Theme

How can citizens innovate, manage, and use technology in ways that are socially responsible?

STEM Innovation Academy Unit 1 Plan

Subject: Principles of Biomedical Science Unit Title: The Mystery Grade: 9th	Teacher: Henry Duration: 82 min blocks

Summary of Unit

Unit 1 sets the stage for the theme of the Principles of Biomedical Science™ course and is meant to introduce students to the world of biomedical science. Students will be introduced to a woman, Anna Garcia, who is found dead in her home. In the first lesson (7-8 blocks), students will investigate the scene, gather evidence, and then move to the lab to analyze their findings in order to determine her manner of death. In each subsequent unit of the course, students will obtain additional medical history information for Anna as well as details from her autopsy report as they explore the various illnesses she encountered throughout her life. Students will maintain a medical file for Anna Garcia, compile their ideas and findings over the duration of the course, and ultimately determine her cause of death in the final unit. In the second lesson (4-5 blocks) students will begin to explore DNA, the fundamental building block of life, in order to determine whose blood was found at the scene. Students will extract DNA from both plant and animal cells, investigate the structural composition of DNA by building a three-dimensional model of the molecule, explore the methods used to analyze DNA, and then work as a forensic DNA analyst to compare the DNA found at the crime scene with the DNA obtained from each of the suspects. In the third lesson (3-4 blocks) students will investigate autopsy procedures and will be given the first piece of Anna's autopsy report. Students will put together all of the evidence collected and analyzed regarding Anna's mysterious death throughout the unit in order to draw conclusions and create a report detailing the suspected manner of death. Students will learn how to properly cite sources and investigate the role that different biomedical professionals played in Anna's mysterious death investigation. Finally, students will discuss the bioethics of scientific research and explore the bounds of HIPAA legislation.

Stage 1 – Desired Results

Standards/Outcomes/ PARCC Related items:
NGSS and CCSS standards covered in each lesson included in the following link:

https://drive.google.com/open?id=0B4mAG23AqGvkblhYaTFGcEpWb1k

Essential Questions:

Unit 1 lesson 1

1. What can be done at a scene of a mysterious death to help reconstruct what happened?
2. How do the clues found at a scene of a mysterious death help investigators determine what might have occurred and help identify or exonerate potential suspects?
3. How do scientists find the most accurate answers to the questions they are asking?
4. What steps need to be taken to effectively design and conduct an experimental investigation?

Unit 1 lesson 2

1. What is DNA?
2. How do scientists isolate DNA in order to study it?
3. How does DNA differ from person to person?

4. How can tools of molecular biology be used to compare the DNA of two individuals?
5. What are restriction enzymes?
6. What are restriction fragment length polymorphisms?
7. What is gel electrophoresis and how can the results of this technique be interpreted?

Unit 1 Lesson 3

1 What is an autopsy and how can it be used to determine the cause of death?
2 How can the manner of death be determined?
3 Why is confidentiality of patient information important?
4 Who should keep patient information confidential?
5 Is there ever a time when patient confidentiality should be broken?
6 What biomedical science professionals are involved in crime scene analysis and determination of manner of death?

Stage 2 – Assessment Evidence

Unit Pre-Assessment:

Lesson 1

-Blood spatter analysis independent investigation design and procedure
-Experimental design vocabulary
-Experimental design critique

Lesson 2

- DNA bonding rules assessment

Presentation:

-Evidence boards and formal case reports

Performance Task(s):

*Investigative notes: At the crime scene, students compile a living document they revisit and maintain throughout unit 1. The investigative notes should include clues from the witness report, crime scene evidence including a scaled drawing, theories which are subject to revision, person of interest documents, as well as laboratory results from all laboratory activities.

*Career journal entries: At various points throughout the unit, students research and report on professionals involved in the case of Anna Garcia (EMT, blood spatter analyst, crime scene investigator etc.) They must find reliable APA cited sources, document the training required/ daily responsibilities, and write a reflection on their personal interest in the career and why.

* 'The Evidence' Student response sheet: Students compare hair, blood, fingerprint, and shoeprint samples found at the crime scene to the potential suspects and to Anna Garcia. They conclude who each belonged to based on pattern identification. They then complete the unknown substance lab, record their results on the student response sheet, and determine the identity of the unmarked pills at the crime scene.

*Time of Death lab: Students identify a hypothesis, independent/ dependent variables based on a procedure which is provided. They carry out the investigation and apply Galister's equation to their data

in order to determine what time Anna Garcia died.

*Blood spatter analysis lab report: Students design their own controlled experiment, write their own procedure, collect data, and write a conclusion to determine what height the blood droplets at the crime scene fell from.

*DNA Structure: Students assemble 3 Dimensional DNA structures using a magnetic kit. From their experiences and from the data available to Watson and Crick, students derive the bonding rules that dictate DNA structure

* Gel electrophoresis simulation: Students receive DNA sequences for each suspect and Anna Garcia. They cut the sequences into fragments following RFLP protocol and place them in the appropriate lane/ base pair length on a poster which represents an agarose gel. From their findings, they determine who was present at the crime scene and add the data to their investigative notes

*HeLa/ HIPPA debates: Students presented with scenarios about patient privacy rights in medical settings. Debate the ethically sound course of actions in groups or as a class

* Evidence board/ formal case report: Students visually represent all of their findings from the unit (including the autopsy report) in relation to the Anna Garica case on a poster. Connections between evidence are represented with yarn. Posters are presented with updated theories based on the evidence. The formal case report includes all aspects as outlined on the rubric included in the following document:
https://docs.google.com/document/d/1HRYfYDC4lUFrUnJtdeoiDVBUU9Ts8J71-b125Bpe05M/edit?usp=sharing

Authentic Experiences:
*Virtual autopsy
*Laboratory activities: Identifying an unknown substance, blood spatter analysis, determining time of death, DNA extraction

Extensions (Tier I):	Differentiation (Tiers 2 and 3)
• Optional clotting factor blood wet lab • Experimental critique extended with more complex examples	• Group work • Feedback on pre labs prior to start of labs • Study skills (studyblue.com, study guide questions, Frayer model notecards, playposit.com) • Options for potential research websites provided (E.g. HeLa day included video, interview, and article options)

Stage 3 – Learning Plan	
Principles of Biomedical Science: Unit 1 Digital Access (Password Required): https://pltw.read.inkling.com/a/b/d47610f05df0403b90d9d82f476be45e/p/5f04c4f79722460eae84519f9950fe42	
Vocabulary	
Biomedical science Experiments Personal Protective Equipment (PPE) Hypothesis Independent variable Dependent variable Control group Negative/ positive control Controlled variables Forensic science Deoxyribonucleic acid (DNA) Nucleotide Helix	Adenine, thymine, guanine, cytosine Monomer/ polymer Phosphate group/ deoxyribose sugar/ nitrogenous base Purines/ pyrimidines Hydrogen bonds Chargaff's rule genes chromosomes gel electrophoresis RFLPs, Restriction Fragment Length Polymorphisms Restriction enzymes Autopsy
Extensions: Expert/Field Experience(s)	
Potential guest speakers: Crime scene photographer, crime scene investigator, EMT Potential field trips: 'Unlocking your DNA' Liberty Science Center lab	
Literacy Connections/Research	
-Formal case report -Career journal entries -Evidence/ inference/ prior knowledge activity -HeLa debate -HIPPA debate	