**STEM Innovation Academy Unit Plan**

| **Subject:** NJIT FRSC 201- Introduction to Forensic Science  **Unit Title:** Unit 5- Trace Evidence, Ballistics, and Impressions  **Grade:** 12th | | | | | | | | | **Teacher:** Ms. Dy-Anni Austin  **Duration:** 36-80 min blocks (6 Weeks) | | | | | |
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| **Unit Summary** | | | | | | | | | | | | | | |
| Trace Evidence examination is often challenged in court for its uncertainty. Nonetheless, characterization of hair and fiber evidence has played an important role in providing investigative leads in many criminal cases. It is not to be replaced in its entirety by DNA analysis, but to be used complementarity with other disciplines and technology in forensic science. Just as natural variations in skin ridge patterns and characteristics provide a key to human identification,minute random markings on surfaces can impart individuality to inanimate objects. Structural variations and irregularities caused by scratches, nicks, breaks,and wear permit the criminalist to relate a bullet to a gun; a scratch or abrasion mark to a single tool; or a tire track to a particular automobile. Individualization, so vigorously pursued in all other areas of Criminalistics,is frequently attainable in firearms and tool examination. | | | | | | | | | | | | | | |
| **Stage 1 – Desired Results** | | | | | | | | | | | | | | |
| **Enduring Understanding** *Students will understand that…*   * Human hair is a form of class evidence if no follicle is present. * The follicle of a human hair contains DNA. * The main function of hair is to help regulate body temperature. * Fibers are classified as natural or synthetic. * Textiles refer to the weaving patterns of fibers. * Many objects leave impressions that can be used as trace evidence * Different types of firearms have unique characteristics. * Spent cartridges and bullets can be matched with specific firearms used in crimes * There are procedures that can determine if an individual fired a weapon. | | | | | | **Essential Questions**   * How is hair used in a criminal investigation? * How can fibers be used as circumstantial evidence to provide links to the victim, suspect, and the crime scene? * Why is fiber evidence not always conclusive with suspect identification? * 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 be difficult to conceal? * How are the unique characteristics of firearms important to criminal investigations? | | | | | | | | |
| **Student Learning Objectives** | | | | | | | | | | | | | | |
| [*What students should be able to do after instruction.*](http://www.nextgenscience.org/sites/ngss/files/How%20to%20Read%20NGSS%20-%20Final%2008.19.13.pdf) | | | | | | | | | | | | [*Evidence Statements*](http://www.nextgenscience.org/sites/ngss/files/Front%20Matter%20Evidence%20Statements%20PDF%20Jan%202015_1.pdf) | | |
| Identify the various parts of hair | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Describe variations in the structure of the medulla, cortex, and cuticle | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Distinguish between human and nonhuman animal hair | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Explain how hair can be used in a forensic investigation. | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Calculate the medullary index for a hair | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Distinguish hairs from individuals belonging to the broad racial categories | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Determine if two examples of hair are likely to be from the same person. | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Identify and describe common weave patterns of textile samples | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Compare and contrast various types of fibers through physical and chemical analysis. | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Describe principal characteristics of common fibers used in their identification. | | | | | | | | | | | | HS-LS1-1  HS-LS1-2 | | |
| Distinguish between latent, patent, and plastic impressions | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Explain how various types of impressions can be used as trace evidence | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Use track width and wheelbase information to identify a motor vehicle | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Discuss the significance of tool mark impressions in criminal investigations | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Describe three major types of tool mark impressions | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Describe variations in tool surface characteristics that are used to identify individual tools | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Match tool marks with the instrument used to create same | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Describe how tool mark evidence is collected, preserved and documented | | | | | | | | | | | | HS-ETS1-2  HS-PS1-2 | | |
| Describe rifling on a gun barrel and explain how it marks a bullet | | | | | | | | | | | | HS-PS2-1  HS-PS2-2  HS-PS2-3 | | |
| Explain barrel size and caliber | | | | | | | | | | | | HS-PS2-1  HS-PS2-2  HS-PS2-3 | | |
| Describe how bullets are test fired and matched | | | | | | | | | | | | HS-PS2-1  HS-PS2-2  HS-PS2-3 | | |
| Discuss the role of ballistics recovery and examination at a crime scene | | | | | | | | | | | | HS-PS2-1  HS-PS2-2  HS-PS2-3 | | |
| Determine the position of the shooter based on bullet trajectory | | | | | | | | | | | | HS-PS2-1  HS-PS2-2  HS-PS2-3 | | |
| The Student Learning Objectives above were developed using [the following elements from the NRC document  *A Framework for K-12 Science Education*](http://www.nextgenscience.org/2ess2-earth-systems#framework): | | | | | | | | | | | | | | |
| **Science and Engineering Practices** | | | | | **Disciplinary Core Ideas** | | | | | **Crosscutting Concepts** | | | | |
| **Planning and Carrying Out Investigations:**  Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)  **Constructing Explanations and Designing Solutions:**  Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)  Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1 6),(HS-LS2-3)  **Using Mathematics and Computational Thinking**  Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4)  **Engaging in Argument from Evidence**  Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)  Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8)  **Analyzing and Interpreting Data:**  Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3)  **Obtaining, Evaluating, and Communicating Information:**  Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1) | | | | | * LS1: From Molecules to Organisms: Structures and Processes * LS3: Heredity: Inheritance and Variation of Traits * PS2.A: Forces and Motion * ET S1.B: Developing Possible Solutions | | | | | * Patterns   + Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. * Cause and effect   + Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. * Structure and function   + Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.   **Connections to Nature of Science**  Science is a human endeavor   * Technological advances have influenced the progress of science and science has influenced advances in technology. * Science and engineering are influenced by society and society is influenced by science and engineering. | | | | |
| **Stage 2 – Assessment Evidence** | | | | | | | | | | | | | | |
| **What activities truly support this as an honors level class? Use the last three stages of Bloom’s Taxonomy to address this section including 4-analyze- drawing connections among ideas, 5- evaluate- justify a stance or decision, 6- create- produce original work.**  ***Performance Task 1:* Hair and Fiber Variability  *(approximately 4-80 min blocks)***  An effective demonstration of the variability of hair over the human scalp is to have your students compare at least six to eight hairs that have been wet-mounted. Upon completion of the examination, the class is asked to estimate the number of individuals that contributed to the hair collection. Of course, the collection consists of hair from only one individual. The instructor should compile at least 24 hair mounts from one person for this experiment. Additionally, each student is to examine his or her own scalp hair using a glycerin wet mount. Students should also be encouraged to bring in hair from household pets for examination.  **Fibers.** To demonstrate the difficulty of analyzing fiber evidence, find three or four scraps of different material and snip or pull several fiber samples from each. Each scrap should consist of a different type of fiber. At least some of the scraps should contain several different colors; from those scraps collect samples of at least two different colors. Number the samples and record the scrap from which each sample came (do not reveal this information to the students before the demonstration). Have the students examine the scraps with the naked eye and, if possible, under a microscope. Afterward, ask them to indicate which samples they believe came from the same scraps of material and why.  **Questions**  1. How is the hair cuticle used to identify different animal species?  2. What aspect of the hair cortex is most important for the criminalist and why?  3. What is the follicular tag and why is it important to forensic scientists studying hair?  4. In comparing two hair samples, what aspects of the hair is the criminalist particularly interested in matching? What other features of hair are important to compare?  5. Which of the following cannot be confidently determined by a microscopic examination of hair: age, sex, racial origin, the part of the body from which the hair came, or whether the hair was pulled out or fell out?  6. Why are most hair specimens collected at crime scenes not good sources of DNA?  7. What type of hair specimens are potentially the richest source of nuclear DNA and why?  8. What is mitochondrial DNA and why is it useful in analyzing hair samples?  9. List three important considerations when submitting hair samples to a crime laboratory.  10. How has mass production limited the value of fiber evidence?  11. What is the first and most important step in the examination of a fiber? What physical characteristics of fibers might help an examiner identify it?  12. How can microspectrophotometry and chromatography be used to analyze fiber evidence?  13. Name two analytical devices used by forensic scientists to determine the class of a fiber.  **DIFFERENTIATION**: To accurately measure three‐dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.  **TECHNOLOGY**: Chromebooks and internet. Padlet.  ***Performance Task 2****:* **Tool Marks** ***(approximately 2- 80 min blocks)***  The preparation of tool mark casts can readily be accomplished with liquid silicone rubber or silicone rubber putty. Both of these products are available from Sirchie FingerPrint Laboratories, 100 Hunter Place, Youngsville, NC 27596. Alternatively, one can use model clay to make a tool mark cast.  Materials   * 6 used screwdrivers * Piece of wooden board or stiff cardboard * Jar of Play-Doh or other easy-to-use modeling clay (1 for each group)   Procedure  Tool marks and other impressions left at a crime scene are most helpful when they exhibit individual characteristics – variations that distinguish one particular tool, tire, or shoe from all others of its type. In this exercise, students will identify tools based on their individual characteristics. Students should be matched up in teams of four or five. Place the screwdrivers on a table where they are accessible to all teams and mark each with an identifying number or letter. Each team places their modeling clay onto the board and molds it into a shape suitable to hold impressions. One team member takes the clay to the table and makes impressions in the clay with three of the screwdrivers, noting on a separate paper which screwdrivers made each impression. When all teams have finished making impressions, teams trade their impressions with another and note which team they trade with. Each team now has 5 minutes to study the impressions and the screwdrivers and determine which ones made the impressions in the clay. The instructor should allow no more than 2 teams to study the screwdrivers at the same time.  Follow-Up Questions   1. Which screwdrivers made the impressions in your clay? Consult with the team you traded with to determine if you correctly identified all three marks. 2. Were some of the marks easier to identify than the others? What factors made identification easier? 3. Tool marks are often found in harder substances such as wood. How would identifying tool marks in wood be different from identifying them in clay?   **DIFFERENTIATION**: To accurately measure three‐dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.  **TECHNOLOGY**: Chromebooks and internet.  ***Performance Task 3****:* **Footprint Casting** ***(approximately 2- 80 min blocks)***  I always require my class to prepare a cast of a footprint in the laboratory. Each student is asked to bring in a shoe box partially filled with soil. Other supplies required are a can of aerosol hair spray with a lacquer base (spraying the lacquer carefully over the impression will harden it); a 5-pound bag of plaster of Paris; several tongue depressors or a length of wire mesh to serve as reinforcing material; and a mixing bowl.  The following guidelines should be followed when preparing the cast:   1. Spray the lacquer over the impression, being careful not to disturb the details of the impression. 2. Pour the plaster of Paris in two steps. First, add enough plaster to water to make an initial pouring approximately ½ inch thick. The consistency of the mixture should be that of sour cream. Do not pour the material directly onto the impression, but over a tongue depressor or spoon to prevent marring the impression. The cast may then be reinforced with tongue depressors or wire mesh. 3. After reinforcing the cast, prepare another mixture of plaster of Paris for an additional pouring approximately ½ inch thick. 4. Before the plaster completely dries, mark it for identification on the upper surface.   **DIFFERENTIATION**: To accurately measure three‐dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.  **TECHNOLOGY**: Chromebooks and internet.  ***Performance Task 4****:* **Other Impressions: Lip Prints** ***(approximately 1- 80 min blocks)***  This demonstration shows how various types of impressions can be used to help solve a crime. You will need the following items:   * Six tubes of red lipstick (all the same color) * 48 pieces of white paper * Stereomicroscope * Ruler   The Scenario  Each month the local women’s club sponsors a luncheon at which several prospective new members are invited to attend. This month’s meeting was held at the home of club president Janet Graves. Ms. Graves asks the prospective members to wait in her sunroom while the regular members hold a brief business meeting. While they wait they are served lemonade in crystal glasses. Later that day, after the luncheon, Ms. Graves notices that a diamond necklace is missing from her bedroom. When the police arrive they notice a crystal glass in the room with red lipstick on the rim. Ms. Graves states that it must have been used by one of the guests, because she does not wear red lipstick. Suspecting that the person who used the glass was probably the one who stole the necklace, police lift lip prints from the glass. After collecting the names of the prospective members, police visit each woman and take her lip prints for comparison to the prints on the glass.  Divide the students into investigative teams. Choose six students at random as “suspects” and give each six pieces of paper and a tube of lipstick. Have each suspect apply the lipstick, fold each sheet of paper in half, and blot her lips on the paper, making sure not to smudge the lip print. This way you will have six lip prints for each suspect. Have each suspect write her name on a piece of notebook paper and attach the papers with the lip prints to the notebook paper. Each suspect gives the prints to the instructor, who will decide which print matches those found at the scene.  Place the print chosen as the crime scene print under the stereomicroscope. Have one member of each team sketch the print, noting any special characteristics as well as the line patterns in the print. Now have each suspect apply lipstick and make a lip print for the class. Write the person’s name on the paper containing the print. Now have the teams examine each of these prints under the stereomicroscope, then sketch and make notes on them.  After students have completed sketching and note taking, ask them to answer the following questions: Which suspect left the prints on the glass found in the bedroom? What features of the suspect lip prints led you to this conclusion? Is this enough evidence to convict the suspect of theft? Why or why not?  **DIFFERENTIATION**: To accurately measure three‐dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.  **TECHNOLOGY**: Chromebooks and internet. | | | | | | | | | | | | | | |
| **Other Evidence:** | | | | | | | | | | | | | | |
| **Before**  **KWL** – Students will list what they know and what they want to know about the main topics of this unit.  **Brainstorming** – Students will discuss what they know about Scientific Inquiry by breaking down the word and coming up with various meanings.  **Quick Writes** – Before each lesson students will be asked to write their thoughts and questions for the day pertaining to the objectives.  **Pretest** –Students will be given an assessment to understand their knowledge on the unit before any instruction is given. | | | **During**  **Journals** – Students will complete daily journal reflections and take notes when necessary.  **Lab Investigations** – Students will complete one or more lab investigation(s) exploring and utilizing chemistry principles.  **Daily Assignments** – Students will be given vocabulary assignments and calculation problems.  **Observations** –Students will write down any observations in their journals as witnessed in class or during their labs.  **Think-Pair-Share** – Students will work in pairs to discuss vocabulary and reinforce rules as they are introduced.  **Quizzes –** Give short quizzes or Exit Cards - to show mastery of concepts needed before moving to the next concept. | | | | | | | | | **After**  **Unit Test** – Students will be given a test after the unit has been completed and Presentations have been given  **PowerPoint Project** – Students will create a PowerPoint Presentation (as a group) of this unit. This will include various concepts, experimental data, vocabulary, and applications in the “real world”. | | |
| **Student Self-Assessment and Reflection**:  Students will write down their questions and or comments of the day’s events. They will write their questions about any topics or problems they may have, and they will discuss them as a class the following day. Students will also write down any observations they experienced during labs and/or lecture presentations into their Journals. | | | | | | | | | | | | | | |
| **Stage 3 – Learning Plan** | | | | | | | | | | | | | | |
| **Differentiated Instruction (by student readiness):**  **Tiers 2-3**: Students who have scored a 3 or below (approaching expectations) on the ELA and Math NJSLAs   1. Scaffolding 2. Group work 3. Peer tutoring 4. One on one discussions 5. Office hour appointments 6. Laboratory Investigations 7. Group PowerPoint Presentation 8. Unit Test   **Tier 1**: Students who have scored a 4 or 5 (met or exceeded expectations) on the ELA and Math NJSLAs   1. One on one discussions 2. Office hour appointments 3. Laboratory Investigations 4. Group PowerPoint Presentation 5. Unit Test | | | | | | | | | | | | | | |
| **Learning Activities**   1. Human Hair Analysis 2. Animal Hair Analysis 3. Fiber Analysis 4. Ballistics Trajectory Calculations 5. Nova Documentary: JFK Assassination 6. Glass Analysis and Snell’s Law 7. Toolmark Analysis 8. Teeth Impression 9. Shoe Impressions 10. The Science Spot <http://sciencespot.net/Pages/classforsci.html> 11. OREGON STATE POLICE FORENSIC SERVICES DIVISION - <http://www.crime-scene-investigator.net/Phys_Evid_Manual_OR.pdf> 12. World of Forensic Science -<http://www.encyclopedia.com/doc/1G2-3448300449.html> 13. BSAPP Forensics -<http://www.bsapp.com/forensics_illustrated/forensic_text_adobe/text_unit_2_physical_evidence.pdf> 14. Forensic Dentistry <http://science.howstuffworks.com/forensic-dentistry.htm> 15. Ballistics Webquest <http://www.firearmsid.com/> 16. The Forensics Library <http://aboutforensics.co.uk/firearms-ballistics/> 17. Firearms Tutorial <http://library.med.utah.edu/WebPath/TUTORIAL/GUNS/GUNINTRO.html> 18. Footwear and Tire track Examination <http://www.forensicsciencesimplified.org/fwtt/how.html> | | | | | | | | | | | | | | |
| **Vocabulary:**  bore, breech face, caliber, choke, distance determination, ejector, extractor, firearms identification, gauge, Greiss test, grooves, lands, rifling, snell’s aw, refraction, radial fracture, density, anagen phase, catagen phase, cortex, cuticle, follicular tag, macromolecule, manufactured fibers, medulla, mitochondrial DNA, molecule, monomer, natural fiber, nuclear DNA, polymer, telogen phase. | | | | | | | | | | | | | | |
| **Literacy and Math Connections:**  *English Language Arts/Literacy –*  RST.11-12.2. 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.  RST.11-12.3. 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.  RST.11-12.4. 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*.  RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.  RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible  *Mathematics –*  4.5 B. Communication  1. Use communication to organize and clarify their mathematical thinking  2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.  3. Analyze and evaluate the mathematical thinking and strategies of others.  4.5 C Connections  3. Recognize that mathematics is used in a variety of contexts outside of mathematics.  4. Apply mathematics in practical situations and in other disciplines.  4.5 D Reasoning  4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.  5. Make and investigate mathematical conjectures  4.5 E Representations  1. Create and use representations to organize, record, and communicate mathematical ideas as pictorial or symbolic. | | | | | | | | | | | | | | |
| **Expert/Field Experiences:**  **NJIT Forensic Science Mock Apartment**  *David Fisher*  *University Heights, NJ 07102* | | | | | | | | | | | | | | |
| **Connection to End of Year Project:**  Students will participate in a Murder in Miniature Project based on Fransis Glessner Lee’s Nutshells.  For this final project, in a team of up to two students, you will design and create a diorama of a crime scene (murder). You will give your diorama a title and brief description along with a detailed crime scene sketch and autopsy report of the victim. You will then give a presentation (from the perspective of a prosecutor) linking all of the evidence to a particular suspect. This three part project will be your ‘final exam’ grade in this college course. It will count as ONE test grade and TWO authentic assessment grades for the 4th marking period at STEM. This project has three parts: Diorama, Written Portion, and Prosecution Presentation. [Murder in Miniature Worksheet with Rubric](https://docs.google.com/document/d/1pnhOLggfrlSEM64QZo-A4KUgBhP6Rs2B4GdEqURonaQ/edit). This unit provides opportunities for self-organization, group cooperation, and idea sharing, as well as proper research techniques, repeat trails, error analysis, and communication of results through a presentation or model. | | | | | | | | | | | | | | |

**Modifications**

| **Special Education/ 504:** | **English Language Learners:** |
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| -Adhere to all modifications and health concerns stated in each IEP.  -Give students a MENU option, allowing students to pick assignments from different levels based on difficulty.  -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time  -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write  -Provide breaks between tasks, use positive reinforcement, use proximity  -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives  -Implement supports for students with disabilities [(click here)](https://drive.google.com/file/d/1ezZ9goEaY-5BfQSeY_-ZftWm6bI0HptK/view?usp=sharing)  - Make use of strategies imbedded within lessons  -Common Core Approach to Differentiate Instruction: Students with Disabilities [(pg 17-18)](https://drive.google.com/open?id=1J0mPbnb0pIlJk1VMCB8725ClGH3KNVP6) | - Use manipulatives to promote conceptual understanding and enhance vocabulary usage  - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction  - During i-Ready lessons, click on “Español” to hear specific words in Spanish  - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information  - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems  - Utilize program translations (if available) for L1/ L2 students  - Reword questions in simpler language  - Make use of the ELL Mathematical Language Routines (click [here](https://drive.google.com/open?id=11OPlRBw6Gpa1TrJdZydunDjNfcgRtkJA) for additional information)  -Scaffolding instruction for ELL Learners  -Common Core Approach to Differentiate Instruction: Students with Disabilities [(pg 16-17)](https://drive.google.com/open?id=1J0mPbnb0pIlJk1VMCB8725ClGH3KNVP6) |
| **Gifted and Talented:** | **Students at Risk for Failure:** |
| - Elevated contextual complexity  - Inquiry based or open ended assignments and projects  - More time to study concepts with greater depth  - Promote the synthesis of concepts and making real world connections  - Provide students with enrichment practice that are imbedded in the curriculum such as:  ● Application / Conceptual Development  ● Are you ready for more?  - Provide opportunities for math competitions  - Alternative instruction pathways available  - Common Core Approach to Differentiate Instruction: Students with Disabilities [(pg. 20)](https://drive.google.com/open?id=1J0mPbnb0pIlJk1VMCB8725ClGH3KNVP6) | - Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum  - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support  - Constant parental/ guardian contact  - Provide academic contracts to students & guardians  - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives.  - Plan to address students at risk in your learning tasks, instructions, and directions. Anticipate where the needs will be, then address them prior to lessons.  -Common Core Approach to Differentiate Instruction: Students with Disabilities [(pg 19)](https://drive.google.com/open?id=1J0mPbnb0pIlJk1VMCB8725ClGH3KNVP6) |

| **21st Century Life and Career Skills:**  Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.  <https://www.state.nj.us/education/cccs/2014/career/9.pdf> | |
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| ● **CRP1**. Act as a responsible and contributing citizen and employee.  ● **CRP2**. Apply appropriate academic and technical skills.  ● **CRP3**. Attend to personal health and financial well-being.  ● **CRP4**. Communicate clearly and effectively and with reason.  ● **CRP5**. Consider the environmental, social and economic impacts of decisions.  ● **CRP6**. Demonstrate creativity and innovation. | ● **CRP7**. Employ valid and reliable research strategies.  ● **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.  ● **CRP9**. Model integrity, ethical leadership and effective management.  ● **CRP10**. Plan education and career paths aligned to personal goals.  ● **CRP11**. Use technology to enhance productivity.  ● **CRP12**. Work productively in teams while using cultural global competence. |
| **Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.** | |

| **Technology Standards:**  All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.  [**https://www.state.nj.us/education/cccs/2014/tech/**](https://www.state.nj.us/education/cccs/2014/tech/) | |
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| **8.1 Educational Technology:**    All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.    A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.  B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.  C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.  D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.  E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.  F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. | **8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:**    All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.    A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.  B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.  C. **Design:** The design process is a systematic approach to solving problems.  D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.  E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge. |