

Answer on Question#65982 – Chemistry – General chemistry

Question:

A 1.1000 gram hydrate sample chosen from $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$, $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ and $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ was heated and found to lose 0.6920 gram of H_2O . (1) Show the calculation of the % H_2O in the unknown hydrate sample. (2) Show the calculation of the % H_2O in each of the hydrate compounds and identify the unknown hydrate from the list.

Atomic weights: $\text{H} = 1.008$, $\text{O} = 16.00$. MWs: $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O} = 286.15$, $\text{AlCl}_3 \cdot 6\text{H}_2\text{O} = 241.43$, $\text{MgCl}_2 \cdot 6\text{H}_2\text{O} = 203.301$ and $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} = 244.462$

Answer:

- 1) The hydrate sample

$$w(\text{H}_2\text{O}) = \frac{m(\text{H}_2\text{O})}{m(\text{hydrate})} \times 100\% = \frac{0.6920\text{g}}{1.1000} \times 100\% = \mathbf{62.91\%}$$

- 2) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

$$w(\text{H}_2\text{O}) = \frac{N(\text{H}_2\text{O}) \cdot M_w(\text{H}_2\text{O})}{M(\text{Na}_2\text{CO}_3)} \times 100\%,$$

where, $N(\text{H}_2\text{O})$ – number of molecules H_2O in hydrate compound;

$$M_w(\text{H}_2\text{O}) = 2 \times 1.008 + 16.00 = 18.02$$

$$w(\text{H}_2\text{O}) = \frac{10 \cdot 18.02}{286.15} \times 100\% = \mathbf{62.97\%}$$

- 3) $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$

$$w(\text{H}_2\text{O}) = \frac{6 \cdot 18.02}{241.43} \times 100\% = 44.78\%$$

- 4) $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$

$$w(\text{H}_2\text{O}) = \frac{6 \cdot 18.02}{203.301} \times 100\% = 53.18\%$$

- 5) $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$

$$w(\text{H}_2\text{O}) = \frac{2 \cdot 18.02}{244.462} \times 100\% = 14.74\%$$

The unknown hydrate is $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$.