PERCENT OF COMPOSITION 10

Most elements found in nature are most often found combined together with other elements as compounds. It is important for a chemist to be able to find the percentage of composition of compounds. An assayer must determine if many compounds, in the form of rocks, have a high enough percentage of a desired element to make it profitable enough for mining. Rocks that have an element of high enough percentage making it profitable for mining, are ores. A chemist, in order to determine the percentage of a compound, must be able to separate the elements. Separating the elements can be done by heating or with reactions with other elements or compounds.

In this experiment you will find the percentage composition of the compound potassium chlorate. When potassium chlorate is heated to high temperatures (above 400 °C) it decomposes to potassium chloride and the element oxygen.

$$2KClO_3 \longrightarrow 2KCl + 3O_2$$

EQUIPMENT

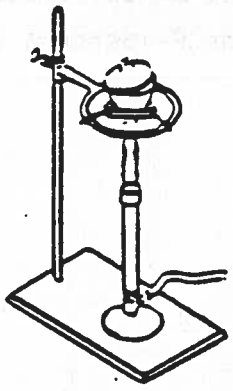
crucible with cover
ringstand with ring
laboratory burner
crucible tongs
clay triangle

PROCEDURE

1. Obtain a clean dry crucible with cover. Measure the mass of the crucible and lid on your balance and on the computer balance. Enter this data on your data sheet.

2. Place about 3 grams of potassium chlorate in the crucible and remeasure on your balance and on the computer balance.

3. Precaution: The oxygen released from potassium chlorate during heating is very reactive and could cause an explosion, WEAR PROTECTIVE GLASSES!



4. Place the covered crucible with $KClO_3$ on the clay triangle on the ringstand and heat at a low temperature for approximately two minutes. Too rapid of heating at first will cause spattering of molten materials and will result in poor experimental results.

5. Heat for 5 more minutes over the hot part of the flame. After the heating process is completed, allow the crucible to cool on the base of the ringstand. Measure the mass of the crucible, lid, and KCl on your balance and on the computer balance.

6. Repeat steps 4 and 5, and check for any change in mass.

7. Repeat steps 4 and 5 a third time, and check for any change in mass. Do not enter item 5 into the computer until you have made two consecutive measurements on your balance with no change in mass.

8. Dispose of the material in the crucible as instructed by your teacher. Wash and dry the crucible.

CALCULATIONS

1. Percentage of oxygen (experimental value)

   = (mass lost by sample / original sample mass) x 100

2. Percentage of potassium chloride in sample (experimental value)

3. Percentage of oxygen from formula (theoretical value)

   = (molecular mass of O_3 / molecular mass of $KClO_3$) x 100

4. Percentage of potassium chloride from formula (theoretical value)

   = (molecular mass of KCl / molecular mass of $KClO_3$) x 100

5. Percentage error in experimental oxygen determination

$$= \frac{(\text{experimental value}) - (\text{theoretical value})}{(\text{theoretical value})} \times 100$$

For grading purposes only enter these values into the computer via the keyboard (from the data sheet):

Line L--percentage of oxygen in $KClO_3$, item 6.

Line N--calculated percentage of oxygen in $KClO_3$, item 7.

Line P--percent error-oxygen, item 8.

me_____

lance #_____ Group #_____

te_____ Period_____

PERCENT OF COMPOSITION

10

		computer item	student value
A	Mass of crucible and lid	1 B	
B	Mass of crucible + lid + $KClO_3$	2	
C	Mass of $KClO_3$		
D	Mass of crucible + lid + $KClO_3$ + heat 1	3 I	
E	Mass of oxygen lost heat 1		
F	Mass of crucible + lid + $KClO_3$ + heat 2	4 I	
G	Mass of oxygen lost heat 2		
H	Mass of crucible + lid + $KClO_3$ + heat 3	5 I	
I	Mass of oxygen lost heat 3		
J	Total mass of oxygen lost		
K	Mass of KCl residue		
L	Percentage of oxygen in $KClO_3$ (lab values)	6	
M	Percentage of KCl in $KClO_3$ (lab values)		
N	Calculated percentage of oxygen in $KClO_3$ (from formula)	7	
O	Calculated percentage of KCl (from formula)		
P	Percent error - oxygen	8	

B Balance check only. Wait for the correct mass to be shown on the computer screen.

I Information only. Check the screen to see if there are tips on your lab process.

SUPPLEMENTAL PROBLEMS:

1. If your percentage of error was greater than 20% what caused the error?

2. How do you know that all of the oxygen was driven off?

3. List the percentage of oxygen of four other lab groups. How does the average of these values compare with your value?

4. What is the percentage of oxygen in these compounds? (theoretical valur)

   a. H_2SO_4

   b. $PbCO_3$

   c. $Be(OH)_2$

5. Find the percent composition of each element in each of the following compounds:

   a. NaBr

   b. CH_3COOH

   c. HgF_2

   d. ZnS

   e. $Sn(CrO_4)_2$

   f. CH_3CH_2OH