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TOWNSHIP OF UNION PUBLIC SCHOOLS
Administration

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District Security…………………………………………………………………………………………Mr. Nicholas Ardito
DEPARTMENT SUPERVISORS

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Mathematics/Science 2-5 ............................................................ Ms. Theresa Matthews
Language Arts/Library Services 9-12 .......................................... Ms. Randi Moran
Science 6-12 ............................................................................. Ms. Maureen Guilfoyle
Math 6-12 ................................................................................. Dr. Jeremy Cohen
Social Studies/Business ............................................................. Ms. Libby Galante
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English/Math/Science/Social Studies K-2 ..................................... Ms. Maureen Corbett
Curriculum Committee
Academic Area

Maureen Guilfoyle, Supervisor of Science

Dr. Richard Massarelli
Dr. Edward J. Boffa
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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 conductive 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


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.
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## Pacing Guide - Course

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<td>Essential Questions:</td>
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<tr>
<td>What is Forensic Science?</td>
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<td>Who are the major contributors to the development of forensic science?</td>
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<td>What is a crime laboratory and what services do they provide?</td>
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<td>Are there any important court decisions that define forensic science?</td>
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<tr>
<th>Instructional Objectives/ Concepts:</th>
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<tr>
<td>Define forensic science/ criminalistics.</td>
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<td>List areas of forensic science that require expertise in specific realms of science and technology.</td>
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<tr>
<td>Name and know contributions of scientists to the development of forensic science.</td>
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<td>Cite examples of the type of crime labs that exist at different government levels within the United States</td>
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<td>Explain the admissibility of scientific evidence in the courtroom with respect to judicial decisions.</td>
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<td>Understand and explain the roles, responsibilities and qualifications of the expert witness.</td>
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- Student Research/ Letter Writing, Interviews, Library Research
- Unsolved Crime Scene Analysis from Actual Local Case Studies
- Games: Jeopardy,
- Movies
- Relevant CSI episodes to material

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<th>NGSS</th>
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<td>RST.11-12.4, RST.11-12.7, RST.11-12.8, RST.11-12.9, WHST.11-12.5, WHST.11-12.10</td>
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</tbody>
</table>
## 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:**

**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
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- Games: Jeopardy
- Movies
- Relevant CSI episodes to material

**Evaluations may include:**
- Case Study Analysis
- Crime Scene Analysis: Lab Practical
- Final Exam
- Tests
- Quizzes
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- 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**

**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
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.

**NGSS**
- 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

**CCLS Literacy**

**CCLS Mathematics**
- MP.2, MP.4, HSN-Q.A.1, HSN-Q-A.3
**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 are major technologies 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  | • Crime Scene Analysis: Lab Practical |
| • Power Point Presentations          | • Final Exam                          |
| • Student Presentations             | • Tests                               |
| • Actual Case Studies from News Media| • Quizzes                             |
| • Overhead transparencies           | • Debate                              |
| • Demonstrations                    | • Student Presentations               |
| • Web Quests                        | • Lab Reports                         |
| • Laboratory Activities: Group and Individual | • Research Papers               |
| • Small Group Discussions           | • Exit Cards                          |
| • Debate                            | • Formative assessments               |
| • 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  |                                      |

**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
PARCC Scoring Rubric