Unit 1: Analysis of Glass

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **3 weeks**
Status: **Published**

Brief Summary of Unit

This unit focuses on the study and application of glass as evidence in forensic science. Analysis of glass evidence has wide-reaching implications in forensic science given the prevalence of glass. This analysis provides students and investigators with the opportunity to sequence impacts, place suspects or vehicles at the scene of the crime, and as well as other pertinent information. Some topics students will discuss will include how glass is made, the influence of composition on glass formation, calculations for density and refractive index, fracture pattern analysis, sequencing, and determining the direction of impact. Students will participate in direct instruction, laboratory style, and inquiry-based instruction techniques to deliver the material.

Revised: July 2023

Essential Questions/Enduring Understandings

Essential Questions

- What can be determined from glass evidence and what is its value?
- How can the physical properties of glass be utilized to determine if two pieces of glass originate from the same source?
- How can fracture patterns in glass determine the number and direction of impacts?

Enduring Understandings

- Students can perform tests and calculations on glass samples (density, refractive index, etc.) to discern the chemical and physical properties of glass, demonstrating the likelihood of samples originating from the same source.
- Students are adept at demonstrating differences in fracture patterns in glasses, identifying primary and secondary fracture patterns, and using the 3R Rule to determine the sequence and direction of impacts based on fracture patterns.

Objectives

- Students will know the main chemical components of glass.
- Students will know the impact of adding additional components to the formation of glass type.
- Students will know the main types of glass and their uses.

- Students will be skilled at identifying the differences in fracture patterns of different types of glass.
- Students will be skilled at calculations pertaining to the density of glass.
- Students will be skilled at calculations pertaining to the refractive index of glass.
- Students will know Snell's Law and how to apply it.
- Students will be skilled at applying the 3R rule to determine the sequence and direction of impact.
- Students will know the 3R rule and what each R represents.
- Students will know the relevance and applicability of glass evidence to resolving investigations.

Learning Plan

- Review lab safety and emergency procedures.
    - Ensure students are aware of the locations of important safety equipment (ie eye wash station, fire extinguisher, etc.)
- Review classroom expectations and guidelines to optimize success.
- Preview essential questions and connect to learning throughout the unit.
- Establish prior knowledge and understanding prior to the start of the unit.
- Introduction to the material via direct instruction with the use of Google Slides presentations and infographics.
- Participate in demonstrations and activities that build upon information delivered via direct instruction.
- Have students create and participate in a jigsaw activity using scissors and paper.
- Identify the differences in fracture patterns, physical characteristics, and other features in shattered glass samples of different chemical compositions.
- Complete sample analysis and calculation questions for density, refractive index, and sequencing.
- Locate and consider case studies where glass analysis and evidence are utilized.
- Participate in a laboratory activity where glass is broken, practicing shattering patterns, sequencing, the 3R rule, and side of impact.
    - Other lab activities--> Visual comparison of glass types, determining the density of glass, determining the refractive index of glass
    - Students will wear protective eyewear (safety goggles), gloves where appropriate, double bag glass, tape glass, and adhere to the proper protocol to ensure safety and success.
- Watch an episode of Forensic Files that demonstrates how glass evidence and analysis are used to investigate and solve a crime.
- Develop a complex understanding of how glass evidence and analysis can be used to resolve an investigation.

Assessment

Formative

- Do Now Questions
- Exit Ticket Questions
- Whole class discussion participation
- Small group discussion participation
- Individual student questions/responses

- Independent tasks
- Lab experiments
- Quizzes

Summative

- Unit test
- Lab activities throughout the unit
    - Jigsaw Lab Activity
    - Density & Refractive Index Lab
    - Visual Comparison of Glass Lab
    - Glass Fracture Pattern Lab w/ Lab Report

Benchmark

- Final Exam

Alternative Assessments

- Open note test
- Project on glass-->Create your own case study

Materials

- Forensic Science, An Introduction by Roy Saferstein textbook
- Glass Analysis Google Slides
- Assorted episodes of Forensic Files & CSI Season 1
- Lab materials

Standards

P.1	Act as a responsible and contributing community members and employee.
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
P.4	Demonstrate creativity and innovation.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
P.6	Model integrity, ethical leadership and effective management.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
P.7	Plan education and career paths aligned to personal goals.
P.8	Use technology to enhance productivity increase collaboration and communicate

	effectively.
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
MA.K-12.5	Use appropriate tools strategically.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
P.9	Work productively in teams while using cultural/global competence.
LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
LA.K-12.NJSLSA.W7	Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
LA.K-12.NJSLSA.W8	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
MA.F-BF.B	Build new functions from existing functions
LA.W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
LA.W.11-12.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.K-12.NJSLSA.SL4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.SL5	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
LA.K-12.NJSLSA.L1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
LA.K-12.NJSLSA.L2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L6	Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
LA.L.9-10.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
LA.L.9-10.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
ETS1.C	Optimizing the Design Solution
	Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.
	Mathematical and computational thinking in 9–12 builds on K–8 experiences and

	progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
	Cause and Effect
	Constructing Explanations and Designing Solutions
	Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
	Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
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ETS1.B	Developing Possible Solutions
	Analyzing and Interpreting Data
	Asking Questions and Defining Problems
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.