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| **TEXAS CTE LESSON PLAN**  [www.txcte.org](http://www.txcte.org) | |
| **Lesson Identification and TEKS Addressed** | |
| **Career Cluster** | Law, Public Safety, Corrections, & Security |
| **Course Name** | Forensic Science |
| **Lesson/Unit Title** | Forensic Anthropology |
| **TEKS Student Expectations** | **130.339. (c) Knowledge and Skills**  (3) The student uses scientific methods and equipment during laboratory and field investigations.  (F) The student is expected to collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures.  (16) The student explores principles of anthropology relevant to forensic science.  (A) The student is expected to identify the major bones of the human skeletal system.  (D) The student is expected to explain the characteristics of the human skeletal system indicative of specific gender, racial origin, and approximate range of age and height.  (E) The student is expected to explain the role of dental records in identification of human remains.  (17) The student calculates the time and cause of death in relationship to decomposition of the human body.  (A) The student is expected to explain the process and timeline of rigor mortis and its role in calculating time of death.  (C) The student is expected to determine time of death using entomology. |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | The students will be able to:   * Review the major bones of human skeletal system * Compare the composition and structure of human and animal bones * Describe the techniques used to excavate bones * Determine the unique characteristics of an individual (such as age, gender, race, and height) from his or her bones * Explain the role of Forensic Odontology * Explain the processes and timelines of human death and decomposition * Identify characteristics of Forensic Entomology |
| **Rationale** | If human remains are found, what can be determined about that person’s identity? Forensic Anthropology is concerned with the identification and examination of human skeletal remains. These remains can possibly reveal a person’s approximate age, sex, race, height, and physical injury. |
| **Duration of Lesson** | This lesson should take 3 Hours. |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | * Forensic Anthropology * Pathology * Odontology * Decomposition * Entomology * Necrophilious insects * Indigenous insects |
| **Materials/Specialized Equipment Needed** | * Bone Crossword Puzzle * Human Anthropology Lab * Handouts * Bones * Measuring tape/ruler * Calculator * Handouts * 2 foam cups * Gloves * Stereoscopic microscope or magnifying glass (if needed) * Forensic Entomology Lab * Forensic Entomology Lab Key * Chicken or beef liver (cut up) * Plastic containers with ventilated lids * Magnifying glass or stereoscopic microscope with petri dish * Forceps * Bone Review Crossword Puzzle and Key * X-rays of a human skeleton |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | Do an Internet search for the following articles:   * Forensic science central John Wayne Gacy * Forensic anthropology by Katherine Ramsland   Go to the first article above and read the story about John Wayne Gacy. Focus on the association of forensic anthropology. Then, continue reading the story in the second article above and identify the role of the following individuals within this case: Clyde Snow, Betty Gattliff, and Stanley Rhine. Use the Discussion Rubric for assessment. |
| **Direct Instruction \*** | I. Forensic Anthropology  A. The study of skeletonized human remains and their time of death to try to establish the identity and cause of death of an individual  B. Can possibly identify the following  1. Age  2. Sex  3. Race  4. Height  5. Pathologies that may be present  6. Whether trauma is evident  C. When bones are found, the following should be answered  1. Are they bones or some other type of material?  2. Are they human bones?  3. Is there only one individual present, or more than one?  4. How long have the bones been there?  5. What is the cause of death?  6. Who is this?  D. Age Determination  1. Sutures  a. Zigzag-like cracks appearing on the skull  b. Separated at birth, and gradually close from the inside out  c. The older the individual, the less visible sutures  2. In toddlers and infants, length of the long bones is measured and compared to known growth curves  3. After age 21, age is estimated by the level of change on the surfaces of the bones  E. Gender Determination  1. Males  a. Narrow pelvic opening  b. Long, narrow sacrum  c. Acute (less than 90o) subpubic angle  d. Overall larger skull  e. Pronounced brow bone  f. Overall robust skeleton  2. Females  a. Larger, circular pelvic opening  b. Wide sacrum  c. Wide subpubic angle (approximately 90o)  d. Smaller skull  e. Diminished brow bone  f. Overall slender skeleton  F. Race Determination  1. Most commonly divided into 3 categories  a. Mongoloid (Asian or Native descent)  1. Flat or projected outward frontal plane  2. Small, rounded nasal cavities  3. Circular eye orbits  b. Caucasoid (European)  1. Flat cranium  2. Long, narrow nasal cavities  3. Oval eye orbits  c. Negroid (African)  1. Cranium projected outward  2. Wide nasal cavity  3. Square eye orbits  G. Height Determination  1. Determined by measuring the long bones and calculating from known equations  2. The equations are different based on the bone, the race of the individual, and the gender  3. The long bones used are the femur, radius, tibia, and humerus  H. Other Determining Factors  1. A forensic anthropologist or sculptor may create facial reconstructions from skulls to help identify skeletal remains  2. Pathological identities such as past surgeries and broken bones that show healing and/or scarring  3. Trauma may be studied by observing cracks, holes, or tool marks on the bones  II. Excavation of Skeletal Remains  A. These are the guidelines provided to expose and recover remains to minimize their damage  B. Guidelines will differ based on scene conditions  C. The steps  1. Remove litter and vegetation if present  2. Stake out and map the exact excavation area  3. Determine the grave outline and remove the soil covering; sift each layer to check for evidence or small bones  4. Work in horizontal layers  5. As work continues, document with photography, maps, inventory, and measurements  6. Once all remains have been exposed, document again  7. Remove each bone separately and bag it individually  III. Forensic Odontology  A. The study of teeth for body identification  1. Can estimate age by observing deciduous teeth in children and wear patterns in older adults  2. Can be compared to dental records  3. May contain DNA  4. Teeth are harder to destroy in a fire than are bones  5. Can be used with bite mark identification  IV. Human Death  A. If death has occurred, the following must be determined  1. Cause  a. The disease or injury responsible for initiating the sequence of events that resulted in death  b. Examples  1. Gunshot wound  2. Drug overdose  3. Cardiovascular disease  2. Manner  a. The “reason” the cause of death occurred  b. Examples  1. Accidental  2. Homicidal  3. Natural  4. Suicidal  5. Undetermined  3. Mechanism  a. The immediate physiological derangement resulting in death  b. Examples  1. Hemorrhage  2. Cardiac arrhythmia  B. Stages of Decomposition  1. Fresh  a. Immediately after death  b. Blood is not pumping, so it drains and pools to the lower parts creating livor mortis, or lividity  c. Rigor mortis, the stiffening of the muscles, can also be seen  2. Bloat  a. When anaerobic metabolism causes gases to build up, making a body swell or bloat  b. Can cause fluids to leak or “purge” from orifices  3. Active decay  a. The greatest body mass loss  b. Most of the tissue is liquefied, and strong odors persist  c. Much of the maggot mass pupates  4. Advanced decay  a. Little insect activity  b. Bones are revealed  5. Dry remains  a. All that remains are dry skin, cartilage, and bones, either partially or fully skeletonized  V. Forensic Entomology  A. The study of insects and their life cycles to determine how long a body has been deceased  B. When a dead body is present, necrophilious insects, or insects that feed on dead tissue, will usually infest a body within 24 hours  C. The first and most commonly found insect is the blow fly  D. Other insects include  1. Flies in different stages of the lifecycle, including eggs, larvae, pupae, and adults  2. Several types of beetles that can either be necrophilious or predatory on other insects  3. Predator insects that prey on necrophilious insects  4. Omnivorous insects, such as ants and wasps, that might feed on the body itself, other insects, or the surrounding vegetation  5. Indigenous insects and/or spiders, might be present, but their presence is usually coincidental to the location of the body  E. The timeframe for lifecycle development is influenced by environmental conditions such as  1. Climate  2. Weather  3. Geographical location  4. Drugs and/or toxins present in the body |
| **Guided Practice \*** |  |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | 1. Bone Quiz. Have students complete the Bone Quiz (this allows students an opportunity to review their knowledge of the locations of the major bones).   * Use the Bone Quiz Key for assessment.   2. Who is the Skeleton in the Closet? – Human Anthropology Lab. Have students observe the differences between various characteristics of bones, including race, gender, height, and age. Use the Human Anthropology Lab handouts.   * Note: For this activity, you can use either an articulated skeleton or disarticulated bones. Having a separate skull, femur, humerus, and pelvic girdle helps with measurement. The information and activity in this assignment provide the basics needed to fulfill this objective. However, the level of difficulty can be increased by adding more calculations and observations, such as measuring subpubic angles with a protractor or using calipers for measurement. There are no set answers to the data tables and questions above because different bones are provided in the lab. However, there should be right/wrong answers based on the bones a student has, so the instructor will have to go through the lab first and observe/calculate the answers.   3. One Bite Out of Crime – Forensic Odontology Lab. Have students explore odontology by studying teeth and bite marks. Divide the class into two groups. After the students bite their cups, pick someone to be the suspect. Mark the two blank bites as “Crime Scene.” Throw away all other blank bite marks. Give one Crime Scene bite mark and one of each of the remaining  suspects to each of the groups. (See the lab handouts for more details.)   * Use the Forensic Odontology Lab Handouts for the activity and the Forensic Odontology Lab Key for assessment.   4. Forensic Entomology Lab. Have students observe the various stages of a fly’s life cycle on decomposing flesh. Use the Forensic Entomology Lab handouts and the Forensic Entomology Lab Key for assessment.   * Note: Make sure you complete a “Crime Scene Sample” ahead of time and document how many days it has been there. Students will compare the appearance and insects found with their daily observations to conclude how long the crime scene has been present. For the plastic containers, make sure holes in lids allow for ventilation, but not for other insects to intrude (or possible escape). Relatively nice weather is important. Stay away from excessive wind and cold temperatures if possible. Also, make sure nothing can “steal” the corpses. When placing the containers outside to sit, 30–40 minutes is usually adequate. |
| **Lesson Closure** | None |
| **Summative/End of Lesson Assessment \*** | * Forensic Anthropology Exam and Key * Bone Quiz and Key * Forensic Entomology Lab Key * Forensic Odontology Lab Key * Bone Crossword Puzzle Key * Discussion Rubric |
| **References/Resources/**  **Teacher Preparation** | * Saferstein, Richard. *Forensic Science: An Introduction.* New Jersey: Pearson Prentice Hall, 2008 * Saferstein, Richard. *Forensic Science: An Introduction.* 2nd ed. New Jersey: * Pearson Prentice Hall, 2011 * Saferstein, Richard. *Criminalistics: An Introduction to Forensic Science.* 8th ed. Upper Saddle River, NJ; Pearson Prentice Hall, 2004 * Do an Internet search for the following articles: * Forensic science central John Wayne Gacy * Forensic anthropology by Katherine Ramsland |
| **Additional Required Components** | |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | Science Standards  I. Nature of Science: Scientific Ways of Learning and Thinking  C. Collaborative and safe working practices  1. Collaborate on joint projects.  2. Understand and apply safe procedures in the laboratory and field,  including chemical, electrical, and fire safety and safe handling of live or  preserved organisms.  3. Demonstrate skill in the safe use of a wide variety of apparatuses,  equipment, techniques, and procedures. |
| **Recommended Strategies** | |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy**  **Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies**  **Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication**  **90 Second Speech Topics** |  |
| **Other Essential Lesson Components** | |
| **Enrichment Activity**  (e.g., homework assignment) | Students will review the names of bones and their locations by creating a life-size skeleton. Obtain several x-ray films from a local doctor’s office, hospital, etc. Trim them, leaving only the images of the bones, and separate bones of clusters such as ribs, vertebrae, bones of the hands, bones of the feet, etc. Have students divide into small groups. For each group, on a large piece of butcher paper, have the students outline someone’s body in the correct anatomical position (matching the x-ray). Students will receive a stack of x-ray films and must identify the bones and place them on the body in the correct location. Next, the groups will “tour” the other bodies to check for accuracy. Use the Discussion Rubric for assessment. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)