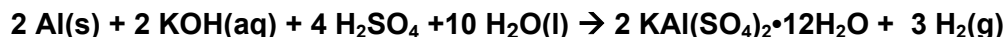


Lab #5 - PREPARATION OF ALUM

Alum is a compound made from aluminum. It is found in baking powder, used in making pickles, used in coloring textiles and used to clarify water. Essentially, you are taking soda cans and turning them into food!!

OBJECTIVES

1. Perform a reaction of multiple steps.
2. Prepare a useful chemical compound, **ALUM**, using **scrap aluminum cans** as our starting material. Alum has the formula **KAl(SO₄)₂·12H₂O**.
3. **Observe a gas**, hydrogen (**H₂, flammable**), that is evolved in the first step of the procedure that makes alum.
4. **Safely** observe the **combustion of hydrogen gas**. THIS IS FUN!!!!
5. **Perform multiple reactions** to obtain useful products. The net reaction is:



****Hydrogen** is **evolved** in the first step.

****Alum** (KAl(SO₄)₂·12H₂O) is **precipitated** in the last step. Alum is used in baking powder, and in the coloring of textiles.

Safety concerns :

Potassium hydroxide (KOH) is CAUSTIC If your hands feel slippery, you have KOH on them.
Rinse your hands with tap water.

Aluminum (Al) pieces are SHARP Do not cut yourself.

Sulfuric acid will BURN your skin Do not get it on your skin

Safety glasses must be worn at all times in the laboratory!!!!!!

Recommendation: rinse your hands after lab.

Procedure:

1. Take your empty beverage container and cut about **20 small pieces of aluminum** (5 mm by 10 mm) using the metal cutters at your desk (make sure that you have an aluminum can).

BE VERY CAREFUL NOT TO CUT YOURSELF ON THE SHARP METAL EDGES!!

2. Use these small pieces of aluminum to weigh out a **1 gram sample of aluminum**.

WEIGHT OF Al sample _____ (∇ 0.01 grams)

3. **Place your pieces of Al after weighing them into a 250 mL flask.**

4. Use a **100 mL graduated cylinder** to add **50 mL of a 1.5 Molar (m/L)** solution of **potassium hydroxide** to the **flask containing the aluminum sample**.

BE CAREFUL!! THIS SOLUTION IS VERY CAUSTIC!!

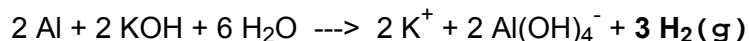
Rinse the graduated cylinder with water SEVERAL TIMES when you are done!!

5. **Clamp the flask on a ring stand** and **GENTLY heat** using a **Bunsen burner** until the reaction begins. The **evolution of hydrogen gas** indicates that the **reaction is started** (as long as you are well below the boiling point of water).

YOU WILL BE COLLECTING the HYDROGEN GAS THAT EVOLVES (See 4c)

Be careful not to heat any container to dryness. If the liquid level gets too low, add water using a squirt bottle!!!!!!

- a. **As soon as bubbles begin to form, REMOVE** the Bunsen burner.
- b. If the reaction stops, heat the mixture again. Remove the Bunsen burner when bubbles begin to form, as before.



NOTE – For future use, it is a good idea to start boiling water NOW in a 600 mL beaker for use later in the lab. Fill the beaker slightly less than half full. This hot water will be your "heat bath,"

- c. **Collect the hydrogen gas** that is evolved from the aluminum reaction. (This is for FUN)
 - i. **Invert an 8 inch test tube and hold it over the solution.** This technique will be demonstrated in the pre-lab lecture.
 - ii. Then (while still inverting the tube) place it over the Bunsen burner and you will hear a POP!

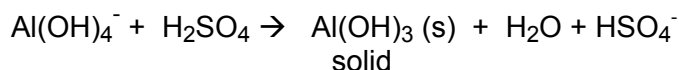
6. **After 10 minutes** most of the **aluminum should be dissolved.**

7. **When aluminum is dissolved**, place a **long stem funnel** (containing a piece of filter paper) in a funnel support and filter your solution **while it is still hot** into a **250 mL erlenmeyer flask** (this technique will be demonstrated in the pre-lab lecture). This will remove any unreacted material which is the plastic inside the can and the paint on the outside of the can!!!

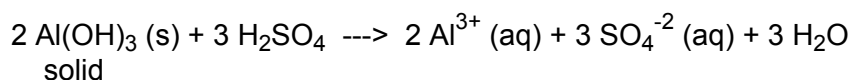
BE SURE TO RINSE ALL GLASSWARE WITH WATER BEFORE RETURNING IT TO YOUR DESK DRAWER!!! Also rinse off the filter paper before throwing it away!

8. **Let the filtrate** (the fairly clear solution after filtering) **cool.**

9. Using a glass rod, **stir the filtrate** (solution) (one person can stir and the other one can add) and **CAREFULLY ADD 20 mL of 9 M sulfuric acid.** As the acid is being added, you will note a **white precipitate** being formed. The following reaction is occurring:



10. **You NOW want to induce the following reaction.** The following reaction equation represents $\text{Al}(\text{OH})_3$ being dissolved with an acid. You may need to add more **9M sulfuric acid.** You can also help this along (dissolving $\text{Al}(\text{OH})_3$) by heating it in the "**heat bath.**"



Do not pour this into the hot water bath.

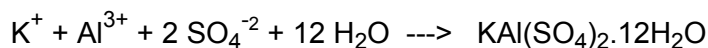
Do not heat the solution directly with the burner.

11. **After the $\text{Al}(\text{OH})_3$ is dissolved**, transfer the solution to a **400 mL beaker**.

12. **Cool the beaker** in an **ice water bath**.

13. **Alum crystals should form**.

!!!! If they do not, scratch the bottom or side of the beaker with a glass stirring rod!!!!



14. **Filter** the crystals using a **Buchner funnel**. The Buchner funnel filtering apparatus is already set up in the laboratory.

Summary of steps for Buchner funnel use :

1. Turn on water (full force)
2. Attach pinch clamp
3. wet filter paper (with wash liquid)
4. QUICKLY filter sample
5. wash sample (see following)
6. dry sample in air (see following)
7. remove pinch clamp
8. remove sample
9. turn off water

15. While the crystals are still in the Buchner funnel, **WASH them** with **two 5 mL portions** (10 mL total) of a **cold 50/50 alcohol-water mixture**.

16. **After all of the liquid has been drawn through the filter paper**, continue to **draw air** through the **solid** until it is **dry**.

While you are doing that, weigh a watch glass – put weight in the chart on next page!!!

17. **When the crystals are dry, transfer them** (not the filter paper) to the **watch glass**.

18. **Let the crystals dry in the air for a few minutes**.

19. **Weigh the watch glass and crystals**.

20. Determine your "**weight of product**". The ideal yield of alum would be 17.6 grams.

BE SURE TO RINSE ALL THE EQUIPMENT WITH WATER

BEFORE RETURNING IT TO THE DESK DRAWER!!!

DATA

Weight of watch glass _____

Weight of watch glass and product _____

WEIGHT OF PRODUCT _____

DON'T THROW YOUR PRODUCT AWAY!!!!!!!

21. Transfer your product into a **LABELED beaker** and put it on one of the shelves near the hoods. It will be used in a later experiment.

22. Describe your product :