Science Flame Tests

Concepts:

Flame tests, atomic and electron structure, absorption and emission, electromagnetic spectrum

Use the following recommendations to increase and/or decrease the challenge difficulty for your students.

Short-on-time Inquiry Lab:

Students are tasked with putting on a fireworks display at Homecoming. Students follow a detailed procedure to perform flame tests as a small scale analysis to determine which firework substances to use. The overarching question in this short-on-time experiment is: How can the small scale flame tests (and, ultimately the fireworks display) help us understand the structure of the atom? (30 min.)

Guided Inquiry Lab:

Students follow a detailed procedure in this two-part activity to model electron structures. Students discuss and determine which color fireworks their team will use for a fireworks display at Homecoming by performing small scale flame tests analysis to determine which firework substances to use. Then, model electronic structure with bingo chips and filter papers to observe and understand the importance of an atom's outermost energy level. Get ready to observe some beautiful colors to understand one of the most complex topics in science! (50 min.)

Open Inquiry Lab:

This lab challenges your students to ask and answer questions about electron structure. Students carry out a small scale investigation to select the chemicals used in a big fireworks display where they make conclusions about energy input, electron excitation, and photons. When students predict the number of electrons in various energy diagrams using bingo chips, they will have a visual of the probability of where the electrons reside in the Bohr-type atomic structure of atoms. (50–90 min.)

Advanced Inquiry Lab:

Students take ownership of their very own lab when they are tasked with determining unknowns. This lab challenges the students to use flame test analysis to determine the presence of sodium and potassium in the everyday food item, banana chips. Then, students dig deeper into electron structure with a bingo chip and filter paper activity. The electron filling order in the Bohr-type filter paper models provide a visual of the energy levels in which the electrons reside. Select filter paper Bohr models of the atom are unknowns and students must determine their identity. (60–90 min.)

Outcomes:

These four labs will help you help your students understand atomic structure. Specifically, electron structure and how all elements have their own electron configuration similar to a human's fingerprint. When students witness the various colors emitted in the flame test lab, they will understand the unique electrons in each metallic salt. Furthermore, the dry portion of the lab safely utilizes bingo chips and filter papers to model the Bohr-type atom. These models solidify that electrons reside in various energy levels. Your students are sure to appreciate the electron filling order!

Associated Phenomena:

What causes the colors in a fireworks display?

Standards

Asking questions and defining problems HS-PS1.A: Structure and Properties of Matter Patterns	cutting concepts

Performance Expectations

HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.