Ion Flame Test Inquiry

I. Pre-lab

A. Purpose: To determine what part of a compound in household products is responsible for flame color in a flame test.

B. Determining the Independent and Dependent variables:

1. The Independent variable in this experiment is _____.

2. The Dependent variable in this experiment is _____.

C. Write a problem statement:

1. How will the _____ (I.V.)

effect the _____ (D.V.)?

D. Decide on a hypothesis using the If/then format:

1. _____

_____.

II. During Lab:

A. The experiment:

1. Place a small amount of the solid compounds on an evaporating dish.
2. Add 2 mL of methanol to dissolve the solid.
3. Light a match and ignite the methanol.
4. Watch the flame color and observe any changes from the control.

B. Data and Observations

Household Product	Compound Formula	Positive Ion	Negative Ion	Flame test color	What ion causes color?
Control ??	CH_3OH	None	None	blue	None
Antacid tablets	$CaCO_3$	Ca^{2+}	CO_3^{-2}	Red-orange	
Eyewash	H_3BO_3	None	None	green	
Plaster of Paris	$CaSO_4$	Ca^{2+}	SO_4^{-2}	Red-orange	
Cream of Tartar	$KC_4H_5O_6$	K^{1+}	$C_4H_5O_6^{-1}$	Pale purple	
Epsom salt	$MgSO_4$	Mg^{2+}	SO_4^{-2}	Blue	
De-icer	$CaCl_2$	Ca^{2+}	Cl^{-1}	Red-orange	
Salt substitute	KCl	K^{1+}	Cl^{-1}	pale purple	
Detergent booster	Na_2CO_3	Na^{1+}	CO_3^{-2}	Orange	
Table salt	NaCl	Na^{1+}	Cl^{-1}	Orange	
Other compounds tested:					
	$BaCl_2$			Yellow/green	
	$SrCl_2$			Red	
	LiCl			Magenta	
	$CuCl_2$			Green	
	CsCl			Purple	

III. Post-lab questions:

A. Why is it important to test the flame color of the methanol without any compounds dissolved in it?

B. Do the positive ions or the negative ions cause the change in flame color? Explain why based on your observations.

C. Which of the compounds would be a good choice for making purple fireworks? What about green freworks?

CHALLENGE QUESTIONS:

D. Potassium gluconate (formula = $K^+C_6H_{11}O_7^-$) produces a light purple flame. Copper (II) sulfate (formula = $Cu^{2+}SO_4^{-2}$) produces a green flame. What flame color would you expect for copper (II) gluconate (formula = $Cu^{2+}[C_6H_{11}O_7^-]_2$)? Explain.

E. How could you tell the following three white artificial sweetner powders apart using the flame test? You have:

1. Equal ($C_{14}H_{18}N_2O_5$, a non-ionic compound)
2. Ace-K ($K^+C_3H_4NO_4S^-$)
3. Sweet 'N Low ($Ca^{2+}[C_7H_4NO_3S^-]_2$).

F. Boric acid is a molecular, non-ionic compound. Based on its flame test there is a color observed, but is this due to positive ions or negative ions? Why?

***TURN IN THESE ANSWERS IN ON A SEPARATE SHEET OF PAPER BY JANUARY 15th, 2008 TO WIN A PRIZE FOR CORRECT ANSWERS.