

# TOWNSHIP OF UNION PUBLIC SCHOOLS



## Forensic Science Curriculum Guide Revised December 2018

## **Mission Statement**

The mission of the Township of Union Public Schools is to build on the foundations of honesty, excellence, integrity, strong family, and community partnerships. We promote a supportive learning environment where every student is challenged, inspired, empowered, and respected as diverse learners. Through cultivation of students' intellectual curiosity, skills and knowledge, our students can achieve academically and socially, and contribute as responsible and productive citizens of our global community.

## **Philosophy Statement**

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is formulation of a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

## **Statement of District Goals**

- **Develop reading, writing, speaking, listening, and mathematical skills.**
- **Develop a pride in work and a feeling of self-worth, self-reliance, and self discipline.**
- **Acquire and use the skills and habits involved in critical and constructive thinking.**
- **Develop a code of behavior based on moral and ethical principals.**
- **To be able to work with others cooperatively.**
- **Acquire a knowledge and appreciation of the historical record of human achievement and failures and current societal issues.**
- **Acquire a knowledge and understanding of the physical and biological sciences.**
- **Efficient and effective participation in economic life and the development of skills to enter a specific field of work.**
- **Appreciate and understand literature, art, music, and other cultural activities.**
- **Develop an understanding of the historical and cultural heritage.**
- **Develop a concern for the proper use and/or preservation of natural resources.**
- **Develop basic skills in sports and other forms of recreation.**

## **Course Description**

Forensic Science is an all-encompassing term which refers to the application of science and technology to law. This course will focus on the integration of science and technology for the purpose of solving crimes and enforcing criminal and civil law. This course will allow the student to apply their knowledge of biology, chemistry and physics to analyze evidence, evaluate crime scenes and solve crimes.

Forensic Science will allow the student to understand the importance of science and technology in everyday life. Students will also be introduced to many careers that support and relate to forensic science. Many of these careers that are related to forensic science encourage students to continue their education to the doctorate level, however, there are also related careers that the student can pursue from high school.

Utilizing student centered learning, cooperative learning, technology, practical laboratory activities, cross curricular and STEM activities, this full year course will introduce the student to advanced concepts in the Sciences while seeking to increase scientific literacy.

## **Recommended Textbooks**

Saferstein, Richard, Forensic Science: An Introduction, Pearson Prentice Hall, NJ 2008

Saferstein, Richard, Basic Laboratory Exercises for Forensic Science, Pearson Prentice Hall, NJ 2008

Ancillary materials supplied as needed

## Course Proficiencies

### Students will be able to...

1. Describe the history, origin, and progression of criminalistics and forensic science.
2. Describe a crime scene setup, legal ramifications and documentation of a crime scene.
3. Identify the types and uses of physical evidence via organic analysis and microscopic analysis.
4. Cite the differences between man made and natural hair fibers and morphology of each.
5. Discuss how serology, nature of blood, blood typing and staining patterns of blood play a role in blood analysis.
6. Interpret findings of DNA profiling.
7. Apply the history/ origin/ fundamental principles of fingerprinting to the laboratory methods of detecting fingerprints, as well as footprints, bite marks, arson, explosives, ballistics, anthropology, drugs, toxicology and document forgery.
8. Apply the practical laboratory/ investigative techniques learned in class to analyze a staged crime scene, along with various clues and evidence for identification

## Curriculum Units

Unit 1: History and Introduction to Criminalistics/ Forensics

Unit 2: The Crime Scene and  
Evidence: Identification and Collection

Unit 3: Fingerprints, Hair & Fiber Analysis

Unit 4: Drug Identification and Toxicology

Unit 5: Ballistics, Forensic Serology and Anthropology

Unit 6: Surveillance and Trace Evidence II

Unit 7: Arson, Explosives, Document analysis and forgery

## Pacing Guide- Course

<b><u>Content</u></b>	<b>Number of Days</b>
<b><u>Unit 1:</u></b> History and Introduction to Criminalistics/ Forensics	12
<b><u>Unit 2:</u></b> The Crime Scene and Evidence: Identification and Collection	25
<b><u>Unit 3:</u></b> Fingerprints, Hair & Fiber Analysis	28
<b><u>Unit 4:</u></b> Drug Identification and Toxicology	24
<b><u>Unit 5:</u></b> Ballistics, Forensic Serology and Anthropology	40
<b><u>Unit 6:</u></b> Surveillance and Trace Evidence II	15
<b><u>Unit 7:</u></b> Arson, Explosives, Document analysis and Forgery	36

**Unit 1; History and Introduction to Criminalistics/ Forensics**

*Essential Questions:*

- What is Forensic Science?
- Who are the major contributors to the development of forensic science?
- What is a crime laboratory and what services do they provide?
- Are there any important court decisions that define forensic science?
- What are expert witnesses?

*Instructional Objectives/ Concepts:*

- Define forensic science/ criminalistics.
- List areas of forensic science that require expertise in specific realms of science and technology.
- Name and know contributions of scientists to the development of forensic science.
- Cite examples of the type of crime labs that exist at different government levels within the United States
- Explain the admissibility of scientific evidence in the courtroom with respect to judicial decisions.
- Understand and explain the roles, responsibilities and qualifications of the expert witness.

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate

*Evaluations may include:*

- Case Study Analysis
  - Crime Scene Analysis: Lab
- Practical
- Final Exam
  - Tests
  - Quizzes
  - Debate
  - Student Presentations
  - Lab Reports
  - Research Paper
- Exit Cards
- Formative assessments

<ul style="list-style-type: none"> <li>• Student Research/ Letter Writing, Interviews, Library Research</li> <li>• Unsolved Crime Scene Analysis from Actual Local Case Studies</li> <li>• Games: Jeopardy,</li> <li>• Movies</li> <li>• Relevant CSI episodes to material</li> </ul>	
<p><b>NGSS</b> HS-ETS1-1, HS ETS1-3</p>	<p><b>CCLS Literacy</b> RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9, WHST.11-12.5, WHST.11-12.10</p>

## **Unit 2: The Crime Scene and Evidence: Identification and Collection**

### *Essential Questions:*

- What can be considered physical evidence and how can it be properly collected to maintain its integrity for court proceedings?
- What responsibilities do various members of law enforcement have as they arrive at a crime scene?
- How is a crime scene properly documented or recorded?
- What types of physical evidence are typically found at a crime scene?
- What is the difference between identification and comparison of physical evidence?
- What techniques are used to analyze physical evidence?
- What value is placed on physical evidence relative to criminal investigation?

### *Instructional Objectives/ Concepts:*

- Define physical evidence.
- Discuss the role of the first responding officer as well as subsequent investigators that arrive at a crime scene.
- Understand the roles and responsibilities of the different forensic scientists that may be involved in analyzing physical evidence.
- Understand what “chain of custody” is, who is responsible for it and what the ramifications are if it is broken.
- Describe the roles of the forensic entomologist, odontologist, anthropologist and pathologist as they relate to a homicidal investigation
- Describe procedures to systematically search a crime scene for physical evidence.
- Demonstrate/describe proper techniques for collecting and packaging common types of physical evidence.
- Analyze, illustrate and label a crime scene correctly.
- Properly analyze collected physical evidence using good laboratory technique.
- List and describe the common types of evidence found at a crime scene
- Discuss the difference between identification and comparison of physical evidence.
- Discuss the difference between individual and class characteristics with examples of such as it pertains to physical evidence.
- Describe the value of physical evidence as it pertains to criminal investigation
- List and describe the various major computerized databases that relate to physical evidence.

- Explain the role physical evidence plays in crime scene reconstruction during criminal investigation

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local Case Studies
- Games: Jeopardy
- Movies
- Relevant CSI episodes to material

*Evaluations may include:*

- Case Study Analysis
- Crime Scene Analysis: Lab Practical
- Final Exam
- Tests
- Quizzes
- Debate
- Student Presentations
- Lab Reports
- Research Papers
- Exit Cards
- Formative assessments

**NGSS:**

HS-ETS1-1, HS ETS1-3

**CCLS Literacy:**

RST.11-12.3, RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9, WHST.11-12.1.D, WHST.11.12.5, WHST.11-12.10

**CCLS Mathematics**

MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.3

### **Unit 3: Fingerprints, Hair & Fiber Analysis**

#### *Essential Questions: (Fingerprints)*

- How are fingerprints different between individuals?
- The work of which scientists led to our knowledge and understanding that fingerprints are a vital tool for identification?
- How are fingerprints related to forensic science and criminal investigation?
- What technological resources are available to law enforcement to identify unknown fingerprints recovered at a crime scene?

#### *Instructional Objectives/ Concepts:*

- Name those individuals who made significant contributions to the development of fingerprint technology and its ultimate acceptance as a tool for identification.
- Discuss the case of William West
- Define and describe ridge characteristics
- Explain why fingerprints are an unchangeable feature of human anatomy.
- List the three major fingerprint patterns as well as their subclasses
- Describe the differences between visible, latent, and plastic fingerprints
- List and describe methods for developing prints on both porous and non-porous objects
- Describe methods utilized to preserve a developed latent print
- Explain what automated fingerprint identification system is and how it is used in criminal investigation

#### *Essential Questions: (Hair and Fiber Analysis)*

- How does hair as physical evidence relate to forensic science and investigation?
- How do fibers as physical evidence relate to forensic science and investigation?

#### *Instructional Objectives/ Concepts:*

- Describe the anatomical structure of hair
- Know the three phases of hair growth
- Differentiate between animal and human hairs
- Describe/demonstrate proper methods of collection and packaging of both hair and fibers

- Describe how DNA can be obtained from hair samples
- Describe microscopic features of both hair and fibers that are useful for comparison and identification
- Describe properties of fibers that can be used for investigation in forensic science.

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local Case Studies
- Games: Jeopardy
- Movies
- Relevant CSI episodes to material

*Evaluations may include:*

- Case Study Analysis
  - Crime Scene Analysis: Lab Practical
  - Final Exam
  - Tests
  - Quizzes
  - Debate
  - Student Presentations
  - Lab Reports
  - Research Papers
- Exit Cards  
Formative assessments

**NGSS**

HS-ETS1-1, HS-ETS1-2, HS-ETS1-3  
HS-LS1-1, HS-LS1-2, HS-LS3-2

**CCLS Literacy**

RST.11-12.3, RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9,  
WHST.11.12.5, WHST.11-12.10

**CCLS Mathematics**

MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.3

## Unit 4: Drug Identification and Toxicology

### *Essential Questions:*

- How are drugs related to forensic science?
- How can drugs be analyzed using principles of chemistry?
- What is the Controlled Substances Act and how does it relate to drug classification?
- How does alcohol affect the human body?
- What court proceedings led to alcohol related traffic enforcement?
- How can poisoning be detected in the body?
- Why are most consumer products tamper resistant?

### *Instructional Objectives/Concepts:*

- Differentiate between psychological and physical dependence
- List and classify commonly abused drug
- Know the type of dependency (psychological/physical) that may be caused by the more commonly abused drugs
- Know the schedules and meaning of some of the Controlled Dangerous Substances Act
- Describe both field and laboratory tests that forensic chemists may employ to identify an unknown drug
- Describe the process of gas chromatography
- Describe mass spectrometry and its usefulness in drug identification
- Describe proper techniques of collection and preservation of drug evidence
- Describe how alcohol is absorbed, travels through the body and ways it is eliminated from the body.
- Describe the human circulatory system
- Describe the design of the Breathalyzer as well as the chemical reaction which takes place in the presence of alcohol.
- Explain what a field sobriety test through words and demonstration
- Discuss laboratory procedures for blood alcohol analysis
- Know driving impairment levels at the state and federal level
- Explain the significance of *Schmerber v. California* relative to traffic enforcement.
- Discuss hair analysis as it relates to toxicology

- Discuss major poisoning cases and how they were solved
- Know how Tylenol was tampered with, its results and how changes were subsequently made to all consumer food and drug products.
- Describe methods for isolating and identifying drugs and poisons.
- Describe the role of the toxicologist in the criminal justice system.

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local Case Studies
- Games: Jeopardy
- Movies
- Relevant CSI episodes to material

*Evaluations may include:*

- Case Study Analysis
- Crime Scene Analysis: Lab Practical
- Final Exam
- Tests
- Quizzes
- Debate
- Student Presentations
- Lab Reports
- Research Papers

**NGSS**

HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-PS1-2

**CCLS Literacy**

RST.11-12.3, RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9, WHST.11.12.5, WHST.11-12.10

**CCLS Mathematics**

MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.3

## **Unit 5: Ballistics, Forensic Serology and Anthropology**

### *Essential Questions: (Ballistics):*

- What are firearms, what types of firearms are there?
- How can examination link a bullet or cartridge to a firearm?
- How is NIBIN/IBIS vital to criminal investigation?

### *Instructional Objectives/ Concepts:*

- Differentiate between a handgun and rifle
- Know basic mechanics of revolver & semi-automatic handgun
- Describe how a barrel is rifled
- List both class and individual characteristics of bullets and cartridges
- Use with good technique a comparison microscope to compare bullets and cartridges
- Distinguish between caliber and gauge and describe how they are determined
- Describe how databases are important to law enforcement
- Describe how to determine shooting distance
- Describe Gun Shot Residue test and how it is utilized
- Describe how obliterated serial numbers can be restored
- Know proper technique to collect and package all firearm evidence
- Explain how a tool mark can be compared to a suspects tool

### *Essential Questions:(Forensic serology)*

- How does the study of blood contribute to forensic science?
- How can body fluids be identified at a crime scene?
- How does the study of blood spatter help with crime scene reconstruction?
- In what ways can body fluids be detected at a crime scene?

### *Instructional Objectives/ Concepts:*

- Explain the ABO blood typing system and the genetic reasoning behind it concerning antigens and antibodies.(5.5)

- Describe agglutination and how and why this happens.
- Know what a presumptive blood test is
- Explain how human blood can be differentiated from animal blood
- Use a Punnet Square to determine genotype and phenotype of offspring
- Describe how physical evidence is collected in a rape investigation.
- Describe how serologic stains are preserved and packaged for laboratory analysis.

*Essential Questions:(Forensic Anthropology)*

- What is forensic anthropology and odontology, and how are they used in forensic investigation?
- What is the morphology and physiology of bones and teeth?

*Instructional Objectives/ Concepts:*

- Describe the origin and structure of human bones and teeth.
- Discuss how the characteristics of bone and muscle help provide valuable clues in forensic investigation.
- Compare and contrast bones in regard to age, disease, and race.

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research

*Evaluations may include:*

- Case Study Analysis
- Crime Scene Analysis: Lab Practical
- Final Exam
- Tests
- Quizzes
- Debate
- Student Presentations
- Lab Reports
- Research Papers

<ul style="list-style-type: none"> <li>• Unsolved Crime Scene Analysis from Actual Local Case Studies</li> <li>• Games: Jeopardy,</li> <li>• Movies(<i>Fracture</i>)</li> <li>• Relevant CSI episodes to material</li> </ul>	
<p><b>NGSS</b>  HS-ETS1-1, HS-ETS1-2, HS-ETS1-3  HS-LS1-1, HS-LS1-2, HS-LS3-1, HS-LS3-2, HS-LS3-3  HS-PS2-1</p>	<p><b>CCLS Literacy</b>  RST.11-12.3, RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9,  WHST.11.12.9, WHST.11-12.10</p> <p><b>CCLS Mathematics</b>  MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.3</p>

**Unit 6: Surveillance and Trace Evidence II**

*Essential Questions:*

- How are trace elements important to forensic science?
- How are trace elements detected?
- What methods of surveillance are used in modern detective work?
- What federal and local requirements must be met for surveillance to take place?

*Instructional Objectives/Concepts:*

- Describe the usefulness of trace elements for the forensic comparison of various types of physical evidence.
- Define the term isotope.
- Define radioactivity.
- Explain how elements can be made radioactive.
- Describe the components of paint.
- Describe the proper collection and preservation of paint evidence.
- List the important forensic properties of soil.
- Describe the density-gradient tube technique.
- Describe the proper collection of soil evidence.

*Strategies and Activities may include:*

- Guest Speakers
- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local and National Case Studies
- Games: Jeopardy
- Movies(*Enemy of the State*)
- Relevant CSI episodes to material
- 

*Evaluations may include:*

- Case Study Analysis
- Crime Scene Analysis: Lab
- Practical
- Final Exam
- Tests
- Quizzes
- Debate
- Student Presentations
- Lab Reports
- Research Papers
- Exit Cards
- Formative assessments

**NGSS:**

HS-ETS1-1, HS-ETS1-2, HS-ETS1-3  
HS-PS1.2, HS-PS1.8

**CCLS Literacy**

RST.11-12.7, RST.11-12.8, RST.11-12.9, WHST.11.12.4, WHST.11-12.5, WHST.11-12.10

**CCLS Mathematics**

MP.2, HSN-Q.A.1, HSN-Q-A.3

## **Unit 7: Arson, Explosives, Document Analysis and Forgery**

### *Essential Questions:*

- What is arson?
- How can fire scenes be investigated by forensic science?
- How are explosives classified?
- How can suspected bombing scenes be investigated by forensic science?
- What are the major goals of forensic handwriting analysis?
- What major technologies are used in document and handwriting analysis?
- What are ways businesses prevent fraud and forgery?
- How is paper currency protected from counterfeiting?

### *Instructional Objectives/Concepts:*

- Define heat of combustion and ignition temperature.
- Describe the difference between an exothermic and endothermic chemical reaction.
- List the requirements necessary to initiate and sustain combustion.
- Describe how physical evidence must be collected at the scene of a suspected arson.
- Describe the laboratory procedure used for the detection and identification of hydrocarbon residues.
- Explain how explosives are classified.
- Identify some common commercial, homemade, and military explosives.
- Describe how physical evidence must be collected at the scene of a suspected arson or explosion.
- Describe common individual characteristics associated with handwriting.
- Define “questioned document”.
- List some important guidelines to be followed for the collection of known writings for comparison to a questioned document.
- Describe class and individual characteristics of a typewriter.
- Analyze typewritten passages and associate to suspect typewriter

### *Strategies and Activities may include:*

- Guest Speakers

### *Evaluations may include:*

- Case Study Analysis

- Crime Scene Analysis / Reenactment
- Power Point Presentations
- Student Presentations
- Actual Case Studies from News Media
- Overhead transparencies
- Demonstrations
- Web Quests
- Laboratory Activities: Group and Individual
- Small Group Discussions
- Debate
- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local and National Case Studies
- Games: Jeopardy,
- Movies (*Catch me if You Can*)
- Relevant CSI episodes to material

- Crime Scene Analysis: Lab Practical
- Final Exam
- Tests
- Quizzes
- Debate
- Student Presentations
- Lab Reports
- Research Papers
- Exit Cards
- Formative assessments

**NGSS**

HS-ETS1-1, HS-ETS1-2, HS ETS1-3

**CCLS Literacy**

RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9,  
WHST.11.12.4,WHST.11-12.5, WHST.11-12.10

**CCLS Mathematics**

MP.2, HSN-Q.A.1, HSN-Q-A.3

## Next Generation Science Standards and Common Core Literacy Standards

### **EXPECTED OUTCOMES with link to NGSS and CCLS**

The following list identifies the relevant standards to the course material:

- 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-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- 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-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay
- HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the Mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- 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-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
- 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-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.
- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
- 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.11-12.1 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.
- 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.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.
- 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.
- WHST.11-12.1.D Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- WHST.11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
- WHST.11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- HSN.QA.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.
- HSN.QA.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- MP.2 Reason abstractly and quantitatively with mathematics
- MP.4 Model with mathematics

**The following standards are threaded throughout all units of the NJSL-Science:**

**21st Century Life and Career Standards: Career Awareness, ELD Standards, and Technology Standards.**

**WIDA ELD Standards: Teaching with Standards | WIDA**

WIDA has established language development standards for English and Spanish. These standards represent the language students need to be successful in early childhood programs and Grades K-12.

The first standard, **Social and Instructional Language**, reflects the ways in which students interact socially to build community and establish working relationships with peers and teachers in ways that support learning.

The remaining four standards present ways multilingual learners can communicate information, ideas and concepts necessary for academic success in **Language Arts, Math, Science** and **Social Studies**.

**Specifically in Science Standard 4- Language of Science- English Language learners communicate information, ideas and concepts necessary for academic success in the content area of science.**

**New Jersey Student Learning Standards**

**Standard 9**

**21st Century Life and Careers**

In today's global economy, students need to be lifelong learners who have the knowledge and skills to adapt to an evolving workplace and world. To address these demands, Standard 9, 21st Century Life and Careers, which includes the 12 Career Ready Practices, establishes clear guidelines for what students need to know and be able to do in order to be successful in their future careers and to achieve financial independence.

**Mission:** *21st century life and career skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the 21st century global workplace.*

**Vision:** To integrate 21st Century life and career skills across the K-12 curriculum and to foster a population that:

- Continually self-reflects and seeks to improve the essential life and career practices that lead to success.
- Uses effective communication and collaboration skills and resources to interact with a global society.
- Is financially literate and financially responsible at home and in the broader community.
- Is knowledgeable about careers and can plan, execute, and alter career goals in response to changing societal and economic conditions.
- Seeks to attain skill and content mastery to achieve success in a chosen career path.

### **Career Ready Practices**

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.

#### **CRP1. Act as a responsible and contributing citizen and employee.**

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that

contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

**CRP2. Apply appropriate academic and technical skills.**

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

**CRP3. Attend to personal health and financial well-being.**

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial wellbeing, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

**CRP4. Communicate clearly and effectively and with reason.**

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

**CRP5. Consider the environmental, social and economic impacts of decisions.**

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

**CRP6. Demonstrate creativity and innovation.**

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices,

and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

**CRP7. Employ valid and reliable research strategies.**

Career-ready individuals are discerning in accepting and using new information to make decisions, changes. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

**CRP9. Model integrity, ethical leadership and effective management.**

Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

**CRP10. Plan education and career paths aligned to personal goals.**

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

**CRP11. Use technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

**CRP12. Work productively in teams while using cultural global competence.**

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

## 2014 New Jersey Core Curriculum Content Standards - Technology

<b>Content Area</b>		<b>Technology</b>	
<b>Standard</b>		<b>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.</b>	
<b>Strand</b>		<b>A. Technology Operations and Concepts:</b> <i>Students demonstrate a sound understanding of technology concepts, systems and operations.</i>	
<b>Grade Level bands</b>	<b>Content Statement</b> <b>Students will:</b>	<b>Indicator</b>	<b>Indicator</b>
<b>P</b>	Understand and use technology systems.	8.1.P.A.1	Use an input device to select an item and navigate the screen
		8.1.P.A.2	Navigate the basic functions of a browser.
	Select and use applications effectively and productively.	8.1.P.A.3	Use digital devices to create stories with pictures, numbers, letters and words.
		8.1.P.A.4	Use basic technology terms in the proper context in conversation with peers and teachers (e.g., camera, tablet, Internet, mouse, keyboard, and printer).
		8.1.P.A.5	Demonstrate the ability to access and use resources on a computing device.
<b>K-2</b>	Understand and use technology systems.	8.1.2.A.1	Identify the basic features of a digital device and explain its purpose.

	Select and use applications effectively and productively.	8.1.2.A.2	Create a document using a word processing application.
		8.1.2.A.3	Compare the common uses of at least two different digital applications and identify the advantages and disadvantages of using each.
		8.1.2.A.4	Demonstrate developmentally appropriate navigation skills in virtual environments (i.e. games, museums).
		8.1.2.A.5	Enter information into a spreadsheet and sort the information.
		8.1.2.A.6	Identify the structure and components of a database.
		8.1.2.A.7	Enter information into a database or spreadsheet and filter the information.
<b>3-5</b>	Understand and use technology systems.	8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
	Select and use applications effectively and productively.	8.1.5.A.2	Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.
		8.1.5.A.3	Use a graphic organizer to organize information about problem or issue.
		8.1.5.A.4	Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.
		8.1.5.A.5	Create and use a database to answer basic questions.
		8.1.5.A.6	Export data from a database into a spreadsheet; analyze and produce a report that explains the analysis of the data.
<b>6-8</b>	Understand and use technology systems.	8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
	Select and use applications effectively and productively.	8.1.8.A.2	Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
		8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
		8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results
		8.1.8.A.5	Create a database query, sort and create a report and describe the process, and explain the report results.
<b>9-12</b>	Understand and use technology systems.	8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
	Select and use applications effectively	8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or

	and productively.		professional audience and present it to peers and/or professionals in that related area for review.
		8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
		8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
		8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
<b>Content Area</b>		<b>Technology</b>	
<b>Standard</b>		<b>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.</b>	
<b>Strand</b>		<b>B. Creativity and Innovation:</b> <i>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.</i>	
Grade Level bands	Content Statement Students will:	Indicator	Indicator
P	Apply existing knowledge to generate new ideas, products, or processes.	8.1.P.B.1	Create a story about a picture taken by the student on a digital camera or mobile device.
K-2	Create original works as a means of personal or group expression.	8.1.2.B.1	Illustrate and communicate original ideas and stories using multiple digital tools and <a href="#">resources</a> .
3-5		8.1.5.B.1	Collaborative to produce a digital story about a significant local event or issue based on first-person interviews.
6-8		8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
9-12		8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
<b>Content Area</b>		<b>Technology</b>	
<b>Standard</b>		<b>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.</b>	
<b>Strand</b>		<b>C. Communication and Collaboration:</b> <i>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.</i>	
<b>Grade</b>	<b>Content Statement</b>	<b>Indicator</b>	<b>Indicator</b>

<b>Level bands</b>			
<b>P</b>	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.	8.1.P.C.1	Collaborate with peers by participating in interactive digital games or activities.
<b>K-2</b>	Communicate information and ideas to multiple audiences using a variety of media and formats.  Develop cultural understanding and global awareness by engaging with learners of other cultures.	8.1.2.C.1	Engage in a variety of developmentally appropriate learning activities with students in other classes, schools, or countries using various media formats such as online collaborative tools, and social media.
<b>3-5</b>		8.1.5.C.1	Engage in online discussions with learners of other cultures to investigate a worldwide issue from multiple perspectives and sources, evaluate findings and present possible solutions, using digital tools and online resources for all steps.
<b>6-8</b>		8.1.8.C.1	Collaborate to develop and publish work that provides perspectives on a global problem for discussions with learners from other countries.
<b>9-12</b>		8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
<b>Content Area</b>	<b>Technology</b>		
<b>Standard</b>	<b>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.</b>		
<b>Strand</b>	<b>D. Digital Citizenship:</b> <i>Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.</i>		
<b>Grade Level bands</b>	<b>Content Statement</b>	<b>Indicator</b>	<b>Indicator</b>
<b>K-2</b>	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.2.D.1	Develop an understanding of ownership of print and nonprint information.
<b>3-5</b>	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.5.D.1	Understand the need for and use of copyrights.
		8.1.5.D.2	Analyze the resource citations in online materials for proper use.
	Demonstrate personal responsibility for	8.1.5.D.3	Demonstrate an understanding of the need to practice cyber safety, cyber

	lifelong learning.		security, and cyber ethics when using technologies and social media.
	Exhibit leadership for digital citizenship.	8.1.5.D.4	Understand digital citizenship and demonstrate an understanding of the personal consequences of inappropriate use of technology and social media.
<b>6-8</b>	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.8.D.1	Understand and model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics including appropriate use of social media.
	Demonstrate personal responsibility for lifelong learning.	8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
		8.1.8.D.3	Demonstrate an understanding of fair use and Creative Commons to intellectual property.
	Exhibit leadership for digital citizenship.	8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.D.5		Understand appropriate uses for social media and the negative consequences of misuse.	
<b>9-12</b>	Advocate and practice safe, legal, and responsible use of information and technology.	8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
	Demonstrate personal responsibility for lifelong learning.	8.1.12.D.2	Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.
		8.1.12.D.3	Compare and contrast policies on filtering and censorship both locally and globally.
	Exhibit leadership for digital citizenship.	8.1.12.D.4	Research and understand the positive and negative impact of one's digital footprint.
8.1.12.D.5		Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.	
<b>Content Area</b>	<b>Technology</b>		
<b>Standard</b>	<b>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.</b>		
<b>Strand</b>	<b>E: Research and Information Fluency: <i>Students apply digital tools to gather, evaluate, and use information.</i></b>		

<b>Grade Level bands</b>	<b>Content Statement</b> <b>Students will:</b>	<b>Indicator</b>	<b>Indicator</b>
<b>P</b>	Plan strategies to guide inquiry.	8.1.P.E.1	Use the Internet to explore and investigate questions with a teacher's support.
<b>K-2</b>	Plan strategies to guide inquiry  Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.	8.1.2.E.1	Use digital tools and online resources to explore a problem or issue.
<b>3-5</b>	Plan strategies to guide inquiry.  Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.	8.1.5.E.1	Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.
<b>6-8</b>	Plan strategies to guide inquiry.  Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.	8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

	Process data and report results.		
9-12	Plan strategies to guide inquiry.	8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.  Process data and report results.	8.1.12.E.2	Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
<b>Content Area</b>		<b>Technology</b>	
<b>Standard</b>		<b>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.</b>	
<b>Strand</b>		<b>F: Critical thinking, problem solving, and decision making:</b> <i>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.</i>	
<b>Grade Level bands</b>	<b>Content Statement</b> <b>Students will:</b>	<b>Indicator</b>	<b>Indicator</b>
K-2	Identify and define authentic problems and significant questions for investigation.  Plan and manage activities to develop a solution or complete a project.  Collect and analyze data to identify solutions and/or make informed decisions.  Use multiple processes and diverse perspectives to explore alternative	8.1.2.F.1	Use geographic mapping tools to plan and solve problems.

	solutions.		
<b>3-5</b>	<p>Identify and define authentic problems and significant questions for investigation.</p> <p>Plan and manage activities to develop a solution or complete a project.</p> <p>Collect and analyze data to identify solutions and/or make informed decisions.</p> <p>Use multiple processes and diverse perspectives to explore alternative solutions</p>	8.1.5.F.1	Apply digital tools to collect, organize, and analyze data that support a scientific finding.
<b>6-8</b>	<p>Identify and define authentic problems and significant questions for investigation.</p> <p>Plan and manage activities to develop a solution or complete a project.</p> <p>Collect and analyze data to identify solutions and/or make informed decisions.</p> <p>Use multiple processes and diverse perspectives to explore alternative solutions.</p>	8.1.8.F.1	Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.
<b>9-12</b>	<p>Identify and define authentic problems and significant questions for investigation.</p> <p>Plan and manage activities to develop a solution or complete a project.</p>	8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

	Collect and analyze data to identify solutions and/or make informed decisions.		
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	Use multiple processes and diverse perspectives to explore alternative solutions.		
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