FORENSIC SCIENCE CURRICULUM

By Eleni Koundi

Chapter 1: Introduction (Time - 8 periods)

Essential Question(s):

What is the role of Forensic Science in our society?

Why crimes that have taken place hundred s of years ago and were never solved, they would be easily resolved with today's technology?

Content:

As a result of this study, students will know and understand:

The meaning and purpose of Forensic Science.

The names of the people who contributed to the development of Forensic Science.

The names of the main crime laboratories as they exist on the national, state and local levels of government in the United States.

The type of services provided by a typical comprehensive crime laboratory in the criminal justice system.

The different approaches espoused by the Frye and Daubert decisions to the acceptance of scientific evidence in the courtroom.

The role and responsibilities of the expert witness.

The names of the different areas of Forensic Science that require expertise in a specialized area.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Derive the definition of Forensic Science by watching a portion of a crime scene show (CSI).

Complete an outline to obtain the history of Forensic Science.

Develop matching section of scientists and their major contributions.

Write short descriptions of crime laboratories and the jobs they do after watching a DVD from the History Channel, the "FBI's Crime Lab".

Research on the importance of the Frye and Daubert decisions in today's legal system.

Discuss how an expert witness is vital to Forensic investigation.

Investigate the Locard's Exchange Principle (When a criminal came in contact with an object or person, a cross-transfer of evidence occurred) – Lab Activity

Assessment:

Have students:

Write a summary of their definitions of Forensic Science.

Create a timeline of Forensic Scientists for major contributions.

Complete a matching worksheet on the crime laboratories and their jobs.

Complete a matching worksheet on the fields of Forensics.

Perform a laboratory activity and write a brief report including: purpose, procedure, data, results and conclusion.

Take an open book test on Unit 1. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

The History Channel (DVD): FBI's Crime Lab

Power Point Presentation on Chapter 1: Intoduction

Chapter 1worksheets.

Chapter 2: The Crime Scene (Time - 10 periods)

Essential Question(s):

What is the importance of protecting the crime scene properly?

How the abilities and intelligence of the lead detective influences the quality and reliability of the evidence collected at the crime scene?

Content:

As a result of this study, students will know and understand:

What is considered to be physical evidence at a crime scene.

What are the responsibilities of the first police officer who arrives at a crime scene.

What are the steps to be taken for thoroughly recording the crime scene.

What are the proper procedures for conducting a systematic search of crime scenes for physical evidence.

What are the proper techniques for packaging common types of physical evidence.

What is chain of custody.

What is the role of forensic pathologists, entomologists, and anthropologists at homicide crime scenes.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Define what physical evidence is.

List all the physical evidence found at the crime scene set up in the classroom.

Justify the importance of all the physical evidence identified at the scene.

Pretend they are the first officer at the scene and try to improvise by showing how they would handle the situation at a professional level.

Watch a movie clip where the police are searching an area and identify the method they use.

Search the crime scene set up in the classroom using all four methods on search.

Evaluate which method was the most effective in the current situation.

Collect different types of evidence from the scene and pack them properly.

Define “chain of custody”

Describe the jobs of the forensic scientists, express their preference among the different fields, and explain why they like that particular field.

Search on the Internet (Crime Scene Investigation) about the guidelines and information regarding crime scene response and the collection and preservation of physical evidence.

Assessment:

Have students:

Complete a description of all the types of physical evidence.

Draw and label the crime scene set in the classroom.

Complete a sketch of their crime scene.

Create a log with evidence found at the crime scene.

Complete a matching section on the different forensic fields and their jobs.

Perform a laboratory activity on a crime scene investigation where students use deductive reasoning to eliminate distracting information and stay focused on the elements of the crime, after they read a case study.

Perform a laboratory activity in which they sketch and photograph crime scenes.

Take an open book test on Unit 2. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Web site: Crime Scene Investigation

http: www.crime-scene-investigator.net/index.html

Web site: The Science Spot – Forensic Science Lesson Plans
http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 2: The Crime Scene

Chapter 2 worksheets.

Chapter 3: Physical Evidence (Time - 4 periods)

Essential Question(s):

Sometimes we hear on the news that old crimes have been resolved using today's technology. What is the significance of collecting and properly preserving old evidence that were not able to give us any answers in the past, but they might come handy in the future.

Content:

As a result of this study, students will know and understand:

What is considered to be a type of physical evidence encountered at crime scenes.

What is the difference between the identification and comparison of physical evidence.

What is the difference between individual and class characteristics and some examples of physical evidence possessing these characteristics.

What is the value of class evidence to a criminal investigation.

What is the purpose physical evidence plays in reconstructing the events surrounding the commission of a crime.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Discuss the importance of physical evidence after they read the case study of Wayne Willimas.

Explain the difference between the identification and comparison of several samples of evidence found in a crime scene.

Explain the difference between individual and class samples of evidence found in a crime scene and justify their significance to the criminal investigation.

Solve a problem using the crime scene reconstruction model.

Assessment:

Have students:

Create a list of evidence and match it to individual or class evidence.

Solve a fiction case after they put together some physical evidence.

Perform a laboratory activity on Forensic Anthropology in which they will compare the anatomy of the victims, determine their sex, measure physical characteristics in different sexes, practice on odontology, investigate bite mark cases.

Take an open book test on Unit 3. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

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Youtube: CSI episodes

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http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 3: Physical Evidence

Power Point Presentation: Jeopardy Chapter Review

Power Point Presentation: Power of Evidence Review

Chapter 3 worksheets.

Chapter 4: Properties of Matter and the Analysis of Glass (Time – 8 periods)

Essential Question(s): How do investigators use broken or shattered glass fragments collected from a crime scene as a tool to create evidence and reveal a suspect?

What kind of information people at Forensic Labs can retrieve by investigating glass pieces, and which properties or characteristics of glass are essential to this type of investigation?

Content: As a result of this study, students will know and understand:

The difference between the physical and chemical properties of glass.

Metric system's basic units and prefixes.

Difference between metric and English units and how to convert from one system to the other.

The difference between elements and compounds as well as the difference between solids, liquids and gases (phases of matter).

When does light behave as a wave and as a particle and the theories that support both identities.

What dispersion of light is and how is this phenomenon created.

What electromagnetic spectrum is.

What is the relationship between color and selective absorption of light by molecules.

What density, mass, and weight are.

How to calculate density of irregular shaped objects.

What index of refraction is.

What are crystalline and amorphous solids.

What is double refraction and birefringence.

How scientists use the flotation and immersion methods to compare glass speciments.

How scientists examine glass fractures to determine the direction of impact for a projectile of a bullet.

What is the proper method to collect glass evidence.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Measure several common classroom objects for their length, liquid volume and mass.

Construct a table to convert from measurements from one metric unit to another.

Distinguish different phases of mater and their relationship to temperature after a class demo.

Experience dispersion of sunlight through a prism (class demo).

List in order of increasing frequency and wavelength all the components of the electromagnetic spectrum after they see visual representations.

Experience reflection on plane mirror and refraction in water, oil and glass using laser beams. (class demos)

Measure room temperatures using Celsius and Fahrenheit scales.

Measure masses and weights of different objects to understand the difference between kilograms and Newtons.

Measure the density of several regular and irregular objects.

Using a diagram of glass, show how it is broken in a crime scene.

Show by example how broken glass from a crime scene should be collected.

Assessment:

Have students:

Perform mini lab activities on measurements, phase changes, densities, masses and weights, index of refraction and angles of reflection and refraction.

Solve word problems on how to calculate density, weight and index of refraction using formulas.

Convert units from metric to English system.

Convert temperatures from Celsius to Fahrenheit degrees.

Perform a laboratory activity on Forensic Glass Analysis in which

a. they will measure the density of Aluminum using the Water Displacement method

b. they will compare glass density

c. perform a glass fracture analysis.

Take an open book test on Unit 4. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Web site: The Science Spot – Forensic Science Lesson Plans
http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 4: Properties of Matter and Glass Analysis

Chapter 4 worksheets.

Chapter 5: Drugs (Time – 8 periods)

Essential Question(s): How does psychological and physical dependence on drugs can lead to a crime?

In a drug related case, what is the role of the forensic scientists and what are the steps he/she needs to take to solve the case?

Content: As a result of this study, students will know and understand:

The meaning of psychological and physical dependence of drugs.

The names and categories commonly abused drugs.

The tendency to develop dependence on the more commonly abused drugs.

The schedules of the Controlled Substances Act.

The laboratory tests that forensic chemists normally rely upon to comprise a routine drug identification scheme.

How do scientists properly collect and preserve drug evidence.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Use the internet to describe psychological and physical dependence.

Create a poster board with the classification of the most commonly abused drugs and their side effects.

Research the controlled Substances Act to find the schedules of drugs.

Watch movies on youtube to understand the function of certain devices used to detect and identify drugs such as: spectrophotometer.

Illustrate how drug evidence is collected.

Assessment:

Have students:

Present a power point or even make a poster board to demonstrate the classification of the most common drugs and their side effects, including pictures, real stories, short movies showing the effects those drugs had on people and their families, and some case studies related to drug crimes.

Perform two laboratory activities on: Thin-Layer Chromatography of Ink and Liquid Lip Color.

Take an open book test on Unit 5. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

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Web site: www.learn360.com

Power Point Presentation on Chapter 5: Drugs

Chapter 5 worksheets.

Chapter 6: Forensic Toxicology (Time – 8 periods)

Essential Question(s): If a driving accident which involves alcohol use, what are the procedures to be followed in order to investigate the case? What is the minimum alcohol consumption which is allowed to drivers and how is assessed?

What is the role of forensic toxicology in an alcohol related crime?

How effective and reliable are different alcohol-testing devices in measuring the alcohol content in the blood?

Content: As a result of this study, students will know and understand:

How alcohol is absorbed into the bloodstream, transported throughout the body, and finally eliminated by oxidation and excretion.

The important parts involved in the human circulatory system.

How alcohol is excreted in the breath via the alveoli.

How a Breathalyzer works.

What is an infrared and fuel-cell breath-testing device.

What are the most common sobriety tests.

What are the most common laboratory procedures for measuring alcohol's concentration in the blood.

What are the precautions to be taken to properly preserve blood for analysis for its alcohol content.

What is the presumptive impairment level for blood alcohol in NY state.

What is the significance of a toxicologist in the criminal justice system.

What are the techniques that forensic toxicologists use for isolating and identifying drugs and poisons.

What is the significance of finding a drug in human tissues and organs.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Draw a simple diagram of the human circulatory system and describe the path of the blood stream within.

Explain how alcohol is absorbed into the blood stream and circulated through the blood.

Describe the Breathalyzer, compare it to different alcohol testing devices and see how the device can fail, after watching the following movie clips on youtube:

Breathalyzers Put to the Test - See Which One is Best

Mythbusters - breath test

Mythbusters: Sobering up techniques

Compare the Breathalyzer to standard blood alcohol measuring in the lab.

Describe how blood is collected and preserved at a crime scene.

Describe the role of a Forensic Toxicologist.

Describe the significance of drugs in human tissues and organs.

Assessment:

Have students:

Research on the Breathalyzer and field sobriety tests, and make a comparison on the effectiveness of them.

Explain the importance of the Forensic Toxicologists and what tests they perform using a court case involving drugs.

Take an open book test on Unit 6. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

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Web site: www.learn360.com

Power Point Presentation on Chapter 6: Forensic Toxicology

Chapter 6 worksheets.

Chapter 8: Forensic Serology (Time – 8 periods)

Essential Question(s): What determines whether a blood transfusion can be a success or a failure and it can save lives or cause an instantaneous death?

How Forensic characterization of bloodstains or semen can help resolve a crime of murder, injury or rape?

Content: As a result of this study, students will know and understand:

What are the A-B-O antigens and antibodies found in the blood for each of the four blood types: A, B, AB, and O.

How agglutination occurs.

How whole blood is typed.

What are the most common tests to characterize a stain as blood.

What is the significance of the precipitin test to forensic serology.

What are the laboratory tests necessary to characterize seminal stains.

How suspect stains are to be properly preserved for laboratory examination.

What is the procedure on collecting physical evidence related to a rape investigation.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Understand how blood is used in a Forensic case after they watch the movie "A Killer's Trail", a story of Dr. Sam Sheppard who was convicted in 1954 of bludgeoning his wife to death.

Describe the four basic blood types and the genetics behind each one.

Draw or illustrate the antigens and antibodies in each type of blood.

Explain how the antigen/antibody reaction causes agglutination.

Describe how blood is identified in a crime scene.

Describe how seminal fluid is identified in a crime scene.

Explain how evidence is collected in a rape case.

Assessment:

Have students:

Perform a laboratory activity on Blood Stain Analysis.

Perform a laboratory activity on a simple blood test reaction using common blood and anti-sera materials.

Perform a laboratory activity on Blood Spatter Analysis.

Take an open book test on Unit 8. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Web site: The Science Spot – Forensic Science Lesson Plans
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Web site: www.learn360.com

Movie "A Killer's Trail", a story of Dr. Sam Sheppard

Power Point Presentation on Chapter 8: Forensic Serology

Chapter 8 worksheets.

Chapter 9: DNA The Indispensable Forensic Science Tool (Time – 10 periods)

Essential Question(s): How and why DNA became an important part of forensic science and crime solving in the last few decades?

How does a person can be linked to a crime, based on the genetic information that is found at a crime scene or another individual's name can be cleared from the list of suspects?

What do investigators collect as samples to be tested for the DNA information?

Since forensic technology has advanced so much in recent years, why do police are reopening cold cases to further analyze any possible DNA evidence left over from the original investigation?

Content: As a result of this study, students will know and understand:

The parts of the nucleotide and how they are linked together to make DNA.

How DNA strands coil into a double helix.

How base pairing relates to the double helix structure of DNA.

How the sequence of bases along a DNA strand determines the structure of proteins that are synthesized within the body.

How a double-strand DNA replicates itself and what are the implications of this process for forensic science.

How DNA can be cut and spliced into a foreign DNA strand.

What are some commercial applications of this recombinant DNA technology.

What is meant by the restriction fragment length polymorphism (RFLP).

What is the process of DNA typing by the RFLP technique.

What is the difference between nuclear DNA and mitochondrial DNA.

What is the significance of a DNA computerized database to criminal investigation.

What are the necessary procedures to be taken for the proper preservation of bloodstained evidence for laboratory DNA analysis.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Define the parts and functioning of DNA.

Explain how DNA codes for a protein.

Describe how DNA replicates itself.

Show how DNA might be cut and re-assembled.

Describe the technique of RFLP and how is this applied to DNA.

Explain the importance of DNA to a Forensic Investigation.

Assessment:

Have students:

Construct a simple DNA helix using common materials.

After reading the O.J. Simpson case, and watching a movie on youtube, identify the role of DNA investigation in the situation and research on the justifications on the verdict.

Research on cases of people who while in prison, they were found innocent after DNA testing.

Take an open book test on Unit 9. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Youtube: A Link for the Missing -- DNA "Fingerprinting"

Molecular Visualizations of DNA

DNA Replication

How DNA Copies Itself

Forensics DNA Fingerprinting 7 Apr 11

OJ Simpson - The Untold Story - part 1,2,3,4,5,6

Web site: The Science Spot – Forensic Science Lesson Plans
http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 9: DNA The Indispensable Forensic Science Tool.

Chapter 9 worksheets.

Chapter 10: Hairs and Fibers (Time -8 periods)

Essential Question(s): How accurate are hair evidence collected at a crime scene to identify the identity of a criminal and how the validity of this evidence compares to other evidence such as blood or fingertips.

How easy is to distinguish human hair from animal hair or the part of the body which a particular hair came from?

How the study of a single fiber collected at a crime scene can give us clues about the criminal, and is this evidence alone enough to single him out?

Content:

As a result of this study, students will know and understand:

What is the structure of a single hair (cuticle, cortex, medulla).

What are the three phases of hair growth.

How to distinguish between animal and human hair.

What are the hair features that are useful for the microscopic comparison of human hairs.

How hair evidence are properly collected.

What is the role of DNA typing in hair comparisons.

How do we classify fibers.

What are the properties of fibers that are most useful for forensic comparisons.

How fiber evidence are properly collected.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Observe different samples of hair under the microscope and identify their characteristics as well as their source (whether they come from a human or an animal body).

Explain the outcome of their observations.

Explain how hair and fiber is used at a crime scene and how DNA identification can be derived from that evidence.

Observe different fibers under the microscope and identify their weave patterns.

Describe the proper collection of hair and fiber at the crime scene.

Assessment:

Have students:

Prepare a visual presentation with microscopic pictures of hairs coming from humans, different types of animals and different parts of the body.

Prepare a visual presentation with microscopic pictures of fibers with different weave patterns.

Perform a laboratory activity: "Forensic Hair Analysis" which is designed to teach students the basic principles of the microscopic identification of human and other animal hair. This exercise also contains a section which emphasizes the comparison of human head hairs for the purpose of determining common origin.

Take an open book test on Unit 10. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Web site: The Science Spot – Forensic Science Lesson Plans
http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 10: Hairs and Fibers

Chapter 10 worksheets.

Chapter 14: Fingerprints (Time -10 periods)

Essential Question(s): What is a fingerprint and how justice officers retrieve them?

Why fingerprints are so crucial to Forensic Science?

Can fingerprints alone reveal the person who committed the crime?

Can we single out a suspect just by the study of fingerprints found on a crime scene?

What is the current technology to store images of fingerprints, and what method scientists use to narrow down results of fingerprints?

Content:

As a result of this study, students will know and understand:

Those individuals who have made significant contributions to the acceptance and development of fingerprint technology.

What are the ridge characteristics.

Why a fingerprint is a permanent feature of the human anatomy.

What are the three major fingerprint patterns and their respective subclasses.

How do we classify a set of fingerprints by the primary classification of the Henry system.

What is an automated fingerprint identification system.

What is meant by visible, plastic and latent fingerprints.

What are the present techniques for developing latent fingerprints on nonporous objects.

What are the most common chemical methods for developing prints on porous objects.

What are the proper procedures for preserving a developed latent fingerprint.

Skills: Procedural Knowledge

As a result of this unit, students will be able to:

Understand fingerprinting procedures after they listen to a presentation of a member of the local police department. Students will be given the opportunity to learn from an expert guess speaker about the popular forensic topic of "fingerprints". They will also be able to ask questions about different forensic topics as well as careers in Forensics.

Create a time line on the history and evolution of fingerprints.

Draw fingerprint patterns.

Practice rolling their own fingerprints using a ten print card and identify patterns and individual characteristics.

Research on different techniques used to obtain latent prints.

Describe how fingerprints can be collected and preserved.

Assessment:

Have students:

Identify an unknown print from a series of ten print cards.

Perform a laboratory activity on Fingerprinting where they use powder and chemical development to expose latent fingerprints.

Take an open book test on Unit 14. Test will include multiple choice, matching, true false and short response questions.

Resources:

Textbook: Richard Saferstein- Forensic Science: An Introduction

Instructor's Manual and Lesson Plans by Thomas J. Costello

Basic Laboratory Exercises for Forensic Science by Richard Saferstein.

Youtube: CSI episodes

Youtube clips: How to Dust for Fingerprints

MythBusters Fingerprints Busted

MythBusters beat fingerprint security system

How to roll fingerprints

Fingerprint wow

Automated Fingerprint Identification System (AFIS)

How to Compare Fingerprints - The Basics

Web site: The Science Spot – Forensic Science Lesson Plans
http://sciencespot.net/Pages/classforsci.html

Web site: www.learn360.com

Power Point Presentation on Chapter 14: Fingerprints

Chapter 14 worksheets.