Fairfield Public Schools
Science Curriculum

Forensics I: Never Gone Without a Trace
Forensics II: You Can't Fake the Prints

Forensics I and Forensics II: Description

Forensics I: Never Gone Without a Trace is a laboratory-based course that will promote and cultivate the development of student's scientific inquiry and scientific method skills, which are important critical thinking skills. Forensics I 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 analyzing evidence, crime scenes, blood/body fluids, trace evidence. The course is laboratory driven and requires students to use advanced tools and equipment in addition to excellent observation skills.

Forensics II: You Can't Fake the Prints is a laboratory-based course that will promote and cultivate the development of student's scientific inquiry and scientific method skills, which are important critical thinking skills. Forensics II 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 and simulations 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, impressions, handwriting and document analysis, forensic anthropology and ethics. The course is laboratory driven and requires students to use advanced tools and equipment in addition to excellent observation skills. It is strongly recommended students take Forensics I before taking this course.

Standards for this course are taken from the *Next Generation Science Standards* and are of three types:

Disciplinary Core Ideas (DCIs): Shown as content objectives, these standards define what students should know about the most essential ideas in the major science disciplines. The focus is on a limited number of core ideas in science and engineering both within and across the disciplines to avoid the shallow coverage of a large number of topics and to allow more time for teachers and students to explore each idea in greater depth. Reduction of the sheer sum of details to be mastered is intended to give time for students to engage in scientific investigations and argumentation and to achieve depth of understanding of the core ideas presented.

Science and Engineering Practices (SEP): These standards enable students to apply the content in the DCI's and the skills of practicing scientists and engineers to explain phenomena and solve real world problems. Engaging in the practices of science helps students understand

how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. Engaging in the practices of engineering likewise helps students understand the work of engineers, as well as the links between engineering and science.

Crosscutting Concepts: These standards provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. These broad concepts tie together the influence of engineering, technology, and science on society and the natural world.
http://www.nextgenscience.org/next-generation-science-standards

Forensics I and Forensics II

Enduring Understandings

Course Essential Questions

- Forensic science requires the interaction of concepts and applications from all areas of science, with emphasis on life science, to analyze and investigate evidence that may be discovered in a criminal investigation.
- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristics traits for matching to potential suspects and paternity HS- LS3-1
- Applying concepts of statistics and probability to explain the variation and distribution of expressed traits in a population HS- LS3-3
- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms HS- LS1 - 2
- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed in processing a crime scene. ETS1. C
- Evaluate a solution to a complex real- world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts. HS- ETS1- 3

Forensics I: Never Gone Without a Trace
Forensics II: You Can't Fake the Prints
Year-at-a-Glance

Course	Unit	Title	Unit Essential Questions
I	1	Intro to Forensics	● How is the integrity of data/evidence and documents preserved? ● How is the portrayal of forensics science in movies, television and books incomplete, misleading or inaccurate? ● How is scientific knowledge created and communicated?
I	2	Trace Evidence	● How does the structure of matter affect the properties and uses of materials? ● How do science and technology affect the quality of our lives? ● How is trace evidence analyzed?
II	3	Biotechnology	● How can forensic science use DNA for identification purposes using DNA fingerprinting? ● How is toxicology used in forensic cases in terms of exposure, factors determining degree of harm and methods to test for toxic substances?
II	4	Human Prints and Impressions	● In what ways are human prints developed, stored and used in solving crimes? ● How is skeletal evidence used in the reconstruction of a person's life and death? ● What are some distinguishing characteristics of handwriting and forgery?

Unit 1: Intro to Forensics

Overview

Forensics is relating the application of scientific knowledge to legal questions. Students will learn to accurately and without bias observe, interpret, and report observations as they apply to legal questions.

Performance Expectations

At the conclusion of this unit, students will be able to:

HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Unit Essential Question

- How is the integrity of data/evidence and documents preserved?
- How is the portrayal of forensics science in movies, television and books incomplete, misleading or inaccurate?
- How is scientific knowledge created and communicated?

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HSETS1-3)

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ETS1.A: Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)
- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Asking Questions and Defining Problems

- Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

Corresponding CT Core Standards:

ELA/Literacy – RST.11-12.7, RST.11-12.8, RST.11-12.9

Mathematics – MP.2 , MP.4

Unit 2: Trace Evidence

Overview

Trace evidence is a broad category and in this unit students will focus on hair, fiber and blood evidence. Students will develop an understanding of how to correctly use compound light microscopes. Students will learn how to collect and analyze hair and determine whether it is from a human or other animal. They will learn how to collect and analyze fibers, including identifying their source. Students will learn how to test whether a substance is blood and if it is human blood or from another animal. Lastly, students will learn how blood typing is utilized and how blood spatter can give details about a crime.

Performance Expectations

At the conclusion of this unit, students will be able to:

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Unit Essential Questions

- How does the structure of matter affect the properties and uses of materials?
- How do science and technology affect the quality of our lives?
- How is trace evidence analyzed?

Crosscutting Concepts

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (HSETS1-2)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Constructing Explanations and Designing Solutions

- Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)

Corresponding CT Core Standards:

ELA/Literacy – RST.11-12.7, RST.11-12.8, RST.11-12.9

Mathematics – MP.2 , MP.4

Unit 3: Biotechnology

Overview

DNA is an essential element of forensic science. Students will learn where a DNA sample can be obtained from a person and how to extract the DNA from cells. Students will learn about processes used to amplify small samples of DNA. Students will learn about how DNA fingerprints are made and be able to make matches between DNA samples from the same individual. Toxicology is used by forensic scientists to identify exposure of drugs and/or poisons. Students will investigate the different ways in which someone can be exposed to a toxic substance, factors that determine how harmful the substance will be and methods used to test for the toxic substance.

Performance Expectations

At the conclusion of this unit, students will be able to:

HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused byenvironmental factors.

Unit Essential Questions

- How can forensic science use DNA for identification purposes using DNA fingerprinting?
- How is toxicology used in forensic cases in terms of exposure, factors determining degree of harm and methods to test for toxic substances?

Crosscutting Concepts

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions-including energy, matter, and information flows—-within and between systems at different scales. (HS-ETS1-4)

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2)

NGSS Unit Standards

Asking Questions and Defining Problems

Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

Engaging in Argument from Evidence

- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)

Corresponding CT Core Standards:

ELA/Literacy – RST.11-12.7, RST.11-12.8, RST.11-12.9

Mathematics – MP.2 , MP.4

Unit 4: Human Prints and Impressions

Overview

Human prints and impressions are valuable pieces of evidence analyzed and observed in the field of forensic science. Students will be able to analyze remains in order to determine time and cause of death. Student will also identify remains left behind and the determine origin which they are derived from: gender, age, and race. Students will also be analyzing various print impressions to identify the origin by identifying and categorizing the characteristics and traits of the impressions being analyzed.

Performance Expectations

At the conclusion of this unit, students will be able to:

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Unit Essential Questions

- In what ways are human prints developed, stored and used in solving crimes?
- How is skeletal evidence used in the reconstruction of a person's life and death?
- What are some distinguishing characteristics of handwriting and forgery?

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HSETS1-3)

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions-including energy, matter, and information flows-within and between systems at different scales. (HS-LS1-2),(HS-LS1-4)

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

LS1.B: Growth and Development of Organisms

- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Constructing Explanations and Designing Solutions

- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)

Developing and Using Models

- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HSLS1-4),(HS-LS1-5),(HS-LS1-7)

Corresponding CT Core Standards:

ELA/Literacy – RST.11-12.7 , RST.11-12.8, RST.11-12.9

Mathematics – MP.2, MP.4