CH 222 Winter 2026:
"Percent Potassium Chlorate"
Lab Instructions

Step One:

Get a printed copy of this lab! You will need a printed (hard copy) version of pages I-1-2 through I-1-7 to complete this lab. If you do not turn in a printed copy of the lab, there will be a 2-point deduction.

Step Two:

Watch the **video introduction** for this lab **here: http://mhchem.org/y/1.htm**
The video introduction will help prepare you for the lab and assist you in completing the work before turning it in to the instructor.
Also **complete the PreLab questions** before starting the lab.

Step Three:

Bring the printed copy of the lab with you on Monday, January 5 (section L1), Wednesday, January 7 (section L2) *or* **Friday, January 9 (section L3).** During lab in room AC 2507, you will use these sheets (with the valuable instructions!) to gather data, all of which will be recorded in the printed pages below.

Step Four:

Complete the lab work and calculations on your own, then **turn it in** (pages I-1-3 through I-1-7 *only* to avoid a point penalty) **at the beginning of recitation to the instructor on Monday, January 12 (section L1), Wednesday, January 14 (section L2)** *or* **Friday, January 16 (section L3).** The graded lab will be returned to you the following week during recitation.

If you have any questions regarding this assignment, please email (mike.russell@mhcc.edu) the instructor! Good luck on this assignment!

Percent Potassium Chlorate in a Mixture

Potassium chlorate ($KClO_3$) decomposes on heating to produce potassium chloride and oxygen. The Law of Conservation of Mass states that the mass of the reactants (potassium chlorate) will equal the mass of the products (potassium chloride and oxygen). Since oxygen is a gas, the mass of the final solid will be less than the starting weight. The mass loss is equal to the mass of oxygen.

In this experiment, you will begin with a sample that is a mixture of potassium chlorate and potassium chloride. Your objective is to determine the percentage by mass of potassium chlorate in the original mixture. Upon heating, only the potassium chlorate will decompose. Using the balanced equation and the fact that all the mass that is lost is oxygen gas, you can use stoichiometry to calculate the mass of potassium chlorate in the original mixture.

A catalyst, manganese(IV) oxide, is added to the reaction mixture in order to speed up the reaction. Like all catalysts, the same amount of catalyst is present at the end of the reaction as in the beginning. Therefore, we will include the mass of the catalyst in with the mass of the crucible.

To ensure that the decomposition is complete, the product must be heated to a constant weight. After the first heating, cooling and weighing, the sample must be heated again, cooled and reweighed. This process is continued until two successive weights are within 5 mg of each other (up to four heating cycles.)

PROCEDURE: *You **must** wear safety goggles while performing this lab! **All** mass measurements should be recorded to the milligram (0.001 g.)*

1. Set up a ring stand with a triangle as demonstrated by your teacher. The small white crucible should fit inside the triangle.

2. Place about 0.5 g of manganese(IV) oxide into a clean, dry small white crucible. Heat the crucible and catalyst with a Bunsen burner for about 3 minutes to drive off any moisture that may be in the catalyst or crucible. Wear safety glasses at all times if a Bunsen burner is operational at your lab bench!

3. When the crucible is cool enough to touch, record the entire mass to the nearest 0.001g.

4. Add between 2.0 to 2.5 grams of the unknown mixture to the crucible. Mix the contents to obtain a somewhat uniform mixture. Record the mass of the crucible plus catalyst plus mixture to the nearest 0.001 g. Be sure to also record your unknown number!

5. Begin heating the crucible gently at first followed by a more aggressive treatment for a total of 10 minutes. Be aware that the sample may begin to bubble and spurt; if this happens, turn the flame down a bit.

6. Allow the sample to cool to room temperature. Record the mass to the nearest 0.001 g.

7. Reheat your sample for 5 minutes. Cool and record the mass. If your mass is within 0.005 g of the mass after the previous heating with the unknown sample, congratulations, you can move on to calculations. If not, you should reheat, cool, and weigh until you have two successive masses within 0.005 g of each other. Clean up and put away your equipment (all waste in this lab can be washed down the drain with water.)

8. Clean up! Work on the remainder of the lab.

Percent Potassium Chrloate Lab

YOUR NAME: _____ ***LAB PARTNER(s):*** _____
first and last name *first and last names*

Data: *Record during lab and use in Calculations section*

Unknown Number _____

1. Mass of crucible + catalyst
   (after drying moisture & before adding unknown _____

2. Mass of crucible + catalyst + unknown
   (before heating) _____

3. Mass after first heating _____

4. Mass after second heating _____

   Mass after third heating (if necessary) _____

   Mass after fourth heating (if necessary) _____

Lab Notes and Observations (if any):

CALCULATIONS: *Clearly **show all work** in the area provided, **watch significant figures** and circle final answers.*

1. Write a balanced equation for the decomposition of potassium chlorate into potassium chloride and oxygen gas.

2. Using your data, determine the **mass of the $KClO_3$ mixture** used in this experiment before heating (no MnO_2!).

3. Using your data, determine the **mass of oxygen lost** upon heating the mixture. This answer will be the **α** (below) in the equation.

4. Determine the **molar mass** of **oxygen** (**O_2**) to 0.01 g/mol. This answer will be the **β** (below) in the equation.

5. Determine the **molar mass** of **potassium chlorate** (**$KClO_3$**) to 0.01 g/mol. This answer will be the **δ** (below) in the equation.

6. Use the balanced equation and your values of **α** (the mass of oxygen lost), **β** (the molar mass of oxygen) and **δ** (the molar mass of potassium chlorate) to **determine the mass of potassium chlorate present in the original mixture** (this is the $KClO_3$ that decomposed in this experiment and is represented by **λ**, below, in the equation.) *Show your work! This is the "grams - moles - moles - grams' application we will be talking a lot about soon!* The equation to use:

$$\lambda \text{ g } KClO_3 = (\alpha \text{ g } O_2 \text{ lost}) * \left(\frac{1 \text{ mol } O_2}{\beta \text{ g } O_2}\right) * \left(\frac{2 \text{ mol } KClO_3}{3 \text{ mol } O_2}\right) * \left(\frac{\delta \text{ g } KClO_3}{1 \text{ mol } KClO_3}\right)$$

7. **Determine the percentage of potassium chlorate in your unknown** using your answers from step 6 (the pure KClO3) and step 2 (the mass of the original mixture.)

POSTLAB QUESTIONS:

1. A white powder is a mixture of magnesium carbonate and magnesium oxide. Upon heating, the magnesium carbonate decomposes into magnesium oxide and carbon dioxide. If you have 1.897 g of the mixture and after heating are left with 1.494 g of magnesium oxide, calculate the weight percent of magnesium carbonate in the original mixture. *Hint:* Start by writing a balanced reaction, and remember the 1.897 g value is not pure!

2. Calculate the % oxygen by mass for the following (show calculations): a) $LiNO_3$ b) $NaHCO_3$ *Hint:* first find the molar mass (to 0.01 g/mol) of the compound!

3. If we had doubled the mass of the original mixture and completed the lab as written, would the calculated %$KClO_3$ have changed? Explain.

Please note: The instructor will send you email throughout the term, so *please* c*heck your email several times each week!* The instructor will use your @saints.mhcc.edu address by default, but if you wish to use an alternate email address, email me (mike.russell@mhcc.edu) from your alternate account and it will be changed.

Percent Potassium Chlorate PreLab Questions

Ideally you will complete these before performing the lab.
Include the completed PreLab Questions when you turn in your lab report.

1. What is the formula for sodium chlorate?

2. Determine the molar mass of sodium chlorate. Show detailed steps below as to how you calculate it.

3. List the seven elements which exist naturally as diatomics.

4. When heated, solid sodium chlorate decomposes to sodium chloride and oxygen gas. Write a balanced chemical equation for this reaction at room temperature. (Remember that oxygen is a diatomic!)

5. Using your reaction from question #4 above, what stoichiometric factor would be used to convert moles of oxygen gas to moles of sodium chlorate?

6. If my 2.135 g mixture contains 1.174 g of pure sodium chlorate, what is the precent of sodium chlorate in the mixture?

7. How many significant figures should be used when reporting the answer to this calculation: **15.773 g - 15.010 g**

   Answer: _____ sig figs

8. Calculate the value of the following: **15.773 g - 15.010 g**

   Answer: _____ g

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