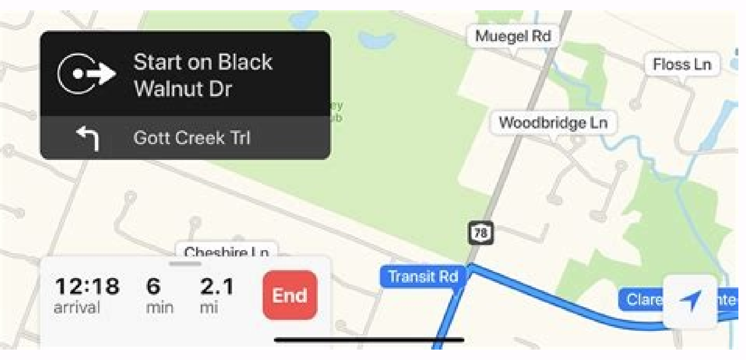
Flame test post lab answer key



Name:________________ Hour:______

Lab 7: Flame Test Lab

Prelab Reading

The normal electron configuration of atoms or ions of an element is known as the **"ground state"**. In this most stable energy state all of the electrons are in the lowest energy levels available. When atoms or ions in the ground state are heated to high temperatures some electrons may absorb energy and "jump" to a higher energy level. The element is then said to be in an **"excited state"**. This excited configuration is unstable and the electrons will "fall back" to their normal positions of lower energy. As the electrons return to their normal levels the energy that was absorbed is now emitted in the form of electromagnetic radiation. Some of this radiation is in the form of **visible light.**

The color of this light can be used as a means of identifying the elements involved. This analysis is known as a **flame test.** Only metals, with their loosely held electrons, are excited by the flame of a bunsen burner. Thus flame tests are useful in the identification of metallic ions. Many metallic ions exhibit characteristic colors when vaporized by the burner flame. In this experiment characteristic colors of several different metallic ions will be observed and unknown ions will be identified by means of the flame test.

Before beginning the pre-lab questions below, be sure to read the procedure on the next page.

Pre-Lab Questions:

1. **What is the difference between ground state and an excited state?**

   Ground state: all electrons are at the lowest possible energy levels. Excited state: Atoms/Ions absorb energy and go to a higher energy.

2. **What does the word "emit" mean?**

   Emit is defined as being produced (i.e. in this case the energy that was absorbed is produced (emitted) in the form of electromagnetic radiation)

3. **In this experiment, where are the atoms getting their excess energy from?**

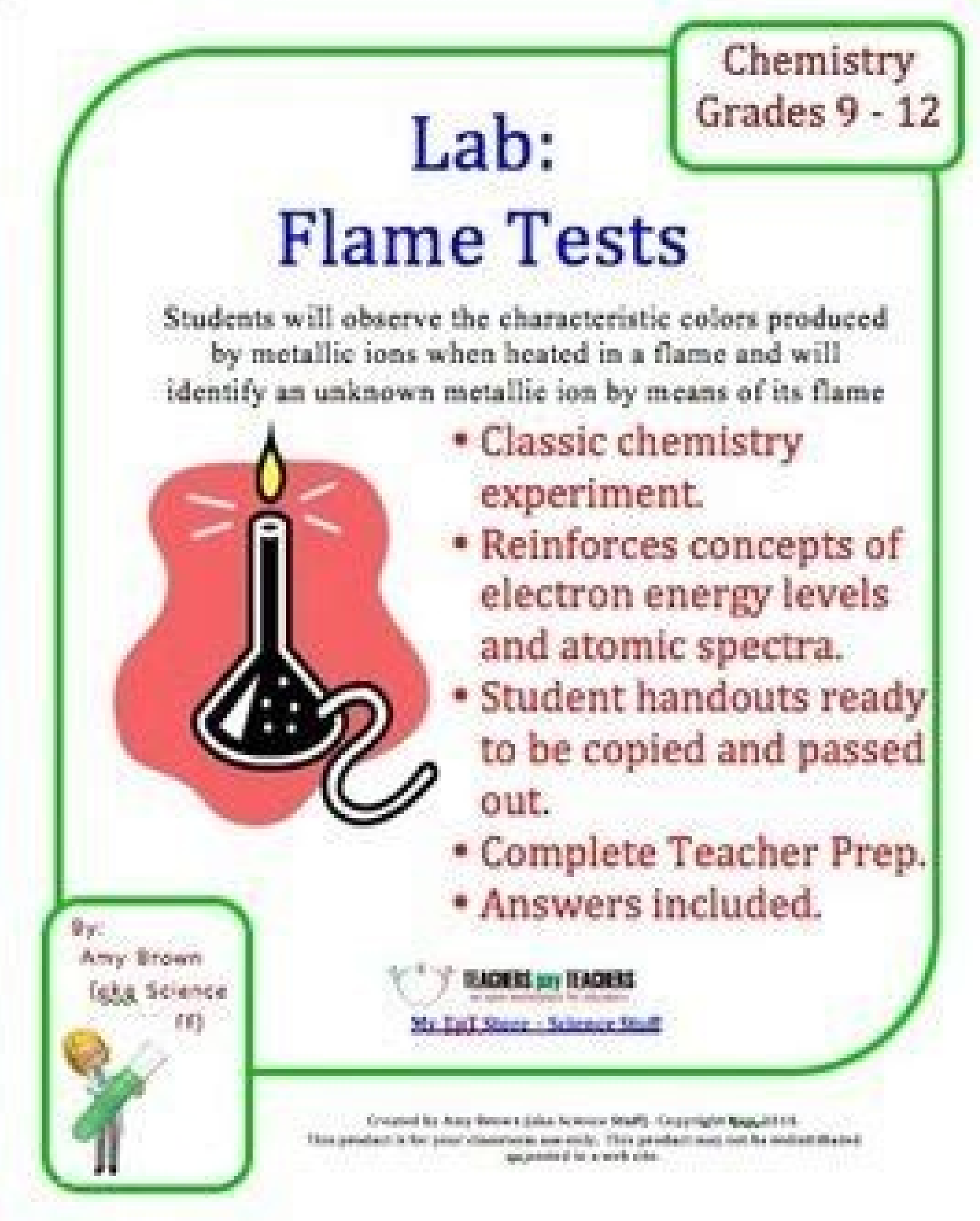
   The electrons are getting the excess energy from a bunsen burner

4. **Why do different atoms emit different colors of light?**

   Atoms emit different colors because of their chemical makeup.

5. **Why is it necessary to clean the nichrome wires between each flame test?**

   It is necessary to clean the wires between the flame tests because if you don't, the atoms might not display their characteristic color because they were mixed with another atom.



Name: Faith LobatonPartner's Name: Johnathon PadillaDate: October 8, 2013 Purpose:The purpose of this lab was to observe the characteristic colors produced by certain metallic ions when vaporized in a flame. As well as to identify unknown metallic ions by means of its flame test. And to learn why light is shown as the color it is by the excitement of electrons jumping from one shell to the next. Procedure:The procedure for this lab was to be in groups of two, one that would observe the reactions to the independent and dependent variables and the other to retrieve the materials we need and mixing the substances together. We had the methanol be the dependent variable and the different metallic ions that were added to it the independent variable, the observations were that when the chemicals together were lit on fire. Pre-Lab Questions:1.) What color of light is the lowest in energy? Red2.) What color of light is the highest in energy? Purple (Violet)3.) What color of light is the highest frequency? Purple (Violet)4.) What color of light is the lowest frequency? Red5.) How are electrons "excited"? Electrons become excited when they gain energy either from heat or from the amount of photons.6.) What does it mean when the electrons are "excited"? When electrons are excited, it means that they have gained enough energy they jump between shells, sometimes leaving the atom altogether if enough energy is gained.7.) If you test 2 solutions and find that they both produce a red flame, how can you determine for sure whether they contain the same metal? If both of the solutions produce a red flame, that means the energy of the photons are the same, as it the placement of the electrons, with the same placement of electrons, it means they are in the same group. To further test this, one has to look at the properties of the material before it was burned, during the process, and the residue left behind, if any.8.) In your own words, write a short explanation of how an electron absorbs energy and re-emits it as light and why different elements have different spectra? When electrons fain energy they move to a higher shell and becomes unstable, if the electron gets rid of the energy that is gained before, by returning the heat it acquired, it would move to a lower shell, releasing energy as it moves back down. different elements emit different colors because of the placement of the electrons and how far the electron moves up of down different shells. Data Table & Observations:Methanol (Dependent)- Lithium Chloride-Copper Chloride-Calcium Chloride-Sodium Chloride-Calcium Carbonate-Magnesium Sulfate-Potassium Chloride-Borax-Copper Sulfate- Cream of Tartar-Unknown #1-Unknown #2- Before the Match was Lit/ The Element mixed with MethanolClear, LiquidWhite Powder, Isn't completely dilutedDusty and Turquoise, it becomes a dark forest green, darker in the middleWhite, chalky, small chunks, still a bit chunky with remains in the middleWhite, lustrous powder, crystal structure, diluted quicklyWhite, dusty, powdered milk look when mixed with methanolClear, Dusty Diamond, Sugar Sprinkles, Looks clear, mostly dilutedWhite, finer than salt, not as white as sugar, solution mostly at the bottomWhite, thin, powder like, did not dilute very wellCobalt blue liquid, lightened with methanol and became crystal likeWhite, clumpy, slightly like flour, milky liquid when mixedWhite, chalky powder, mostly diluted until contact with methanolrainy white powder, similar to salt, diluted well, with remains at bottom During and After the Match was LitFlame was blue, some orange, burned from edge to centerStarted off blue, became red-ish when it reached the middle, white trailGreen flame, a trail of dark brown, light green-ish streaksBlue flame until it reaches the middle, becomes red-ish orangeOrange flame, left a thin trail to the middle, some salt in the middleTransparent/ Light Blue flames, residue is thick and pastyTransparent blue flame, bubbly, milky residueDeep blue flame, faint purple, slight white residue, mostly transparentBlue flame to green at the top to slight orange, left a white residuePurple-blue flames with slight flickers of green and orange, blue liquid leftPinkish-purple flame some blue, left white sand like residueBlue with orange flame, bubbly residue, perhaps Calcium ChlorideOrange, green, and slightly blue flame, powdery residue, borax? Conclusion:As we observed the different characteristics of the flame, and the properties of the element before and after it became a flame, we found many distinguishing traits for each element. From these observations, we were able to distinguish the unknown elements that we tested by mixing with methanol and lighting a fire. Our guesses were that of Calcium Chloride and Borax, due to their reactions with the methanol and the way they looked before and after the test. Discussion of Theory:The theory we were working on branched off from one of the pre-lab questions we did, "If you test 2 solutions and find that they both produce a red flame, how can you determine for sure whether they contain the same metal?". However, just knowing that the flame was red in the experiment did little to confirm whether or not it was the same element. So along with the flame color of the element, we looked into the residue it left behind, the way the element looked before it was mixed with methanol, and the way it looked with methanol. With only the knowledge of the color of the flame, we would never be sure if the elements were the same, but with all of the known properties we are clearly able to determine whether the two elements that produced red flames are the same. Error Analysis:The most prominent mistake that I had made would be my lack of detailed information about the flame during the process. I had written down descriptive traits for the elements before it became a flame, and the residue left behind, but not of the changes in the flame. I would have missed a few of the colors of the flames if the other group at the table not shared their findings with us. Without their information about the different colors the flames became during the process, I would have gotten the unknown's incorrect. That is why, next time we are doing a lab, I will note any properties or changes that happen to the independent product during the lab. Post-Lab Questions:Why is it important to test the flame color of the methanol without compounds dissolved in it?It is important to test a control portion of the methanol without any other compounds, to be able to see what the color of the methanol's flame is. We must do this to make sure that the color of the flame of the compound itself is not mistaken for the color of the methanol.List the colors observed in this lab from highest energy to lowest energy.(Violet), Faint Purple,(Indigo), Blue, Green, Orange(Yellow), Orange/Red, RedLIst the colors observed in this lab from the highest frequency to lowest frequency.(Violet), Faint Purple,(Indigo), Blue, Green, Orange,(Yellow), Orange/Red, RedList the colors observed in this lab from shortest wavelength to longest wavelength.(Violet), Faint Purple,(Indigo), Blue, Green, Orange,(Yellow), Orange/Red, Red What is the relationship between energy, frequency, wavelength?The more amount of energy you have, the higher the frequency. The higher the frequency, the shorter the wavelength.Based on the results of your experiments, what metal was found in you unknowns? Explain.The two elements that our table group thought the unknowns to be was Calcium Chloride and Borax. Examining the element before the fire didn't help very much since one of them unknowns were crushed further than what we had tested before. However, the change in the flame, from it's simple blue to green to orange, gave away the unknowns for what they really were. The residue that was left over just further proved the assumptions correct.Do you think we can use the flame test to determine the identity of unknown in a mixture? Why or why not?I think that the flame test could be used to determine the identity of unknowns in a mixture, however it would not be very effective. This is because if there are to many different compounds, or elements, all of the colors of light mixed together would bring the flame closer to just emitting white light.Why do chemicals emit different colors of light?Different chemicals have different elements with different arrangements of electrons. The arrangements of electrons determine the sizes of the quantum jumps which in turn decide each element's emission spetrum. If all of the different elements have different arrangements of electrons, they each have a different emission spectrum. Therefore, two different chemicals would emit different colors of light.Why do you think the chemicals have to be heated in the flame first before the color light is emitted?The chemicals need to be heated in the flame before emitting colored light because the electrons in each atom need to absorb enough light to cause them to jump from a ground state to an excited state and back to a ground state to emit colored light.Most salts contain a metal and a non-metal. Look at the compounds we tested and explain how we can be sure that is is the metal atoms that are responsible for the color that you see?Since different colors were observed, the differences in colors must be attributed to the different metals, and not to the non-metal which repeats in the same compounds in most cases. Colorful light emissions are applicable to everyday life. Where else have you observed colorful light emissions? Are these light emission applications related? Explain.Some examples of colorful light emissions are street lights, neon signs and, of course, fireworks. Neon signs emit light when an electric current passes through the neon gas. The electric current excites the element's electrons causing it to jump from a ground state, to an excited state, an back to a ground state. Fireworks emit light when a fire, such as the fuse, excites the different electrons in different metals. These light emissions are related because they both have to do with and element's elctrons become excited.Can you think of a way in which to use the flame test? Please describe below.One way in which to use the flame test is to tell what chemical is burning at a chemical plant that is caught on fire, the firefighters are then able to fight against it with the correct resources. Another way is to use the different compounds to make different colors and thus creating a fireworks show. Challenge Extensions:What professionals would use this type of information?A professional in the hazardous waste disposal field would use this information because there are different ways to dispose of different elements, and incorrectly disposing and element can cause greater harm to the environment then not disposing of it at all.Why is the statue of liberty green?The Statue of Liberty was made of copper, and as the years pass, the oxygen in the air and the water in the ocean reacted with the copper and a green layer was formed around the copper statue.Suppose you were a firefighter and you were called to a chemical plant fire. Upon arriving, you see a bright violet/purple flame. What chemical would you know is burning?From the information above, I would have to guess it was copper sulfate, due to the way it says bright violet/purple instead of faint, taking out Potassium Chloride and Cream of Tartar, the other two purple flames.Using the information in your data table, design a firework display that transitions between four different colors. Explain what is happening.To begin this process I would choose copper sulfate, borax, lithium chloride, and copper chloride due to the various color(s) that is produced from their flames. Perhaps, there would be a rope dipped in methanol and throughout the length of the rope, would be a section that had copper sulfate, a section for borax, a section for lithium chloride, and a section for copper chloride. Research some information about the origin of fireworks. Explain how they are made, what chemicals are used, what colors they burn and their uses.Fireworks are created by burning different chemicals such as lithium carbonate, barium chloride, and copper chloride. These different chemicals are put into a container connected to a fuse that then makes it explode creating the effects in the air. They were created in China, when villagers threw bamboo into a fire, causing the air pockets inside to 'explode' with sparkles and crackles following suit. Determine the wavelength of any two elements that you observed. Calculate the frequencies (c=wavelength x frequency) and the energy (E=hf) for each. Make a table of your results with the following columns: 1: wavelength in meters, 2: frequency in Hz, 3: Energy in J. List the results in order from the least energetic to the most energetic photons.

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