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| **Forensics (30 and 40 week0** | | | |
| **Unit Rationale** | **Learning Objectives and Next Generation Science Standards** | **Instructional Resources** | **Vocabulary** |
|  | **Unit 8: Blood and Blood Spatter** |  |  |
| Blood is among the most common forms of evidence found at scenes of violent and brutal crimes. All suspected blood—liquid or dried, animal or human—present suggests a relationship to the offense or persons involved in a crime. Blood may be found in trace amounts, puddles, spatters, smears, or droplets. Blood samples may be collected from suspects and victims for examination and comparison. Blood evidence can help narrow a group of suspects, support identification of a suspect, and even guide the reconstruction of a crime. | **Objectives:**  • Describe the forensic significance of the different types of blood cells.  • Summarize the history of the use of blood and blood spatter analysis in forensics.  • Outline the procedure used to determine blood type.  • Describe how to screen for the presence of human blood.  • Describe the proper procedures for handling blood evidence  • Calculate the probability of certain blood types within a population.  • Analyze blood spatter evidence using angle of impact, area of convergence, and area of origin.  • Compare and contrast different types of blood-spatter evidence  • Describe how different types of blood-spatter patterns are formed.  **Next Generation Science Standards**  **HS-LS1-1** - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells  **HS-LS1-2** - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.  **HS-LS3-2** - Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors  from one generation to another.  **HS-PS1-2** - Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.  **HS-ETS1-1** - Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.  **HS-ETS1-2** - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. | Bertino Chapter 8  Activity 8-1 - A presumptive test for blood  [Click Here](https://www.ww-p.org/common/pages/DisplayFile.aspx?itemId=15786486)  Activity – Blood Type Webquest [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EVYrkRsyYHtLnJYXTQ_egqgBmPZLckeIqIU7COdi7gDsmw?e=7s07gi)  Activity 8-2- Blood Typing  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/Efuerj8CJERGuMVEmvmeOn0B9Av9kCfLiT0T9wk1q3QbZw?e=FLmnia)    Activitiy 8-3- Effect of Height on Blood Drops  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EReIs69pzOtOk2sIFydjv1QBc4N7S1-8lOsVbBWG-e_geA?e=TjZ1Pv)    Activity 8-4 - Area of Convergence  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EbgAQ5a3eDlDrILCF4mXvxYBX2mwSwrr8rPexAOqtPVzXg?e=akPpgV)  Activity 8-5 Blood-Droplet Impact Angle [Click Here](http://wranatomyclass.weebly.com/uploads/1/3/3/7/13374819/lab_2-_blood_spatter_impact_angle.pdf)  Activity 8-6 Area of Origin  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EYyL-7BuWvZJviTnQmXwXSIBEkzOn1N9sJit6oGV3oSgFA?e=hI1pDy)  Activity 8-7 Crime Scene Investigation [Click Here](https://wardlhs.weebly.com/uploads/1/3/2/9/13292041/activity_8-7.pdf)  -Darlie Routier Video  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EbgAQ5a3eDlDrILCF4mXvxYBX2mwSwrr8rPexAOqtPVzXg?e=akPpgV)  -Dingo Case Study  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EQxLR-ju7qlAq0qXe-oWOLQBhjxwCKMPD3BWZC6lkRFtWQ?e=6eQTzI)  -Sam Sheppard Case Study [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EW7q9EKqR2xNmfzab_P_8oEBeXT_cyV6YOzGpjuFS21CqA?e=7oLpya)  -David Camm Case Study  [Click Here](https://investigatinginnocenceblog.com/2020/01/28/the-case-of-david-camm/)  -CH 8 Reading Guide  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EReIs69pzOtOk2sIFydjv1QBc4N7S1-8lOsVbBWG-e_geA?e=TjZ1Pv) | Agglutination, angle of impact, antibodies, antigen, antigen-antibody response, area of convergence, area of origin, cast-off pattern, passive drop, satellite, spine |
|  | **Unit 9: Forensic Toxicology** |  |  |
| Forensic science utilizes all levels of scientific inquiry, specifically chemistry, human physiology and biochemistry,to analyze physical evidence with the ultimate goal of recreating the events of the crime for a jury in a court of law. This unit focuses on drugs, toxicology and the chemistry of alcohol, physical evidence collection and analysis using technology that incorporates core principles from chemistry, physics, biochemistry and human physiology. | **Objectives:**   * Provide examples of drugs, poisons, and toxins * List factors that affect drug toxicity * Describe the role of a toxicologist in analyzing substance evidence * Compare and contrast presumptive testing and confirmatory testing * Describe how people get exposed to environmental toxins * Distinguish among the terms: tolerance, addiction, dependence, and withdrawal * Relate the signs and symptoms of overdose with a specific substance or combination of substances * Show the relationship between the law, crime, and the use of drugs   **Next Generation Science Standards**  **HS-LS1-2** - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.  **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  **HS-PS1-5** - Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.  **HS-PS2-6** - Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. | Bertino Chapter 9  Activity 9-1 Drug Analysis  Pg 300  Activity 9-2 Should  Medical Marijuana Be Legalized? Pg 303  Activity 9-3 Drug Spot Test Pg 308  Toxicology Case Studies  [Click Here](https://ucps.instructure.com/courses/194517/assignments/1437982?module_item_id=3215564)  Forensic Case – Toxicology Tales  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/Ebj40flOQp1OtSe2y99vq-QBQVsxv7OU7LDlxPXZeEYuXQ?e=AeHO5c)  Bertino Forensics Reading Guide – Chapter 9  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EShuNzrpqjRGhZMOp2KGvroBw7F9GMSe7Acc2Ta-v1uagQ?e=OMPdQG) | Addiction, controlled substance, dependency, depressant, hallucinogen, illegal drug, narcotic, poison, stimulant, tolerance, toxicity, toxicology, toxin |
|  | **Unit 10: Handwriting Analysis, Forgery, and Counterfeiting** |  |  |
| This unit is designed to address the fundamental aspects of document examination as it applies to forensic science. Students will explore handwriting  analysis as well as some guidelines for collecting known writings for comparison to a questioned document. Students will also discuss some of the class and  individual characteristics of printers, photocopiers, inks. Students will use document examination techniques to uncover alterations, erasures, obliterations, and  variations in pen inks. Students will familiarize themselves with US currency security features and identify counterfeit currency. | **Objectives:**   * Explain how a sample of handwriting evidence is compared with an exemplar using both qualitative and quantitative characteristics * Describe some of the limitations of handwriting analysis * Identify a historical case of document fraud and explain how the fraudulent documents in technology for use in handwriting analysis * List and describe several ways in which businesses prevent check forgery * Describe features of new paper currency that protect against counterfeiting * Compare and contrast older paper currencies with new currencies, including those on plastic stock   **Next Generation Science Standards**  **HS-ETS1-1** - Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.  **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  **HS-PS1-2** Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table and knowledge of the patterns of chemical properties. | Bertino Chapter 10  Activity 10-1 Handwriting Analysis [Click Here](http://mrkingegsd.weebly.com/uploads/5/4/5/6/54567441/ch10_activities.pdf)  Activity 10-2 Analysis of Ransom Note and Expert  Testimony [Click Here](http://mrkingegsd.weebly.com/uploads/5/4/5/6/54567441/ch10_activities.pdf)  Activity 10-3 Examination of U.S. Currency: Is it Real  or a Forgery? [Click Here](http://mrkingegsd.weebly.com/uploads/5/4/5/6/54567441/ch10_activities.pdf)  Bertino Forensics Reading Guide – Chapter 10  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EZgU3f90netOrFlG_aq6Mb4BhD6DPNleOU5a5bgL91bWkw?e=aLR4ex)  Currency Training Course  [Click Here](https://www.uscurrency.gov/educational-materials/training-course)    Counterfeit Currency Webquest [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EcMZSwjZ9bRAiNaJ55Ha9fgBqpUvgSXhNc08PpZKuZhdYQ?e=vWDK7L)  Catch Me If You Can Article and worksheet  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EStw4lDrxOZBvusbTR8VrYUBUpPKJXfPVgZjx8o8dUaswg?e=gD6jXb)  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EUvqgOshV35DkCLb38vPhx4Bw8Byiq_i2y5LpoktzArpLw?e=aCnsB2)  The Accountant and Al Capone [Click Here](https://www.grantthornton.co.uk/insights/the-accountant-and-al-capone/)  The Enron Scandal  [Click Here](https://linkurious.com/blog/investigating-the-enron-email-dataset/)  [Videos](https://aguilarforensics.weebly.com/handwriting-analysis-forgery--counterfeiting) | Counterfeiting, currency, document analysis, document expert, exemplar, forgery, fraudulence, questioned document |
|  | **Unit 11: Forensic Entomolgy** |  |  |
| Forensic entomology is an exciting field that uses insect evidence at a crime scene to help solve a crime. Specimens are analyzed by forensic entomologists who identify species and stages of development. Using accumulated degree hour studies, an entomologist can estimate how long it took for the insects collected at the crime scene to develop to their current stage under local conditions. The pattern of insect succession that occurs on a body undergoing decomposition is predictable and provides evidence of first colonization of a body. | **Objectives:**   * Describe several examples of the ways that forensic entomology is used to help solve crimes. * Compare and contrast the four stages of blowfly metamorphosis, and describe the significance of blowflies in forensic entomology. * Describe the function of each of the following organs on blowflies and explain the significance of each structure to forensic entomology: spiracles, mouth hooks, crop. * Describe the effect of different environmental factors on insect development. * Describe the five stages of decomposition. * Relate the process of insect succession to the changing environment that occurs during the stages of decomposition. * Explain how forensic entomologists interpret forensic evidence and environmental conditions to estimate a postmortem interval. * Explain how insect evidence is analyzed to provide evidence of the deceased person’s identity or drug, poison, or toxin exposure. * Summarize the procedures for documenting and collecting insect evidence from a crime scene.   **Next Generation Science Standards**  **HS-LS1-1** - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells  **HS-LS1-2** - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.  **HS-LS2-2** - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. | Bertino Chapter 11  Activity 11-1 How to Raise Blowflies for Forensic Entomology Pg 370  Activity 11-2 Mini Projects for Forensic Entomology Pg 375  Activity 11-3 Observation of Living or Preserved  Blowflies or Houseflies: Adult, Larvae and Pupae  Activity Pg 377  Activity 11-4 Factors Affecting Postmortem Interval  Estimates and Accumulated Degree Hours Pg 381  Blow Fly Case Study  [Click Here](https://docs.google.com/document/d/1H6TN_Z--ZrYZB9GgLMHFNhrD-TPS7Igoi9EFu1dyjL8/edit)  [Crime Solving Insects](http://www.sfu.museum/forensics/eng/)  Forensic Entomology Webquest [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EfbklQyaUXNDr7WgOrsZbP4BxINSUDl3heJxq6vP9oA8Rg?e=NgvlHG)  Bertino Forensics Reading Guide – Chapter 11  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EXTDF0te2yFBusoqfK9Si7ABQGpYbQiAlbWMTPU7EfF5OQ?e=LIeYID) | Accumulated degree hour (ADH), metamorphosis, crop, entomology, forensic entomology, grub, insect succession, instar, larva, maggot, oviposition, pupa, spiracles |
|  | **Unit 12: Death: Manner, Mechanism, Cause** |  |  |
| To recognize cause and effect of death on the human body, the chronological chains of events, related biological and chemical changes, the  connections between humans and other living things, and understand the potential data made available by concurrent events. | **Objectives :**   * Distinguish between cellular death and death of an organism. * Distinguish among four manners of death: natural, accidental, suicidal, and homicidal. Explain the fifth classification, undetermined. * Distinguish among cause, manner, and mechanism of death. * Outline the sequence of events that occurs in the first few minutes after death. * Explain how algor, rigor, and livor mortis develop following death and describe how their development is affected by environmental factors. * Sequence and describe the chemical and physical changes during decomposition, including autolysis, putrefaction, marbling, and adipocere formation. * Analyze the evidence from algor, livor, and rigor mortis, stomach contents, and decomposition, along with environmental factors to estimate a postmortem interval. * Compare and contrast the roles of medical examiners and coroners. * Describe the procedures of an autopsy, and give examples of how an autopsy helps establish the cause of death, manner of death, and postmortem interval. * Support the claim that it is often difficult to pinpoint the postmortem interval.   **Next Generation Science Standards**  **HS-LS1-1** - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells  **HS-LS1-2** - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.  **HS-LS2-2** - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.  **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  **HS-PS1-5** - Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. | Bertino Chapter 12  Manner, Mechanism and Cause of Death  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EWuwpx0QGfFGherYd3cIIzUBimYpqqr3ygf6MLWGePgoCg?e=ecY45M)  Activity 12-1 Calculating Postmortem Interval Using Rigor Mortis  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EdrivliCkttAkOpk8p7lGwUBpI0MCxC6pGteXmgZlt_5Rg?e=JFJDgE)  Activity 12-2 Calculating Postmortem Interval Using Algor Mortis Pg 408  Activity 12-3 Tommy the Tub Pg 411  Activity 12-4 Analysis of Evidence from Death Scenes Pg 414  Virtual Autopsy  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EUkS8MfXrSdCh9OTOGCq-LsBeRQUwWCqtXpUKerkHFlBwg?e=qmPvH0)  The Body Farm Video  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EWad9y7wqk1Og0x2vZH-rb4B3wPwbcEdBy8jUB6NaZO1BA?e=AKWDU8)    Paul Bernardo Case  [Click Here](https://www.oxygen.com/true-crime-buzz/paul-bernardo-karla-homolka-ken-and-barbie-killers)  Bertino Forensics Reading Guide – Chapter 12  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EecCrbJh8LxHmPXINiLmoeEBBBN_rYNWYbguzGTh7Csabg?e=79oCOl) | algor mortis, autolysis, autopsy, cause of death, coroner, manner of death, mechanism of death, medical examiner, putrefaction, rigor mortis, decomposition, livor mortis |
|  | **Unit 14: Forensic Anthropology** |  |  |
| To understand the composition, development and structure of bones to recognize the wealth of post mortem information made available. | **Objectives:**   * Summarize the information a forensic anthropologist derives from skeletal remains to construct a biological profile. * Distinguish among growth plates, bone caps, bone shafts, and sutures, and explain their significance for forensic anthropology. * Compare and contrast an adult’s skeleton and a child’s skeleton in terms of composition, number of bones, suture marks, and growth plates. * Summarize the information a forensic anthropologist derives from skeletal remains to construct a biological profile. * Distinguish among growth plates, bone caps, bone shafts, and sutures, and explain their significance for forensic anthropology. * Compare and contrast an adult’s skeleton and a child’s skeleton in terms of composition, number of bones, suture marks, and growth plates. * Provide examples of different types of skeletal trauma due to disease, injuries, occupation, or environmental factors that can provide clues to the identification of skeletal remains. * Discuss the significance of isotopes in determining where someone lived. * Describe methods used to analyze skeletal remains, including radiology, computer imaging, DNA technology, video or photographic superimposition, and craniofacial reconstruction.   **Next Generation Science Standards**  **HS-LS1-1** - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells  **HS-LS1-2** - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.  **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.  **HS-LS3-1** - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.  **HS-LS4-1** - Communicate scientific information that ancestry and biological evolution are supported by multiple lines of empirical evidence. | Bertino Chapter 14  Bone Diagram Worksheet  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EY9RU6C9kGZBpD0w0SHijukBfrwcPxk_s1p_1d17SYGqMw?e=HPc1x3)  Activity 14-1 Determining the Age of a Skull Pg 467  Activity 14-2 Bones: Male or Female? Pg 468  Activity 14-3 Identifying the Romanovs: An Internet Activity Pg 470  Activity 14-4 Estimation of Body Size from Individual Bones Pg 475  Activity 14-5 What the Bones Tell Us Pg 476  Activity 14-6 Height and Body Proportions Pg 478  The Mystery of Bones  [Click Here](https://www.biologycorner.com/projects/bones/?classId=4eba5976-946c-420a-818c-c3dbbf5a7bae&assignmentId=94ac1623-875f-4f7e-a1c5-b69da5905526)  [Click Here](https://nfschools-my.sharepoint.com/:w:/g/personal/cciccone_nfschools_net/EWCJOdOqPHVFhcbzNuhcXykBfBZpTfnKR88M9xDHzo138g?e=YPE7el)  Scatter of Human Bones Activity [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/ETytseK697JMqgj7lIj2zAMB5pY_KS_yFsfFtYQ_lGQaIw?e=ed8p0c)  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EdFfSb6R6zVIm4HYpiTk-28B5vbelo2dztDSYPIC72b6Yw?e=BCuJFs)  Case Article – The Floating Feet [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/Ed_zk7FMi8BMkoGS5CxSqAIB5K9xE6j4Ja9-rvNvAEcXPg?e=Z3sClA)  John Wayne Gacy Case  [Click Here](https://moodlehub.ca/mod/book/view.php?id=5295&chapterid=8854)  Bertino Forensics Reading Guide – Chapter 14  [Click Here](https://nfschools-my.sharepoint.com/:b:/g/personal/cciccone_nfschools_net/EU-NN7Cc2WJKmJHnvwLm3dABrC0fExq9DpoGuM1XnnwrrQ?e=iJVCUW) | biological profile, diaphysis, epiphysis, forensic anthropology, growth plate (epiphyseal plate),  joints, ossification,  osteoporosis,  skeletal trauma analysis |