	Course Title: Forensic Science **Course Description:** Forensic science is an inquiry-based course that uses applied science in civil and criminal cases. The course includes the applications of concepts from the areas of biology, chemistry, physics, earth science, mathematics, and psychology to analyze and investigate evidence that may be discovered in criminal investigations. The application of the scientific method is central to this course – observation, collection and classification of data, examining relationships, forming and testing hypotheses and making conclusions based on evidence. Students will use scientific techniques and technology in order to solve forensic investigations. Research, case studies, mock crime scenes and career exploration are also components of this course. The ultimate goal is to provide the students with an overall view of this field of science which has been subject to increased interest and popularity in the recent years. **Length of Course: Year-long**
Unit	**Suggested Time Frame 2.5 weeks** **Unit 1: Introduction to Forensic Science**
Essential Questions	What is forensic science? What scientific discoveries developed into the forensic techniques used currently? What is the major difference between the Frye standard and the Daubert ruling when dealing with physical evidence? What standards must evidence meet in order to be acceptable in court? How does an individual become an expert witness? How do forensic scientists interface with law enforcement personnel?
Standards	SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations.
Concepts and Skills	**Concepts** • Forensic science is the application of science to criminal and civil laws. • There is a diversity of professions practicing forensic science. • The history of forensic science includes previous centuries. • The advancement of technology has provided new techniques for analyzing evidence. • Locard's exchange principle and the concept of cross-transfer of materials. • Forensic science requires skills in applying principles and techniques of the physical and natural sciences. • The development of guidelines for scientific evidence in the courtroom. • Expert witnesses evaluate evidence based on specialized training and experience. • Forensic scientists participate in training law enforcement to recognize, collect, and preserve physical evidence at a crime scene. **Practices** • Asking questions and defining problems	**Skills** **Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments. 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific

- Developing and using models - Planning and carrying out investigations - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information	context. 5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media. 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. **8.** Draw evidence from informational texts to support analysis, reflection, and research.

Content Objectives	Students will be able to: ➢ Define forensic science and list the major disciplines it encompasses. ➢ Recognize the major contributors to the development of forensic science. ➢ Account for the rapid growth of forensic laboratories in the past 50 years. ➢ Describe the services of a typical comprehensive crime laboratory in the criminal justice system. ➢ Compare and contrast the *Frye* and *Daubert* decisions relating to the admissibility of scientific evidence in the courtroom ➢ Explain the role and responsibilities of the expert witness. ➢ List the specialized forensic services, aside from the crime laboratory, that are generally available to law enforcement personnel.
Assessments/Products	**Labs and Activities** Students will highlight the historic events in forensic science using a timeline. End of chapter review - Chapter 1 pp 33-34 (Saferstein) Web Resources – Chapter 1 pg 35 (Saferstein) Case Reading – Chapter 1 pg 36 (Saferstein) Further Study – Chapter 1 pg 18 (Ball-Deslich, Funkhouser) **Notebooks:** **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.

	• **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Saferstein, R. (2008). *Forensic science as introduction*. Upper Saddle River, New Jersey: Pearson Prentice Hall.
Unit	**Suggested Time Frame 1.5 weeks** **Unit 2: Observations**
Essential Questions	*How is it possible for two witnesses to recount conflicting information even though they witnessed the same crime?* *How can we make sure that trials are based on accurate scientific evidence?* *How can innocent individuals be wrongfully convicted?*
Standards	**Biology** 4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication among different parts of the body and mediates the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works. 4.7 Recognize that communication among cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells. 4.8 Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.
Concepts and Skills	• Our ability to observe is affected by our environment and the natural filters of sensory information in our brains. • The observations of witnesses to crimes can be partial and faulty, but in some cases also precise. • The Innocence Project has found that 87 percent of their wrongful conviction cases resulted from flawed eyewitness testimony. • Police officers and crime-scene investigators are trained in good observation practices. • Forensic scientists find, examine, and evaluate evidence from a crime scene and provide expert testimony to courts. **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

		Common Core Math Standards
		S-IC 3.Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. * S-IC 4.Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
Content Objectives	Students will be able to: ➢ Define *observation* and describe what changes occur in the brain. ➢ Describe examples of factors influencing eyewitness accounts of events. ➢ Compare the reliability of eyewitness testimony to what actually happened. ➢ Relate observation skills to their use in forensic science. ➢ Practice and improve your own observation skills. ➢ Discuss factors that affect your ability to observe and to report correctly on what you have seen. ➢ Compare the ability of someone to accurately recall events when their emotions are heightened compared to when they are feeling less emotional. ➢ Design an experiment involving a television or print commercial that demonstrates how different factors influence one's ability to observe. ➢ Discuss one's ability to accurately recall events when out-of-the ordinary events occur. ➢ Use your five senses to carefully observe simulated crimes and record in detail what you witnessed.	
Assessments/Products	**Labs and Activities** 1-1 Learning to See p.15 (Bertino) 1-2 You're an Eyewitness p. 16 (Bertino) 1-3 What Influences Our Observations p. 17 (Bertino) 1-7 The Deadly Picnic p. 56 (Walker & Wood) 1-8 That's My Story and I'm Sticking To It! (Walker & Wood) Extra Act. 1 – What's in the Box? (Instructor's CD) End of chapter review - Chapter 1 pp 13-14 (Bertino) Exam View CD Chapter 1 from Instructor's Resource CD-ROM **Notebooks:** • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will

	include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Careers in Forensics – Paul Ekman p. 12 (Bertino) Finding patterns of criminal behavior school.cengage.com/forensicscience Instructor Resources CD-ROM (Bertino)
Unit	**Suggested Time Frame 3 weeks** **Unit 3: The Crime Scene**
Essential Questions	*How is Locard's exchange principle used in crime scene investigation?* *How do investigators collect, package, and document evidence in a crime scene?* *How does the forensic science team assimilate evidence to solve a case?*
Standards	Biology 4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood. Earth Science 3.1 Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments, and creates various types of landscapes. Give examples that show the effects of physical and chemical weathering on the environment.
Concepts and Skills	• Locard's exchange principle states that contacts between people and objects during a crime can involve a transfer of material that is evidence of the crime. • Evidence may be direct, as in eyewitness accounts, or circumstantial, which does not directly prove a fact. • Evidence may be physical or biological. Trace evidence is a small amount of physical or biological evidence. • A crime-scene investigation team consists of police officers, detectives, crime-scene investigators, medical examiners, and specialists. • A crime-scene investigation consists of recognizing, documenting, and collecting evidence from the crime scene. • First-responding officers must identify the extent of a crime scene, including primary and secondary scenes, secure the scene(s), and segregate witnesses. • After walking through the crime scene and identifying evidence, the crime-scene investigators document the scene by taking photographs and preparing sketches of the scene. Evidence must be properly handled, collected, and labeled so that the chain of custody is maintained. • Evidence is analyzed in a forensic laboratory, and the results are provided to detectives, who fit the results into the crime scenario. **Practices** • Asking questions and defining problems • Developing and using models	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **CCR Reading Standards** CCRSL.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. **CCR Writing Standards** CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CCR Math Standards** CCSS..SP.A.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. CCSS.SP.C.6 approximate the probability of a chance event by collecting

	• Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
Content Objectives	Students will be able to: ➢ Summarize Locard's exchange principle. ➢ Identify four examples of trace evidence. ➢ Distinguish between direct and circumstantial evidence. ➢ Identify the type of professionals who are present at a crime scene. ➢ Summarize the seven steps of a crime-scene investigation. ➢ Explain the importance of securing the crime scene. ➢ Identify the methods by which a crime scene is documented. ➢ Demonstrate proper technique in collecting and packaging trace evidence. ➢ Describe how evidence from a crime scene is analyzed. ➢ Assemble a personal evidence portfolio that contains samples of various types of physical evidence. ➢ Create a mock crime scene for others to investigate. ➢ Work as a team to investigate a mock crime scene. ➢ Solve a crime using the evidence obtained from a mock crime scene.	

Assessments/Products	**Labs and Activities**
	2-1 Locard's Principle p.37 (Bertino)
	2-2 Crime Scene Investigation p. 41 (Bertino)
	1-5 Don't Touch the Evidence p. 43 (Walker & Wood)
	Capstone project 1 – Assemble a portfolio of evidence p. 515 (Bertino)
	Capstone project 2 – Mock crime scene development and processing p. 518 (Bertino)
	End of chapter review - Chapter 2 pp 33-36 (Bertino)
	Exam View CD Chapter 2 from Instructor's Resource CD-ROM
	
	   Notebooks:
	• **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	• **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	• **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	• **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	  End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.	

Texts, Materials, Resources	Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc.	

	Careers in Forensics – Crime Scene Investigator p. 32 (Bertino) O.J. Simpson's case school.cengage.com/forensicscience Crime Scene Sketching and Digital Photography http://www.crime-scene-investigator.net/ Instructor Resources CD-ROM (Bertino)	
Unit	**Suggested Time Frame 3 weeks** **Unit 4: Hair**	
Essential Questions	*What is the structure and function of hair?* *How can it be determined what region of the body was the origin of the hair?* *Is there a difference between human hair and animal hair?* *How can it be determined that hair is treated?* *How is hair used in a criminal investigation?* *How is microscopic and macroscopic investigation important?* *How is a follicular tag important in forensic investigation?* *What are the possible limitations of using hair as evidence in a crime investigation?* *What are the possible advantages of using hair as evidence?* *What reasons might have prevented investigators from using hair in investigations before 1910?* *What kinds of technological advances have made it possible for investigators to use hair as evidence?*	

Standards	Biology
	   1.2 Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids).
	   2.1 Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, active transport).
	   1.3 Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature that have an effect on enzymes.	

Concepts and Skills	**Concepts**
	   • Describe the structure of a hair.
	   • Differentiate between human and animal hair.
	   • Explain which characteristics of hair are important for forensic analysis.
	   • Determine the probative value of hair samples.
	   • Hair is class evidence.
	   • Hair can be used to back –up circumstantial evidence
	   • Hair absorbs substances from within the body and from the environment.
	   • Compare general physical characteristics of hair from different races
	   • Identify the different patterns of medulla used in forensic hair analysis.
	Practices
	   • Successfully use a compound microscope.
	   • Identify questions and ideas which guide forensic investigations
	   • Communicate and defend a scientific argument.
	   • Asking questions and defining problems
		Skills
		Scientific Inquiry Skills
		SIS1. Make observations, raise questions, and formulate hypotheses.
		SIS2. Design and conduct scientific investigations.
		SIS3. Analyze and interpret results of scientific investigations.
		SIS4. Communicate and apply the results of scientific investigations.
		
		Mathematical Skills
		1. Construct and use tables and graphs to interpret data sets.
		2. Use common prefixes such as *milli-, centi-,* and *kilo-*.
		
		Common Core Reading Standards
		
		1. Cite specific textual evidence to support analysis of science and technical texts.
		2. Determine the central ideas or conclusions of a text.
		3. Follow precisely a complex multistep procedure when carrying out experiments.
		4. Determine the meaning of symbols, key terms, and other domain-

	- Developing and using models - Planning and carrying out investigations - Analyzing and interpreting data - Using mathematics and computational thinking - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information	specific words and phrases as they are used in a specific scientific context. 5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media. 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. 8. Draw evidence from informational texts to support analysis, reflection, and research.
Content Objectives	Students will be able to: - Identify the various parts of a hair. - Describe variations in the structure of the medulla, cortex, and cuticle. - Distinguish between human and nonhuman animal hair. - Determine if two examples of hair are likely to be from the same person. - Explain how hair can be used in a forensic investigation. - Calculate the medullary index for a hair. - Distinguish hairs from individuals belonging to the broad racial categories.	
Assessments/Products	**Notebooks:** **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?	

	End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning.
Unit	**Suggested Time Frame 3 weeks** **Unit 5: Fibers and Textiles**
Essential Questions	*How can fibers be used as circumstantial evidence to provide links to the victim, suspect, and the crime scene?* *Why are statistics important in determining the value of evidence?* *What forms of evidence do you think a criminal might leave behind at the scene of a crime?* *Why is fiber evidence not always conclusive with suspect identification?* *How are fibers classified?* *What is the importance of textile weave patterns?* *What are the current methods used in fiber analysis?*

Standards	Biology
	    1.3 Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, that have an effect on enzymes.
	 Chemistry
	    1.2 Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures.
	    8.2 Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).

Concepts and Skills	**Concepts** Fibers are forms of class and trace evidence. Fibers are distinguished using color, number of fibers found, location, type of textile, consideration of transference. Collection of fiber evidence. Analyzation of fiber evidence. Distinguish and identify different types of fibers. Fibers are spun into yarns. Experiment using chromatography of textiles Determine the probative value of fiber evidence. **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Use technology to investigate and communicate • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information **Skills** **Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*. 3. Construct and use tables and graphs to interpret data sets. 4. Solve simple algebraic expressions. 5. Perform basic statistical procedures to analyze the center and spread of data. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments.

		4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context.
		5. Analyze how the text structures information or ideas into categories or hierarchies.
		6. Analyze the author's purpose in providing an explanation.
		7. Integrate and evaluate multiple sources of information presented in diverse formats and media.
		8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text.
		9. Synthesize information from a range of sources.
		Common Core Writing Standards
		1. Write arguments focused on forensic science.
		2. Write informative/explanatory texts, including scientific procedures/ experiments.
		3. Produce clear and coherent writing.
		4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting.
		5. Use technology to produce, publish, and update individual or shared writing products.
		6. Conduct research projects to answer a question or solve a problem.
		7. Gather relevant information from multiple sources.
		8. Draw evidence from informational texts to support analysis, reflection, and research.
Content Objectives	Students will be able to: ➢ Identify and describe common weave patterns of textile samples. ➢ Compare and contrast various types of fibers through physical and chemical analysis. ➢ Describe principal characteristics of common fibers used in their identification. ➢ Apply forensic science techniques to analyze fibers.	
Assessments/Products	**Labs and Activities** Activity 4-1 Microscopic Fiber p.93-95 (Bertino) Activity 4-3 Weave Pattern Analysis p. 99-100 (Bertino) Assessments and Additional Projects p. 128-129 (Ball-Deslich & Funkhouser) Amanda Davies Case Study p.125 (Ball-Deslich & Funkhouser) Lab Activity Thin-Layer Chromatography of Dyes p. 121-122 (Ball-Deslich & Funkhouser)	
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Kubic, T., & Petraco, N. (2009). *Forensic science laboratory manual and workbook*. (3rd ed.). Boca Raton, FL: Taylor & Francis Group.	
Unit	<u>**Suggested Time Frame 3 weeks**</u> <u>**Unit 6: Fingerprints**</u>	
Essential Questions	How has technology made personal identification easier?	

	If a person is accused of stealing, how can fingerprint evidence support the arguments of innocence or guilt? What are fingerprints? What is the history of fingerprinting? How do friction ridges distinguish between individual prints? How are fingerprints formed? How is the collection process important for obtaining quality prints? Should there be a checks and balances system for fingerprint evidence analysis? How reliable is fingerprinting as a means of identification?

Standards	Biology
	   1.2 Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, nucleic acids).
	Chemistry
	   7.5 Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst).
	   8.2 Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice).

Concepts and Skills	**Concepts** - Properties which allow individual identification by fingerprints. - Be able to obtain a readable fingerprint from a variety of surfaces. - Recognize Ridge patterns and minutiae. - Develop latent prints - Twins and individual fingerprints - The future of fingerprinting **Practices** - Asking questions and defining problems - Developing and using models - Planning and carrying out investigations - Analyzing and interpreting data - Using mathematics and computational thinking - Use technology to investigate and communicate - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information - Design a crime scene and collect evidence Skills **Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*. 3. Construct and use tables and graphs to interpret data sets. 4. Solve simple algebraic expressions. 5. Perform basic statistical procedures to analyze the center and spread of data. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments. 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context. 5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media.

	8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. 8. Draw evidence from informational texts to support analysis, reflection, and research.
Content Objectives	Students will be able to: ➢ Discuss the history of fingerprinting. ➢ Describe the characteristics of fingerprints. ➢ Identify the basic types of fingerprints. ➢ Describe how criminals attempt to alter their fingerprints. ➢ Determine the reliability of fingerprints as a means of identification. ➢ Explain how fingerprint evidence is collected. ➢ Describe the latest identification technologies. ➢ Determine if a fingerprint matches a fingerprint on record. ➢ Use the process of lifting a latent print.
Assessments/Products	Labs and Activities Activities 6-1 through 6-6 pp. 149-156 (Bertino) Study Your Fingerprints Giant Balloon Fingerprint Studying Latent Fingerprints How to Print a Ten Card Is it a Match Fingerprint Matching Case Study The 1933 Hamm Kidnapping p. 70 (Ball-Deslich & Funkhouser) Additional Projects p. 74 (Ball-Deslich & Funkhouser) Experiment 7 Cyanoacrylate "Super Glue" Fuming Technique to Develop Latent Fingerprints p.47 – 51(Kubic & Petraco) **Notebooks:** • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).

	Vocabulary: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2ⁿᵈ edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Kubic, T., & Petraco, N. (2009). *Forensic science laboratory manual and workbook*. (3rd ed.). Boca Raton, FL: Taylor & Francis Group.
Unit	**Suggested Time Frame 3 weeks** **Unit 7: Death and Forensic Entomology**
Essential Questions	*How do dead people tell tales?* *How can forensic examiners solve a criminal case by examining the corpse?* *What role do insects play in decomposition and in identifying time of death?*
Standards	**Biology** 4.1 Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth. 4.3 Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide. 4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells. 4.8 Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop. 6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the complexity of biological communities. **Physics** **3.2** Explain how heat energy will move from a higher temperature to a lower temperature until equilibrium is reached
Concepts and Skills	- There are several definitions of death, or the end of life, including the cessation of the heartbeat and the cessation of brain function. - Upon death, cells break down and release their contents, resulting in decomposition. - The manner of death refers to how the death occurs: by suicide, homicide, natural causes, or accident. If one of these four causes cannot be determined, the manner of death may be ruled undetermined. - The cause of death refers to what led to the death and includes causes such as heart attack, gunshot wound, or cancer. - The mechanism of death refers to the specific bodily function resulting in death. A heart attack might lead to the heart ceasing to beat, whereas a gunshot wound might lead to loss of blood or	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize

	the ceasing of brain function that results in death. • There are several means to determine the time of death: livor mortis, rigor mortis, and algor mortis are changes that happen to a body after it dies. Stomach contents and the condition of the eyes also provide clues. • The states of decomposition of a corpse, as well as the insects on the body, provide further evidence of time of death. **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Common Core Math Standards** N-Q 1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. N-Q 3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-REI 3.Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
Content Objectives	Students will be able to: ➢ Define death and distinguish between four manners of death: natural, accidental, suicidal, and homicidal. ➢ Distinguish between cause, manner, and mechanisms of death. ➢ Explain how the development of rigor, algor, and livor mortis occurs following death. ➢ Use evidence of rigor, algor, and livor mortis to calculate the approximate time of death. ➢ Measure the rate of heat loss of a simulated corpse (warm water at 98.6 °F) over a period of 30 minutes. ➢ Describe the stages of decomposition of a corpse. ➢ Explain how some changes in different organs such as the stomach and the eye can be used to determine the time of death. ➢ Identify species of insects (decomposers) that are found on a corpse. ➢ Estimate the time of death by examining the types of insects found on a corpse and the insects' stage of development. ➢ Predict the cause of death using evidence from forensic entomology. ➢ Use evidence from the autopsy's report on stomach contents to estimate time of death. ➢ Given insect evidence, livor, rigor, and algor mortis data, estimate time of death. ➢ Describe how various environmental factors may influence the estimated time of death. ➢ Research and design a visual to present an actual case study that has used forensic entomology to solve a crime.

	➢ In groups, create hypothetical scenarios using evidence from rigor, livor, algor mortis, and insects, then have different groups solve your case.

Assessments/Products	**Labs and Activities**
	11-1 Calculating Time of Death Using Rigor Mortis p. 326 (Bertino)
	11-2 Calculating Time of Death Using Algor Mortis p. 328 (Bertino)
	11-3 Insect Study p. 331 (Bertino)
	11-4 Estimating Time of Death Using Insect, Algor, and Livor Mortis Evidence p. 324 (Bertino)
	Of Maggots and Murder (The American Biology Teacher)
	Extra Act. 1 – Calculating Accumulated Degree Hours (Instructor's CD)
	Extra Act. 2 – Internet Research Forensic Entomology (Instructor's CD)
	End of chapter review - Chapter 11 pp 324 (Bertino)
	Exam View CD Chapter 11 from Instructor's Resource CD-ROM
	  Notebooks:
	  • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	  • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	  • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	  • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.

Texts, Materials, Resources	Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Carloye, L. (2013). *The American Biology Teacher*, Volume 65, No 5, May 2013 Dr. Jerry Payne's time lapse movie of the decomposition of a baby pig http://www.youtube.com/watch?v=R1CD6gNmhr0 Case Study – Mysterious Death at the Fair p. 308 (Bertino) Careers in Forensics – William Bass p. 323 (Bertino) Instructor's Resource CD-ROM (Bertino) New technique for gathering information from a corpse school.cengage.com/forensicscience
Unit	**Suggested Time Frame 3.5 weeks** **Unit 8: Blood**
Essential Questions	*What will happen when an antibody and an antigen of different types of blood are mixed together?* *What information is obtained by investigators from bloodstain patterns at a crime scene?* *How does an investigator differentiate a sample as human or animal?* *How is serology used in forensic investigation?* *How can a bloodstain be used for individualization?* *How are bloodstains used as evidence to convince a jury of a suspect's innocence or guilt?*
Standards	Biology 3.2 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic

	processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation. 4.2 Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.

	Concepts / Practices	Skills
Concepts and Skills	**Concepts** • The gradual developments in our knowledge of blood (timeline) • The composition of blood – plasma, platelets, red blood cells, white blood cells • DNA profiling using white blood cells • Blood typing – types of blood, blood proteins, Rh Factor, antigen–antibody response, agglutination, typing tests. • Blood-spatter analysis • Examination of directionality of blood-spatter • Lines of convergence of blood-spatter • Crime-scene investigation of blood **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Use technology to investigate and communicate • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information • Design a crime scene and collect evidence	Skills **Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*. 3. Construct and use tables and graphs to interpret data sets. 4. Solve simple algebraic expressions. 5. Perform basic statistical procedures to analyze the center and spread of data. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments. 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context. 5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media. 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising,

	editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. 8. Draw evidence from informational texts to support analysis, reflection, and research.
Content Objectives	Students will be able to: ➢ Explain the composition of blood. ➢ Describe the functions of blood cells. ➢ Describe a brief history of the use of blood and blood-spatter analysis in forensics. ➢ Describe how to determine the blood type of a sample of blood. ➢ Describe how to screen for the presence of human blood. ➢ Calculate the probability of certain blood types within a population. ➢ Conduct a blood-spatter analysis ➢ Examine stab wounds and describe the nature of the weapon. ➢ Use blood-spatter evidence to recreate the events at a crime scene.

Assessments/Products	Lab and Activities
	8-2 Blood Typing pp. 220-224 (Bertino)
	8-3 Blood-Spatter Analysis: Effect of Height on Blood Drops pp. 225-228 (Bertino)
	8-4 Blood-Spatter Impact Angle pp. 229-234 (Bertino)
	8-5 Area of Convergence pp. 235-238 (Bertino)
	8-7 Crime-Scene Investigation pp. 247-249 (Bertino)
	Could The Criminal Live In This House? A Lab on Inheritance of Blood Types Lab 3-8 (Walker & Wood)
	Bloodstains on the Ground A Lab on Testing for the Presence of Blood Lab 3-9 (Walker & Wood)
	Bloodstain Geometry (Part B) pp.165-170 (Kubic & Petraco)
	  Notebooks:
	• **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	• **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	• **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	• **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	  End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.

Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Kubic, T., & Petraco, N. (2009). *Forensic science laboratory manual and workbook*. (3rd ed.). Boca Raton, FL: Taylor & Francis Group. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc.

Unit	**Suggested Time Frame 2 weeks** **Unit 9: DNA**
Essential Questions	*How reliable is DNA evidence? Should juries rely solely on DNA evidence to convict suspects* *How is DNA collected, preserved, analyzed and used to identify individuals?*
Standards	**Biology** 2.1 Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, active transport). 3.1 Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance. 3.2 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.
Concepts and Skills	• Present DNA analysis allows a tissue sample to be identified with a single individual; it has been used to solve crimes, establish paternity, and identify victims of war or large-scale disasters. • DNA fingerprinting can now use a small sample of tissue to identify an individual. • DNA carries the genetic information, in a sequence of nitrogenous bases, required to produce an organism from a single fertilized egg. • DNA contains, in noncoding regions, many repeated sequences that vary in number among individuals; these differences can be used to produce a DNA fingerprint for an individual. • DNA evidence must be collected carefully to avoid contamination with other DNA. • DNA analysis involves extraction of the DNA from the sample, in some cases restriction enzyme digestion of the DNA (cutting), amplification using PCR, electrophoresis of DNA fragments, and visualization of the DNA fragments using probes. • Visualized fingerprints from different tissue samples can be compared in their patterns to determine whether they came from the same person (same pattern) or show a parent—offspring relationship (offspring shares bands with both parents). **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Common Core Math Standards** S-CP 6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the

	model.
Content Objectives	Students will be able to: ➢ Describe the structure and function of DNA. ➢ Explain how crime-scene evidence is collected for DNA analysis. ➢ Describe how crime-scene evidence is processed to obtain DNA. ➢ Extract DNA from fruits and analyze each step. ➢ Describe how radioactive probes are used in DNA fingerprinting. ➢ Explain how DNA evidence is compared for matching tissue and establishing paternity. ➢ Apply DNA fingerprinting steps to determine if DNA from different suspects matches DNA from a crime scene. ➢ Explain how to use DNA fingerprinting to identify DNA from a parent, child, or relative of another person. ➢ Use DNA profiles to identify the parents of a child. ➢ Perform gel electrophoresis to determine whose DNA was found in a crime scene. ➢ Apply the necessary procedures for proper preservation of biological evidence for laboratory DNA analysis. ➢ Explain the role of DNA in genetic engineering. ➢ Debate the pros and cons of genetic engineering.

Assessments/Products	**Labs and Activities**
	7-1 DNA fingerprinting simulation using dyes p. 175 (Bertino)
	7-2 Where's the CAT? Simulation p. 179 (Bertino)
	7-3 Ward's DNA fingerprinting simulation p. 185 (Bertino)
	7-4 Who are the parents? p. 187 (Bertino)
	7-5 Which man is the father? P. 189 (Bertino)
	7-6 The Break In p 191(Bertino)
	7-7 Internet search Romanov family p. 193 (Bertino)
	3-3 Missing Parents p. 148 (Walker & Wood)
	12.1 Extracting DNA from a Banana p. 341 (Kendall/Hunt)
	End of chapter review - Chapter 7 pp 173 (Bertino)
	Exam View CD Chapter 7 from Instructor's Resource CD-ROM
	
	   Notebooks:
	• **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	• **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	• **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	• **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	  End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.

Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Case Study – The Green River Killer p. 363 (Kendall/Hunt)

	Careers in Forensics – Kary Banks Mullis – Noble Prize-Winning Chemist p. 172 (Bertino) Dr. Alec Jeffrey and DNA fingerprinting school.cengage.com/forensicscience	
Unit	**Suggested Time Frame 2 weeks** **Unit 10: Drugs and Toxicology**
Essential Questions	*How can scientists tell what substances are actually drugs?* *How is it possible to find out if athletes are using performance enhancers?* *How does the human body metabolize and excrete drugs?* *How is toxicology used in forensic investigations?* *How is chemistry used to detect and analyze drugs?*
Standards	**Biology** 1.1 Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes. 4.4 Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication among different parts of the body and mediates the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works. **Chemistry** 7.1 Describe the process by which solutes dissolve in solvents. 7.3 Identify and explain the factors that affect the rate of dissolving (e.g., temperature, concentration, surface area, pressure, mixing). 7.5 Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, catalyst).
Concepts and Skills	- Forensic toxicology seeks to identify poisons or drugs in criminals and victims and their likely effects on those people. - Poisoning is rare as a form of murder, but toxicology is important in studying cases of drug overdoses and sporting violations. - Controlled substances fall into five groups: hallucinogens, narcotics, stimulants, steroids, and depressants. - Poisons produced by living organisms include alcohol and bacterial toxins. - Heavy metals and pesticides are also common poisons found in humans. - Bioterrorism agents include ricin, a poisonous compound produced by the castor bean plant, and anthrax, a bacterium that produces potent toxins.	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical

Practices • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Common Core Math Standards** S-IC 3.Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. * S-IC 4.Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

Content Objectives	Students will be able to: ➢ Identify the five types of controlled substances. ➢ Classify the types of illicit drugs and their negative effects. ➢ Relate signs and symptoms of overdose with a specific class of drugs or toxins. ➢ Demonstrate the role of positive and negative control in drug testing. ➢ Perform a simulated drug test on white powders. ➢ Describe the role of various types of toxins in causing death. ➢ Discuss agents that may be used in bioterrorism. ➢ Define and describe the goals and practice of toxicology. ➢ Communicate the need for confirmatory tests. ➢ Perform a series of chemical tests to find out the source of poison in a crime.

Assessments/Products	**Labs and Activities** 9-1 Drug Analysis p. 265 (Bertino) 9-2 Urine Analysis p. 268 (Bertino) 9-3 Drug Identification p. 271 (Bertino) 2-4 White Powders p. 98 (Walker & Wood) Extra Act 1 – Drug Research Presentation (Instructor's CD-ROM) Extra Act 2 – Drug Residue on Paper Money (Instructor's CD-ROM) Project: Legalization of Drugs p. 203 (Kendall/Hunt) End of chapter review - Chapter 9 p. 263 (Bertino) Exam View CD Chapter 9 from Instructor's Resource CD-ROM **Notebooks:** • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these

	conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Case Study – Anna Nicole Smith: Accidental Overdose p. 250 (Bertino) and Georgi Markov p. 219 (Kendall/Hunt) Careers in Forensics – Dr. Don Catlin p. 262 (Bertino) Modern techniques of drug testing school.cengage.com/forensicscience Instructor's Resource CD-ROM (Bertino)
Unit	**Suggested Time Frame 2 weeks** **Unit 11: Tools and Impressions**
Essential Questions	*How can scientists tell that a specific tool created a mark, not one like it?* *How are different types of impressions used in forensic investigations?* *Although they might seem easy to cover up, why might foot prints, bite marks and tire tracks can be difficult to conceal?*
Standards	**Chemistry** 1.1 Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes. **Technology and Engineering** 2.1 Identify and explain the engineering properties of materials used in structures (e.g., elasticity, plasticity, R value, density, strength). 7.1 Describe the manufacturing processes of casting and molding, forming, separating, conditioning, assembling, and finishing.
Concepts and Skills	• Tools have major and minor surface differences that can help differentiate one tool's impression from another. • Tool marks are categorized into one of three categories: indentation marks, abrasion marks, and cutting marks. • The marks made by tools can link a tool to a crime scene and ultimately link the owner of the tool and potential suspect in a crime. • Tool mark evidence should be photographed, documented, collected, or cast. • There are three types of impressions: patent impressions, latent impressions, and plastic impressions. • Generally, any impression evidence made by an object will be considered class evidence unless it has individualizing features, such as wear or damage. • Tire impressions at a crime scene can lead to the identification of a vehicle and can provide evidence pertaining to events that occurred before an accident. • Tire impressions are classified as skid, yaw, or tire scrub impressions. • Impressions from teeth are considered individual evidence and,	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

	like fingerprints, reliability depends on the number of points of comparison and the clarity of the impression. • Photographs of the original impression always accompany the cast or record, such as a gel lift, used in court. • Impressions may be used two ways: (1) to identify a person or object and (2) to determine actions that occurred in committing the crime. **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Common Core Math Standards** N-Q 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. N-Q 3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-REI 3.Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. G-GED 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. S-IC 3.Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. * S-IC 4.Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. MA1 A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. MA1 A-REI 10.Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
	Students will be able to: ➢ Distinguish between latent, patent, and plastic impressions. ➢ Explain how various types of impressions can be used as trace evidence.	

Content Objectives	➢ Describe how to make foot, shoe, and tire impressions. ➢ Preserve tool mark and footwear evidence by creating casts. ➢ Explore the relationship between foot length, shoe size, and height. ➢ Use track width and wheelbase information to identify vehicles. ➢ Prepare dental impressions and match them with bite marks. ➢ Match bite marks found on a victim with bite marks of a suspect. ➢ Discuss the significance of tool mark impressions in criminal investigations. ➢ Describe three major types of tool mark impressions. ➢ State the importance of tool surface characteristics. ➢ Summarize the steps of a tool mark examination and analysis. ➢ Summarize how technology is helping tool experts in criminal investigations. ➢ Match tool marks with the instrument that produced them.

Assessments/Products	**Labs and Activities**
	15-1 Casting Plaster of Paris p. 450 (Bertino)
	15-2 Shoe Size and Height p. 454 (Bertino)
	15-3 Tire Impressions and Analysis p. 457 (Bertino)
	15-4 Vehicle Identification p. 460 (Bertino)
	15-5 Dental Identifications p. 464 (Bertino)
	16-1 Tool Marks: Screwdrivers and Chisels p. 481 (Bertino)
	16-2 Hammer Match p. 484 (Bertino)
	16-3 Hammer Strikes on Wood p. 487 (Bertino)
	1-4 Tracking On p. 30 (Walker & Wood)
	End of chapter review - Chapter 15-16 p. 447, 479 (Bertino)
	Identifying tool marks found on bones school.cengage.com/forensicscience
	Exam View CD Chapter 15-16 from Instructor's Resource CD-ROM
	  Notebooks:
	    • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	    • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	    • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	    • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	  End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.

Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Case Study –O. J. Simpson p. 430 (Bertino) and p. 461 (Kendall/Hunt)

	Careers in Forensics – Thomas Naguchi p. 446 (Bertino)
Unit	**Suggested Time Frame 2 weeks** **Unit 12: Handwriting Analysis, Forgery, and Counterfeiting**
Essential Questions	*How can ransom notes and suicide letters be helpful for forensic scientists?* *How are questioned documents analyzed for use in criminal investigations?*
Standards	**Chemistry** 7.1 Describe the process by which solutes dissolve in solvents.
Concepts and Skills	- Fraudulence is attempting to get financial or other gain from forgery. - Handwriting analysis is the examination of questioned documents compared with exemplars by document experts to establish the authenticity and/or authorship of the documents. - Document experts use scientific tools and protocols to compare handwriting characteristics of a questionable document to those of an exemplar to help identify authors and detect any alterations, erasures, and obliterations. - Certain aspects of a person's handwriting style, such as letter form, line form, and formatting, can be analyzed to ascertain authenticity or authorship. - Handwriting analysis has become an important tool, especially for forensic examiners. Handwriting experts help financial, legal, and governmental institutions, as well as the general public, detect and prevent forgery, counterfeiting, and other fraudulent crimes. - Technological advances, such as the biometric signature pad and the use of the infrared spectroscope, have greatly enhanced the detection of forged documents. - Countries continue to refine methods to protect their currency from counterfeiters. **Practices** - Asking questions and defining problems - Developing and using models - Planning and carrying out investigations - Analyzing and interpreting data - Using mathematics and computational thinking - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Common Core Math Standards** N-Q 3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. S-IC 3.Recognize the purposes of and differences among sample surveys,

	experiments, and observational studies; explain how randomization relates to each. [*]
	S-IC 4.Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
Content Objectives	Students will be able to: ➢ Describe 12 types of handwriting characteristics that can be analyzed in a document. ➢ Demonstrate an example of each of the 12 types of handwriting traits. ➢ Identify the major goal of a forensic handwriting analysis. ➢ Analyze handwriting samples using the 12 characteristics. ➢ Describe some of the technology used in handwriting analysis. ➢ Distinguish between the terms *forgery* and *fraudulence*. ➢ Identify several ways in which businesses prevent check forgery. ➢ Examine US paper currency using different methods to determine if the currency is genuine or forged. ➢ Describe four features of paper currency that are used to detect counterfeit bills. ➢ Compare a handwriting sample to the handwriting of specific individual and determine if the handwriting samples match. ➢ Discuss why handwriting samples from the same individual can differ with time. ➢ Discuss the techniques used in gathering handwriting samples from a suspect. ➢ Design an experiment using paper chromatography to determine which pen altered a note. ➢ Apply techniques that document examiners use to uncover alterations, erasures, obliterations, and variations in pen inks.

Assessments/Products	**Labs and Activities**
	10-1 Handwriting analysis p. 294 (Bertino)
	10-2 Analysis of Ransom Note p. 297 (Bertino)
	10-3 Examination of US Currency: Real or Forged? p. 301 (Bertino)
	1-1 Who Wrote This? p. 3 (Walker & Wood)
	Extra Activity 2 – Presidential Signature (Instructor's CD-ROM)
	End of chapter review - Chapter 10 p. 292
	Exam View CD Chapter 10 from Instructor's Resource CD-ROM
	  Notebooks:
	    • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	    • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	    • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	    • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	  End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.

Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning.

	Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Case Study – Frank Abagnale p. 276 (Bertino) Careers in Forensics –Lloyd Cunningham p. 291 (Bertino) Early forgeries of Shakespeare school.cengage.com/forensicscience
Unit	**Suggested Time Frame 2 weeks** **Unit 13: Soil Examination**
Essential Questions	*How can investigators determine where a soil sample came from?* *How does soil evidence link to a suspect?* *How are soil samples analyzed and tested?* *How can layers of soil found on a suspect's shoes show a sequence of where the suspect traveled?*
Standards	**Chemistry** 1.2 Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures. 6.5 Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy). 7.1 Describe the process by which solutes dissolve in solvents. 8.2 Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice). **Earth Science** 3.1 Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments, and creates various types of landscapes. Give examples that show the effects of physical and chemical weathering on the environment.
Concepts and Skills	- There are three grain sizes of soil: clay, silt, and sand. - There are three subcategories of soil: peat, loam, and chalk. - Soil forms in layers called horizons. Starting from the layer at Earth's surface and moving downward, the horizons are labeled the O horizon, the A horizon, the E horizon, the B horizon, the C horizon, and the R horizon. - The pH scale is used to measure how acidic or basic soil is. A pH from 0 to 6 is considered acidic. A pH from 8 to 14 is considered basic. A pH of 7 is considered neutral. - Sand is formed when weathering breaks up rock into small grains from 0.05 mm to 2 mm in diameter. - There are four main types of sand: continental sand, volcanic sand, skeletal sand, and precipitate sand. - There are special procedures crime-scene investigators must follow when collecting soil evidence. - Soil analysis can involve macroscopic and microscopic examination, chemical testing, and X-ray diffraction analysis. **Practices** - Asking questions and defining problems - Developing and using models - Planning and carrying out investigations	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Common Core Reading and Writing Standards** CCRSL.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. CCRSL.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. CCRSL.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or

	- Analyzing and interpreting data - Using mathematics and computational thinking - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information	technical context relevant to *grades 11–12 texts and topics*. CCWSL.2 Write informative/explanatory texts, including the narration of historical events scientific procedures/ experiments, or technical processes. CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **Math Standards** N-Q 3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Content Objectives	Students will be able to: - Recognize various soil types and describe some methods for examining soil samples. - Examine and compare various samples of sand. - Distinguish sand samples by size, color, and composition. - Perform a soil analysis, including macroscopic and microscopic examination, as well as chemical and physical analysis. - Study soil characteristics and match samples taken from a suspect to samples found at a crime scene.
Assessments/Products	**Labs and Activities** 12-1 Examination of Sand p. 352 (Bertino) 12-2 Soil Profile Examination p. 354 (Bertino) 12-3 Chemical and Physical Analysis of Sand p. 357 (Bertino) 4-5 The Dirt on Crime p. 255 (Walker & Wood) End of chapter review - Chapter 12 p. 350 Exam View CD Chapter 12 from Instructor's Resource CD-ROM **Notebooks:** **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc. Case Study – The Coors Kidnapping p. 285 (Kendall/Hunt)

	Careers in Forensics – Forensic Geologists p. 349 (Bertino)
	Burial of five murder victims school.cengage.com/forensicscience
	Instructor's Resource CD-ROM (Bertino)
Unit	**Suggested Time Frame 2 weeks** **Unit 14: Forensic Anthropology**
Essential Questions	*How do anthropologists use bones to determine whether remains are human?* *How are bones used to determine sex, age, and race of an individual?* *How are bones used to determine when a death may have occurred?* *How are animal bones different from human bones?* *How can the height of an individual be estimated from the skeleton?* *What is the importance of the stages of epiphyseal union?* *How do skeletal remains indicate the cause of death?*

Standards	Biology
	    4.5 Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other
	          systems to support the body and allow for movement. Recognize that bones produce blood cells.
	Chemistry
	2.6 Describe the process of radioactive decay by using nuclear equations, and explain the concept of half-life for an isotope (for example, C-14 is
	a powerful tool in determining the age of objects).
	
	Earth and Space Science
	    3.1 Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments, and creates various types of
	          landscapes. Give examples that show the effects of physical and chemical weathering on the environment.

Concepts and Skills	**Concepts** - The historical development of forensic anthropology (timeline) - The characteristics of bone – development, bone cells, number of bones, connection (cartilage, ligaments, tendons), and the aging of bones - What information can be revealed by bone examination – male or female (using skull, pelvis, and femur) - How to distinguish the age of a person – suture marks, cartilaginous lines, and long bones. - How to estimate an individual's height. - How to distinguish an individual's race. - How is facial reconstruction used in crime investigations. - The use of DNA profiling and mitochondrial DNA - Skeletal trauma analysis – the difference between the weathering of the bone due to the environment and the patterns caused by weapons. **Practices** - Asking questions and defining problems - Developing and using models - Planning and carrying out investigations - Analyzing and interpreting data	**Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*. 3. Construct and use tables and graphs to interpret data sets. 4. Solve simple algebraic expressions. 5. Perform basic statistical procedures to analyze the center and spread of data. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments. 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context.

	- Using mathematics and computational thinking - Use technology to investigate and communicate - Constructing explanations and designing solutions - Engaging in argument from evidence - Obtaining, evaluating, and communicating information - Design a crime scene and collect evidence	5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media. 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. 8. Draw evidence from informational texts to support analysis, reflection, and research.
Content Objectives	Students will be able to: ➢ Describe how bone is formed. ➢ Distinguish between male and female skeletal remains based on skull, jaw, brow ridge, pelvis, and femur. ➢ Describe how bones contain a record of injuries and disease. ➢ Describe how a person's approximate age could be determined by examining his or her bones. ➢ Explain the differences in facial structures among different races. ➢ Describe the role of mitochondrial DNA in bone identification.	
Assessments/Products	Labs and Activities Case Studies pp. 375-376 (Bertino) 13-1 Determining the Age of a Skull p. 380 (Bertino) 13-2 Bones: Male or Female? P.381 (Bertino) 13-3 The Romanovs and DNA: An Internet Activity pp.382-384 (Bertino) 13-4 Estimation of Body Size From Individual Bones p. 385 (Bertino) 13-7 Height and Body Proportions pp. 390-393 (Bertino) Mayor of the Body Farm p. 216 (Lee, Taft, Taylor & Hencken, 2009) Interested in Forensic Anthropology? www.archaeology.org (Lee, Taft, Taylor & Hencken, 2009) Lab 4-2A Bone Bonanaza –o A Lab on Male and Female Skeletons (Walker & Wood) Lab 4-2B Bits and Pieces A Lab on Using Bones to Identify a Missing Person (Walker & Wood) **Notebooks:** **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).	

	• **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt. Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning. Lee, D. H., Taft, G., Taylor , K., & Hencken, J. (2009).*Forensic science today*. (2nd ed.). Tucson, Arizona: Lawyers & Judges Publishing Company. Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc.
Unit	**Suggested Time Frame 2 weeks** **Unit 15: Glass**
Essential Questions	*What are the similarities in the physical properties of amorphous and isotropic substances?* *What are the structural differences in amorphous and isotropic substances?* *How would you determine that glass from a suspect and crime scene have a common origin?* *How would you differentiate between fragments of clear polystyrene, glass, and quartz?* *How is the density of glass calculated?* *What is the significance of glass fracture patterns?*

Standards	Chemistry
	  1.1 Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.
	  4.1 Explain how atoms combine to form compounds through both ionic and covalent bonding. Predict chemical formulas based on the number of valence electrons.
	  4.5 Identify how hydrogen bonding in water affects a variety of physical, chemical, and biological phenomena (e.g., surface tension, capillary action, density, boiling point).
	Physics
	  1.1 Compare and contrast vector quantities (e.g., displacement, velocity, acceleration force, linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work).
	  1.2 Distinguish between displacement, distance, velocity, speed, and acceleration. Solve problems involving displacement, distance, velocity, speed, and constant acceleration.
	  4.4 Describe qualitatively the basic principles of reflection and refraction of waves.
	  4.5 Recognize that mechanical waves generally move faster through a solid than through a liquid and faster through a liquid than through a gas.

Concepts and Skills	**Concepts** The history of glass from natural formation to the Industrial Revolution What is glass, describe the types of glass and how can the composition of glass vary. The importance of the density of glass and how to calculate the density. What is Refractive index – "Snell's Law describing the behavior of light as it travels through different mediums. The application of refractive index to the science of forensics What are "Becke Lines" and how can the refractive index of glass be ‖ **Scientific Inquiry Skills** SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills** 1. Construct and use tables and graphs to interpret data sets. 2. Use common prefixes such as *milli-, centi-,* and *kilo-*.

	estimated using a microscope? How does the thickness of glass provide clues? What are the fracture patterns of glass – radial and concentric, bullet, bulletproof glass, tempered glass, backscatter, heat fractures and scratch patterns. How are crime-scenc glass samples handled? How are the glass fragments prepared for examination in the laboratory? **Practices** • Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Use technology to investigate and communicate • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information • Design a crime scene and collect evidence	3. Construct and use tables and graphs to interpret data sets. 4. Solve simple algebraic expressions. 5. Perform basic statistical procedures to analyze the center and spread of data. **Common Core Reading Standards** 1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text. 3. Follow precisely a complex multistep procedure when carrying out experiments. 4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context. 5. Analyze how the text structures information or ideas into categories or hierarchies. 6. Analyze the author's purpose in providing an explanation. 7. Integrate and evaluate multiple sources of information presented in diverse formats and media. 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text. 9. Synthesize information from a range of sources. **Common Core Writing Standards** 1. Write arguments focused on forensic science. 2. Write informative/explanatory texts, including scientific procedures/ experiments. 3. Produce clear and coherent writing. 4. Develop and strengthen writing as needed by planning, revising, editing, or rewriting. 5. Use technology to produce, publish, and update individual or shared writing products. 6. Conduct research projects to answer a question or solve a problem. 7. Gather relevant information from multiple sources. 8. Draw evidence from informational texts to support analysis, reflection, and research.	
Content Objectives	Students will be able to: ➤ Explain how glass is formed. ➤ List some of the characteristics of glass. ➤ Provide examples of different types of glass. ➤ Calculate the density of glass. ➤ Use the refractive index to identify different types of glass.	

	➢ Describe how glass fractures.
	➢ Analyze glass fracture patterns to determine how glass was broken.
	➢ Explain how glass is used as evidence.
Assessments/Products	14-1 Glass Fracture Patterns pp.416-418 (Bertino)
	14-2 Glass Density pp. 419-421 (Bertino)
	Lab 2-2 Glass is Breaking Up (Walker & Wood)
	Lab 2-3 Glass Can Tell on You A Lab on Glass Identification (Walker& Wood)
	Experiment 20 Glass Fractures and Direction of Force pp. 149-154 (Kubic & Petraco)
	Notebooks:
	• **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize).
	• **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations.
	• **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim.
	• **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?
	End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, Resources	Ball-Deslich, B. & Funkhouser, J. (2009). *Forensic science for high school, 2nd edition*. Kendall/Hunt.
	Bertino, A. (2008). *Forensic science fundamentals & investigations*. Mason, Ohio: South-Western Cengage Learning.
	Walker, P. & Wood, E. (1998). *Crime scene investigations real-life science labs*. John Wiley & Sons, Inc.