evidence is collected, identified and analyzed. (prints, fibers, handwriting, and ballistics etc.)
- 3.7 Evaluate physical evidence collected at a crime scene (prints, fibers, handwriting, and ballistics etc.)
- 3.8 Examine the limitations of physical evidence when identifying suspects.

INSTRUCTIONAL SUPPORT MATERIALS

- Finger print pattern key and ink pad
- Hand writing samples and key
- Samples of assorted fibers
- Chromatography materials

SUGGESTED INSTRUCTIONAL STRATEGIES

- Graphic organizers
- Group discussions
- Directed reading
- Modeling
- Jig-saw activities to share information
- Research on marine organisms, chemical, physical, or biological factor.
- Performance tasks
- Demonstrations
- Suggested labs or inquiry investigations:
 - Diagram structures of different prints and compare to a key
 - View fiber samples under microscope and diagram structure and compare to a key
 - Compare characteristics of student handwriting samples to identify the composer of a ransom note
 - Identification of fingerprints lab
 - Fiber identification lab
 - Chromatography of different ink samples
 - Blood splatter
- Debate whether a handwriting sample is a forgery or authentic
- Community speaker – detective
- Internet resources to investigate wound shapes cartridge markings
- Analysis of case studies (DC Snipers, J.F.K. Assassination, Charles Stielow, James Mitchell, George Ross, Richard Ramirez, Jon-Benet Ramsey, Zodiac Killer, Hitler Diaries, Laci Peterson, Charles Lindbergh, etc.)

	<ul style="list-style-type: none"> Analyze experimental design, data validity, and conclusion(s) for a given experiment <p><u>SUGGESTED ASSESSMENT METHODS</u></p> <ul style="list-style-type: none"> Crime analysis (organize data collected, analyze data, offer possible solution to case, and identify weaknesses in data) Tests and quizzes Lab reports and summary questions (finger print lab, fiber samples, handwriting, etc.) Homework Research and present a current case that highlights physical evidence
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LEARNING STRAND

4.0 Chemical Evidence

ENDURING UNDERSTANDING(S)

- Matter, including forensic evidence, can be described, organized, classified and analyzed to identify individual suspects.
- Science ideas evolve as new information is uncovered.
- Evidence can be analyzed for its chemical components to uncover characteristics that are not always directly observable and thus can give insight into a crime.

LEARNING OBJECTIVES – The student will:

- 4.1 Explore the legal limits of alcohol consumption and its effects on the body.
- 4.2 Describe how chemical evidence is collected, identified and analyzed. (alcohol, chemical substances, organic molecules, accelerants, poisons, etc.)
- 4.3 Evaluate chemical evidence collected at a crime scene (breathalyzer, Benedicts, iodine, Biuret, gas chromatography, spectrophotometry, pH, stomach contents, etc.)
- 4.4 Relate the chemistry of fire to crime scene evidence. (i.e. reactants and products)
- 4.5 Relate changes in temperature and pH to the rate of enzyme function.
- 4.6 Explore different careers related to chemical evidence. (i.e. toxicologist, arson investigator, pathologist, etc.)
- 4.7 Examine the limitations of chemical evidence when identifying suspects.

INSTRUCTIONAL SUPPORT MATERIALS

- Drug and alcohol test kits
- Benedicts, Iodine, Biuret
- pH testing supplies
- Spectrophotometer
- Pictures/diagrams of arson scenes
- Pectinase, sucrase, or amylase
- Web site: forensic.to/forensic.html

SUGGESTED INSTRUCTIONAL STRATEGIES

- Graphic organizers
- Group discussions
- Directed reading
- Modeling
- Jig-saw activities to share information
- Research on marine organisms, chemical, physical, or biological factor.
- Performance tasks
- Demonstrations
- Suggested labs or inquiry investigations:
 - Conduct simulated tests used to determine the presence of chemicals such as breathalyzer results, Benedicts test for sugar, iodine for starch, Buret for protein, gas chromatography, spectrophotometry, pH, identification of accelerants, stomach content, drug tests, etc.
- Analysis of case studies: Pan Am 103 Flight, Murrah Building in Oklahoma, Blanche Taylor, Mary Blandy, Charles Hall, etc.
- Interview a detective, person in a related career field, fire marshal, victim of DWI, etc.
- Internet resources on arson and the effects of drugs and alcohol on the body
 - Debate the legal limit of alcohol and the severity of punishments
- Analyze experimental design, data validity,

	<p>and conclusion(s) for a given experiment</p> <p><u>SUGGESTED ASSESSMENT METHODS</u></p> <ul style="list-style-type: none"> • Crime analysis (organize data collected, analyze data, offer possible solution to case, and identify weaknesses in data) • Tests and quizzes • Lab reports and summary questions • Homework • Research and present a current case that highlights chemical evidence
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LEARNING STRAND

5.0 Legal Aspects of Forensics

NOTE: This learning strand could be taught through the integration of the other learning strands.

ENDURING UNDERSTANDING(S)

- Science ideas evolve as new information is uncovered.
- Laws, including due process, are designed to protect the rights of all citizens.

LEARNING OBJECTIVES – The student will:

- 5.1 Describe the procedures used to secure and process a crime scene.
- 5.2 Critique how evidence is collected and used in a court of law
- 5.3 Explore how improvements in technology related to the collection, identification, and analysis of evidence impact legal decisions. (i.e. DWI, DNA testing, chemical tests, etc.)
- 5.4 Examine the limitations of both expert and witness testimony.

INSTRUCTIONAL SUPPORT MATERIALS

- Samples of case laws - Miranda vs Arizona
- Copies of the Bill of Rights - due process
- Web site: www.crime-scene-investigator.net

SUGGESTED INSTRUCTIONAL STRATEGIES

- Performance tasks
- Group discussions
- Directed reading
- Modeling
- Graphic organizers
- Jig-saw activities to share information
- Research on marine organisms, chemical, physical, or biological factor.
- Demonstrations
- Debate different procedures related to the collection, identification, and analysis of evidence (i.e. search and seizure)
- Community speaker – lawyers
- Research overturned cases based on new evidence (i.e. use of DNA evidence)
- Analysis of case studies – Miranda vs Arizona, see other learning strands, etc.
- Stage a crime and survey class on observations to explore witness testimony
- Explore the qualifications of an expert witness and his/her impact on a jury's decision
- Create a commercial to defend/sell a new technology for crime scene analysis
- Mock trial
- Analyze experimental design, data validity, and conclusion(s) for a given experiment

SUGGESTED ASSESSMENT METHODS

- Tests and quizzes
- Homework
- Research and present a current case that was

	<p>recently overturned</p> <ul style="list-style-type: none">• Debate preparation and participation• Persuasive essay to judge• Commercial script and presentation• Summary of court case(s)
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