Bone Tales!

A flame test is a method used in chemistry to visually determine the identity of an unknown metal or metalloid ion. The characteristics of the metal or metalloid salt will turn the flame of a Bunsen burner (or propane burner) a specific color. Scientists can then compare the color of the unknown substance to known substances to aid in its identification.

At a crime scene there may be unknown substances present that have to be identified to assist in determining foul play or the nature of a crime. Forensic investigators are able to compare the properties of unknown substances to that of known substances for identification.

During this lab activity, you will participate as a forensic investigator and use the flame test and observation skills to aid in the identification of the composition of a bone sample found at a crime scene. Read the following passage and conduct the investigation.

Background

In the small community of New Water, Ohio, new construction of a mini mall has begun on what used to be a large wooded area near the edge of town. The construction company has cleared the trees from the area, and is digging up the soil to lay the building's foundation. Soon after the digging begins, one of the workers notices what appear to be bones. Upon closer inspection the bones appear to be human. The construction is stopped and the local police are called in to investigate.

The condition of the skeletal remains suggests they have been buried for quite some time. Police know in the past 20 years there have only been three cases of missing persons reported who have not been found.

Approximately 18 years ago Mr. Hadley, a gentleman in his early thirties, disappeared but the investigation revealed no evidence of foul play. It was assumed he left town. Five years after Mr. Hadley's disappearance a young local woman, known as Jean, did not show up for work at a local real estate office and her co-workers contacted the police. Like Mr. Hadley, no foul play was detected and she was assumed to have left the small town. In more recent years, a well known woman in her 80s, Mrs. Crawford, disappeared from her home one morning. Her home showed signs of forced entry and many items were missing, suggesting a burglary had taken place. Mrs. Crawford has never been heard from again and her body has never been recovered.

Instructions

1. You will be taking on the role of the forensic investigator employed to analyze the bones at the construction site.
2. Conduct a flame test to determine the consistency of the bone tissue.
3. Test a series of known salts to determine the color given off in a flame.
4. Test the bone sample from the construction site and compare to the known salts to identify the composition of the bone sample.
5. Answer the conclusion and analysis questions to determine whose bones are at the construction site.

Materials

-Bone sample (unknown)
-Sodium chloride
-Copper (II) sulfate
-Iron (III) chloride
-Bunsen burner (propane burner)
-Calcium chloride
-Zinc sulfate
-Potassium chloride
-Strontium chloride
-Wood splints or inoculating loops

Procedures

6. On a clean wood splint or loop place a sample of each of the above known salts and place in the flame. (If using the loop it must be cleaned each time)
7. Record the color of the flame in the data table.
8. Test the bone sample from the construction site.
9. Compare the bone sample with the known samples to determine the substance in the bone.

Data Table

Salt	Observations	Flame Color
Calcium chloride		
Sodium chloride		
Zinc sulfate		
Copper (II) sulfate		
Strontium chloride		
Iron (III) chloride		
Potassium chloride		
Unknown sample		

Conclusion and Analysis

1. What is the major element that makes up bone?

2. What substance is present in the bone sample based on your investigation? Explain your answer.

3. Stable strontium is one of the most abundant elements on Earth and has proven to be medically beneficial. Since the late 1800's it has been used in medical treatments of osteoporosis, bone cancer treatment, tooth decay, and arthritis. Osteoporosis is the deterioration of bone increasing the likelihood of facture. It is a common disease in the elderly, and patients suffering from osteoporosis are often prescribed medications containing strontium. The strontium works by adding additional strength to bones and teeth. It tends to accumulate in areas of the bone or teeth that are undergoing active remodeling.
    a. If bone tissue is comprised of calcium, how is it possible for strontium to be beneficial to bone and teeth? (Hint: Periodic Table)

    b. Based on the information provided which missing person do the bones in the construction site most likely belong too? Explain your answer.

    c. A bone scan is a nuclear scanning test that reveals certain abnormalities in bone that triggers the bone to attempt to repair, such as cancer, bone infections, or fractures. Strontium-87, which is radioactive, is often injected into patients and a bone scan is performed to look for bone abnormalities. Explain why strontium would be used to detect bone abnormalities.

4. Strontium chloride has a wavelength of approximately 671 nm. Calculate the frequency of the wavelength of light in Hertz.

5. Calculate the amount of energy emitted from the strontium atom as it releases a photon of light with the above frequency.