Name_____ Group Name (element + animal) _____

Preparation of Boric Acid
Lab Technical Exercise: Dr. Slotsky

OBJECTIVES: Perform chemical reaction in a safe and careful manner
Characterize product by flame emission and conductivity test
Compare and contrast covalent vs. ionic compounds

PART I: Preparation of Boric Acid (H_3BO_3)

Reaction: $Na_2B_4O_7 \bullet 10H_2O + H_2SO_4 \rightarrow 4\ H_3BO_3 + Na_2SO_4 + 5\ H_2O$

Boric acid is a very weak acid, with applications in medicine, materials science, polymers, and more. It is prepared by the reaction of borax (a natural mineral) with acid.

Start with approximately 5 grams of borax, dissolve in the minimum amount of water in a beaker. Do not use more than 100 mL of water – if there is some undissolved material, remove it by filtering into another beaker. Slowly add 1M sulfuric acid (5% H_2SO_4) with stirring. After each addition, test the reaction mixture with pH paper. When the paper shows a strong red color, indicating excess acid, the reaction should be complete.

We now have to purify the boric acid from the other components of the reaction, such as the sodium sulfate salt (Na_2SO_4). Our advantage is that boric acid is less soluble than sodium sulfate, and is less soluble in cold water than in hot water. Therefore we will attempt to crystallize boric acid out of the solution. Bring the solution to a boil in a beaker and boil off water until solid material just starts to come out of the solution. Remove the solution from the heat (using tongs!) and allow it to slowly cool until solid boric acid crystallizes out. The boric acid may be collected on filter paper using a filter funnel.

In order to remove residual sulfuric acid and sodium sulfate from your product, you should wash it on the filter paper with a small portion of ice water.

It may be left to dry on the filter paper over a pad of paper towels, and then can be stored in a plastic container.

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PART II: Characterization of Boric Acid

1) Boric acid is, as the name suggests, an acid. It is a very weak acid, though. Use pH paper or universal indicator to test the pH of distilled water and of a solution of boric acid in distilled water. Is it an acid? If so, why? Do same experiment with borax ($Na_2B_4O_7 \bullet 10H_2O$) starting material.

2) Boric acid is a covalent compound. Compare the conductivity of solutions of boric acid and of the original borax (an ionic compound) in distilled water. Do you see a difference? If so, what do you think explains this?

3) Borax is a compound containing both sodium and boron. Sodium shows a strong yellow emission on a flame test, while boron gives a green color. The sodium emission is much stronger than boron emission, so borax should give a yellow flame test. If your boric acid is pure and contains no sodium, you should see a green flame test. As we have done in previous experiments, use a Bunsen burner and damp wooden splints to hold a sample in the Bunsen flame.

What did Borax show on a flame test?

What did your Boric acid show on a flame test?

Was your boric acid pure?

4) Ionic compounds are usually hard, crystalline in appearance, and high-melting. Covalent compounds tend to be soft, less crystalline, and low-melting. Can you think of ways to compare boric acid with borax? What was the result of your experiments?