

# Pre-Laboratory Questions

Seen

1. What are alums? Give examples other than potassium alum.

a colorless astringent compound that is a hydrated double sulfate of aluminum & potassium, used in solution medicinally & indyging tanning. ex:  $\text{KAl}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ .

2. What are the hydrates? Give few examples of metal salt hydrates.

is a compound that has crystallized from (aq) solution with weakly bound water molecules contained in the crystal. ex:  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{Na}_2\text{C}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$ .

3. Potassium chromic alum has the formula:  $\text{KCr}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ . A sample of  $1.12 \text{ g}$  of this alum was heated in a crucible to get a constant mass.

The mass of the anhydrous salt produced ( $\text{KCr}(\text{SO}_4)_2$ ) was  $0.64 \text{ g}$ .

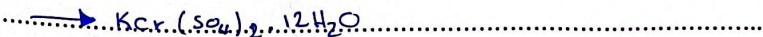
Calculate the value "x" in the formula of the alum.

$$\text{mass of H}_2\text{O} = \text{mass of alum} - \text{mass of salt} = 1.12 - 0.64 = 0.48 \text{ g}$$

$$n_{\text{H}_2\text{O}} = \frac{m}{M} = \frac{0.48}{18} = 0.027 \text{ mol}$$

$$n_{\text{salt}} = \frac{0.64}{283.64} = 0.0023 \text{ mol}$$

$$x = \frac{n_{\text{H}_2\text{O}}}{n_{\text{salt}}} = \frac{0.027}{0.0023} = 12$$



# Results and Calculations

## A. Potassium Alum:

Mass of empty crucible ( $m_1$ )	19.08	g
Mass of crucible and the alum ( $m_2$ )	20.04	g
Mass of crucible and anhydrous salt ( $m_3$ )	19.58	g
Mass of alum ( $m_2 - m_1$ )	0.96	g
Mass of anhydrous salt ( $m_3 - m_1$ )	0.50	g
Mass of water lost upon heating ( $m_2 - m_3$ )	0.46	g
Number of moles of water lost upon heating	0.025	mol
Number of moles of anhydrous salt ( $KAl(SO_4)_2$ ) $= \frac{50}{258.2}$	<del>2.582</del> $\frac{1936}{10^3}$	mol
Percentage of water of crystallization, by mass	47.9	%
The value "x" in the formula, (number of moles of water of crystallization / number of moles of anhydrous salt)	$\frac{0.025}{1.936 \times 10^{-3}}$ $= 12.90$	13

## B. Unknown Hydrate:

Unknown number: U

Mass of empty crucible ( $m_4$ )	19.06	g
Mass of crucible and the hydrate ( $m_5$ )	20.17	g
Mass of crucible and anhydrous salt ( $m_6$ )	19.96	g
Mass of <sup>hydrate</sup> anhydrous salt ( $m_5 - m_4$ )	1.11	g
Mass of water lost upon heating ( $m_5 - m_6$ )	<del>0.21</del> 0.9	g
Percentage of water of crystallization, by mass	<del>18.9</del> 81.1	%

Mass of water lost  $H_2O$

78 17.9

-1.5

# QUESTIONS

1. What is the effect on the calculated value of "x" if the dehydration of the alum is not complete

$$x = \frac{\text{num H}_2\text{O moles}}{\text{num anhydrous}} \dots \text{num. of moles H}_2\text{O} \dots = \frac{m}{M \cdot m}$$

When m decrease num. of moles of H<sub>2</sub>O will decrease.

So x value will decrease.

2. A student heated 1.16 g of hydrated <sup>Maxxy</sup> sodium sulfate in a crucible to get 0.51 g of anhydrous salt. What is the formula of the anhydrous salt? (Show your work)

$$\text{moles H}_2\text{O} = 1.16 - 0.51 = 0.65 \text{ g}$$

$$\text{num. of moles H}_2\text{O} = \frac{0.65}{18} = 0.036$$

$$\text{num. of moles} = \frac{0.51}{142.1} = 3.6 \times 10^{-3}$$

$$x = \frac{0.036}{3.6 \times 10^{-3}} = 10$$

$$\text{Formula} = \text{Na}_2\text{SO}_4 \cdot 10 \text{H}_2\text{O}$$