

## 2 Formula of a Hydrate

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Name: ..... كريم ..... Section .....

### Results and Calculations

#### A. Potassium Alum:

Mass of empty crucible	22.70 g
Mass of crucible and the alum	23.79 g
Mass of crucible and anhydrous salt	23.27 g
Mass of alum	1.09 g
Mass of anhydrous salt	0.57 g
Mass of water lost upon heating	0.52 g
Number of moles of water lost upon heating (molar mass = 18.0 g/mol)	0.029 mol
Number of moles of anhydrous salt ( $KAl(SO_4)_2$ ) molar mass = 258 g/mol	0.0022 mol
Percentage of water of crystallization, by mass	91.2 %
The value "x" in the formula, (number of moles of water of crystallization / number of moles of anhydrous salt)	13.2



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2) A student heated 1.16 g of hydrated sodium sulfate( $\text{Na}_2\text{SO}_4$ ) in a crucible to get 0.51 g of anhydrous salt(molar mass= 142 g/mol). What is the formula of the hydrated salt?

$$m_1 = 1.16 \text{ g}$$

$$m_2 = 0.51 \text{ g}$$

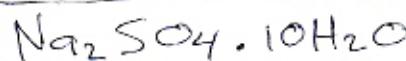
$$m_1 - m_2 = 0.65 \text{ g} \quad \rightarrow \text{mass of loss water}$$

$$\frac{0.51}{142} = \underline{\underline{0.0036}} \text{ moles of anhydrous salt}$$

$$\text{moles of water} = \frac{0.65}{18} = \underline{\underline{0.036}}$$

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$$\text{value of } x = \frac{0.036}{0.0036} = 10$$



## Quiz 2

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**Results and Calculations****A. Precipitation of  $\text{Ba}_3(\text{PO}_4)_2$ :**

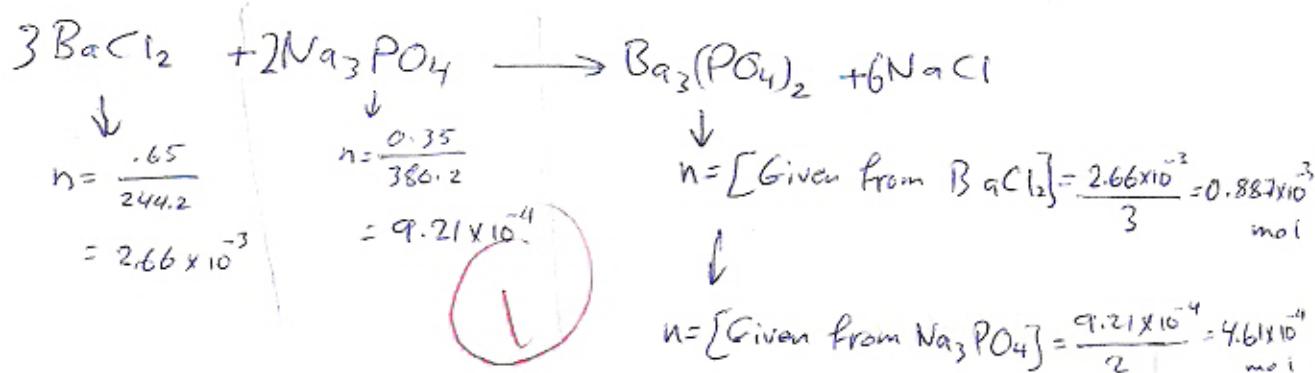
Mass of salt mixture	0.76 g
Mass of filter paper	0.62 g
Mass of filter paper and $\text{Ba}_3(\text{PO}_4)_2$	0.81 g

**B. Determination of the Limiting Reactant:**Limiting reactant in salt mixture is  $\text{Na}_3\text{PO}_4$ Excess reactant in salt mixture is  $\text{BaCl}_2$ 

Mass of $\text{Ba}_3(\text{PO}_4)_2$ precipitated	0.190 g
Number of moles of $\text{Ba}_3(\text{PO}_4)_2$ precipitated (molar mass = 601.64 g/mol)	$3.16 \times 10^{-4}$ mol

Number of moles of $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$ reacted	$6.32 \times 10^{-4}$ mol
Number of moles of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ reacted	$9.47 \times 10^{-4}$ mol
Mass of $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$ reacted (molar mass = 380.2 g/mol)	0.240 g
Mass of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ reacted (molar mass = 244.2 g/mol)	0.231 g
Mass percentage of $\text{Na}_3\text{PO}_4$	31.58 %

2) A mixture of 0.65 g  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  (molar mass 244.2 g/mol) and 0.35 g  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  (molar mass 380.2 g/mol) was dissolved in water. Which of the two reactants is the limiting reactant? Calculate the mass of  $\text{Ba}_3(\text{PO}_4)_2$  (molar mass 601.64 g/mol) precipitate formed.



#  $\text{BaCl}_2$  is the ~~limiting Reactant~~.

$$\Rightarrow \text{mass of } \text{Ba}_3(\text{PO}_4)_2 = 0.887 \times 10^{-3} \times 601.64 = [0.534 \text{ g}] \cancel{\#}$$



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Volumetric AnalysisQuestion 1

Given the following set of data:

Volume of vinegar solution = 20.00 mL

Volume of 0.15 M NaOH solution needed to neutralize acid in above vinegar solution = 18.00 mL

Density of vinegar solution = 1.05 g/mL

Calculate the mass percent of acetic acid (molar mass = 60.0 g/mol) in above vinegar solution.

$$n = 0.18 \times 0.02 = 2.7 \times 10^{-3} \text{ mol} = \text{number of moles of acetic acid} \Rightarrow m = 2.7 \times 10^{-3} \times 60 = 0.162 \text{ g}$$

~~$m = 2.7 \times 10^{-3} \times 60 = 0.162 \text{ g}$~~

$$\text{mass} \times \frac{16.2}{21} = \boxed{77.14\%}$$

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Question 2

a) Given the following set of data:

Mass of antacid sample = 0.30 g

Volume of 0.12 M HCl solution added = 60.00 mL  $n_1 = 7.2 \times 10^{-3} \text{ mol}$ Volume of 0.10 M NaOH solution needed for back titration = 16.00 mL  $n_2 = 1.6 \times 10^{-3} \text{ mol}$ 

Calculate the number of moles of HCl neutralized by 1.00 g tablet.

$$n_1 - n_2 = 5.6 \times 10^{-3} \text{ mol}$$



b) Given:

Density of stomach acid is 1.10 g/mL.

Concentration of stomach HCl is 0.10 M.

Neutralization capacity of antacid is 0.030 mol H<sup>+</sup>/g tablet.

Calculate the mass of stomach acid that can be neutralized by 1.00 g antacid tablet.

