# Hydrogen Bromide

Student Worksheet

**Name**_____

**Overview:** You will heat up two chemicals, potassium bromide and sodium hydrogen sulfate, to create hydrogen bromide gas. Is it an acid? A base? You'll do a lot of investigating to find out!

**What to Learn:** You should understand how you produced hydrogen bromide, and the four tools you used to determine if it was an acid: litmus paper, magnesium strip, sodium carbonate, and silver nitrate.

**Materials**

- Alcohol burner
- Lighter
- Wire screen
- Tripod stand
- Glass jar
- Rubber tubing
- 90° Glass tubing
- One-hole rubber stopper
- Chemistry stand
- Test tube holder
- Test tube stopper
- pH paper
- Potassium bromide (KBr) (MSDS)
- Sodium hydrogen sulfate ($NaHSO_4$) (MSDS) **Sodium hydrogen sulfate is very toxic. Respect it, handle it carefully and responsibly. Do not take it for granted.**
- Burette
- Water
- Magnesium strip
- Sodium carbonate ($Na_2CO_3$) (MSDS)
- Silver nitrate ($AgNO_3$) (MSDS)

**NOTE: Be very careful when handling the sodium hydrogen sulfate – it's highly corrosive and dangerous when wet. Handle this chemical only with gloves, and be sure to read over the MSDS before using.**

**Lab Time**

1. Prepare your work station and materials:
    a. Put your mesh screen on the chemistry stand, and put the alcohol burner on top.
    b. Put three spoonfuls of potassium bromide (KBr) into a clean, dry test tube. Add three spoonfuls of sodium hydrogen sulfate ($NaHSO_4$). Put on stopper and shake to mix.
    c. Put the long end of a 90° glass tube into a one-hole stopper, and put the stopper in the test tube.
    d. Put rubber tubing on the short end of the 90° glass tube, and place the end of the rubber tubing into a burette.
    e. Place the burette upside down in 1-2 centimeters of water in a glass jar.

2. With adult help, light the alcohol burner. Gently heat the mixture of potassium bromide and sodium hydrogen sulfate. Bubbles should form in the water, showing the reaction is working. Allow the reaction to continue for a while, until there is a lot of brown in the test tube, and vapor is coming down into the water.
3. Extinguish your flame.
4. Test your solution to determine if it is an acid or a base:
    a. Test the solution in the jar with pH paper. Blue litmus paper will turn red in the presence of an acid. Also test the condensation on the inside of the test tube with pH paper. Record your results.
5. Remove the burette and place the end of the rubber tubing into a test tube containing a small amount of water. Relight the alcohol burner and allow the hydrogen bromide gas to bubble into the test tube.
6. When finished, extinguish the flame.
7. Test the solution in the test tube to determine if it is an acid or a base:
    a. Test with litmus paper.
    b. Drop a bit of solution on a magnesium strip. If bubbles form, and the Mg strip gets eaten away, this indicates an acid.
    c. Add sodium carbonate, $Na_2CO_3$, to the solution. Sodium carbonate is a base and will react with an acid if present in the solution.
    d. To a fresh sample, add silver nitrate, $AgNO_3$. Do white clouds of crystals form? If so, this tells us it's an acid.
8. Make your observations on your data table.
9. Allow apparatus to cool before disposing solids in an outside trash can, and cleaning thoroughly.

Cleanup: We are going to clean everything thoroughly after we finish the lab. After cleaning with soap and water, rinse thoroughly. Chemists use the rule of "three" in cleaning glassware and tools. After washing, chemists rinse out all visible soap and then rinse three times more.

Storage: Place cleaned tools and glassware in their respective storage places.

Disposal: Liquids can be washed down the drain. Solids are thrown in the trash

# Hydrogen Bromide Data Table

| Test for acidity | Observations | Result (Acid or Base?) |
|---|---|---|
| litmus paper placed in water in glass jar | | |
| litmus paper placed in condensation (in test tube that was heated) | | |
| litmus paper placed in test tube (where hydrogen bromide bubbled into water) | | |

| | | |
|---|---|---|
| magnesium strip | | |
| sodium carbonate | | |
| silver nitrate | | |

**Exercises** Answer the questions below:

1. Is hydrogen bromide an acid or a base? Provide four reasons for your answer.

2. Why did brown streaks appear in the glass jar?

3. Can I take some of this stuff home to show my little sister? Explain.

4. Write the chemical reaction for this experiment.

**Exercises**

1. Is hydrogen bromide an acid or a base? Provide four reasons for your answer. (It is an acid because blue litmus paper turned red; it bubbled on a magnesium strip; it bubbled with the addition of sodium carbonate; and the addition of silver nitrate caused white clouds to form.)
2. Why did brown streaks appear in the glass jar? (Bubbles of hydrogen bromide were seeping in.)
3. Can I take some of this stuff home to show my little sister? Explain. (No! Bromide is a very dangerous element that is toxic and can burn. It needs to be transported in a very precise way to be safe.)
4. Write the chemical reaction for this experiment. ($KBr + NaHSO_4 \rightarrow HBr + KNaSO_4$)

**Closure:** Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.