

Curriculum Guide

The following curriculum guide was designed with consideration for the National Science Standards

Course 536: Forensics

Level: Grades 11-12

1. Course Structure

This half-year course meets four or five class periods a week.

2. Intended Audience

Forensics is an elective course intended for motivated, college bound students interested in the application of science to criminal investigations. Prerequisites include successful completion of biology and concurrent enrollment in or completion of chemistry.

3. Course Goals

Forensic science is a natural vehicle for students to practice science as inquiry. For every piece of physical evidence brought in for analysis, the students must apply the scientific method and then advance toward a conclusion or opinion. Students must then be prepared to defend conclusions based on their own empirical evidence. The ultimate goal is for students to become confident that they can make sense of complex problems involving numerical data, evidence, uncertainty, and logical reasoning.

4. Course Objectives

Content:

- I. Types of Evidence
- II. Human Remains
- III. Fingerprints
- IV. Hair and Fibers
- V. Properties of Matter and Analysis of Glass
- VI. Forensic Serology
- VII. DNA Evidence
- VIII. Arson
- IX. Document Examination

National Science Education Content Standards

Standard K-12: Unifying Concepts and Processes

- Evidence, models, and explanation
- Change, constancy, and measurements
- Form and function

Standard A: Scientific as Inquiry:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Standard B: Physical Science

- Structure and properties of matter
- Motions and forces
- Conservation of energy and increase in disorder
- Interactions of energy and matter
- Chemical Reactions
- Properties and changes of properties in matter

Standard C: Life Science

- Matter, energy, and organization in living systems
- Molecular basis of heredity
- Diversity and adaptations of organisms
- Regulation and behavior

Standard E: Science and Technology

- Understandings about scientific and technology

Standard F: Science in Personal and Social Perspectives

- Science and technology in local, national, and global challenges
- Personal and community health
- Natural and human-induced hazards
- Risks and benefits

Standard G: History and Nature of Science

- Science as a human endeavor
- Nature of scientific knowledge
- History perspectives

5. Content Standards: Broad Concepts

I. Types of Evidence

- Physical evidence includes any and all object that can establish that a

crime has been committed or can link a crime and its victim or its perpetrator. Testimonial (direct) evidence is a statement made under oath.

- II. Human Remains
 - Human remains may allow investigators to estimate the time of death using concepts such as entomology and anthropology, and autopsy.
- III. Fingerprints
 - Once the finger touches a surface, perspiration, along with oils are transferred onto that surface, leaving a fingerprint. Various techniques can be used to elucidate fingerprints that are invisible. Since fingerprints are unique to each individual, they serve as valuable evidence;
- IV. Hair and Fibers
 - Microscopic examination of hair and fibers reveal morphological features that allow scientists to identify its origin or at least narrow the possibilities to a limited number of sources
- V. Properties of Matter and Analysis of Glass
 - To compare glass fragments, physical properties such as density and refractive index are evaluated. By analyzing the fracture patterns in glass, the forensic scientist can determine the direction of impact.
- VI. Forensic Serology
 - A broad scope of laboratory tests that utilizes specific antigen and serum antibody reactions. This type of testing could be used to determine A-B-O blood groups, for example.
 - The location, distribution of bloodstains and spatters may be useful in reconstructing the evidence that produced the bleeding.
- VII. DNA Evidence
 - The gene is the fundamental unit of heredity. Each gene is composed of DNA specifically designed to control the genetic traits of our cells. Portions of the DNA structure are as unique to each individual as fingerprints.
- VIII. Arson
 - The arson investigator must search the fire scene for the fire's origin. In the laboratory, the gas chromatograph is the most sensitive and reliable instrument for detecting and characterizing flammable residues.
- IX. Document Examination
 - Any object with handwriting or printing whose source or authenticity

is in doubt may be referred to as a question document. Document examiners apply knowledge to recognize and compare the individual characteristics of questioned and known authentic writings.

6. Course Outline/ Curriculum Map

Quarter 1

- I. Introductory/Types of Evidence
 - The Functions of the Forensic Scientist
 - Physical evidence vs. eye-witness testimony
 - Types of physical evidence

- II. Human Remains
 - Estimating time of death by:
 - Forensic Anthropology
 - Mortis
 - Forensic Entomology

- III. Fingerprints
 - History of Fingerprinting
 - Fundamental Principles of Fingerprints
 - Classification of Fingerprints
 - Henry System
 - Methods of Detecting Fingerprints
 - Preservation of Developed Prints

- IV. Hair and Fibers
 - Locard's Principle
 - Morphology of hair
 - Identification and Comparison of Hair
 - Identification and Comparison of Man-Made Fibers

- V. Physical Properties and Analysis of Glass
 - Physical properties of Glass
 - Density
 - Refractive index and Snell's Law
 - Becke Lines
 - Class Evidence vs. Individual Evidence
 - Fracture Patterns

Quarter 2

- VI. Forensic Serology
 - The Nature of Blood
 - A-B-O Blood typing
 - Forensic Characterization of Blood stains
 - Stain Patterns of Blood
 - Area of Convergence
- VII. DNA Evidence
 - What is DNA?
 - Replication of DNA
 - DNA Typing
 - Mitochondrial DNA
 - RFLP Analysis
 - Electrophoresis
 - PCR
 - STR
 - CODIS
- VIII. Arson
 - Forensic Investigation of Arson
 - The Chemistry of Fire
 - Gas Chromatography
 - Searching the Fire Investigation
 - Analysis of Flammable Residues
- IX. Analysis of Documents
 - Handwriting Comparisons
 - Forgery/ Counterfeiting

7. Course Text and Other Materials

The text for this course is:

- Deslich, Barbara, Funkhouser, John, **Forensic Science for High School**, Kendall Hunt (2006).

Support materials include:

- Saferstein, Richard, *Forensic Science: An Introduction*, Prentice Hall Inc. (2007).
- Walker, Pam, Wood, Elaine, *Crime Scene Investigations: Real-Life Science Labs*, John Wiley and Sons (1998).

8. Instructional Methods and Course Activities

Content will be conveyed through:

- Class dialogue and discussion
- Laboratory investigations
- Videos and tables
- Topic lectures and demonstrations

9. Learning Strategies

- The primary instructional mode will include class dialogue/discussion and problem solving accompanied by laboratory experiences carefully selected to complement classroom work and to ensure the mastery of essential laboratory skills.
- Students will be encouraged to approach each learning experience with an objective, critical, and analytical attitude.
- Mathematical problem solving will include careful attention to, and processing of, dimensions.

10. Assessment

The assessment of students will occur through:

- Daily evaluation of class preparation and participation
- Laboratory performance including bench work, recording organization, analysis, and reporting of observations and data
- Homework assignments
- Formal testing
- Semester examination

11. Course Evaluation

The assessment of this course will occur through:

- On-going feedback from current students, graduates and other teachers.
- A formal student questionnaire at the end of the semester.