

Math Diversion Problem 909

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Source: <https://www.chemteam.info/Mole/Determine-formula-of-hydrate-prob1-10.html>

Title: Computing an hydration formula

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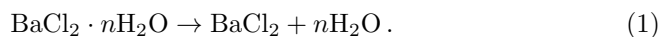
1 Problem

A 5.00 g sample of hydrated barium chloride, $\text{BaCl}_2 \cdot n\text{H}_2\text{O}$, is heated to drive off the water. After heating, 4.26 g of anhydrous barium chloride, BaCl_2 , remains. What is the value of n in the hydrate's formula?

2 Solution

Step 1.

The chemical reaction is as follows:



Step 2. Once again, a diagram.

Molar mass (g/mol):		208.23		18.01	
Substance:	$\text{BaCl}_2 \cdot n\text{H}_2\text{O}$	\longrightarrow	BaCl_2	+	H_2O
Molestats:	1		1		n
Mass (g):	5.00		4.26		<u>0.74</u>
Moles:			$\dagger 0.020458$		$\dagger 0.041088$

Figure 1. At this point, the problem is most easily finished by choosing the best two columns to form the mole proportion.

Step 3.

We can calculate n by using a mole proportion on columns 2 and 3:

$$\frac{n}{1} = \frac{0.041088}{0.020458} \approx 2. \quad (2)$$

Thus, we choose $n = 2$, resulting in the formula to be $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$.

3 Appendix: How to interpret the Stoich diagrams

There are four main types of data in the stoich diagrams I make. The most common are data from given information, from the coefficients of the balanced equation, and from data tables, such as a periodic table of elements for molar mass information. This kind of data I do not mark up. The second kind of data in stoich diagrams comes from computations based on data in the same column, for which I use the turnstile (\dagger) to indicate. The third kind of data is a result in one column that required data from at least one other column to calculate it, and I indicate that kind of value or result by use of the underlining. The fourth kind of data in the figures is the result of combining given information to derive a secondary value. I indicate this kind of data with a right arrowhead (\blacktriangleright).