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 & in dyeing tanning ex: $NaFe(SO_4)_2 . xH_2O$

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

is a compound that has crystallized from (aq) solution with weekly bound water molecules contained in the crystal ex: $CuSO_4 . 5H_2O$, $NaC_2H_3O_2 . 3H_2O$

3. Potassium chromic alum has the formula: $KCr(SO_4)_2.xH_2O$. A sample of 1.12 g (m) of this alum was heated in a crucible to get a constant mass. The mass of the anhydrous salt produced ($KCr(SO_4)_2$) was 0.64 g (m). Calculate the value "x" in the formula of the alum.

mass of H_2O = mass of alum − mass of salt = $1.12 - 0.64 = 0.489$ g

$n_{H_2O} = \frac{m}{mm} = \frac{0.48}{18} = 0.027$ mol

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

$x = \frac{n_{H_2O}}{n_{salt}} = \frac{0.027}{0.0023} = 12$

$KCr(SO_4)_2 . 12H_2O$

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 ($KAl(SO_4)_2$) $= \frac{0.50}{258.2}$	1.936 $\times 10^{-3}$	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)	$\frac{0.025}{1.936 \times 10^{-3}}$ $= 12.90 \approx 13$	

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 ~~anhydrous~~ hydrate salt (m_5–m_4)	1.11	g
Mass of water lost upon heating (m_5–m_6)	0.9	g
Percentage of water of crystallization, by mass	18 12.9	%

Mass of unknown H_2O

QUESTIONS

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

$X = \frac{\text{num } H_2O \text{ mols}}{\text{num anhydrous}}$ ..... num of moles $_{H_2O} = \frac{m}{M.m}$

When m decrease num of moles of H_2O will decrease.

so X value will decrease.

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

moles $H_2O = 1.16 - 0.51 = 0.65$ g

num of moles $H_2O = \frac{0.65}{18} = 0.036$

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

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

formula = $Na_2SO_4 . 10 H_2O$