Boron Glass

Materials:

Item	Amount per student	Amount for 24 students
Powdered borax ($B_4N_2O_7$)	2-3 crucibles full	72 crucibles full?
1 M HCl (in a dropper bottle)	10 drops	1 dropper bottle full
Iron (III) Chloride ($FeCl_3$)	A pinch	1 g?
Manganese Oxide (MnO_2)	A pinch	1 g?
Copper (I) Chloride (CuCl)	A pinch	1 g?
Ice?	A pinch	1 g?

Equipment:

Item	Amount per student	Amount for 24 students
Fischer burner	1	6-8
Crucibles	4	24

Staff Notes: The crucibles will be coated on the inside and sometimes on the outside with the glass after this lab! Sometimes the crucibles crack when the glass inside of them is cooling. Even though the students will be sharing the crucibles with the different colors of glass in them, we will "go through" a few crucibles with this experiment!

Safety Issues:

- Hot glass looks the same as cold glass! Use extreme caution in handling these glass globs!
- Use care with the HCl solutions, since it can burn the skin. Flush any skin surface with copious amounts of water upon exposure.
- MnO_2 is a strong oxidizer, especially irritating to the skin, lungs, and other mucous membranes. Gloves would be sensible during this experiment!
- $FeCl_3$ is an irritant (used to deodorize sewage!) and is hygroscopic. Please keep the bottle tightly capped.
- All heavy metal waste should be disposed of in a properly labeled waste bottle.

Procedure:

1. Set up a Fischer burner under a triangle stand. Set the ring and triangle such that the crucible will be approximately 1 inch above the top of the burner.

2. Fill a porcelain crucible 1/3 full of powdered borax, add 2 drops of 1 M HCl, and heat on the crucible until the Borax melts. It will bubble and swell before shrinking to almost nothing. Swivel the ringstand out of the flame to add a small amount of additional borax, then continue to heat the crucible. Continue adding borax until there is enough melted glass to pour out. Describe the liquid glass in your LNJ.
3. For colored glass drops, use a crucible that has been used previously for that color if possible! After melting the amount of borax that you want to use, add a few crystals of a metal salt. See the table below for the colors of each metal salt pigment and the approximate amounts of them needed. Stir the mixture with a glass stirring rod. Record any changes you see in the appearance of the molten glass.
4. Using tongs, lift the crucible out of the flame, and quickly pour the glass onto the bench top. Allow the drop to solidify and cool. Broken or unsatisfactory beads may be remelted and repoured, if you wish.
5. Repeat steps 1-4 until you have at least one glass drop with no pigment, and one with each pigment. Experiment with pouring and molding shapes, and the color of different amounts of pigments. Try pouring a bead into a beaker of warm water or of ice (or just cold) water. In your LNJ, describe and/or draw the glass drops and shapes that you made.

Pigment	**Color**	**Comments**
None	Clear	Small bubbles may still be seen!
$FeCl_3$	Light yellow	Lots of crystals needed for any color at all!
MnO_2	Light mauve	Crystals seem to need extra heating to blend with glass.
CuCl (?)	Bright blue	Only a few crystals were needed for intense color. A lighter blue glob was obtained by adding fresh borax to a "used" crucible with some dark blue glass still adhering to sides.

Reflections:

1. In this exploration, you make small droplets of glass. Making large sheets of glass requires careful temperature control during cooling. Why? Did you notice any changes in your beads that could be caused by the cooling process?
2. What would you do differently to improve the quality of your glass globs?