The Chemistry of Arson

WebQuest Description: Students will apply chemical concepts of combustion and hydrocarbons to evaluate an arson crime scene.

Grade Level: 9-12
Curriculum: Science
Keywords: combustion, hydrocarbon, chemical reaction, accelerant, gas chromatography
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Introduction:
How do police determine if a fire is an act of arson? One out of every three fires in the United States is set deliberately. If fire fighters suspect that a fire has been set on purpose, forensic investigators (CSI's) are assigned to the case. First, they process the fire scene, then search for clues that can identify the cause of the fire. If arson is confirmed, CSI's also try to collect evidence that will help police identify and locate the arsonist. Forensic scientists combine scientific inquiry skills with technology to solve complex problems. They require a strong background in chemistry, and must be knowledgeable of the chemical and physical properties of various substances, such as hydrocarbons, and also of the different chemical reactions. CSI's must also process suspected arson crime scenes and collect evidence using a specific protocol.

What Do You Think?
Based on your current understanding of chemical changes and fires, how can you distinguish an accidental fire from an arson?

Tasks

1. Crime Scene Investigation
   a. Outline the steps taken by a forensic scientist to investigate a suspected arson.
   b. Identify and describe the laboratory methods used to confirm and identify accelerants.
2. Analyze forensic evidence from fire scene and classify the fire as accidental or arson. *
3. Present conclusion to the class. *

Group Assignment

Step 1. Research information on the five types of chemical reactions and complete the chemical reaction research guide.
Step 2. Complete combustion lab and report.
Step 3. Research information on hydrocarbons and accelerants and complete the research guide.

Arson and Crime Scene Investigation

Step 4: Review the attached resources. Answer the following questions:
1. How does a fire ignite? How does a fire grow?
2. How does learning where the fire originated help in arson investigations?
3. How is evidence from a fire collected and preserved in an arson crime scene investigation?

4. Describe the laboratory methods used to isolate and identify accelerants in fire debris.

Take Note from the resources - you will not be turning in a written document. This information will be included in the group Arson Crime Scene case study presentation.

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**Arson Case Study and Group Presentation**

Step 5: Arson Case Study and Group Presentation.

You will work in a group of 3 to analyze and present a specific arson case study (see case study page). This case study will be presented to the class. Each group member will be assigned a role. Each role is responsible for presenting the following:

**CSI** - Describe the fire scene and outline how evidence is collected and preserved. Explain why arson was suspected.

**Lab Technician** - Describe the lab methods used to identify possible accelerants. Present your findings.

**District Attorney** - Present your conclusion to the jury (class) and provide evidence for your argument.

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**Evaluation**

Teacher Name: Mrs. kirk Student Name: ________________________________________

**CATEGORY**

- Novice (0-3 points)
- Developing (3-4 points)
- Expert (5-6 points)

**Chemistry Knowledge**

Research guides are incomplete or indicate minimal understanding of chemical concepts.

Research guides reflect a relatively accurate understanding of chemical concepts.

Research Guides reflect advanced understanding of chemical concepts.

**Lab Experiments**

Labs are missing minor parts, contain several errors and represent some understanding of the material.

Labs are complete with minor errors and represent a good understanding of material.

Labs are complete without error represent a thorough level of understanding of the material.

**Forensics Process**

Procedure is missing several step of an arson investigation, and or major laboratory methods.

Procedure includes most step of an arson investigation, including most laboratory detection methods.

Procedure include all steps of arson investigation including all laboratory detection methods.
Arson Crime Scene Evaluation

Conclusion s inaccurate and/or is not supported or some evidence is missing.

Accurate conclusion describes a series of events. Some conclusion is not well supported or some evidence is missing.

Accurate conclusion describes a series of events, and uses evidence to support the conclusion.

Class Presentation

Speaker is poorly organized, lacks good voice projection and appropriate body language. Several errors in grammar and pronunciation.

Speaker uses good organization, used good voice projection and appropriate body language. Some errors in grammar and pronunciation.

Speaker demonstrates good organization, uses good voice projection, appropriate body language, correct grammar and pronunciation.

### Category and Score

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**Total Score**

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**Conclusion**

Reflect on what you have learned in this activity.

1. What have you learned about chemical reactions, specifically combustion?
2. What types of materials "accelerate" a fire?
3. What are the signs of an arson and how is arson confirmed?
4. What careers are associated with forensic work and what training is necessary for each?

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**Teacher Page**

Chemistry of Arson Webquest by T. A. Kirk

A webquest for grades 9-11

Objectives:
1. Describe the reactants and products of combustion reactions.
2. Describe the chemistry of hydrocarbons, and will list various fire accelerants.
3. Describe the procedures for crime scene analysis, including evidence collection.
4. Describe the lab methodology for detecting and identifying accelerants.
5. Analyze a fire scene and use forensic evidence to determine if arson took place.

**Standards**

**Credits**

**Other**