

CRIME LAB FORENSICS

Description

Crime Lab Forensics, which is a laboratory-based course, will promote and cultivate the development of student's scientific inquiry and scientific method skills, which are important critical thinking skills. Crime Lab Forensics applies concepts and skills acquired in grades nine and ten to look at the criminal justice area. This course focuses on problem solving, with an emphasis on writing, using experimentation and evidence based conclusions. Students will write reports that record their results, conclusions and analyses of case studies and investigations. Students will participate in hands-on laboratory exercises that require lengthy laboratory procedures with many recently developed techniques for DNA extraction, DNA fingerprinting by gel electrophoresis, molecular DNA probes, protein analysis, PCR, sequencing, bioinformatics, drug and toxicology testing, handwriting and document analysis, arson investigation and ethics. The course is laboratory driven and requires students to use advanced tools and equipment in addition to excellent observation skills.

Course Overview

Course Goals

Students should:

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Essential Questions

- What processes are responsible for life's unity and diversity?
- How do materials cycle through the Earth's systems?
- How do science and technology affect the quality of our lives?
- How are organisms structured to ensure efficiency and survival?
- How do science and technology affect the quality of our lives?
- How does the structure of matter affect the properties and uses of materials?
- How is scientific knowledge created and communicated?

Assessments

Common Assessments

Skill Assessments

Content Outline

- I. [Unit 1](#) - DNA Evidence
- II. [Unit 2](#) - Forensic Pathology
- III. [Unit 3](#) - Toxicology
- IV. [Unit 4](#) - Arson and Explosives Investigation
- V. [Unit 5](#) - Handwriting and Document Analysis

Standards

[State of Connecticut Science Curriculum Frameworks](#)

Connecticut State Standards are met in the following areas:

Grade Level Skills

Students will:

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	<p><u>Core Science Standards</u></p> <ul style="list-style-type: none"> • <i>Scientific Inquiry</i> • <i>Chemical Structures and Properties - Science and Technology in Society</i> • <i>Cell Chemistry and Biotechnology – Science and Technology in Society</i> 	
	<p><u>Biology Enrichment Standards</u></p> <ul style="list-style-type: none"> • <i>Genetics</i> • <i>Ecology</i> • <i>Physiology</i> 	
	<p><u>Chemistry Enrichment Standards</u></p> <ul style="list-style-type: none"> • <i>Atomic and Molecular Structure</i> 	

Pacing Guide				
1st Marking Period		2nd Marking Period		
Month 1	Month 2	Month 3	Month 4	Month 5
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
<u>DNA Evidence</u>	<u>Forensic Pathology</u>	<u>Toxicology</u>	<u>Arson and Explosives Investigation</u>	<u>Handwriting and Document Analysis</u>
4 weeks	3.5 weeks	3 weeks	2 weeks	3 weeks

Unit 1 - DNA Evidence, 4 weeks [top](#)

Biology Enrichment Standards

Genetics

The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.

- DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation and transformation) is used to construct recombinant DNA molecules.

Unit Objectives

Students will be able to:

- identify where within a body DNA can be found.
- distinguish between the forensic usefulness of nuclear DNA vs. mitochondrial DNA.
- explain the importance of various DNA markers to criminal investigations.
- describe the methods of DNA collection, amplification, and analysis.
- describe the function and purpose of a restriction enzyme.
- explain applications of Polymerase Chain Reaction (PCR) technology in forensics.
- analyze the use of molecular DNA probes in DNA fingerprinting.
- explain the purpose of DNA databases and identify whose DNA is collected.

Essential Question

- What processes are responsible for life's unity and diversity?

Focus Questions

- How is DNA analyzed and when is each method of DNA analysis used?
- Why are molecular probes used to develop a DNA fingerprint?
- How is a small sample of DNA used to produce billions of identical copies?

Assessments

- Romanov Family Mystery - DNA
- DNAi.org
- Gel electrophoresis

Skill Objectives

Students will:

- isolate and extract DNA from cells.
- use lab equipment associated with gel electrophoresis.
- compare and analyze DNA samples using gel electrophoresis.
- calculate probabilities of identity using short tandem repeats (STR).
- analyze a DNA fingerprint to determine family relationships and match unknowns.

Unit 2 – Forensic Pathology, 3.5 week [top](#)

Core Science Standards

Cell Chemistry and Biotechnology – Science and Technology in Society

Microorganisms have an essential role in life processes and cycles on Earth.

- Students will describe the similarities and differences between bacteria and viruses.

Biology Enrichment Standards

Ecology

Stability in an ecosystem is a balance between competing effects.

- A vital part of an ecosystem is the stability of its producers and decomposers.

Unit Objectives

Students will be able to:

- describe the nature of death and decomposition.
- explain how determining time of death relates to decomposition.
- discuss the role of insects in determining the time of death.
- explain how to determine the cause of an injury and death.
- identify the parts of a skeleton that can help determine age, gender, and race.
- describe the nature of an autopsy.
- describe the role of a Forensic Anthropologist.

Essential Question

- How do materials cycle through the Earth's systems?
- How do science and technology affect the quality of our lives?

Focus Question

- How is skeletal evidence used in the reconstruction of a person's life and death?

Assessments

- Autopsy of Fetal Pig
- Romanov Family Mystery – bones
- Sherlock Bones

Skill Objectives

Students will:

- apply methods of identification using a skeleton: teeth, gender, age, and race and the limits of such determination.
- estimate the height of a victim.

Unit 3 - Toxicology, 3 weeks [top](#)

Core Science Standards

Chemical Structures and Properties - Science and Technology in Society

Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.

- The products of chemical technologies include synthetic fibers, pharmaceuticals, plastics, and fuels.

Biology Enrichment Standards

Physiology

As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.

- The nervous system mediates communication between different parts of the body and the body's interactions with the environment.

Unit Objectives

Students will be able to:

- identify and give examples of 5 classes of controlled substances.
- identify types of toxins and their sources of exposure.
- describe the factors that determine the degree to which a substance is poisonous.
- describe the types of screening tests for drugs and alcohol.
- explain the equipment and tests used by forensic scientists in identifying toxins.

Essential Questions

- How are organisms structured to ensure efficiency and survival?
- How do science and technology affect the quality of our lives?

Focus Question

- How do we detect and identify poisons and toxins in humans?

Assessments

- Analysis of Drugs and Poisons Lab
- Poisoning Project

Skill Objectives

Students will:

- perform paper chromatography.
- perform drug and alcohol screening tests.

Unit 4 - Arson and Explosives Investigation, 2 weeks [top](#)

Chemistry Enrichment Standards

Atomic and Molecular Structure

The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure

- The electronic configuration of elements and their reactivity can be identified based on their position in the periodic table.

Unit Objectives

Students will be able to:

- describe how to determine a fire's point of origin.
- summarize the techniques used to determine how the fire started.
- explain how samples from a crime scene are collected.
- describe how samples are analyzed to identify the presence and type of accelerants.
- classify different types of explosives.
- describe bomb scene protocol and evidence collection.

Essential Question

- How does the structure of matter affect the properties and uses of materials?

Focus Questions

- How do we determine if a fire is caused by arson?
- How are explosives identified before and after a blast?

Assessment

- Flight 103 Investigation

Skill Objectives

Students will:

- find point of origin.
- use techniques to determine how a fire started.
- collect evidence at crime scene.
- identify methods for accelerants/explosives.

Unit 5 - Handwriting and Document Analysis, 3 weeks [top](#)

Core Science Standards

Scientific Inquiry

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

- Students will use appropriate tools and techniques to make observations and gather data.

Unit Objectives

Students will be able to:

- classify various types of document evidence.
- identify examples of 12 points of handwriting analysis.
- identify ways for businesses to prevent check forgery.
- describe methods use to detect art forgery.

Essential Question

- How is scientific knowledge created and communicated?

Focus Questions

- What are some distinguishing characteristics of handwriting and forgery?
- What kind of precautions are in place to prevent document fraud?

Assessments

- Examination of US currency - Is it real?
- Detection of art forgery

Skill Objectives

Students will:

- characterize his/her own handwriting using 12 points of analysis.
- detect deliberately disguised handwriting by examining documents.
- identify the safeguards against counterfeiting of US currency.