Unit 02: Physics/Pattern Interpretation

Content Area: **Science**
Course(s): **Forensics**
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

Standards

ETS1.C	Optimizing the Design Solution
PS1.B	Chemical Reactions
PS2.A	Forces and Motion
	Systems and System Models
	Patterns
	Obtaining, Evaluating, and Communicating Information
	Constructing Explanations and Designing Solutions
	Cause and Effect
	Asking Questions and Defining Problems
ETS1.A	Delimiting Engineering Problems

Enduring Understandings

1. Conclusions must be continually revised in the light of new evidence.
2. There are a limited number of methods in a forensic scientist's "bag of tricks" that get used over and over again in different situations.
3. The choice of which trick to use depends on the chemical and physical properties of the materials being tested.
4. When two objects come in contact with one another there will be a transfer of evidence.
5. Fingerprints are unique to individuals and can be used as evidence in arguing which individuals were present at a crime scene.
6. Different types of firearms have unique characteristics.
7. Spent cartridges and bullets can be matched with specific firearms used in crimes.
8. Handwriting becomes personalized almost as soon as students begin learning it.
9. Questioned documents and other collected documents can be analyzed for handwriting comparisons to determine if the author of each is the same.
10. Inks (printer, pen, and photocopier) can be compared to determine if they share a common source.
11. Questioned documents may be analyzed for alterations, obliterations, erasures, or variations in pen

inks.

12. Analysis of blood spatter is one of the few ways one can reconstruct the events occurring during a crime.

13. Individual blood stains can convey the directionality and impact of the blood when it strikes a surface.

Essential Questions

1. Why is individualization more convincing as evidence than simple classification?

2. Why do you need to have references in analysis?

3. How can the various methods for processing,classifying, and identifying fingerprints aid in a criminal investigation?

4. Do scientists really "know" that fingerprints are unique?

5. How much evidence is enough?

6. How are different types of impressions used in forensic investigations?

7. How can handwriting be used as individual evidence?

8. How can the forensic scientist detect forgeries or counterfeits?

9. How can information be inferred based on blood spatter patterns?

10. How can crime scene reconstruction assist forensic scientists in solving crimes?

Knowledge and Skills

Knowledge:

1. Students will know impressions can be 2 dimensional or 3 dimensional.

2. Students will know how to cast impressions and maintain their integrity.

3. Students will know an electrostatic lifter can be used to lift delicate impressions made in dust.

4. Students will know that there are class characteristics of impressions which can be used to exclude suspects or narrow down the field/search for a suspect.

5. Students will know that the individual characteristics of impressions can be used to link impressions to a person, place, or thing.

6. Students will know the anatomy of a shoe print and be able to identify the: outsole, vamp, tread design.

7. Students will know the appropriate procedures for matching impressions.
8. Students will know how to predict a person's height from their shoe size.
9. Students will know the anatomy of a tire and be able to identify the: rib, tread marks, groove, sipe, tire identification number, track width, wheelbase, and turning diameter.
10. Students will know the history of using fingerprints for identification purposes.
11. Students will know how to classify fingerprints found at a crime scene based on their main class and subclass.
12. Students will know how to identify minutiae patterns found in an unknown fingerprint and compare those patterns to minutiae patterns of a suspect print
13. Students will know how to lift fingerprints using appropriate lifting techniques using fingerprint power and magnetic powder.
14. Students will know how to develop latent fingerprints with iodine fuming, superglue fuming, and ninhydrin.
15. Students will know how to identify different characteristics of firearms and cartridges as they pertain to ballistics such as: slide, barrel, extractor, trigger, hammer, safety, breech face, ejector, firing pin aperture, extractor, cartridge, bullet, gun powder, primer, headstamp, caliber, lands, and grooves.
16. Students will know how the manufacture of firearms creates lands and grooves which produce rifling that can be used for forensic identification.
17. Students will know how to analyze evidence from striation patterns, breech markings, and firing pin patterns and explain their significance in different scenarios.
18. Students will know the three main components of the study of ballistics: interior ballistics, exterior ballistics, and terminal ballistics.
19. Students will know how to approximate the distance a bullet was fired from based on the shape and coloring or a bullet wound.
20. Students will know how to estimate bullet trajectory utilizing two points along the bullet's path to determine where the bullet originated from.
21. Students will know strategies for restoring serial numbers that have been obliterated.
22. Students will know how to match tool marks/impressions left on surfaces to the tool that created the mark.
23. Students will know two ways that chemistry can be used to catch a counterfeit bill.
24. Students will know features that the U.S. Treasury has included in the design of bills to make them more difficult to counterfeit.
25. Students will know methods to detect art forgery.
26. Students will know the 12 characteristics of handwriting.

27. Students will know methods of document analysis including: how to utilize chromatography to separate ink pigments, paper examination, determination of softness of pencil markings, determination of order of pencil marks, chemical erasures, and secret messages.

28. Students will know how to use mathematical formulas to calculate the angle at which a blood stain strikes a surface.

29. Students will know how to compare blood stain patterns at different velocities, heights, with different weapons, and on different surfaces.

Skills:

1. Discuss the key concepts of comparison, classification and uniqueness or individualization using fingerprint examination to illustrate these concepts.

2. Predict a person's height based on their shoe size.

3. Determine whether two tire or shoe prints are a match utilizing class and individual characteristics.

4. Analyze the individual characteristics of bullets & cartridges to determine if the same gun fired them.

5. Restore an obliterated serial number.

6. Create tool marks on various surfaces to look for individual characteristics within the mark that could be used for identification.

7. Describe how fingerprints are formed and discuss whether or not fingerprints can be permanently altered.

8. Classify fingerprints according to the main class and subclass.

9. Identify and classify minutiae in an individual print using FBI standards.

10. Compare and match prints to identify an individual.

11. Analyze cases when fingerprint analysis was faulty.

12. Discuss the benefits of developing uniform standards for declaring a match between prints.

13. Describe the chemical reactions and physical processes used to develop latent fingerprints.

14. Link together techniques of pattern matching between various evidence types.

15. Develop fingerprints using a wide range of techniques (inking, dusting, latent, iodine fuming, ninhydrin processing, crazy glue fuming).

16. Discuss why not all development techniques work for all individuals.

17. Utilize the 12 characteristics of handwriting to analyze the ransom note in the Jon Benet Ramsey case.

18. Design an experiment to test the effect that gravity, angle, type of surface, and height has on falling blood.

19. Use geometrical measurements of blood spatter to reconstruct a crime scene in three dimensions
20. Analyze bloodstains at a crime scene.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit