3. Using scissors or metal snips, cut a piece of aluminum approximately 5 cm x 7.5 cm from the can.

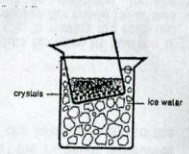
4. Using a piece of sandpaper, scrape off any paint and/or plastic coating from both sides, as completely as possible. Weigh the cleaned piece of aluminum. You need approximately 1.0 g of aluminum (between 0.9 and 1.2g is okay).

5. Weigh a 250-mL beaker and record the mass. Cut your aluminum sample into small squares of about 0.2 cm length (small pieces will react at a faster rate) and place them in the 250-mL beaker. Weigh the beaker and final sample to the nearest 0.01 g and record the mass. Determine the mass of the aluminum and record on your data table.

6. Add 50 mL of 1.4 M potassium hydroxide to the 250-mL beaker containing the aluminum pieces. Place the beaker on a hotplate, and heat it so it is hot, but not boiling. If the liquid level in the beaker drops to less than half of its original volume, add distilled water to maintain the volume at approximately 25 mL. The reaction is complete when the hydrogen evolution ceases and there are no visible pieces of aluminum metal. The final volume of the liquid should be about 25 mL. Record observations of the reaction.

7. While the solution is cooling, set up a filter stand, funnel with filter paper and a 250 mL beaker underneath the funnel to catch the filtrate. The filter paper should be moistened before you begin. Filter the warm solution to remove any solid residue. The filtrate should be clear with any dark residue left on the filter paper. Rinse the beaker twice with 5-mL portions of distilled water, pouring each rinse through the filter residue.

8. If the filtrate is not yet cool, place the beaker in a cooling bath of cold water. You can make a cooling bath by nesting your 250 mL beaker into a larger beaker Slowly *and carefully, with stirring,* add 35 mL of 3.0 M H_2SO_4 to the cooled solution. The solution will get hot from the neutralization reaction occurring. Record observation of the reaction. You may notice the appearance of a white precipitate of aluminum hydroxide. Addition of the last few milliliters of the sulfuric acid will usually dissolve the $Al(OH)_3$. If necessary, warm the solution gently, while stirring, to completely dissolve any $Al(OH)_3$ that might have formed. The final solution will contain potassium ions (from the KOH used), aluminum ions, and sulfate ions. If, after a few minutes of heating, any solid residue remains, filter the mixture and work with the clear filtrate.



9. Prepare an ice-water bath by filling a 600-mL beaker two-thirds full with ice. Add cold water to just cover the ice. Set the reaction beaker into the ice-water bath to chill thoroughly. Crystals of the alum should begin to form in a few minutes. If crystals do not form, you may have to induce crystallization. To induce crystallization, try stirring the solution rapidly, but do not splash any of the liquid from the beaker, or you may scratch the inside bottom of the beaker containing the solution with your stirring rod. As an alternative, you may add one or two very minute seed crystals. Seed crystals (if desired) can be obtained by placing a drop of solution on the end of a stirring rod and blowing on it until it is dry. As a last resort only, reduce the volume of solution by boiling away some of the water and then cooling the solution in the ice bath.

K $1 \times (39.10)$
Al $1 \times (26.98)$
S $2 \times (32.06)$
O $20 \times (16.00)$
H $24 \times (1.01)$
$= 474.44$ grams

10. Clean and reassemble filtration apparatus. Get a clean piece of filter paper. Record the mass of your filter paper. Note that this is the 2nd piece of filter paper that is used in this experiment.

11. Get 25 mL of 50% ethanol and water. Remove the chilled solution of alum crystals from the ice bath and chill the ethanol mixture.

12. Filter the alum crystals from the chilled solution, transferring as much of the crystalline product as possible to the funnel. Use half of the chilled ethanol solution to rinse the remaining crystals from the beaker into the funnel. Rinse the beaker again with the second half of the solution. (Ethanol in the wash solution reduces the solubility of the alum.)

13. While the crystals are drying, weigh a clean, dry watch glass. Record this mass. Transfer the filter paper and crystals to a watch glass and allow to dry overnight.

14. The next day: Record the mass your crystals, filter paper and watch glass. Record observations of your crystals. Determine the mass of Alum crystals obtained and record the mass of the Alum in the data table.

CALCULATIONS

Theoretical Yield (Put this definition into your notes)

The theoretical yield, sometimes called the expected yield, is the amount of alum you would obtain from your starting mass of aluminum if all the reactions work perfectly and you are able to obtain all the intermediate compounds and products. The theoretical yield can be calculated from the overall reaction that takes place:

"ALUM"

$$2\ Al(s) + 2\ KOH(aq) + 4\ H2SO4(aq) + 22\ H2O(l) \rightarrow 2\ KA1(SO4)2{\cdot}12H2O(s) + 3\ H2(g)$$

1. According to the reaction, _____moles of aluminum will react to form _____moles of alum.

2. To calculate the theoretical yield of the alum, use the mass of aluminum you used in your reaction and determine the mass of alum that could potentially be produced in this reaction.

Percent Yield (Put this definition and equation into your notes)

The percent yield is the percent of the theoretical yield you actually obtained. To calculate the percent yield, use the equation:

$$\text{Percent yield} = \frac{\text{Mass of alum obtained}}{\text{Theoretical yield of alum}} \times 100\%$$

Answer questions on the report sheet

If ya have 999 moles Al $\times \left(\frac{2 \text{ moles ALUM}}{2 \text{ moles Al}}\right) = 999$ moles $KAl(SO_4)_2 \cdot 12H_2O$

If you have 100 grams Al $\times \left(\frac{1 \text{ mol Al}}{26.98 \text{ grams Al}}\right) \times \left(\frac{2 \text{ mol ALUM}}{2 \text{ mol Al}}\right) \times \left(\frac{474 \text{ grams ALUM}}{1 \text{ mol ALUM}}\right) = 1760$ grams $KAl(SO_4)_2 \cdot 12H_2O$